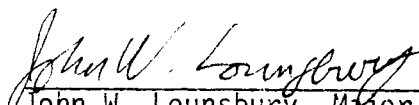
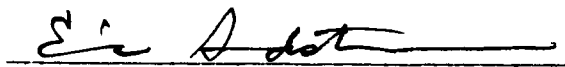


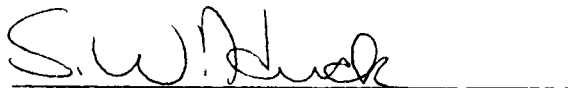
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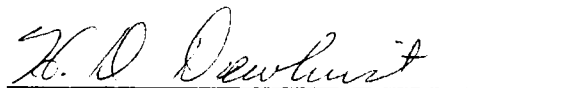
I am submitting herewith a dissertation written by Robert Ernest Webber entitled "Psychological Attributes of Energy Conservation Activities." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Industrial and Organizational Psychology.

  
John W. Lounsbury, Major Professor

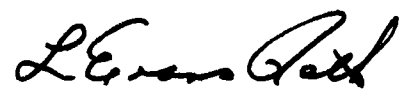
We have read this dissertation  
and recommend its acceptance:







Accepted for the Council:

  
Vice Chancellor  
Graduate Studies and Research

PSYCHOLOGICAL ATTRIBUTES OF ENERGY  
CONSERVATION ACTIVITIES

A Dissertation  
Presented for the  
Doctor of Philosophy  
Degree  
The University of Tennessee, Knoxville

Robert Ernest Webber

August 1980

**3045038**

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## ABSTRACT

This study applied a multi-attribute model to improve the level of understanding of psychological factors associated with residential energy conservation. Personal interviews were conducted with 126 middle-class households and ratings of 12 attributes were obtained for five residential energy conservation activities.

Seven research issues were investigated and it was found that: (1) attribute ratings were not generalizable across energy conservation activities; (2) multiple regression models were superior to simple summation models for predicting activity levels from attribute ratings; (3) a normalizing transformation of the attribute ratings did not substantially improve activity prediction; neither did (4) multiplicative inclusion of a general importance rating of each attribute; (5) attempts to identify attribute subsets by factor analysis and stepwise multiple regression led to mixed results; (6) monetary and nonmonetary attributes should be considered together for predicting activity levels; and (7) both attribute ratings and demographic variables were useful for predicting level of residential energy conservation activities.

It was concluded that performance of one energy conservation activity by a household did not necessarily imply performance of other activities; there were no general energy conservation activity subsets. In addition, no common set of predictors was identified which could be applied across activities; there was no general strategy for predicting energy conservation activities. Implications for policy-makers and program planners are discussed.

## TABLE OF CONTENTS

| CHAPTER                                                          | PAGE |
|------------------------------------------------------------------|------|
| I. DEVELOPMENT OF RESEARCH ISSUES . . . . .                      | 1    |
| Background of Research Issues . . . . .                          | 1    |
| Economics. . . . .                                               | 2    |
| Diffusion of innovations . . . . .                               | 7    |
| Process models of consumer behavior . . . . .                    | 13   |
| Attitude theory . . . . .                                        | 15   |
| Marketing research . . . . .                                     | 19   |
| Statement of Research Issues . . . . .                           | 22   |
| II. METHOD . . . . .                                             | 25   |
| Pilot Studies . . . . .                                          | 25   |
| First pilot study . . . . .                                      | 25   |
| Second pilot study . . . . .                                     | 26   |
| Procedures . . . . .                                             | 31   |
| Target population . . . . .                                      | 31   |
| Household sampling method . . . . .                              | 32   |
| Data collection methods . . . . .                                | 33   |
| Household primary decision-maker . . . . .                       | 36   |
| Measures . . . . .                                               | 38   |
| Personal background and household characteristics . . . . .      | 38   |
| Energy conservation activities . . . . .                         | 39   |
| Perceived attributes of energy conservation activities . . . . . | 42   |
| Importance ratings of attributes . . . . .                       | 45   |
| Personality and attitudinal measures . . . . .                   | 46   |

| CHAPTER                                                                 | PAGE |
|-------------------------------------------------------------------------|------|
| Analysis Techniques . . . . .                                           | 46   |
| Models . . . . .                                                        | 46   |
| Basic attribute model . . . . .                                         | 48   |
| Normalized attribute model . . . . .                                    | 48   |
| Importance-weighted attribute model . . . . .                           | 49   |
| Research issues . . . . .                                               | 50   |
| III. RESULTS . . . . .                                                  | 53   |
| Responses to Survey Items . . . . .                                     | 53   |
| Characteristics of the completed sample . . . . .                       | 53   |
| Primary decision-makers for activities . . . . .                        | 55   |
| Energy conservation activities . . . . .                                | 55   |
| Rated importance of attributes . . . . .                                | 58   |
| Analysis of Research Issues . . . . .                                   | 61   |
| 1. Generalizability of attribute ratings . . . . .                      | 61   |
| 2. Multiple regression model versus simple summation<br>model . . . . . | 66   |
| 3. Normalized attribute rating . . . . .                                | 66   |
| 4. Attribute importance rating . . . . .                                | 69   |
| 5. Attribute subsets . . . . .                                          | 70   |
| Factor analysis . . . . .                                               | 70   |
| Stepwise regression . . . . .                                           | 79   |
| 6. Monetary attributes versus nonmonetary attributes .                  | 80   |
| 7. Attribute ratings versus demographic data . . . . .                  | 82   |

| CHAPTER                                                                     | PAGE |
|-----------------------------------------------------------------------------|------|
| IV. DISCUSSION AND SUMMARY . . . . .                                        | 88   |
| Research Issues . . . . .                                                   | 88   |
| 1. Generalizability of attribute profiles . . . . .                         | 88   |
| 2. Multiple regression models versus simple summation<br>models . . . . .   | 89   |
| 3. Normalized attribute ratings . . . . .                                   | 90   |
| 4. Attribute importance ratings . . . . .                                   | 91   |
| 5. Attribute subsets . . . . .                                              | 91   |
| 6. Monetary attributes versus nonmonetary attributes .                      | 94   |
| 7. Attribute ratings versus demographic data . . . . .                      | 95   |
| Critique of the Study . . . . .                                             | 96   |
| Implications for Research and Policy . . . . .                              | 98   |
| BIBLIOGRAPHY . . . . .                                                      | 102  |
| APPENDICES . . . . .                                                        | 106  |
| A. SURVEY MATERIALS . . . . .                                               | 107  |
| B. CHARACTERISTICS OF COMPLETED SAMPLE . . . . .                            | 127  |
| C. RESPONSES TO ENERGY CONSERVATION ACTIVITY ITEMS . . . . .                | 137  |
| D. MULTIPLE REGRESSION EQUATIONS USING 12 ATTRIBUTE<br>PREDICTORS . . . . . | 141  |
| E. INTERCORRELATIONS AMONG ATTRIBUTE RATINGS . . . . .                      | 148  |
| VITA . . . . .                                                              | 154  |

## LIST OF TABLES

| TABLE                                                                                                                                                                                                      | PAGE |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| I-1. Federal Programs Designed to Serve Residential Energy<br>Conservation Needs . . . . .                                                                                                                 | 5    |
| II-1. Attributes of Energy Conservation Activities . . . . .                                                                                                                                               | 27   |
| II-2. Selection of Energy Conservation Activities . . . . .                                                                                                                                                | 29   |
| II-3. Structured Interview Format in Order of Presentation . .                                                                                                                                             | 35   |
| II-4. Operationalization of Implementation Level of Energy<br>Conservation Activities . . . . .                                                                                                            | 43   |
| II-5. Summary Table of Symbols for Attribute Analysis Models .                                                                                                                                             | 47   |
| III-1. Person in Household with Primary Responsibility for<br>Each Energy Conservation Activity . . . . .                                                                                                  | 56   |
| III-2. Correlations Among Levels of Household Implementation<br>of Energy Conservation Activities . . . . .                                                                                                | 59   |
| III-3. Relationship of Male and Female Attribute Importance<br>Ratings . . . . .                                                                                                                           | 60   |
| III-4. Attribute Ratings of Household Primary Decision-makers<br>for Each Energy Conservation Activity . . . . .                                                                                           | 63   |
| III-5. Prediction of Household Energy Conservation Activities:<br>Comparison of Attribute Predictor Models . . . . .                                                                                       | 67   |
| III-6. The Energy-Environment Factor: Comparison of Orthogonally<br>Rotated Factor Loadings of Household Primary Decision-<br>makers' Attribute Ratings across Energy Conservation<br>Activities . . . . . | 73   |

| TABLE                                                                                                                                                                                     | PAGE |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| III-7. The Cooperation Factor: Comparison of Orthogonally Rotated Factor Loadings of Household Primary Decision-makers' Attribute Ratings across Energy Conservation Activities . . . . . | 74   |
| III-8. The Effort Factor: Comparison of Orthogonally Rotated Factor Loadings of Household Primary Decision-makers' Attribute Ratings across Energy Conservation Activities . . . . .      | 75   |
| III-9. The Comfort Factor: Comparison of Orthogonally Rotated Factor Loadings of Household Primary Decision-makers' Attribute Ratings across Energy Conservation Activities . . . . .     | 76   |
| III-10. Undefined Factors: Comparison of Orthogonally Rotated Factor Loadings of Household Primary Decision-makers' Attribute Ratings across Energy Conservation Activities . . . . .     | 77   |
| III-11. Best Multiple Regression Equations Using Attributes to Predict Energy Conservation Activity . . . . .                                                                             | 81   |
| III-12. Best Multiple Regression Equations Using Personal and Household Characteristics to Predict Energy Conservation Activity . . . . .                                                 | 84   |
| III-13. Comparison of Best Multiple Regression Equations Using Attributes and Personal and Household Characteristics to Predict Energy Conservation Activity . . . . .                    | 86   |

| TABLE                                                                                                                                         | PAGE |
|-----------------------------------------------------------------------------------------------------------------------------------------------|------|
| D-1. Prediction of Number of Inches of Attic Insulation:<br>Comparison of Regression Equations Using All 12<br>Attribute Predictors . . . . . | 143  |
| D-2. Prediction of Percentage of Storm Windows: Comparison<br>of Regression Equations Using All 12 Attribute<br>Predictors . . . . .          | 144  |
| D-3. Prediction of Degrees of Thermostat Setback: Comparison<br>of Regression Equations Using All 12 Attribute<br>Predictors . . . . .        | 145  |
| D-4. Prediction of Use of Returnable Bottles: Comparison<br>of Regression Equations Using All 12 Attribute<br>Predictors . . . . .            | 146  |
| D-5. Prediction of Save Paper for Recycling: Comparison of<br>Regression Equations Using All 12 Attribute<br>Predictors . . . . .             | 147  |
| E-1. Intercorrelations Among Attribute Ratings for the<br>Insulate Attic Activity . . . . .                                                   | 149  |
| E-2. Intercorrelations Among Attribute Ratings for the Storm<br>Window Activity . . . . .                                                     | 150  |
| E-3. Intercorrelations Among Attribute Ratings for the<br>Thermostat Setback Activity . . . . .                                               | 151  |
| E-4. Intercorrelations Among Attribute Ratings for the<br>Returnable Bottle Activity . . . . .                                                | 152  |
| E-5. Intercorrelations Among Attribute Ratings for the Save<br>Paper Activity . . . . .                                                       | 153  |

## CHAPTER I

### DEVELOPMENT OF RESEARCH ISSUES

#### Background of Research Issues

One of the most pressing and far-reaching issues facing society today is the need to achieve a long-range balance between the supply and demand for energy resources. In the quest for that delicate balance, the physical sciences have provided many technological advances with great promise to either increase available energy supplies (solar collectors, biomass conversion, enhanced oil recovery) or reduce consumer demand (heat pump systems, clock thermostats, insulation materials). Until lately, however, little attention has been paid to the social sciences' potential contributions in providing effective mechanisms for encouraging adoption of available energy conservation technologies. Ferber (1977) addressed a role for the social sciences in energy research:

As the nation becomes sensitized to the growing problems of energy scarcity, government officials are becoming sensitized to the need for social science research in the field of energy. . . . Policy makers are beginning to recognize that research on human behavior and social organization may produce some clues to solving the energy crisis. (p. 4)

One important contribution from the behavioral sciences to the energy situation can be made in the area of reducing residential energy demand through voluntary conservation. This presents an exciting opportunity for behavioral scientists. By improving the level of understanding of psychological factors associated with household energy

conservation activities, researchers can provide critical input in a number of policy areas. Appropriate research would be useful for developing a marketing approach for increasing the effectiveness of conservation publicity campaigns. Planning for federal and state energy conservation programs would be improved and implementation problems reduced. Energy conservation needs assessments within target populations would be facilitated by identification of salient psychological dimensions related to specific activities.

Since the Arab oil embargo in 1973, there has been an increasing number of psychological studies related to energy use and conservation. Little of the research, however, has addressed the issue of how residential consumers perceive energy conservation activities and how these perceptions are associated with adoption and continued practice of the activities. It was the intent of the present investigation, therefore, to develop a methodology for examining the relationships between the characteristics associated with household energy conservation activities and the level of performance of those activities in the home.

### Economics

Extravagant energy use is tempting. McClelland and Canter (1979) recognized the many immediate positive benefits of energy consumption compared to the few negative consequences for the individual. By using energy, individuals maintain comfortable temperatures in their homes, they save time with energy-consuming appliances, they travel at their own convenience in private automobiles, and they gain social status from possession of material goods. Balanced against these benefits are

but few negative consequences. The monetary cost of energy is the major negative consequence of energy use. However, payment for energy consumed by residential consumers is temporally removed from actual energy use. Utility bills appear only about once a month. Consumers are seldom aware of the energy required to produce manufactured goods. The negative socio-political consequences of energy use, such as depletion of natural resources and international balance of trade, are even more remote to the individual.

When McClelland and Canter's observations about energy use benefits are viewed in the context of behavioral reinforcement contingencies, the challenge of promoting energy conservation becomes more apparent. Energy use provides a variety of immediate positive reinforcers to consumers. These reinforcers serve to maintain behaviors which require energy use. The financial cost of energy can be viewed as a negative reinforcer, thus greater use of energy would incur higher costs, punishing the consumption behavior and decreasing future energy use. One major difference between the positive and negative reinforcers of energy consumption is the immediacy of their application. The observation that positive reinforcers are so closely related to energy use and negative reinforcers are fewer and more distantly associated with actual usage of energy suggests that the negative economic reinforcers which may moderate energy consumption would have relatively less influence on behavior than the positive reinforcers.

Economic sanctions to promote energy conservation have been emphasized by major governmental programs and administrative policies. Fuel taxes have been raised, tax credits have been provided, and loans have

been offered to residents. A review of federal energy conservation programs (excluding solar) revealed 21 directly serving homeowners (Cowperthwaite and Murphy, 1979). Most of the programs involved some sort of financial incentives or dissemination of information (Table I-1). Only four programs emphasized direct personalized consumer counseling approaches which could more adequately address the positive benefits of energy use.

Though financial incentives to homeowners can effectively encourage energy conservation, they are not necessarily critical. The Tennessee Valley Authority (TVA) offered its residential consumers free home energy audits to help identify specific activities residents could do in their homes to conserve energy. TVA also provided optional interest-free loans to each audited consumer for implementing audit recommendations. The loans could be conveniently repaid by the consumer as part of the monthly utility bill. Of 134,482 residential energy audits, 45.5 percent (61,253) of the consumers accepted loans to implement energy conservation recommendations. What about the 54.5 percent who did *not* accept loans? A random survey of 1,327 persons who had received audits from TVA but chose not to accept interest-free loans showed that 44.7 percent (593) had taken energy conservation actions without free financial assistance from TVA (Whisenant, 1979). Something in addition to economic factors contributed to consumer decisions to take action.

The contrast between negative economic consequences and positive personal benefits of energy conservation activities formed the basis for one of the research issues of the present investigation. Specifically, nonmonetary characteristics of energy conservation activities should be considered in conjunction with monetary characteristics to

TABLE I-1

## FEDERAL PROGRAMS DESIGNED TO SERVE RESIDENTIAL ENERGY CONSERVATION NEEDS

| Federal Agency            | Program                                       | Type of Program      |                           |                       |              |
|---------------------------|-----------------------------------------------|----------------------|---------------------------|-----------------------|--------------|
|                           |                                               | Financial Assistance | Information Dissemination | Individual Counseling | Energy Audit |
| Department of Energy      | State Energy Conservation Program (EPCA-ECPA) | ---                  | XXX                       | ---                   | ---          |
|                           | Energy Extension Service                      | ---                  | XXX                       | XXX                   | XXX          |
|                           | Weatherization Grants                         | XXX                  | ---                       | ---                   | ---          |
|                           | Residential Conservation Service              | XXX                  | ---                       | XXX                   | XXX          |
|                           | Conservation Education                        | ---                  | XXX                       | ---                   | ---          |
|                           | Project Conserve                              | ---                  | ---                       | ---                   | XXX          |
|                           | Energy Education                              | ---                  | XXX                       | ---                   | ---          |
|                           | Consumer Impact and Citizen Participation     | ---                  | XXX                       | ---                   | ---          |
|                           | Publications Branch                           | ---                  | XXX                       | ---                   | ---          |
|                           | Exhibits Branch                               | ---                  | XXX                       | ---                   | ---          |
| Department of Agriculture | Audiovisual Branch                            | ---                  | XXX                       | ---                   | ---          |
|                           | Farmers Home Administration                   | XXX                  | ---                       | ---                   | ---          |
|                           | Extension Service                             | ---                  | XXX                       | XXX                   | ---          |
|                           | Food and Nutrition Service                    | ---                  | XXX                       | XXX                   | ---          |

TABLE I-1 (Continued)

| Federal Agency                              | Program                                             | Type of Program      |                           |                       |              |
|---------------------------------------------|-----------------------------------------------------|----------------------|---------------------------|-----------------------|--------------|
|                                             |                                                     | Financial Assistance | Information Dissemination | Individual Counseling | Energy Audit |
| Department of Housing and Urban Development | Community Development Block Grants                  | XXX                  | ---                       | ---                   | ---          |
|                                             | Section 312 Loans                                   | XXX                  | ---                       | ---                   | ---          |
| Internal Revenue Service                    | Residential Insulation and Conservation Tax Credits | XXX                  | ---                       | ---                   | ---          |
|                                             | Crisis Intervention Assistance                      | XXX                  | ---                       | ---                   | ---          |
| Veteran's Administration                    | Guaranteed Home Loan Program                        | XXX                  | ---                       | ---                   | ---          |
|                                             | Grants for State and Community Programs on Aging    | XXX                  | XXX                       | ---                   | ---          |
| Tennessee Valley Authority                  | Home Insulation Loans                               | XXX                  | ---                       | ---                   | XXX          |
|                                             |                                                     |                      |                           |                       |              |
| TOTAL                                       |                                                     | 10                   | 11                        | 4                     | 4            |

Adapted from: T. Cowperthwaite and K. Murphy, Guide to federal energy conservation programs, *Congressional Record*, February 9, 1979.

Note: Programs addressing primarily solar applications or transportation issues were not included in this compilation of federal programs. Also excluded were programs serving residents indirectly, such as energy education courses aimed at school teachers.

predict level of household energy conservation activities. The six other major issues investigated by the present study relate to the development of an optimal methodology for predicting residential energy conservation activity from the way in which activities are perceived by household members.

Several research traditions offered models useful for understanding factors associated with household energy conservation: interdisciplinary studies of the diffusion of innovations; process models of consumer behavior; attitudinal theories from social psychology; and field applications of marketing research. Representative perspectives from each of these research traditions were reviewed in the context of residential energy conservation.

### Diffusion of Innovations

In a society emerging from an era of cheap and plentiful energy, activities oriented to conserving energy may be viewed by many as new and innovative. The transfer of new ideas and behavior to members of a social system was the basic focus of Rogers and Shoemaker's (1971) diffusion of innovations paradigm. An examination of the diffusion of innovations paradigm offers valuable insights for increasing understanding of residential energy conservation behavior.

Diffusion of innovations research was considered by Rogers and Shoemaker as a subset of communication research; their paradigm, therefore, reflected a particular concern for communication variables and resembled consumer behavior models. The diffusion of an innovation through a society was conceptualized in terms of an information

processing continuum consisting of four stages: knowledge, persuasion, decision, and confirmation.

In the *knowledge* stage, the individual becomes aware of a new idea, practice, or object (innovation) and gains a preliminary understanding of how it functions. Rogers and Shoemaker, like the majority of other communication researchers, did not view the individual as a passive receiver of information. People tend to select information which is congruent with their personal interests, needs, and attitudes and with social system variables, such as group norms.

Having developed some cognitive understanding (knowledge) of an innovation, Rogers and Shoemaker (1971) suggested that during the *persuasion* stage,

. . . the individual becomes more psychologically involved with the innovation . . . . Selective perception is important in determining the receiver's communication behavior at the attitude formation stage. For it is at the persuasion stage that a general perception of the innovation is developed.  
(p. 109)

In the *decision* stage of the diffusion process, the individual engages in activities which lead to a choice to adopt or reject the innovation. Activities may include actually trying the innovation or assessing the experiences of others with the innovation. Within the context of a dynamic social system, acceptance or rejection of an innovation at any given time is not considered final. Whether accepted or rejected, the innovation may be reassessed at a later time and the decision regarding the innovation may be changed.

Based on information gained through cognitive awareness (knowledge), affective impact (persuasion), and experience (decision), the individual

makes subsequent decisions about continuing behavior toward the innovation. Rogers and Shoemaker referred to this stage as *confirmation*. Depending on the nature of the innovation, the diffusion process may extend beyond simple one-time permanent adoption of an innovation (such as attic insulation) and require continuing behavior by the adopter (such as daily adjustment of household thermostat settings). Over time, as a social system and its members change, what were once perceived as innovations become commonplace or forgotten, and other innovations emerge in the continuing cycle of diffusion.

Influencing the individual at various points in the diffusion process are four critical elements: the subjective *attributes* of the innovation as perceived by the potential users; the *communication channels* through which information about the innovation is disseminated; the *time frame* of the diffusion process; and the *characteristics* of the individual and the social system in which the innovation is diffused. The complex interactions among these elements and the process stages have been investigated in a wide variety of settings and invariably provide insights to the factors affecting behavioral change in response to innovations.

The first of these elements, in particular, has aroused considerable interest among researchers concerned with maximizing the diffusion of an innovation in a population. A small number (one to four) of perceived attributes associated with an innovation has been shown in empirical studies to account for a sizable percentage of the variance (from 49 to 87 percent) in the adoption rate of technological and social innovations (Rogers and Shoemaker, 1971, pp. 140-141).

Rogers and Shoemaker stressed the need to study attributes of innovations:

We need a standard classification scheme for describing the perceived attributes of innovations in universal terms. Then one would not have to study each innovation in order to predict its rate of adoption. We could say, for example, that team teaching is more like modern math (in the eyes of the adopters) than it is like kindergartens. This general classification system is an eventual objective of diffusion research on innovation attributes. (p. 137)

While Rogers and Shoemaker did not feel they had met this objective, they proposed a comprehensive set of five characteristics of innovations which were, as much as possible, mutually exclusive among themselves and generalizable to a wide variety of innovations:

1. *Relative advantage* is the degree to which an innovation is perceived as better than the idea it supercedes. For a particular innovation, several facets of relative advantage may be appropriate, such as: economic impact, perceived risk, effect on personal comfort, effort required, and immediacy of reward.

2. *Compatibility* is the degree to which an innovation is perceived as consistent with existing values, past experiences, and needs of the receivers. An innovation should fit within the social and personal milieu of the receivers.

3. *Complexity* is the degree to which an innovation is perceived as relatively difficult to understand and use.

4. *Trialability* is the degree to which an innovation may be experimented with on a limited basis before the receiver makes a full commitment to the innovation.

5. *Observability* is the degree to which the results of an

innovation are visible to others. Included in the observability attribute is the ease with which an innovation can be described or communicated to other persons.

An illustrative application of the use of attribute perceptions to predict diffusion of innovations was provided by Fliegel and Kivlin (1966). These researchers investigated the impact of a farm community's perception of 15 attributes of 33 farm practices on the rate of adoption of these practices in the community. The set of 15 attributes was defined by Fliegel and Kivlin based on a review of relevant literature and a familiarity with agricultural innovations. The 33 farm practices were selected to maximize variability of attribute ratings among them. Each of the 33 farm practices was rated by farmers on a four-point scale reflecting the degree to which they perceived the practice to possess a particular attribute. To reduce the respondents' rating task, only three to four attributes were rated across all 33 practices by any one respondent. The ratings were then combined by Fliegel and Kivlin to produce "not a measure of individual perceptions of the attributes, but an estimate of the shared perceptions of a particular segment of the community" (p. 240). To minimize variations in personal and situational factors suspected to affect adoption decisions, a purposive sample of 229 farm operators in a single Pennsylvania county had been selected. For instance, to qualify for the sample a respondent had to be, among other things, a sole owner-operator of a medium-sized commercial dairy farm. The dependent variable in Fliegel and Kivlin's study was "the average percentage of adoption per year for the eight consecutive years of most rapid adoption of a given practice" (p. 241).

Fliege1 and Kivlin used all 15 attributes in a multiple regression equation to predict rate of adoption and found that 51 percent of the rate variance was accounted for by attribute ratings. Review of simple and fourteenth-order partial correlations revealed that high initial cost of practices was not a deterrent to adoption; actually, high initial cost and low rate of cost recovery were positively associated with adoption rates. Farm practices perceived as easy to try out on a small scale and with high payoff were most strongly associated with the adoption rate.

The fairly large proportion of adoption variance accounted for in Fliege1 and Kivlin's study may be due, in part, to the aggregated nature of the predictor and criterion variables. Ostlund (1974) has pointed out that prediction of such aggregated data is "a far easier statistical task than to predict adoption or nonadoption by individuals" (p. 23).

The use of aggregated variables has been common in diffusion research. A review of 6,811 publications in the Michigan State University Diffusion Documents Center (Rogers and Shoemaker, 1971, p. 72) identified 82 studies using attributes of innovations as predictors. In every case, the dependent variable was rate of adoption in a social system. Rogers and Shoemaker (1971) have defined rate of adoption as "the length of time required for a certain percentage of members of a system to adopt an innovation" (p. 28).

In two studies of consumer product preferences, Ostlund (1974) used individual housewives' perceptions of product attributes to predict their subsequent product purchases. In addition to the issue of

disaggregated dependent variables, Ostlund examined the relative predictive effectiveness of attribute ratings and demographic variables commonly used in marketing studies.

Using a multiple discriminant function with only perceptual variables to predict housewife purchase behavior, Ostlund was able to correctly classify between 68 and 79 percent of respondents as purchasers or nonpurchasers. By including demographic variables, the percentage of correct classification increased by only 1 percent. Ostlund therefore concluded that ratings of perceived attributes, such as relative advantage, compatibility, and complexity, are very effective predictors of behavior. Personal characteristics, such as income, education, age, and scores on several attitude scales, added little to the prediction of product purchase.

#### Process Models of Consumer Behavior

An alternative conceptualization of the forces which influence personal choice behavior has been advocated by process models of consumer behavior. Several variations of consumer behavior models have been proposed to explain consumer purchase and consumption patterns. A brief discussion of one such model will serve to illustrate the similarity of consumer behavior toward products and behavior related to energy consumption and conservation. McGuire (1976) reviewed psychological research concerned with internal cognitive characteristics which may influence consumer behavior. Though not specifically applied to energy conservation, McGuire proposed an eight-step model of consumer decision-making.

The first step of McGuire's model involves *exposure* of the consumer to an information source. For the most part, the consumer determines from which source to receive information. Market segmentation studies have shown that demographic characteristics tend to be indicative of information exposure habits.

Once an information source is selected by the consumer, only a portion of the information transmitted from the source is actually perceived. Different levels of *perception* can be caused by varying attention spans and selection perception by the consumer. A homeowner reviewing a January utility bill, for instance, may be quite receptive to perceiving a public service announcement offering a free home energy audit.

Perception must be followed by some degree of *comprehension*, either conscious or unconscious, for the information to have an ultimate impact on consumer decisions. McGuire described comprehension with such constructs as philosophical abstraction and psycholinguistic encoding. Comprehension in this sense is typically assumed in other models to occur with perception.

At the time the information is perceived and comprehended, the consumer, according to McGuire's model, makes tentative assessments regarding the level of agreement with or *acceptance* of the information. Many psychological constructs impact on the consumer's acceptance of information such as perception of source credibility and prior attitudes relevant to the information.

Most information directed at consumers is intended to elicit behavioral actions at some time following receipt of the information.

*Retention* of information over a period of time includes the distinction between short- and long-term memory storage, along with mechanisms of forgetting.

Information which has been perceived, comprehended, evaluated, and retained must be recalled at the appropriate moment to have a bearing on a consumer decision. *Retrieval* of information from mental storage can range from explicit brand name recognition to subtle subconscious effects.

The consumer must *decide* among several options.

Assuming that more than one consideration must be taken into account because of what has been retrieved from the cognitive system and of what the consumer's current environment presents, the consumer must put it all together by deciding which considerations will be taken into account and how the information will be weighted and integrated so as to yield a decision regarding whether to purchase or which product to purchase. (p. 311)

The mental strategies used by consumers to integrate information and make a choice is a critical step in decision-making models. The aggregate weighting of information and beliefs form the basis for the present investigation.

The final step in McGuire's model is actual consumer *behavior*. The relationship between information processed in the first seven steps and actual behavior has also been examined by Fishbein and Ajzen (1975), discussed in the following section.

### Attitude Theory

The consumer behavior and diffusion of innovation models discussed thus far have been fairly general in their approaches to the interrelationships among model components. A more quantitative model, relating

perceptions about an innovation with behavior toward the innovation, has been proposed by Fishbein (1967), and later extended by Fishbein and Ajzen (1975). Developed from a social psychological perspective of attitude theory, the Fishbein and Ajzen model presented a rich framework for understanding and predicting human behavior.

The foundation of the Fishbein model was built on the relationships among four critical elements, each a function of the preceding element: beliefs about behavior; attitudes toward behavior; intentions to perform behavior; and actual behavior. Fishbein and Ajzen (1975) suggested that beliefs are acquired from several sources. Basically, beliefs may be descriptive and based on direct experience with an object, or beliefs may be inferential and come from indirect experiences, logic, or through other communication channels.

Two types of beliefs about behavior are proposed in the Fishbein model: beliefs about attributes of behavior and beliefs about social norms regarding behavior. Though many attributes and attendant beliefs may relate to behavior, a relatively small number of attributes are salient to the formation of a person's attitude and subsequent intention and behavior. Fishbein and Ajzen cited literature on information processing and attention span which suggested that only five to nine attributes about behavior are salient at any given time. Specific salient attributes, however, vary across individuals; the amount of effort necessary to purchase returnable bottles may be salient to person A, but make little difference to person B. Thus, in a multi-attribute study, Fishbein and Ajzen suggested that as many as 12 attributes may be included to allow individual variability of attribute salience. To account

for social influences on an individual, Fishbein and Ajzen included a set of normative beliefs as a factor affecting intention to perform behavior. It is a function of two components: the belief as to how others feel about the behavior; and motivation to comply--the degree to which the person cares what others think about the behavior.

The sum of a person's beliefs about the relationship between a set of attributes and behavior served as the primary information base for development of attitudes toward behavior. Attitude toward behavior was proposed to be a function of two belief components: an evaluative component and a belief strength component. The evaluative component was a bipolar measure of the affective relationship of an attribute with behavior. Bipolar dimensions, such as good-bad, like-dislike, and approve-disapprove, were suggested by Fishbein and Ajzen as appropriate measures of attribute evaluation. Belief strength involved the subjective probability that a particular attribute is associated with behavior. Though normally measured on a 0-1 probability scale, other indices of association were acknowledged, such as likely-unlikely, agree-disagree, true-false.

In Fishbein and Azjen's (1975) model, attitude was viewed as a general disposition toward behavior and, as such, was more closely related to overall behavior patterns than any specific behavior. In the same sense that a single attribute may be used to form several beliefs, and beliefs contribute to several attitudes, attitudes are related to a set of intentions and behaviors. Attitudes, therefore, would be expected to be better predictors of a class of behaviors than any one specific behavior.

An example of the application of Fishbein and Azjen's model to consumer behavior was provided by Bearden and Woodside (1977), who used the model to assess consumer preference for four brands of beer and five brands of soft drink. The relative contribution of a summated attitude score and subjective norm measure on the prediction of consumers' behavioral intentions to purchase each brand was determined by multiple regression analysis. Interviews with a sample of consumers formed the basis for developing a list of 15 beer attributes and 18 soft drink attributes. Four components of the Fishbein and Azjen model--belief strength, evaluation, subjective norm, and motivation to comply--were assessed on a seven-point scale from -3 to +3. *Belief strength* was operationalized as how well the respondent felt each attribute described each brand. *Evaluation* was operationalized as how strongly the respondent agreed or disagreed with each attribute, without regard to brand. Attitude was computed by summing the products of the belief strength and evaluation of each attribute. The degree to which respondents felt a single reference group would think they should or should not drink each brand was used to measure normative beliefs. *Motivation to comply* was measured by how much the respondents cared what their drinking companions thought about the brand they were drinking. *Subjective norm* was computed by multiplying normative belief by motivation to comply. The intention to purchase each brand within four weeks was predicted by multiple regression equations using attitude and subjective norm as predictor variables. The average coefficient of determination ( $R^2$ ) across the nine beverage brands was .24; the two predictor variables accounted for 24 percent of the variance in measures of intention to

purchase. Though both attitude and subjective norm contributed significantly to each regression equation, the contribution of attitude was consistently higher than subjective norm. Bearden and Woodside concluded that brand choice was based substantially on perceived product attributes.

### Marketing Research

The quantification of attitude structure provided by Fishbein and Azjen (1975) and other similar models (Fishbein, 1967; Rosenberg, 1956) has been recognized by marketing researchers as an opportunity to gain information about consumer impressions of products and brands, and to shape marketing strategies. The attitude structure models suggest specific interrelationships among critical variables. The models, however, are concerned primarily with an aggregated set of beliefs and discount the relative contribution of each belief in the attitude structure. As such they lack the power to accurately assess product strengths and weaknesses as viewed by consumers. A thorough understanding of consumer product perceptions is essential for adjusting physical characteristics, associated images, and advertising campaigns to optimize consumer acceptance.

More precise multi-attribute models have been used by marketing researchers to assess the relative impact of each attribute on consumer behavior. Wilkie and Pessemier (1973) reviewed 42 marketing studies which utilized multi-attribute models and concluded:

In general, results have been consistent across products; the multi-attribute model yields attitude scores which are significantly related to measures of purchase or purchase disposition. While one might be able to choose better predictors of these dependent variables (e.g., last period

purchases), diagnostic benefits often are not offered by the better predictors. The basic purpose of the multi-attribute model is to gain understanding of purchase predisposition. (p. 429)

A critical element of the multi-attribute model is the identification and application of the attributes. Wilkie and Pessemier offered several suggestions to researchers utilizing the model: "Basic criteria for specification of attribute lists require that they be exhaustive, semantically meaningful, subject to unidimensional interpretation, and reflect possible variations in choice or use contexts" (p. 429). To assure accurate representation of consumer perceptions, the definition of attributes should reflect salient perceptual dimensions of the consumer, rather than objective measures arbitrarily generated by researchers.

The appropriate number of attributes to include in the model must be considered. As Fishbein and Ajzen (1975) have pointed out, although only a few attributes may be salient to any one individual for a product, the particular set of salient attributes may vary across individuals. Wilkie and Pessemier's review of 42 studies found 10 studies which identified subsets of useful attributes. From an average of 15.2 initial attributes per study, an average subset of 4.5 attributes was found to be useful for the particular study under investigation.

The basic multi-attribute model has three major components: (1) the consumer's belief as to the extent that each attribute is provided by a product; (2) the importance of each attribute to the consumer; and (3) the overall attitude of the consumer toward a product, as determined by the sum of the products of belief and importance of each attribute.

Beliefs have been conceptualized in multi-attribute studies as representing both belief components of the Fishbein and Ajzen (1975) model: evaluation (bipolar affect) and belief strength (association probability). Operationalization of beliefs, however, favors the evaluation component.

Importance ratings allow individual respondent differences in the emphasis placed on each attribute in their attitude structures. Research findings on the efficacy of including ratings of the relative importance of each attribute in a multi-attribute model are mixed. Importance ratings were shown to improve, to have no effect, and to suppress the model's predictability by Bass and Wilkie (1973), who suggested that these discrepant findings may be a consequence of the cross-sectional nature of the studies. Cross-sectional designs assume respondent homogeneity and obscure individual differences, weakening the predictability of the model. By normalizing individual importance ratings across attributes to adjust for within-subject response variance, dramatic increases in  $r^2$  were realized; coefficients of .15 were increased to .39 after normalization ( $p \leq .001$ ). Normalization may also be applied to the attribute ratings. The normalized attribute rating of respondent  $i$  for attribute  $j$  and product  $k$  is  $B_{ijk}^* = B_{ijk} / \sum_k B_{ijk}$ . The normalized values are then substituted into the multi-attribute model.

Given the complexity and subtlety of the decision-making process described in all the models discussed, the ability of the consumer to adequately describe the importance of factors influencing his/her decision is questionable. The importance of attributes typically has been measured on a five- to seven-point bipolar scale. Some researchers have

used constant sum techniques to force variability among ratings. An alternate method of assigning importance weights to attributes has been to use multiple regression coefficients.

The relative predictability of self-reported importance weights and empirically-derived weights was investigated by Summers, Taliaferro, and Fletcher (1970). Subjects were instructed to rate the future socio-economic growth of 175 hypothetical underdeveloped nations based on four attributes of each nation provided by the investigators. Following the rating task, subjects distributed 100 points among the four attributes to reflect the relative weights of each attribute they felt they used in reaching their decisions about the growth ratings of the nations. Regression coefficients were determined by regressing subjects' actual judgments on the four attributes. The weights derived from self-rating were substantially different from the regression weights. The median correlation between actual and predicted judgments of the respondents using regression weights was .75, compared to a median correlation of .60 when self-rating weights were substituted for regression weights. The subjects' self-ratings of attribute significance predicted their judgments less well than empirically-derived regression weights.

#### Statement of Research Issues

Review of the previously discussed literature led to formation of seven research issues. These issues were addressed by surveying residential energy consumers and analyzing relationships among 12 common attributes and the implementation level of five energy conservation activities in the household. Four of the following seven issues are

stated in the form of hypotheses; hypothesis statements were not appropriate for three of the issues.

1. *Generalizability of attribute profiles*: Ratings of perceived attributes form profiles which are generalizable across similar energy conservation activities.

2. *Multiple regression models versus simple summation models*: It is hypothesized that predictions of household energy conservation activities based on a multiple regression model for combining attribute ratings will account for more activity variance than predictions based on a simple attribute summation model.

3. *Normalized attribute ratings*: It is hypothesized that accounting for within-respondent variability by normalizing attribute ratings will improve the predictability of the implementation level of household energy conservation activities as compared to the use of nontransformed attribute ratings.

4. *Attribute importance ratings*: It is hypothesized that multiplicative inclusion of general importance ratings of attributes will not improve the predictability of the level of implementation of household energy conservation activities.

5. *Attribute subsets*: A small number of attributes can account for substantial household energy conservation attribute and activity implementation variance.

6. *Monetary attributes versus nonmonetary attributes*: Prediction of energy conservation activity implementation is enhanced by consideration of both monetary and nonmonetary attribute ratings.

7. *Attribute ratings versus demographic data*: It is hypothesized

that perceived attribute ratings of energy conservation activities are better predictors of level of household implementation of energy conservation activities than personal background or household characteristics.

## CHAPTER II

### METHOD

This chapter describes the methods by which interviews were conducted with a sample of middle-class households to examine the aforementioned research issues. A brief summary of the objectives of two pilot studies and how they shaped the format of the major study is provided. The remainder of the chapter focuses on methodological considerations of the major study. Identification of the target audience and selection of middle-class households is described. Procedures for training interviewers and conducting the interviews are also described. Specification of the household member with primary responsibility for energy conservation activities is discussed. The energy conservation activities and perceived attributes which were investigated are described, as are other interview materials. Finally, the analysis of techniques which were used to address each research issue are summarized.

#### Pilot Studies

##### First Pilot Study

Although a review of the literature on diffusion of innovations and multi-attribute marketing studies suggested many potential attributes to include in the study, their applicability for household energy conservation was questionable. A pilot study, therefore, was conducted in the summer of 1976 to develop a comprehensive list of attributes relevant to energy conservation activities and particularly meaningful to the target population.

Thirteen middle-class households participated in semi-structured interviews to discuss the advantages, disadvantages, and other characteristics of 16 energy conservation activities. To avoid overburdening the respondents, only eight activities were actually discussed by any one household. Content analysis of the responses produced 16 common attributes of energy conservation activities (Table II-1). In addition, the number of appropriate energy conservation activities was reduced from 16 to 11 for inclusion in the second pilot study (Table II-2).

### Second Pilot Study

The second pilot study, in fall 1976, involved 28 middle-class household interviews (50 individual respondents). Appropriate scale values were defined for each of the 16 attributes identified from the first pilot study. Interviewers collected information on personal and household characteristics from male and female heads of household responding together (each aware of the other's response). On separate questionnaires, male and female respondents independently recorded: the level at which each activity was performed in the household; who had primary responsibility for each activity; sources of information about each activity; an evaluation of the 16 attributes for each of the 11 activities; and responses on several attitude measures.

Considerable disagreement was evident between the independent ratings of the two household respondents. For instance, there was only 73 percent agreement (16 of the 22 male-female pairings) about how many windows were in the house. The average percentage of agreement across the 11 activities concerning which of the two respondents had primary

TABLE II-1

## ATTRIBUTES OF ENERGY CONSERVATION ACTIVITIES

| Study <sup>a</sup> | Attribute and Definition                                                                                                             | Scale and Anchors <sup>b</sup> |   |                                   |   |   |   |                             |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---|-----------------------------------|---|---|---|-----------------------------|
|                    |                                                                                                                                      | 1                              | 2 | 3                                 | 4 | 5 | 6 | 7                           |
| P M                | 1. COST: How much money does it cost to do this activity?                                                                            | No Cost                        |   | Moderate Cost                     |   |   |   | Great Cost                  |
| P M                | 2. SAVINGS: How much money does this activity save the household?                                                                    | No Savings                     |   | Moderate Savings                  |   |   |   | Great Savings               |
| P M                | 3. EFFORT: How much effort is required to do this activity?                                                                          | Very Little Effort             |   | Moderate Effort                   |   |   |   | A lot of Effort             |
| P M                | 4. UNDERSTANDABILITY: How easy is it to understand how to do this activity?                                                          | Not at all Easy                |   | Moderately Easy                   |   |   |   | Very Easy                   |
| P M                | 5. COMFORT: How much does this activity affect the personal comfort of household members?                                            | Great Decrease                 |   | No Effect                         |   |   |   | Great Increase              |
| P M                | 6. CLEANLINESS: How clean is this activity?                                                                                          | Not at all Clean               |   | Moderately Clean                  |   |   |   | Very Clean                  |
| P M                | 7. COOPERATION: How much cooperation is required of household members to do this activity?                                           | No Cooperation                 |   | Moderate Amount                   |   |   |   | A Lot of Cooperation        |
| P M                | 8. OBSERVABILITY: How noticeable/observable is this activity to people who may visit the house?                                      | Not Noticeable/ Observable     |   | Moderately Noticeable/ Observable |   |   |   | Very Noticeable/ Observable |
| P M                | 9. SOCIAL OPINION: To what extent would friends and acquaintances have positive or negative opinions about your doing this activity? | Very Negative                  |   | Neutral                           |   |   |   | Very Positive               |

TABLE II-1 (Continued)

| Study <sup>a</sup> | Attributes and Definition                                                                                  | Scale and Anchors <sup>b</sup>                              |        |    |                         |    |    |                           |    |    |    |     |
|--------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|--------|----|-------------------------|----|----|---------------------------|----|----|----|-----|
|                    |                                                                                                            | 1                                                           | 2      | 3  | 4                       | 5  | 6  | 7                         |    |    |    |     |
| P M                | 10. COMMUNICATIONS: How often have you heard about this activity?                                          | Never                                                       | Before |    | Moderate Amount         |    |    | Very Often                |    |    |    |     |
| P M                | 11. ENERGY: How much would this activity conserve energy resources if everyone were to do it?              | No Energy Conservation                                      |        |    | Moderate Amount         |    |    | Great Energy Conservation |    |    |    |     |
| P M                | 12. ENVIRONMENT: How beneficial for the environment would this activity be if everyone were to do it?      | Not at All Beneficial                                       |        |    | Moderately Beneficial   |    |    | Very Beneficial           |    |    |    |     |
| P                  | 13. TIME: How much time does it take to do this activity?                                                  | Very Little Time                                            |        |    | Moderate Amount of Time |    |    | A Lot of Time             |    |    |    |     |
| P                  | 14. SAFETY: How does this activity affect the level of safety around the household?                        | Makes it Less Safe                                          |        |    | No Effect               |    |    | Makes it More Safe        |    |    |    |     |
| P                  | 15. PLEASANTNESS: How pleasant is it to do this activity?                                                  | Very Unpleasant                                             |        |    | Neutral                 |    |    | Very Pleasant             |    |    |    |     |
| P                  | 16. DIFFUSION: Approximately what percentage of the households of people you know are doing this activity? | [Ratings for this attribute were made on an 11-point scale] |        |    |                         |    |    |                           |    |    |    |     |
|                    |                                                                                                            | 0                                                           | 10     | 20 | 30                      | 40 | 50 | 60                        | 70 | 80 | 90 | 100 |
|                    |                                                                                                            | None                                                        |        |    |                         |    |    | Half                      |    |    |    | All |

<sup>a</sup>All 16 attributes were included in the second pilot study and are noted by a "P." The first 12 attributes listed were included in the major study and are noted by an "M."

<sup>b</sup>All attributes, except Diffusion, were rated on a 7-point scale from "1" representing less of the attribute to "7" representing more of the attribute.

TABLE II-2

## SELECTION OF ENERGY CONSERVATION ACTIVITIES

| Conservation Strategy  | Activities Considered in First Pilot Study                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Activities Considered in Second Pilot Study                                                                                                                                                                                                                | Activities Considered in Major Study                                                                                                      |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| I. Increase Efficiency | <ol style="list-style-type: none"> <li>1. Put in or make sure attic has 6-8 inches of insulation and is well-ventilated.</li> <li>2. Use storm windows and storm doors year round.</li> <li>3. Weatherstrip door frames.</li> <li>4. Put a brick or stoppered container in the toilet tank.</li> <li>5. Put in or make sure floor has 2 to 3-1/2 inches of insulation.</li> <li>6. Clean lint trap in clothes dryer after every load.</li> <li>7. Defrost refrigerator when frost is 1/4 inch thick and not much thicker.</li> <li>8. Make sure fireplace damper is closed when fireplace is not in use.</li> </ol> | <ol style="list-style-type: none"> <li>1. Install at least 6 inches of insulation in the attic.</li> <li>2. Use storm windows.</li> <li>3. Weatherstrip exterior door frames.</li> <li>4. Put a brick or weighted container in the toilet tank.</li> </ol> | <ol style="list-style-type: none"> <li>1. Install at least 6 inches of insulation in the attic.</li> <li>2. Use storm windows.</li> </ol> |

TABLE II-2 (Continued)

| Conservation Strategy   | Activities Considered in First Pilot Study                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Activities Considered in Second Pilot Study                                                                                                                                                                                                            | Activities Considered in Major Study                                                                                            |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| II.<br>Reduce Benefits  | <ol style="list-style-type: none"> <li>1. Lower temperature in the water heater to approximately 125°F.</li> <li>2. Use light bulbs of a lower wattage wherever possible (garage, hallways, closets).</li> <li>3. Carpool or ride a bus or bicycle to work.</li> <li>4. Wash only full loads in clothes washer.</li> <li>5. Measure the exact amount of detergent used in clothes washer.</li> <li>6. Turn on yard or outside lights only when you expect people to be outside after dark.</li> </ol> | <ol style="list-style-type: none"> <li>1. Adjust temperature setting of water heater to approximately 125°F.</li> <li>2. Use light bulbs of a lower wattage wherever possible.</li> <li>3. Carpool to work.</li> <li>4. Ride a bus to work.</li> </ol> | <ol style="list-style-type: none"> <li>1. Reduce room temperature thermostat setting at night.</li> </ol>                       |
| III.<br>Reuse Materials | <ol style="list-style-type: none"> <li>1. Buy returnable bottles.</li> <li>2. Use a compost heap to dispose of organic materials, such as food scraps, lawn clippings, leaves, etc.</li> </ol>                                                                                                                                                                                                                                                                                                        | <ol style="list-style-type: none"> <li>1. Buy beverages in returnable bottles.</li> <li>2. Save paper for recycling.</li> <li>3. Use a compost heap.</li> </ol>                                                                                        | <ol style="list-style-type: none"> <li>1. Buy beverages in returnable bottles.</li> <li>2. Save paper for recycling.</li> </ol> |

responsibility for activities was only 57 percent. These inconsistencies forced deletion of valuable data points and led to modification in the major study requiring discussion between respondents to assure agreement on household activity level and responsibility for activity.

The attribute ratings of the energy conservation activities in the second pilot study were examined for differential means, intersubject variance, and intercorrelations among themselves. Through a process of elimination and combination, 12 attributes were selected from the 16 tested. Based on the frequency of occurrence and variability of attribute ratings, the number of activities was reduced from 11 to 5 for the major study.

### Procedures

The major study was conducted during spring, summer, and fall 1977. A sample of 126 households was interviewed to assess male and female head of household perceptions of a set of 12 attributes for five energy conservation activities. In addition, personal and household characteristics, and personality and attitude measures were obtained. The remainder of this section describes in detail the procedures used to implement the major study.

### Target Population

The target population for the major study was male and female heads of middle-class households residing in single-unit dwellings in Knoxville, Tennessee. A middle-class population was specified because of its disproportionate impact, as a group, on energy demand and its potential for

affecting significant contributions to energy conservation programs. Residents of single-unit dwellings were selected in preference to multiple-unit dwellers because they were more likely to be personally responsible for the operation and maintenance of their residences, especially if they owned the structures. Since both male and female heads of household (typically, husband and wife) often share responsibility for implementing activities, input from both the male and female heads of household was necessary for a comprehensive analysis of household energy conservation activities. Restricting the population to Knoxville, Tennessee, served to provide a reasonable area within which a representative sample could be selected.

#### Household Sampling Method

Middle-class households were selected by multistage cluster sampling using family income and property values to define clusters. The most current available U.S. Census data (1970) were used to identify tracts with median incomes for families and unrelated individuals above Knoxville's median (\$5,214). Fifteen of Knoxville's 55 census tracts (27 percent) met this sampling requirement. Within each of the 15 tracts, blocks with mean property values above Knoxville's mean (\$14,300) were listed and, by systematic sampling of every fifth block, individual blocks were chosen. These blocks were located in the Knoxville City Directory and addresses indicating apartments or business establishments were removed, as were households which had recently changed addresses. Specific households were selected by systematic sampling of every third qualified address within each chosen block.

Pilot data had indicated that the percentage of occurrence of the conservation activities ranged from about 40 percent to 80 percent. Employing a variance estimate of .5 ( $PQ = .25$ ), confidence limits of .95, and .10 precision, a minimum completed sample size of 100 households was necessary (Cochran, 1963). Completed interviews were ultimately obtained from 126 households, resulting in confidence limits of  $.50 \pm .0916$ .

#### Data Collection Methods

Selected households were mailed letters introducing the project and requesting their cooperation with the interviews. Within two weeks, an interviewer contacted each household by telephone to arrange a convenient time to interview both the male head and female head of each household.

Ten undergraduate students enrolled for course credit in field research at The University of Tennessee, Knoxville, were trained to serve as interviewers. Training procedures described below were repeated for three sets of interviewers: two interviewers during Spring Quarter 1977; three interviewers during Summer Quarter 1977; and five interviewers during Fall Quarter 1977.

During the first meeting between the investigator and interviewers, the nature of the project was explained, interview materials were distributed, and a reading assignment was made. Each interviewer was required to read an elementary text describing interview procedures (Adams, 1959). Each interviewer was assigned one of the 15 selected census tracts in which to conduct interviews. Each tract was assigned only once during the project to ensure that households would not be

contacted by more than one interviewer.

In a subsequent meeting, after interviewers had studied the interview material and had passed a written examination on the reading assignment, the investigator conducted a mock interview with each interviewer group. Items which may have caused confusion within a household were pointed out and issues raised by the interviewers were clarified. The investigator accompanied each interviewer on his/her first household interview to be certain that the interview was properly conducted and to relieve interviewer anxiety.

Prior to each interview, the household respondent(s) read and signed a consent form advising them of the research nature of the project and assuring them of confidentiality. The interview session lasted about an hour. During the first half of the interview, verbal responses were collected from both male and female respondents regarding demographic background, household characteristics, and level of implementation of specific energy conservation activities. In the second half of each interview session, respondents independently rated the general importance of each attribute for decision-making in the home and completed separate questionnaires relating each of 12 attributes to each of five activities (60 ratings per respondent). Measures were obtained of psychological locus of control (Rotter, 1966), attitudes toward environmental quality (Lounsbury & Tornatzky, 1977), and perceived quality of personal life (using an amended version of Cantril's [1965] self-anchoring life ladder scale). Table II-3 summarizes the interview format. Copies of the interview forms are presented in Appendix A.

TABLE II-3

## STRUCTURED INTERVIEW FORMAT IN ORDER OF PRESENTATION

| Type of Information                                     | Data Collection Technique                                                        |
|---------------------------------------------------------|----------------------------------------------------------------------------------|
| I. Personal background                                  | Interview discussion (J) <sup>a</sup>                                            |
| II. Household characteristics                           | Interview discussion (J)                                                         |
| III. Energy conservation activities                     |                                                                                  |
| Primary responsibility                                  | Interview discussion (J)                                                         |
| Level of implementation                                 | Interview discussion (J)                                                         |
| Level of effort                                         | Interview discussion (J)                                                         |
| IV. Overall energy conservation effort and satisfaction | 7-point rating scale (I) <sup>a</sup>                                            |
| V. General importance of attributes                     | Q-sort procedure (I)                                                             |
| VI. Attribute ratings                                   |                                                                                  |
| Sources of information                                  | Checklist (I)                                                                    |
| Activity-specific attribute ratings                     | 7-point rating scale (I)                                                         |
| VII. Personality and attitudinal measures <sup>b</sup>  |                                                                                  |
| Locus of control                                        | Short form of Locus of Control scale (Rotter, 1966) (I)                          |
| Attitudes toward environmental quality                  | Amended version of Environmental Quality Scale (Lounsbury & Tornatzky, 1977) (I) |
| Quality of personal life                                | Amended version of self-anchoring life ladder scale (Cantril, 1965) (I)          |

<sup>a</sup>Data collected jointly from the male and female respondents where interaction was permitted to achieve consensus are noted by a "J." Data collected independently from the male and female respondents on separate questionnaires without interaction are noted by an "I."

<sup>b</sup>Analyses of personality and attitudinal measures were not included in the present investigation.

### Household Primary Decision-maker

The household member with primary responsibility for implementing an activity or purchasing a product occupies a critical role in the analysis of consumer behavior (Davis & Rigaux, 1974; Ferber, 1973; Foote, 1961). Often the female homemaker is the subject in consumer studies because of her assumed role as the household member with primary responsibility for product purchases. It is her perceptions of product attributes which are used to shape advertising campaigns and packaging designs. Presumably, when information regarding a product or activity is brought into the household by whatever means--mail, electronic media, friends--that information is routed to the person in the household who has (or would have) primary responsibility for decisions regarding the product or activity. Though that person is often the female homemaker for product purchase decisions, responsibility for implementing some energy conservation activities may be assumed by the male household head. In situations where more than one household member has responsibility, the information is likely to be shared. It is recognized that the person with primary responsibility for implementing an activity may not necessarily be the person responsible for making decisions regarding whether or not to do the activity. For the purpose of this study, however, the distinction between the person with primary responsibility for decision-making and implementation was not finely drawn; the two roles were assumed to rest with the same household member.

Data collected during the interview were used to identify the primary decision-maker for each of the five energy conservation activities

in each of the 126 households. Owing to discrepancies between independent responses by male and female in the second pilot study, respondents were required to reach consensus during the interview regarding who had primary responsibility for each activity. If an activity was not being performed in the household, the person who would have responsibility was determined.

Rather than assuming *a priori* the household member with primary responsibility for each activity, attribute ratings from situation-specific decision-makers were used as independent variables to predict household level of each energy conservation activity. The specification of household primary decision-maker for each activity reduced errors of model application which otherwise would have resulted from inappropriate selection of primary decision-maker.

Another reason for using only the primary decision-maker's attribute ratings for predicting activity level was more related to statistical design. The number of independent variables (attributes) in regression analyses using both male and female attribute ratings is twice the number which would be used if only the primary decision-maker's ratings were used (24 versus 12). The effect of an increase of predictor variables in the regression analyses would have been compounded by a decrease in valid cases. The number of cases upon which regression analyses are properly computed is based on a listwise deletion of missing data. In listwise deletion, if any one of the variables to be included in the analyses is missing, the entire case is deleted. Thus, if any one of the 24 attribute ratings for a household was missing, the entire household would be deleted from the regression analysis. As

a result of a larger number of independent variables and a corresponding reduction in the number of valid cases, the ratio of valid cases to independent variables would be unacceptably low and lead to spuriously high multiple regression coefficients.

The situation-specific primary decision-maker was operationalized as follows:

1. If the primary decision-maker for activity  $k$  in household  $i$  was the male, only his attribute ratings were used in analyses related to that activity.
2. If the primary decision-maker for activity  $k$  in household  $i$  was the female, only her attribute ratings were used in analyses related to that activity.
3. If the primary decision-maker for activity  $k$  in household  $i$  was a role shared by both male and female, the average response of the two was used in analyses related to that activity.
4. If the primary decision-maker for activity  $k$  in household  $i$  was someone besides the male or female, the household was removed from the analysis for that activity.
5. If the respondent lived alone, that individual was considered the primary decision-maker unless the respondent indicated that someone outside the household was responsible, in which case the household was removed from the analysis for that activity.

### Measures

#### Personal Background and Household Characteristics

A variety of personal and household characteristics, suggested in

the literature to relate to energy conservation behavior, were collected through verbal responses by male and female respondents during each interview. Personal characteristics included: age, education, number of magazines or periodicals read by each respondent, number of clubs or organizations in which each respondent was an active member, and occupation. Some of the household characteristics recorded were: size of house in square feet; value of property; gross income of the household members; type of heating equipment; how many of each of 20 listed appliances were used by the household; children in household; and automobiles used by household members. The complete set of personal and household characteristics is included in the survey materials in Appendix A.

#### Energy Conservation Activities

Five energy conservation activities were investigated: install at least six inches of insulation in the attic; install storm windows; reduce room temperature thermostat setting at night; buy beverages in returnable bottles; and save paper for recycling. The activities selected represent samples of three strategies for conserving energy: (I) increase efficiency; (II) reduce benefits; and (III) reuse materials.

The first strategy involves using energy more efficiently by installing relatively permanent equipment (attic insulation and storm windows). Initial capital expenses are required, but once performed, these one-time activities conserve energy with little effect on the benefits of energy use and without requiring continued attention by the consumer.

The second strategy demands periodic input by the consumer to achieve energy conservation at the expense of some of the benefits of energy use.

The activity selected to represent this strategy was to reduce room temperature thermostat setting at night. Periodic input by the consumer for this particular activity can be eliminated by the installation of a clock thermostat which automatically adjusts thermostat settings at pre-determined times. The clock thermostat innovation, however, is fairly new and has not been widely diffused in the population. For most respondents, periodic manual adjustment was necessary to set back room thermostats.

The third strategy involves reducing the energy demand of new consumer goods by reusing materials. The purchase of beverages in returnable bottles and saving paper for recycling are representative of this strategy. Continued effort is required of the consumer and the result of energy conservation is not readily apparent. In effect, the consumer is providing an impetus for someone else (the manufacturer or producer) to conserve energy.

The impact of these conservation actions can be considerable. Delene and Gaston (1976) computed energy saving potentials for three activities in Knoxville, Tennessee. Adding six inches of attic insulation in an average home heated by electrical resistance units can annually save 14,366 kilowatt hours or about \$217 (in 1975 dollars). Installing storm windows can annually save 6,052 kilowatt hours or about \$91 (1975 dollars). Lowering daytime and nighttime thermostat heating settings from 74°F to 68°F can reduce consumption by about \$105 (1975 dollars) annually. The energy saving potential of each activity considered independently, however, may be misleading. The reduction in energy use by implementing activities is not a simple

cumulative function; the impact of each activity interacts with other activities and household variables in a highly complex manner. In addition, climatic variations often disguise the effect of conservation activities. Further discussion of issues involved in the measurement of residential energy consumption is provided by Hirst (1979) and Office of Energy Use (1978).

The use of returnable beverage containers has become mandatory in several states, notably Michigan, Oregon, and Vermont. The difference in energy requirements between producing one-way disposable containers and round-trip returnable containers is substantial. In Michigan, refillable bottles averaged 15 trips and made a much smaller energy demand per trip than one-way containers (Porter, 1978). Porter estimated that energy savings from container production alone which could result from a mandatory deposit on beverage containers in Michigan was 12.67 trillion Btu's. This figure does not include energy savings which could result from reduced need for litter collection and solid waste treatment.

Paper recycling, like container reuse, reduces energy use primarily in the production process. Scudder (1976) pointed out that "it takes the energy of a pound of coal to make a pound of standard newsprint" (p. 26). However, about 25 percent less energy is required to manufacture a pound of recycled newsprint than is required to manufacture a pound of standard newsprint from trees. Assuming a coal energy equivalent of 12,000 Btu's per pound, a pound of recycled newsprint represents an energy savings of 3,000 Btu's. Besides reducing energy use for paper production, paper recycling would also reduce energy used in paper disposal since about 44 percent of dry residential wastes are paper (Americans for Energy Independence, 1977).

Each of the five energy conservation activities met the following four criteria before being selected:

1. Household members in the population were generally capable of doing each activity without outside assistance.
2. Each activity was a viable option in most households. For instance, paper recycling was acceptable because an aggressive paper recycling project was being conducted by a large university in the Knoxville area at the time of the interview.
3. Each activity was fairly common within the population, so respondents would have heard about each activity prior to the interview and would have had the opportunity to accumulate beliefs and make a choice regarding activity implementation.
4. A convenient measure of the level of household implementation of each activity was available.

The interview questions used to assess each activity and the operational measures of household implementation are displayed in Table II-4.

#### Perceived Attributes of Energy Conservation Activities

Given the central role of attribute ratings in multi-attribute models, it is important to review how the 12 specific attributes were selected. Based on a content analysis of advantages and disadvantages of energy conservation activities identified by interviews in the first pilot study, and a review of relevant literature, a list of 30 attributes was produced. This list was reviewed by the investigator for appropriateness to residential energy conservation activities, redundancy, likelihood of eliciting variance among respondents and among activities, and

TABLE II-4

## OPERATIONALIZATION OF IMPLEMENTATION LEVEL OF ENERGY CONSERVATION ACTIVITIES

| Activity and Interview Item(s)                                                                                                    | Operationalization <sup>a</sup>                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| I. INSULATE ATTIC: How many inches of insulation are <i>currently</i> in the attic?                                               | 1 = none<br>2 = less than 2 inches<br>3 = 2 to 3.9 inches<br>4 = 4 to 5.9 inches<br>5 = 6 to 7.9 inches<br>6 = 8 to 9.9 inches<br>7 = 10 or more inches<br>9 = missing or don't know                               |
| II. STORM WINDOWS: The following two items were required to operationalize the implementation level of the storm window activity: | Item B was divided by Item A to compute the percentage of storm windows on the house at the time of the interview.                                                                                                 |
| A. How many exterior windows are in the house?<br>(Enter exact number)                                                            |                                                                                                                                                                                                                    |
| B. How many of the exterior windows in the house currently have storm windows? (exact number).                                    |                                                                                                                                                                                                                    |
| III. THERMOSTAT SETBACK: How many degrees Fahrenheit are the household temperature control thermostat(s) set back at night?       | 1 = do not set back thermostat(s) at night<br>2 = 1 to 2 degrees<br>3 = 3 to 4 degrees<br>4 = 5 to 6 degrees<br>5 = 7 to 8 degrees<br>6 = 9 to 10 degrees<br>7 = more than 10 degrees<br>9 = missing or don't know |

TABLE II-4 (Continued)

| Activity and Interview Item(s)                                                                                            | Operationalization <sup>a</sup>                                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IV. RETURNABLE BOTTLES: How often does the household purchase beverages in returnable bottles, as opposed to disposables? | 1 = only buy disposables<br>2 = mostly disposables, but occasionally some returnables<br>3 = slightly more disposables<br>4 = about equal amounts of disposables and returnables<br>5 = slightly more returnables<br>6 = mostly returnables, but occasionally some disposables<br>7 = only buy returnables<br>9 = missing or don't know |
| V. PAPER RECYCLING: How much paper does the household save for recycling?                                                 | 1 = none<br>2 = very little<br>3 = a moderate amount<br>4 = quite a lot<br>5 = all<br>9 = missing or don't know                                                                                                                                                                                                                         |

<sup>a</sup>Some scales were recoded from the actual values on the interview form (Appendix A).

potential salience to the target population.

Sixteen attributes together with their definition, scale, and scale anchors were presented in Table II-1 (page 27). Attribute-specific scale anchors were defined for each attribute on a 7-point scale from 1 to 7 (except a Diffusion attribute which was scaled as a percentage from 0 to 100). The low end of each scale represented less of the attribute; the high end of the scale represented more of the attribute. In the second pilot study, each of the 16 attributes was rated for 11 energy conservation activities (176 scale responses per respondent). The attribute ratings were examined for intersubject variance, differences in activity means, and intercorrelations among attributes. Through a process of elimination and combination, 12 attributes were defined for use in the major study.

#### Importance Ratings of Attributes

The importance of each attribute to the respondents' general household decision-making processes was assessed by a Q-sort procedure (Kerlinger, 1964). The Q-sort technique was chosen to protect against a leniency bias and concomitant reduction of variance among attribute importance ratings.

Both male and female respondents were given a deck of 12 cards, each card with an attribute and definition printed on it (e.g., "COST: How much money it costs to do the activity"). Respondents independently sorted the 12 cards into four piles representing the general level of importance placed on each attribute when making decisions regarding activities around the house. Two attribute cards were permitted in the

first pile (least important), four cards each in the second and third piles, and two cards in the fourth pile (most important). The sorting procedure was accomplished just once, without reference to any particular activity.

### Personality and Attitudinal Measures

Responses to three instruments were collected from each respondent. Each instrument is presented in Appendix A. The first was the short (11-item) form of the Locus of Control Scale (Rotter, 1966). The Locus of Control Scale is a measure of the degree to which respondents feel they have control over their environment as opposed to trusting to luck. The second measure was a modified version of a scale for assessing attitudes toward environmental quality (Lounsbury & Tornatzky, 1977). The third measure was Cantril's three-item self-anchoring life ladder scale (1965). These three measures were not analyzed for use in the present study.

### Analysis Techniques

#### Models

To facilitate discussion of analysis techniques used to address the research issues described in the first chapter, six data analysis models are described. All six models included, as a principal component, the attribute ratings of each household's primary decision-maker for each energy conservation activity. The models differed in the format of the attribute ratings and the manner in which the attribute ratings were combined. The six models, and the symbols used to abbreviate them, are summarized in Table II-5.

TABLE II-5

## SUMMARY TABLE OF SYMBOLS FOR ATTRIBUTE ANALYSIS MODELS

| Format of Predictor Variables                                                                              | Method of Combining Predictor Variables |                     |
|------------------------------------------------------------------------------------------------------------|-----------------------------------------|---------------------|
|                                                                                                            | A. Regression Weights                   | B. Simple Summation |
| 1. Attribute rating of primary decision-maker                                                              | P                                       | SP                  |
| 2. Normalized attribute rating of primary decision-maker                                                   | NP                                      | SNP                 |
| 3. Attribute rating of primary decision-maker times general attribute importance of primary decision-maker | PI                                      | SPI                 |

Basic attribute model. The basic predictor variables ( $p$ ) in each model were the primary decision-maker's 12-attribute ratings (on their respective 7-point scales) of each energy conservation activity. These attribute ratings were combined by either linear regression weights or simple summation to predict the level of implementation of each energy conservation activity. In algebraic notation, the regression model (P) took the form:

$$P_{ik} = c_k + \sum_{j=1}^{12} w_{jk} p_{ijk} \quad (1)$$

where  $P_{ik}$  = the predicted level of implementation of activity  $k$  by household  $i$  using the P model;

$c_k$  = the regression constant for activity  $k$ ;

$w_{jk}$  = the regression weight of attribute  $j$  for predicting activity  $k$ ; and

$p_{ijk}$  = the rating of attribute  $j$  by the primary decision-maker of household  $i$  for activity  $k$ .

In contrast to the regression model, the summated model (SP) took the following algebraic form:

$$SP_{ik} = \sum_{j=1}^{12} p_{ijk} \quad (2)$$

where  $SP_{ik}$  = the predicted level of implementation of activity  $k$  by household  $i$  using the SP model; and

$p_{ijk}$  = the same as defined for Equation (1).

Normalized attribute model. The normalized attribute model (NP), as suggested by Bass and Wilkie (1973), accounted for within-respondent use of attribute rating scales across activities. The predictor

variables ( $p_{ijk}$ ) in the two previously defined models were replaced by transformed attribute ratings created in the following manner: the primary decision-maker's rating of attribute  $j$  for activity  $k$  was divided by the sum of that respondent's ratings assigned to attribute  $j$  for all five activities. Thus, the proportion of the total attribute scale ratings, across all five activities, assigned to attribute  $j$  served as the predictor variable for activity  $k$ . Algebraically, the predictor variable for the NP model took the form:

$$(np)_{ijk} = p_{ijk} / \sum_{k=1}^5 s_{ijk} \quad (3)$$

where  $(np)_{ijk}$  = the normalized rating of attribute  $j$  for household  $i$  and activity  $k$ ; and

$\sum_{k=1}^5 s_{ijk}$  = the sum of attribute ratings, across the five activities, of the person(s) who was primary decision-maker for the activity being predicted; and

$p_{ijk}$  = the same as defined for Equation (1).

Substitution of the np predictor variables into the regression and sum-mated models in Equations (1) and (2) gives:

$$NP_{ik} = c_k + \sum_{j=1}^{12} w_{jk} (np)_{ijk} \quad (4)$$

and

$$SNP_{ik} = \sum_{j=1}^{12} (np)_{ijk} \quad (5)$$

respectively.

Importance-weighted attribute model. The importance-weighted attribute model (PI) introduced a measure of the primary decision-maker's

perceived general importance of each attribute to the basic predictor variable. The importance rating of attribute  $j$ , as defined by the four-point Q-sort procedure, was multiplied by the seven-point scale rating of attribute  $j$ . This new variable  $(pi)$  was used to predict the level of activity  $k$  by both the regression and summated models. The predictor variable for the importance-weighted attribute model was stated algebraically as follows:

$$(pi)_{ijk} = p_{ijk} i_{ij} \quad (6)$$

where  $(pi)_{ijk}$  = the importance-weighted rating of attribute  $j$  for the primary decision-maker of household  $i$  for activity  $k$ ;

$i_{ij}$  = the general importance rating by the primary decision-maker of household  $i$  for attribute  $j$  using the four-point Q-sort rating; and

$p_{ijk}$  = the same as defined for Equation (1).

Substituting the  $pi$  predictor variables into the regression and summated models in Equations (1) and (2) gives:

$$PI_{ik} = c_k + \sum_{j=1}^{12} w_{jk} (pi)_{ijk} \quad (7)$$

and

$$SPI_{ik} = \sum_{j=1}^{12} (pi)_{ijk} \quad (8)$$

respectively.

### Research Issues

The analysis techniques used to address each of the seven research issues are briefly described in this section.

1. *Generalizability of attribute profiles.* The attribute ratings of the household primary decision-maker for each activity were compared across activities to identify similar attribute rating profiles and to provide a description of each activity relative to other activities.

2. *Multiple regression models versus simple summation models.* This research issue was addressed by examining correlations between actual and predicted level of household implementation using regression weights to combine attribute ratings (models P, NP, and PI) and using simple summation of attribute ratings (models SP, SNP, and SPI). Referring to Table II-5 (page 47), correlation coefficients from Column A models were compared to coefficients from Column B models.

3. *Normalized attribute ratings.* Regression equations derived from the NP model were compared to equations from the P model to examine this research issue.

4. *Attribute importance ratings.* Multiple regression equations derived from the PI model were compared to equations from the P model to examine this research issue.

5. *Attribute subsets.* Two independent techniques were used to isolate subsets of attributes for each activity. A factor analytic procedure was used to examine the interrelationships among the household primary decision-maker's attribute ratings. Separate factor analyses were conducted for each of the five energy conservation activities. A stepwise multiple regression approach was used to identify a subset of attributes which best predicted each energy conservation activity.

6. *Monetary attributes versus nonmonetary attributes.* The contribution of monetary and nonmonetary attributes to multiple regression

equations using both the full 12-attribute set and subsets derived from stepwise regression were examined to address this research issue.

7. *Attribute ratings versus demographic data.* Stepwise regression equations using attribute ratings were compared to stepwise regression equations using personal and household data as predictors.

## CHAPTER III

### RESULTS

Results of the study are of two types: (1) analysis of responses to the survey and (2) analysis of the research issues. The survey responses are analyzed according to the characteristics of the completed sample, identity of the primary decision-makers for the energy-conservation activities, degree of implementation of the activities, and importance of activity attributes in decision-making. The seven research issues are analyzed in terms of survey results and proposed multi-attribute predictive behavior models.

#### Responses to Survey Items

The study's sample consisted of 126 completed household interviews. One hundred interviews included both male and female heads of household; 11 were with males only and 15 were with females only, for a total of 226 individual respondents (111 males and 115 females).

#### Characteristics of the Completed Sample

Demographic information and characteristics of the home were collected during each interview. A detailed breakdown of each interview item is presented in Appendix B. A summary of characteristics of the completed sample is presented below.

All 226 respondents were Caucasian. Slightly more than half were born in Tennessee and the average respondent's age was about 50. College

degrees had been earned by 69 percent of male respondents and 48 percent of female respondents. Most males (51 percent) were employed full-time in professional, technical, or managerial positions. Many females were employed full-time (28 percent) or part-time (12 percent), but the majority considered themselves homemakers (55 percent). The modal household gross income was in a range from \$20,000 to \$24,999. Respondents, on the average, read three magazines or periodicals on a regular basis and were active members in at least one club, society, or organization.

The average number of years that respondents had lived in Knoxville was approximately 30 years, while the average number of years respondents had lived at the address occupied at the time of the survey was 14 years. In virtually every case (98 percent), the respondents owned the home. Over half of the homes (57 percent) were smaller than 2,500 square feet, with a modal value (including lot) in a range from \$30,000 to \$39,999. The primary energy source used to heat the house was electricity (70 percent), and the primary heating equipment was ceil heat (37 percent) and warm air furnace (30 percent). The most common household appliances and the average number per household were: color televisions (1.19), gas-powered lawn mowers (1.02), automatic washing machines (.99), electric stoves (.98), electric clothes dryers (.93), and frost-free refrigerators (.90).

All households owned at least one automobile. The average age of the newest automobile owned by the 126 households was 2.7 years. Most of the newest model automobiles (63 percent) were midsize or large models. The average miles per gallon of all newest automobiles was 16.1, with

77 percent of households monitoring their gasoline consumption.

#### Primary Decision-Makers for Activities

Responsibility for energy conservation activities was not uniformly assumed by any one household member; primary decision-makers varied across both activities and households (Table III-1). The pattern of responsibility was consistent within type of energy conservation strategy. Males tended to be most often responsible for one-time activities which increase efficiency (attic insulation and storm windows); females were responsible for reusing materials (bottles and paper). Responsibility for reducing energy consumption by setting back thermostats was less clear-cut but tended to be a joint activity for the household members. It is worth noting that the two activities which require permanent installation of equipment (insulation and storm windows) were delegated to someone outside the household more often than the two other types of activities.

#### Energy Conservation Activities

The degree to which the five energy conservation activities were being implemented in the surveyed households was fairly well distributed over the range of response alternatives on the questionnaire (Appendix C). This even distribution was expected; the questions and response alternatives had been refined through extensive review and pilot testing. Each household was asked two types of questions about each activity: (1) how much the activity was currently being done in the household; and (2) how much of a role household members had in having it done.

Ten percent of households did not know how many inches of insulation

TABLE III-1  
PERSON IN HOUSEHOLD WITH PRIMARY RESPONSIBILITY  
FOR EACH ENERGY CONSERVATION ACTIVITY

| Activity           | Proportion of Households |        |      |       |
|--------------------|--------------------------|--------|------|-------|
|                    | Male                     | Female | Both | Other |
| Insulate Attic     | .57                      | .09    | .19  | .15   |
| Storm Windows      | .65                      | .11    | .13  | .12   |
| Thermostat Setback | .22                      | .37    | .40  | .01   |
| Returnable Bottles | .10                      | .78    | .10  | .02   |
| Save Paper         | .12                      | .55    | .28  | .06   |

Note: All proportions were computed with a sample size of 126 households.

were in their attics. Among households aware of the amount of insulation in their attics, just over half had six or more inches of attic insulation. Many households took an active role in having attic insulation installed; 32 percent indicated they were responsible for at least some insulation installed in their attics.

The number of exterior windows in the surveyed households ranged from 5 to 30 and averaged 15.4 windows. There were no storm windows in 61 households (48 percent). In the entire sample, the average number of storm windows was 6.6. However, among the 65 households which did have some storm windows, the average number was 12.7.

The criterion variable for prediction of the storm window activity was the proportion of exterior windows in a household which had storm windows. The average proportion of storm windows in households was .402; the standard deviation was .454.

Over half of the households (57 percent) set back thermostats at night. The modal range for setback was three to six degrees. Most households (57 percent) had one central thermostat unit; 28 percent had six or more thermostat units in the household, suggesting separate room controls.

Reported consumption of beverages, which are available in returnable bottles, was somewhat low to very low for 70 percent of households. There was a moderate preference (66 percent) for returnable bottles over disposables.

The volume of paper used by households was generally reported as quite a lot or a moderate amount (73 percent). Saving paper for recycling was done to some extent by 60 percent of the surveyed households. Among

the 60 percent of households which do save paper, over half save quite a lot or all of the paper used by the household.

A description of household implementation levels begs an examination of the interrelationships among activities within a household. A correlation matrix was prepared among the five activity criterion measures (Table III-2). None of the ten correlations was found to be significant. Even within the three conservation strategies, the level at which a household implemented an activity was uncorrelated with implementation levels of other activities.

#### Rated Importance of Attributes

A Q-sort procedure was used to assess the general importance of each of the 12 attributes for making general household decisions. The Q-sort procedure forced an even distribution of importance ratings throughout a four-point scale range and eliminated leniency bias in the data.

The three most important attributes for making general household decisions were (in order of rated importance): monetary savings; monetary costs; and the effect on the personal comfort of household members (Table III-3). The mean importance ratings for male respondents and for female respondents were rank-ordered and a highly significant Spearman rank-order correlation was obtained ( $\rho = .99, p < .001$ ). Within a population of middle-class males and females, the relative self-reported importance of attributes for making household decisions was practically identical between sexes.

The strong relationship between male and female attribute importance

TABLE III-2  
CORRELATIONS AMONG LEVELS OF HOUSEHOLD IMPLEMENTATION  
OF ENERGY CONSERVATION ACTIVITIES

| Activity           | Activity          |                  |                       |                       |               |
|--------------------|-------------------|------------------|-----------------------|-----------------------|---------------|
|                    | Insulate<br>Attic | Storm<br>Windows | Thermostat<br>Setback | Returnable<br>Bottles | Save<br>Paper |
| Insulate Attic     | 1.00              |                  |                       |                       |               |
| Storm Windows      | .10               | 1.00             |                       |                       |               |
| Thermostat Setback | .05               | -.06             | 1.00                  |                       |               |
| Returnable Bottles | .11               | .04              | -.03                  | 1.00                  |               |
| Save Paper         | -.15              | .05              | .12                   | .03                   | 1.00          |

Note: All correlations were computed with a sample size of 105. Missing and "don't know" responses were removed prior to computing correlations. None of the correlation coefficients were significant at  $p < .05$ .

TABLE III-3  
RELATIONSHIP OF MALE AND FEMALE ATTRIBUTE  
IMPORTANCE RATINGS

| Attribute         | Male <sup>a</sup> |     |                   | Female <sup>a</sup> |     |                   | Within-household<br>Correlation <sup>c</sup> |
|-------------------|-------------------|-----|-------------------|---------------------|-----|-------------------|----------------------------------------------|
|                   | Mean              | SD  | Rank <sup>b</sup> | Mean                | SD  | Rank <sup>b</sup> |                                              |
| Cost              | 3.18              | .94 | 2                 | 3.08                | .88 | 2                 | <u>.24</u>                                   |
| Savings           | 3.24              | .86 | 1                 | 3.39                | .67 | 1                 | <u>.32</u>                                   |
| Effort            | 2.34              | .88 | 8                 | 2.21                | .74 | 9                 | .11                                          |
| Understandability | 2.24              | .80 | 9                 | 2.34                | .75 | 8                 | .13                                          |
| Comfort           | 3.05              | .82 | 3                 | 2.99                | .85 | 3                 | .12                                          |
| Cleanliness       | 2.52              | .75 | 7                 | 2.55                | .78 | 7                 | .09                                          |
| Cooperation       | 2.61              | .85 | 6                 | 2.56                | .75 | 6                 | -.06                                         |
| Observability     | 1.73              | .76 | 11                | 1.76                | .81 | 11                | .03                                          |
| Social Opinion    | 1.51              | .67 | 12                | 1.38                | .62 | 12                | -.11                                         |
| Communications    | 1.99              | .82 | 10                | 1.98                | .79 | 10                | .06                                          |
| Energy            | 2.92              | .82 | 4                 | 2.89                | .83 | 4                 | -.04                                         |
| Environment       | 2.75              | .72 | 5                 | 2.86                | .82 | 5                 | .05                                          |

Note: Attribute importance ratings were assessed independently by male and female respondents using a 0-sort procedure allowing two attributes a value of 1 (least important), four attributes a value of 2, four attributes a value of 3, and two attributes a value of 4 (most important).

<sup>a</sup>The mean attribute importance rating was computed separately for males and females, but each analysis was based on a sample size of 85.

<sup>b</sup>The mean attribute importance ratings by male and female respondents were rank-ordered. The Spearman rank-order correlation of the two sets of ranks was .99, significant at  $p < .01$ .

<sup>c</sup>Due to missing values, the within-household correlations of male and female attribute importance ratings were based on a sample size of 73. Coefficients significant at  $p < .05$  are underlined.

ratings, however, was not apparent *within* a household. Correlations between male and female attribute importance ratings (on the original four-point scale) within the same household were quite low. Only two of 12 attribute importance correlations between male and female respondents were significant ( $p < .05$ ). The two attributes which were significantly correlated were monetary savings and monetary costs--the two most important rated attributes in the population (see Table III-3).

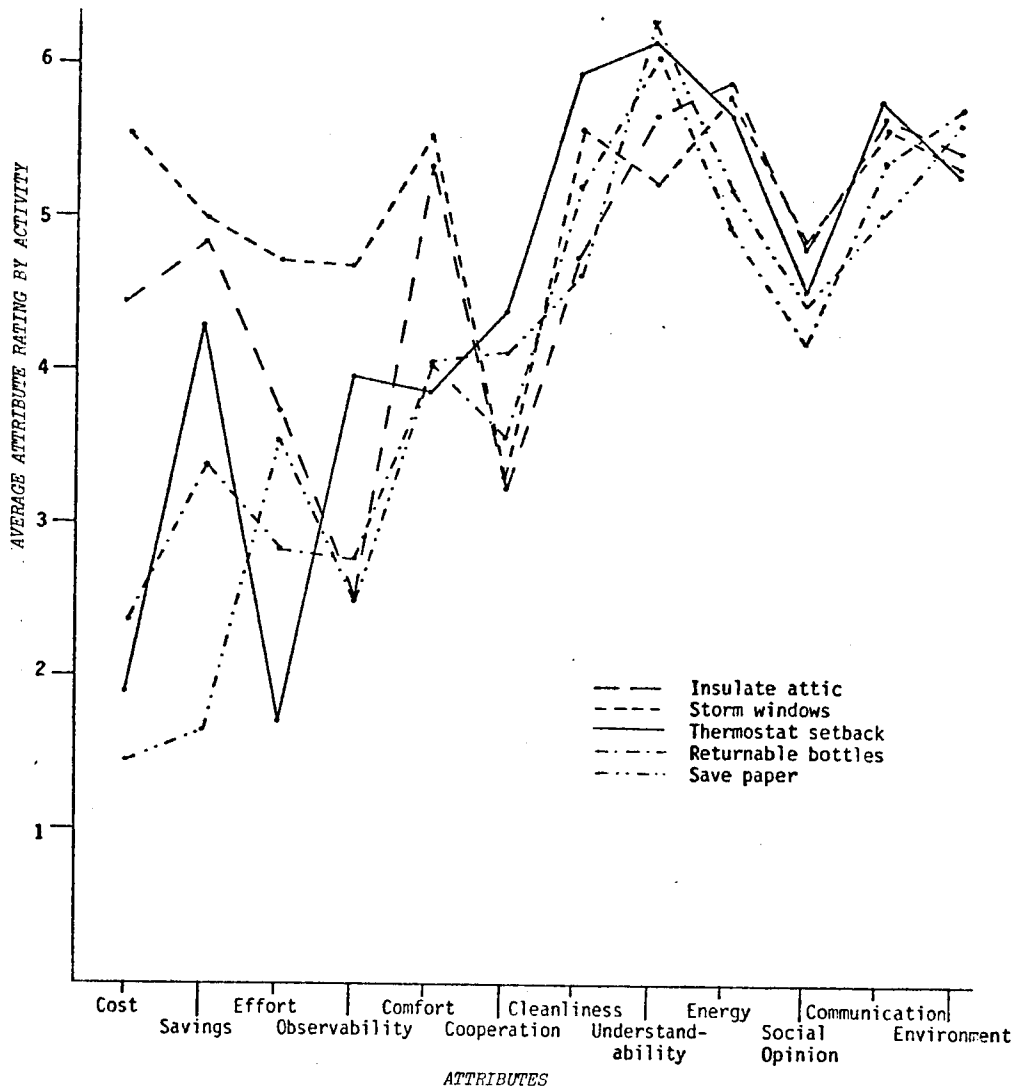
### Analysis of Research Issues

Survey results relevant to each research issue are described. Research issue headings are numbered for convenient reference to previous discussions.

#### 1. Generalizability of Attribute Ratings

Attribute rating patterns were examined both across the five activities and within each activity. Ratings which indicated grouping of activities by the three types of activities (increase efficiency, reduce benefits, and reuse materials) are discussed. Particularly notable ratings of individual activities are identified.

The average ratings of the primary household decision-maker for each activity are displayed in Figure III-1. Means and standard deviations are presented in Table III-4. Attribute ratings of each activity were made independently on a seven-point scale. Respondents, for example, did not directly compare the cost of attic insulation with the cost of storm windows. The ratings of each of the 12 attributes will be discussed in the order presented in Figure III-1.



Note: The mean and standard deviation of each attribute for each energy conservation activity is displayed in Table III-4.

FIGURE III-1

AVERAGE ATTRIBUTE RATING OF HOUSEHOLD PRIMARY DECISION-MAKERS  
FOR EACH ENERGY CONSERVATION ACTIVITY

TABLE III-4  
ATTRIBUTE RATINGS OF HOUSEHOLD PRIMARY DECISION-MAKERS  
FOR EACH ENERGY CONSERVATION ACTIVITY

| Attribute <sup>a</sup> | Energy Conservation Activity |      |                            |      |                                 |      |                                 |      |                         |      |
|------------------------|------------------------------|------|----------------------------|------|---------------------------------|------|---------------------------------|------|-------------------------|------|
|                        | Insulate Attic<br>(n = 100)  |      | Storm Windows<br>(n = 106) |      | Thermostat Setback<br>(n = 113) |      | Returnable Bottles<br>(n = 113) |      | Save Paper<br>(n = 109) |      |
|                        | Mean                         | SD   | Mean                       | SD   | Mean                            | SD   | Mean                            | SD   | Mean                    | SD   |
| Cost                   | 4.45                         | .90  | 5.58                       | .97  | 1.89                            | 1.36 | 2.36                            | 1.53 | 1.50                    | .99  |
| Savings                | 4.83                         | 1.20 | 5.01                       | 1.07 | 4.40                            | 1.33 | 3.39                            | 1.60 | 1.62                    | 1.16 |
| Effort                 | 3.72                         | 1.55 | 4.70                       | 1.49 | 1.74                            | 1.12 | 2.81                            | 1.66 | 3.52                    | 1.73 |
| Understandability      | 5.66                         | 1.53 | 5.21                       | 1.59 | 6.15                            | 1.35 | 6.11                            | 1.52 | 6.29                    | 1.23 |
| Comfort                | 5.34                         | 1.09 | 5.51                       | .96  | 3.79                            | 1.22 | 4.06                            | .66  | 4.10                    | .71  |
| Cleanliness            | 4.70                         | 1.66 | 5.59                       | 1.38 | 5.85                            | 1.39 | 5.25                            | 1.52 | 4.67                    | 1.59 |
| Cooperation            | 3.21                         | 1.88 | 3.23                       | 1.63 | 4.38                            | 1.66 | 3.53                            | 1.61 | 4.19                    | 1.59 |
| Observability          | 2.53                         | 1.75 | 4.68                       | 1.69 | 3.98                            | 1.64 | 2.77                            | 1.70 | 2.52                    | 1.53 |
| Social Opinion         | 4.86                         | 1.35 | 4.90                       | 1.15 | 4.54                            | 1.14 | 4.26                            | 1.24 | 4.48                    | 1.14 |
| Communication          | 5.58                         | 1.33 | 5.56                       | 1.36 | 5.71                            | 1.31 | 5.37                            | 1.45 | 5.02                    | 1.36 |
| Energy                 | 5.89                         | 1.22 | 5.85                       | 1.25 | 5.69                            | 1.39 | 4.93                            | 1.67 | 5.23                    | 1.30 |
| Environment            | 5.46                         | 1.68 | 5.35                       | 1.72 | 5.34                            | 1.60 | 5.74                            | 1.53 | 5.71                    | 1.24 |

Note: The sample size upon which each attribute mean was computed varied slightly (from one to three respondents) within an activity due to missing data. The n displayed for each activity is the modal sample size for the 12 attribute rating means.

<sup>a</sup>Attribute ratings were made on a seven-point scale with attribute-specific anchors where "1" was less of the attribute and "7" was more of the attribute.

*Cost.* The two activities requiring permanent installation of equipment (attic insulation and storm windows) were consistently perceived as costing considerably more than the thermostat setback or the two material reuse activities. The activity perceived as most costly was installing storm windows; the least costly activity was saving paper for recycling.

*Savings.* Responses to the Savings attribute followed a pattern similar to the Cost attribute. Attic insulation and storm windows were perceived as saving more money for the household than the other three activities. The savings resulting from thermostat setback and returnable bottles were notably higher than their perceived costs.

*Effort.* There were no clear groupings of activity types among the Effort attribute ratings. Installing storm windows was perceived as requiring the greatest effort to implement. Thermostat setback was perceived as requiring the least amount of effort. Saving paper was perceived to require about the same amount of effort as installing attic insulation.

*Observability.* The activities perceived to be most noticeable or observable to people who may visit the house were storm windows and thermostat setback. The other three activities were less, and about equally, observable.

*Comfort.* The greatest perceived increase in household comfort was accomplished by the two increased efficiency activities (attic insulation and storm windows). Thermostat setback tended to be perceived as decreasing the comfort of household members. Among all attribute ratings, respondents were in most agreement (as indicated

by low standard deviations) that the two material reuse activities had no effect on the comfort of household members.

*Cooperation.* The two activities perceived to require the most cooperation from household members were thermostat setback and saving paper for recycling. The two equipment installation activities required a moderate level of cooperation from household members.

*Cleanliness.* Clear activity groupings were not apparent among the ratings of the Cleanliness attribute. The cleanest activity tended to be thermostat setback; the least clean activities were installing attic insulation and saving paper for recycling.

*Understandability.* All five activities were fairly easy to understand, though the two activities requiring installation of permanent equipment were slightly less easy to understand than the other activities.

*Energy.* The two increase efficiency activities and the reduced benefit activity (thermostat setback) were viewed by the respondents as leading to slightly greater energy conservation than the two material reuse activities.

*Social opinion.* There were virtually no differences among the five activities in terms of the extent to which respondents felt friends and acquaintances would have opinions about respondents doing the activities. Each activity was viewed as eliciting slightly positive opinions.

*Communications.* For the most part, respondents fairly often had heard about each of the five activities.

*Environment.* All five activities were perceived as being very beneficial for the environment if everyone were to do them.

## 2. Multiple Regression Model Versus Simple Summation Model

Attribute ratings were used in six separate models to predict implementation level of each of the five energy conservation activities. The models differed on two dimensions: (1) the format of the predictor variables; and (2) the method of combining the predictor variables. Three formats were fully crossed with two combination methods (Table II-5, page 47). In each model, all 12 attribute ratings of the household primary decision-maker were included as predictors. In the three regression models, appropriate regression weights were multiplied by the primary decision-maker's attribute rating and the predicted value was correlated with the actual household activity implementation. Appendix D displays the resultant equations for each energy conservation activity. In the three summative models, the 12 attribute ratings of the primary decision-maker were simply added together and the resultant sum was correlated with implementation levels. Comparison of the 15 multiple correlation coefficients and the 15 zero-order coefficients are presented in Table III-5.

There was a distinct advantage in prediction of energy conservation activity by using multiple regression techniques over a simple summation of attribute ratings. The median correlation across five activities and three predictor variable formats using multiple regression was .42; the median correlation using simple summation was .03.

## 3. Normalized Attribute Rating

Individual differences in the use of attribute rating scales were taken into consideration by the normalized attribute format. The research

TABLE III-5

PREDICTION OF HOUSEHOLD ENERGY CONSERVATION ACTIVITIES:  
COMPARISON OF ATTRIBUTE PREDICTOR MODELS

| Energy<br>Conservation<br>Activity | Attribute Predictor Model <sup>a</sup> |        |            |        |            |        |      |      |      |
|------------------------------------|----------------------------------------|--------|------------|--------|------------|--------|------|------|------|
|                                    | P                                      |        | NP         |        | PI         |        | SP   | SNP  | SPI  |
|                                    | R                                      | (SE)   | R          | (SE)   | R          | (SE)   | r    | r    | r    |
| Insulate Attic                     | .40                                    | (1.16) | <u>.53</u> | (1.11) | <u>.54</u> | (1.13) | .01  | .14  | -.04 |
| Storm Windows                      | .41                                    | (.45)  | .42        | (.45)  | .42        | (.45)  | .00  | -.09 | -.01 |
| Thermostat Setback                 | .26                                    | (1.93) | .36        | (1.84) | .42        | (1.93) | -.07 | .05  | -.02 |
| Returnable Bottles                 | <u>.52</u>                             | (1.89) | .46        | (2.03) | .45        | (2.12) | .00  | -.01 | .01  |
| Save Paper                         | .40                                    | (1.48) | .36        | (1.56) | <u>.56</u> | (1.41) | .03  | -.19 | .10  |
| -----                              |                                        |        |            |        |            |        |      |      |      |
| Median                             | .40                                    | (1.48) | .42        | (1.56) | .45        | (1.41) | .01  | -.09 | -.02 |

Note: Due to missing attribute predictors and activity criterion values, the correlations presented in each cell are based on different sample sizes. Coefficients significant at  $p < .01$  are underlined.

<sup>a</sup>The following six attribute predictor models were compared:

- P: Multiple regression analysis using all 12 attribute ratings of the household primary decision-maker for each activity.
- NP: Multiple regression analysis using the normalized transformation of all 12 attribute ratings of the household primary decision-maker for the specific activity being considered.
- PI: Multiple regression analysis using the product of the general importance rating of each attribute and the activity-specific rating of each attribute by the household primary decision-maker for each activity.
- SP: The simple correlation of the sum of the 12 attribute ratings of the household primary decision-maker for each activity.
- SNP: The simple correlation of the sum of the 12 normalized attribute ratings of the household primary decision-maker for each activity.
- SPI: The simple correlation of the sum of the products of the general importance rating of each attribute and the activity specific rating of each attribute by the household primary decision-maker for each activity.

design called for each respondent to ultimately rate each of the 12 attributes five times, once for each activity. Examination of primary decision-makers' five ratings of each attribute provided an indication of the *relative* degree to which the attribute was associated with each activity. For example, a primary decision-maker who rated the cost of each of the five activities as moderate (scale value 4) was distinguished from a primary decision-maker who used the entire seven-point scale range, rating great cost for attic insulation (scale value 7) and no cost for thermostat setback (scale value 1). The manner in which the normalizing transformation was computed was described algebraically in Equation (3), page 49.

Comparison of multiple correlation coefficients ( $R$ ) using the basic attribute model ( $P$ ) and the normalized attribute model ( $NP$ ) for each of the five activities revealed inconsistent results (Table III-5). Use of the  $NP$  model substantially improved prediction of the attic insulation activity; the  $NP$  model accounted for a statistically significant 28 percent ( $R = .53$ ,  $p < .01$ ) of the activity variance, whereas the  $P$  model accounted for only 16 percent ( $R = .40$ ) of the activity variance (nonsignificant,  $p > .01$ ). Prediction of the storm window and thermostat setback activities was only slightly improved by use of the  $NP$  model, but neither model's multiple correlation coefficients were significantly different from zero ( $p > .01$ ). The only statistically significant coefficient among the five basic attribute ( $P$  model) equations was for the returnable bottle activity ( $R = .52$ ,  $p < .01$ ). Use of the  $NP$  model to predict the returnable bottle activity actually reduced the relationship of attribute ratings and returnable bottle activity level

( $R = .46$ , nonsignificant,  $p > .01$ ). Prediction of the save paper activity was slightly better using the P model, but neither the P model nor the NP model coefficient was significantly better than chance ( $p > .01$ ). Overall, there was little difference in the median multiple correlation coefficient of the P and NP models across the five activities; the median correlation for the P model was .40, and .42 for the NP model.

#### 4. Attribute Importance Rating

The importance-weighted attribute model introduced a measure of the differences individuals placed on the importance of attributes in routine household decisions. The individuals' general importance rating of attributes on a four-point Q-sort scale were multiplied by the seven-point rating assigned to the attribute for each conservation activity. Attribute ratings in the importance-weighted format were entered into a regression model to predict household level of conservation activities.

The multiplicative inclusion of attribute importance ratings in regression equations for predicting energy conservation activities (PI model) led to conclusions very similar to the normalized transformation (NP) model (Table III-5, page 67). The multiple correlation coefficients for the PI and NP models were nearly identical, except for the save paper activity. Contrasted to the basic attribute (P) model, the PI model was more predictive of the attic insulation activity, about the same for the storm window and thermostat setback activities, and less predictive of the returnable bottle activity. Prediction of the save paper activity, however, was substantially improved by the PI model; the PI model accounted for 31 percent of the activity variance ( $R = .56$ ,  $p < .01$ )

compared to only 16 percent by the P model ( $R = .40$ , nonsignificant,  $p > .01$ ). The large statistically significant multiple correlation coefficient for predicting the save paper activity contributed to an overall median correlation for the PI models of .45, accounting for roughly 4 percent more activity variance than the basic attribute (P) model.

### 5. Attribute Subsets

Identification of attribute subsets was approached from two perspectives: (1) factor analytic procedures were used to examine the interrelationships among attribute ratings for each energy conservation activity; (2) stepwise regression techniques were employed to identify the best set of attributes for predicting each energy conservation activity. In each analysis the basic attribute variable format (p) was used.

Comparison of factor analysis and stepwise regression results revealed different subsets of attribute ratings. Factor analysis results indicated some similarities across activities in the interrelationship among attribute ratings and suggested four to five factors common to energy conservation activities. The stepwise regression method produced fairly unique attribute subsets of from 0 to 7 attributes for predicting each activity.

Factor analysis. The interrelationships among the set of 12 attributes were examined by factor analyzing the household primary decision-makers' attribute ratings for each of the five activities. The factor analysis program used for these analyses was the SPSS factor procedure

(Nie *et al.*, 1975). The squared multiple correlation between a variable and the rest of the variables served as initial communality estimates in the main diagonal of the correlation matrix. The simple correlation matrices of attribute ratings upon which the five activity factor analyses were computed are presented in Appendix E. Factor loadings were interpreted from an orthogonal varimax rotation of factors from the initial factor matrix with eigenvalues greater than one. This rotation method maximized the squared loadings of each factor which, in turn, minimized the number of factors to which a variable contributed a large portion of its variance. The result was a simple factor structure where each variable contributed primarily to one factor. Variables with factor loadings greater than .30 were considered as marker variables for a factor.

Five factor analyses were computed--one for each energy conservation activity. The resultant attribute factor structure of each activity was examined and salient marker variables were identified to define each factor. The attribute correlation matrix of the attic insulation activity yielded four factors which together accounted for 62.9 percent of the total attribute variance. Four factors were also found for the storm window and thermostat setback activities and accounted for 59 and 62 percent of the total attribute variance, respectively. The attribute intercorrelation matrices of the returnable bottle and save paper activities produced five factors each which included 66.2 and 68.2 percent of the respective attribute variances.

The intent of identifying attribute subsets, however, was to isolate factors common to all residential energy conservation activities.

Comparisons of factor loading similarities across activities provided an indication of the generalizability of each factor to the population of activities. If the same group of variables served to define factors in several independent analyses, it may be anticipated that the factors would appear in other conceptually similar situations. Support for the use of common factor-defining variables from separate analyses to identify generalizable factors has been suggested by Gorsuch (1974): "If the marker variables again form the same pattern as previously found, then the factor could be considered replicated" (p. 247).

To facilitate interpretation of a factor's generalizability across activities, Tables III-6 through III-10 are arranged by factor across activity, rather than within activity, as they were computed. It is important to note that factors were defined from independent factor analyses conducted on the attribute correlation matrix of each activity. Results of the factor analysis for any one activity can be obtained by examining the activity's factor loadings in each table. This can be confirmed by adding the percentage of common within-activity attribute variance for any one activity across the five tables.

In every one of the five independent factor analyses, the factor which accounted for the greatest amount of total and common within-activity variance was defined by extremely high loadings on two attributes: Energy and Environment. The average percentages of total and common within-activity attribute variance accounted for by the Energy-Environment factor were 23.2 and 42.4, respectively (Table III-6). The simple correlation between the Energy and Environment attribute ratings across the five activities ranged from .54 to .74, with a

TABLE III-6

THE ENERGY-ENVIRONMENT FACTOR: COMPARISON OF ORTHOGONALLY  
 ROTATED FACTOR LOADINGS OF HOUSEHOLD PRIMARY DECISION-  
 MAKERS' ATTRIBUTE RATINGS ACROSS ENERGY  
 CONSERVATION ACTIVITIES

| Attribute                                                     | Energy Conservation Activity |                  |                       |                       |               |
|---------------------------------------------------------------|------------------------------|------------------|-----------------------|-----------------------|---------------|
|                                                               | Insulate<br>Attic            | Storm<br>Windows | Thermostat<br>Setback | Returnable<br>Bottles | Save<br>Paper |
| Cost                                                          | .17                          | -.10             | .07                   | -.06                  | .19           |
| Savings                                                       | .45                          | .22              | .65                   | .27                   | .21           |
| Effort                                                        | .10                          | .02              | -.06                  | .01                   | -.03          |
| Understandability                                             | .17                          | .19              | -.16                  | -.02                  | .04           |
| Comfort                                                       | .13                          | .43              | .24                   | .02                   | -.01          |
| Cleanliness                                                   | .35                          | .29              | .23                   | .02                   | .11           |
| Cooperation                                                   | .09                          | .17              | .07                   | .05                   | .09           |
| Observability                                                 | .22                          | .10              | .14                   | .20                   | .09           |
| Social Opinion                                                | .12                          | .11              | .15                   | .27                   | .43           |
| *Communication                                                | .18                          | .24              | .37                   | .43                   | .42           |
| *Energy                                                       | .93                          | .66              | .93                   | .72                   | .86           |
| *Environment                                                  | .55                          | .86              | .80                   | .89                   | .83           |
| Percentage of total<br>within-activity<br>attribute variance  | 24.6                         | 26.6             | 22.9                  | 20.2                  | 21.9          |
| Percentage of common<br>within-activity<br>attribute variance | 44.0                         | 52.9             | 41.9                  | 36.2                  | 37.2          |

Note: Five independent factor analyses--one for each activity--were examined to identify the common, recurrent factor displayed in this table. Attributes which had consistently high loadings across independent factor analyses are asterisked. Factor loadings in excess of .30 were considered in defining the factor and are underlined.

TABLE III-7

THE COOPERATION FACTOR: COMPARISON OF ORTHOGONALLY  
ROTATED FACTOR LOADINGS OF HOUSEHOLD PRIMARY  
DECISION-MAKERS' ATTRIBUTE RATINGS ACROSS  
ENERGY CONSERVATION ACTIVITIES

| Attribute                                                     | Energy Conservation Activity |                  |                       |                       |               |
|---------------------------------------------------------------|------------------------------|------------------|-----------------------|-----------------------|---------------|
|                                                               | Insulate<br>Attic            | Storm<br>Windows | Thermostat<br>Setback | Returnable<br>Bottles | Save<br>Paper |
| Cost                                                          | .12                          | <u>.39</u>       | -.19                  | .06                   | .06           |
| Savings                                                       | .05                          | <u>.00</u>       | .19                   | -.25                  | -.08          |
| *Effort                                                       | <u>.38</u>                   | <u>.60</u>       | .28                   | .07                   | <u>.77</u>    |
| Understandability                                             | -.45                         | -.34             | -.05                  | -.15                  | -.07          |
| Comfort                                                       | .03                          | -.04             | -.23                  | -.07                  | -.03          |
| Cleanliness                                                   | .16                          | -.30             | -.06                  | -.04                  | -.32          |
| *Cooperation                                                  | <u>.76</u>                   | <u>.54</u>       | <u>.67</u>            | <u>.79</u>            | <u>.70</u>    |
| *Observability                                                | <u>.75</u>                   | <u>.06</u>       | <u>.58</u>            | <u>.35</u>            | .26           |
| Social Opinion                                                | .12                          | -.01             | .25                   | .06                   | -.05          |
| Communication                                                 | -.05                         | -.03             | .24                   | .08                   | -.06          |
| Energy                                                        | -.10                         | -.06             | -.05                  | .16                   | .06           |
| Environment                                                   | .19                          | .02              | .06                   | -.07                  | .04           |
| Percentage of total<br>within-activity<br>attribute variance  | 17.4                         | 8.5              | 13.5                  | 10.4                  | 17.0          |
| Percentage of common<br>within-activity<br>attribute variance | 27.7                         | 12.3             | 18.8                  | 12.8                  | 27.3          |

Note: Five independent factor analyses--one for each activity--were examined to identify the common, recurrent factor displayed in this table. Attributes which had consistently high loadings across independent factor analyses are asterisked. Factor loadings in excess of .30 were considered in defining the factor and are underlined.

TABLE III-8

THE EFFORT FACTOR: COMPARISON OF ORTHOGONALLY ROTATED  
FACTOR LOADINGS OF HOUSEHOLD PRIMARY DECISION-  
MAKERS' ATTRIBUTE RATINGS ACROSS  
ENERGY CONSERVATION ACTIVITIES

| Attribute                                                     | Energy Conservation Activity |                  |                       |                       |               |
|---------------------------------------------------------------|------------------------------|------------------|-----------------------|-----------------------|---------------|
|                                                               | Insulate<br>Attic            | Storm<br>Windows | Thermostat<br>Setback | Returnable<br>Bottles | Save<br>Paper |
| *Cost                                                         | <u>-.36</u>                  | .                | <u>.35</u>            | <u>.43</u>            | <u>-.17</u>   |
| Savings                                                       | <u>-.09</u>                  | .                | <u>.07</u>            | <u>.18</u>            | <u>-.10</u>   |
| *Effort                                                       | <u>-.57</u>                  | .                | <u>.84</u>            | <u>.82</u>            | <u>-.49</u>   |
| Understandability                                             | <u>.24</u>                   | .                | <u>-.24</u>           | <u>.01</u>            | <u>.03</u>    |
| Comfort                                                       | <u>.00</u>                   | .                | <u>-.02</u>           | <u>.05</u>            | <u>.37</u>    |
| Cleanliness                                                   | <u>.12</u>                   | .                | <u>.01</u>            | <u>-.21</u>           | <u>.10</u>    |
| Cooperation                                                   | <u>-.02</u>                  | .                | <u>-.04</u>           | <u>.13</u>            | <u>.08</u>    |
| Observability                                                 | <u>.08</u>                   | .                | <u>.01</u>            | <u>.09</u>            | <u>.02</u>    |
| *Social Opinion                                               | <u>.60</u>                   | .                | <u>-.37</u>           | <u>-.04</u>           | <u>.05</u>    |
| *Communication                                                | <u>.32</u>                   | .                | <u>-.06</u>           | <u>-.24</u>           | <u>.41</u>    |
| Energy                                                        | <u>-.05</u>                  | .                | <u>-.10</u>           | <u>.02</u>            | <u>.06</u>    |
| Environment                                                   | <u>.10</u>                   | .                | <u>.06</u>            | <u>-.03</u>           | <u>-.02</u>   |
| Percentage of total<br>within-activity<br>attribute variance  | 8.9                          | .                | 9.9                   | 14.6                  | 8.4           |
| Percentage of common<br>within-activity<br>attribute variance | 12.7                         | .                | 12.4                  | 23.5                  | 6.3           |

Note: Five independent factor analyses--one for each activity--were examined to identify the common, recurrent factor displayed in this table. Attributes which had consistently high loadings across independent factor analyses are asterisked. Factor loadings in excess of .30 were considered in defining the factor and are underlined.

TABLE III-9

THE COMFORT FACTOR: COMPARISON OF ORTHOGONALLY ROTATED  
FACTOR LOADINGS OF HOUSEHOLD PRIMARY DECISION-  
MAKERS' ATTRIBUTE RATINGS ACROSS ENERGY  
CONSERVATION ACTIVITIES

| Attribute                                                     | Energy Conservation Activity |                  |                       |                       |               |
|---------------------------------------------------------------|------------------------------|------------------|-----------------------|-----------------------|---------------|
|                                                               | Insulate<br>Attic            | Storm<br>Windows | Thermostat<br>Setback | Returnable<br>Bottles | Save<br>Paper |
| Cost                                                          | .27                          | .19              | .                     | .09                   | -.04          |
| *Savings                                                      | <u>.48</u>                   | <u>.89</u>       | .                     | .10                   | <u>.80</u>    |
| Effort                                                        | <u>-.18</u>                  | <u>-.01</u>      | .                     | -.07                  | <u>-.09</u>   |
| Understandability                                             | .09                          | .11              | .                     | <u>-.42</u>           | .01           |
| *Comfort                                                      | <u>.89</u>                   | <u>.44</u>       | .                     | <u>.69</u>            | <u>.60</u>    |
| Cleanliness                                                   | <u>.35</u>                   | <u>.07</u>       | .                     | .00                   | <u>.23</u>    |
| Cooperation                                                   | <u>.13</u>                   | .00              | .                     | -.01                  | -.03          |
| Observability                                                 | .09                          | <u>.37</u>       | .                     | .27                   | .17           |
| Social Opinion                                                | -.02                         | <u>.09</u>       | .                     | .01                   | .25           |
| Communication                                                 | <u>.33</u>                   | .13              | .                     | .12                   | .08           |
| Energy                                                        | <u>.15</u>                   | <u>.45</u>       | .                     | .09                   | .11           |
| Environment                                                   | .15                          | <u>.08</u>       | .                     | -.14                  | .05           |
| Percentage of total<br>within-activity<br>attribute variance  | 12.0                         | 14.4             | .                     | 9.8                   | 11.7          |
| Percentage of common<br>within-activity<br>attribute variance | 15.6                         | 19.3             | .                     | 12.0                  | 16.5          |

Note: Five independent factor analyses--one for each activity--were examined to identify the common, recurrent factor displayed in this table. Attributes which had consistently high loadings across independent factor analyses are asterisked. Factor loadings in excess of .30 were considered in defining the factor and are underlined.

TABLE III-10

UNDEFINED FACTORS: COMPARISON OF ORTHOGONALLY ROTATED  
FACTOR LOADINGS OF HOUSEHOLD PRIMARY DECISION-  
MAKERS' ATTRIBUTE RATINGS ACROSS ENERGY  
CONSERVATION ACTIVITIES

| Attribute                                                     | Energy Conservation Activity |                  |                       |                       |               |
|---------------------------------------------------------------|------------------------------|------------------|-----------------------|-----------------------|---------------|
|                                                               | Insulate<br>Attic            | Storm<br>Windows | Thermostat<br>Setback | Returnable<br>Bottles | Save<br>Paper |
| Cost                                                          | .                            | .06              | -.25                  | -.04                  | -.14          |
| Savings                                                       | .                            | .11              | -.01                  | .21                   | .00           |
| Effort                                                        | .                            | -.11             | -.12                  | -.16                  | .03           |
| Understandability                                             | .                            | .03              | .92                   | .29                   | .86           |
| Comfort                                                       | .                            | .23              | -.26                  | .10                   | -.08          |
| Cleanliness                                                   | .                            | .14              | .48                   | .64                   | .23           |
| Cooperation                                                   | .                            | .12              | .01                   | -.05                  | -.11          |
| Observability                                                 | .                            | .37              | -.03                  | .18                   | -.30          |
| Social Opinion                                                | .                            | .92              | -.05                  | .61                   | .24           |
| Communication                                                 | .                            | .27              | .06                   | .15                   | .03           |
| Energy                                                        | .                            | .14              | .01                   | .10                   | -.11          |
| Environment                                                   | .                            | .10              | .03                   | .05                   | .01           |
| Percentage of total<br>within-activity<br>attribute variance  | .                            | 9.5              | 15.7                  | 11.2                  | 9.2           |
| Percentage of common<br>within-activity<br>attribute variance | .                            | 15.5             | 27.2                  | 15.5                  | 12.7          |

Note: Five independent factor analyses--one for each activity--were examined to identify the common, recurrent factors. The factors displayed in this table did not appear consistent across activities and have, therefore, been left undefined. Factor loadings in excess of .30 were considered in defining factors and are underlined.

median correlation of .66. Energy and Environment were clearly viewed by the household sample as similar attributes and formed a dominant factor in the perception of energy conservation activities.

One of three other factors which tended to show up across activities was labeled the Cooperation factor (Table III-7, page 74). It was defined by salient loadings on the Cooperation attribute in the factor analysis of all five activities. The Effort and Observability attributes were included in the factor for three activities. The percentages of total within-activity attribute variance of the Cooperation factor ranged from 8.5 for the storm window activity to 17.4 for the attic insulation activity, with a mean across all five activities of 13.4.

A factor (labeled the Effort factor, Table III-8, page 75) appeared in four of the five factor analyses. The Effort factor did not show up for the storm window activity. The Effort attribute had a salient loading in the Effort factor for the other four activities. The Cost attribute had low, but salient, factor loadings in the Effort factor for three activities. Social Opinion and Communication were salient for two activities. The average percentage of total within-activity attribute variance was 10.5 for the Effort factor.

The Comfort attribute had a salient loading in four activity factor analyses and served to define the Comfort factor. Occurring with the Comfort attribute in three of the four analyses was the Savings attribute. The Comfort factor accounted for an average of 12 percent of the total within-activity attribute variance (Table III-9, page 76).

Only four of the 22 total identified factors could not be considered to cut across activities (Table III-10). Each undefined factor

had only two salient factor loadings and were inconsistent in their loading patterns across activities.

Stepwise regression. Using the basic attribute (P) model, a subset of attribute predictors which best predicted each energy conservation activity was identified in the following manner. A forward stepwise entry of variables was used to generate a series of regression equations for each activity (Nie *et al.*, 1975). Within each activity, at each step, a single attribute was added to the equation which contributed most to the explained variance of the activity. This forward stepwise iteration process was continued until one of three criteria was met: (1) all 12 attributes were included in the equation; (2) the value of the F-ratio that would be obtained for a nonincluded variable if it were entered in the next step was .01; or (3) if 99.9 percent of the nonincluded attributes' variance was already accounted for by the equation. Inevitably, these lenient criteria permitted most of the attributes to be included in the terminal equation. The following additional considerations were employed to identify the best subset of attribute predictors for each energy conservation activity: the significance of the multiple correlation coefficient (R) at each step; the F-ratio of the change in  $R^2$  contributed by each variable at each step; the magnitude of the standardized regression (beta) weights; and the simple correlation between each attribute and the activity.

The attribute subsets identified by the stepwise regression procedure for each activity did not correspond with any of the attribute subsets derived from the factor analysis method. The stepwise regression

subsets were much more variable across activities; while there were no attributes which met the stepwise criteria for the thermostat setback activity, the returnable bottle activity included seven attributes which defined the best regression equation (Table III-11).

There were no attributes which consistently appeared in all five best regression equations. The Cleanliness and Social Opinion attributes significantly entered three activity equations, though not the same activities. The Cost attribute entered two equations: storm windows and returnable bottles. Of the remaining nine attributes, six entered only one equation and three did not enter any equation.

#### 6. Monetary Attributes versus Nonmonetary Attributes

Two monetary-related attributes were included among the 12 attributes examined in this investigation: how much money it costs to do an activity (Cost) and how much money the activity saves the household (Savings). These two attributes were rated in the Q-sort exercise by household heads as the most important attributes in their consideration of general household decisions (Table III-3, page 60).

The importance of the monetary attributes was not apparent, however, when considered in relation to implementation levels of energy conservation activities. The simple correlation between the Cost attribute rating of the household primary decision-maker and household implementation level was significant for only the storm window activity. The Savings attribute rating was not significantly correlated with the implementation level of any of the five activities.

TABLE III-11

BEST MULTIPLE REGRESSION EQUATIONS USING ATTRIBUTES  
TO PREDICT ENERGY CONSERVATION ACTIVITY

| Attributes        | Energy Conservation Activity |      |  |               |      |  |                    |   |  |                    |      |     |
|-------------------|------------------------------|------|--|---------------|------|--|--------------------|---|--|--------------------|------|-----|
|                   | Attic Insulation             |      |  | Storm Windows |      |  | Thermostat Setback |   |  | Returnable Bottles |      |     |
|                   | R = .33                      |      |  | R = .35       |      |  | .                  |   |  | R = .49            |      |     |
|                   | SE = 1.13                    |      |  | SE = .44      |      |  | .                  |   |  | SE = 1.88          |      |     |
|                   | N = 89                       |      |  | N = 103       |      |  | .                  |   |  | N = 109            |      |     |
|                   | Beta                         | r    |  | Beta          | r    |  | Beta               | r |  | Beta               | r    |     |
| Cost              | .                            | .    |  | -.25          | -.27 |  | .                  | . |  | -.17               | -.20 | .   |
| Savings           | .                            | .    |  | .             | .    |  | .                  | . |  | -.22               | -.08 | .   |
| Effort            | .                            | .    |  | .             | .    |  | .                  | . |  | .                  | .    | .   |
| Understandability | .                            | .    |  | .             | .    |  | .                  | . |  | .                  | .    | .   |
| Comfort           | .                            | .    |  | .             | .    |  | .                  | . |  | .22                | .13  | .   |
| Cleanliness       | .                            | .    |  | .             | .    |  | .                  | . |  | .28                | .15  | .   |
| Cooperation       | .                            | .    |  | .21           | .20  |  | .                  | . |  | .19                | .09  | .21 |
| Observability     | -.21                         | -.24 |  | .             | .    |  | .                  | . |  | .                  | .    | .   |
| Social Opinion    | .                            | .    |  | .             | .    |  | .                  | . |  | .                  | .    | .   |
| Communication     | -.16                         | -.15 |  | -.14          | -.12 |  | .                  | . |  | -.34               | -.12 | .   |
| Energy            | .21                          | .18  |  | .             | .    |  | .                  | . |  | .                  | .    | .   |
| Environment       | .                            | .    |  | .             | .    |  | .                  | . |  | .                  | .    | .   |
|                   | .                            | .    |  | .             | .    |  | .                  | . |  | .33                | .19  | .   |

Note: Selection of the best attribute predictors of energy conservation activities was made by examination of iterations of a forward stepwise multiple regression procedure using the attribute perceptions of the household primary decision-maker for each activity (the P prediction model). Cells without applicable entries are noted by a dot. Correlation coefficients significant at  $p < .01$  are underlined.

The extent of each attribute's direct contribution to the prediction of activity implementation level was assessed by examining the squared standard partial regression coefficients (beta weights) in each of the five 12-attribute regression equations (Appendix D). The squared beta weight of a variable in a regression equation represents the proportion of unique variance contributed by the variable with effects of other variables held constant. The average of squared beta weights of the two monetary attributes across activities was compared to the average of the squared beta weights of the 10 other attributes. The two monetary attributes accounted for an average, across activities, of 4.7 percent of unique variance compared to an average of 20.4 percent by the 10 nonmonetary attributes.

The Cost and Savings attributes played a moderate role in the stepwise regression equations previously discussed (Table III-11). The Cost attribute was included in the equations for predicting the storm window and returnable bottle activities. In both equations, the Cost attribute entered with a negative beta weight and negative simple correlation--lower perceived costs were associated with higher percentage of storm windows and greater use of returnable bottles. The Savings attribute only entered into the returnable bottles activity equation; also with negative, but nonsignificant, coefficients--the lower the perceived savings, the greater the use of returnable bottles.

## 7. Attribute Ratings versus Demographic Data

In order to gauge the relative efficacy of using attribute ratings to predict energy conservation activities, a set of demographic predictors

was used to develop a separate series of regression equations to predict each activity. Nineteen personal and household characteristics of the sample were chosen which met assumptions for regression analyses regarding level of measurement; each variable was measured on either an interval or dichotomous scale. Nominal scale variables, such as religion and birthplace, were not included. Identification of primary decision-maker for each activity and use of only that respondent's rating, as was done with attribute ratings, was not appropriate for personal and household characteristics. The intention of using alternative predictors was to apply a different approach. Not only were the variables changed, but characteristics of both household heads were included, as may be expected in a more traditional research design. Stepwise multiple regression equations were computed and a best equation was identified for each activity in the same manner as previously described for determining the best attribute regression equations. The 19 selected demographic variables and resultant best regression equations are displayed in Table III-12.

Personal characteristics of respondents were found to be better predictors of energy conservation activities than were general household characteristics. The pattern of demographic variables which were included in the best regression equations, however, were not consistent across the five activities. Only two of the 19 demographic variables appeared in more than one activity prediction equation: number of magazines read by household members and education.

The nature of these variables' contributions interacted with the respondents' sex. The number of magazines read by the male household

TABLE III-12

BEST MULTIPLE REGRESSION EQUATIONS USING PERSONAL AND HOUSEHOLD CHARACTERISTICS  
TO PREDICT ENERGY CONSERVATION ACTIVITY

| Personal/<br>Household<br>Characteristics <sup>a</sup> | Energy Conservation Activity |      |         |      |            |     |            |   |        |      |
|--------------------------------------------------------|------------------------------|------|---------|------|------------|-----|------------|---|--------|------|
|                                                        | Insulate                     |      | Storms  |      | Thermostat |     | Returnable |   | Save   |      |
|                                                        | Attic                        |      | Windows |      | Setback    |     | Bottles    |   | Paper  |      |
|                                                        | R =                          | r    | R =     | r    | R =        | r   | R =        | r | R =    | r    |
|                                                        | .57                          |      | .45     |      | .49        |     |            |   | .61    |      |
|                                                        | SE =                         |      | .41     |      | 1.88       |     |            |   | 1.21   |      |
|                                                        | N = 43                       |      | N = 46  |      | N = 45     |     |            |   | N = 46 |      |
|                                                        | Beta                         | r    | Beta    | r    | Beta       | r   | Beta       | r | Beta   | r    |
| M n of magazines                                       | .21                          | .15  |         |      | .36        | .35 |            |   |        |      |
| F n of magazines                                       |                              |      | -.45    | -.45 |            |     |            |   |        |      |
| M education                                            |                              |      |         |      |            |     |            |   | -.36   | -.36 |
| F education                                            |                              |      |         |      | .34        | .33 |            |   | .47    | .21  |
| M age                                                  | -.65                         | .14  |         |      |            |     |            |   |        |      |
| F age                                                  | .86                          | .21  |         |      |            |     |            |   |        |      |
| M Socio. Index Occ. <sup>b</sup>                       |                              |      |         |      |            |     |            |   | -.35   | -.40 |
| M n of clubs                                           | -.49                         | -.33 |         |      |            |     |            |   |        |      |
| F n of clubs                                           | -.28                         | -.16 |         |      |            |     |            |   |        |      |
| Children's ideas                                       |                              |      |         |      |            |     |            |   |        |      |
| Household income                                       |                              |      |         |      |            |     |            |   |        |      |
| Value of property                                      |                              |      |         |      |            |     |            |   |        |      |
| Size of house                                          |                              |      |         |      |            |     |            |   |        |      |
| M years in town                                        |                              |      |         |      |            |     |            |   |        |      |
| F years in town                                        |                              |      |         |      |            |     |            |   |        |      |
| Years in house                                         |                              |      |         |      |            |     |            |   |        |      |
| People in house                                        |                              |      |         |      |            |     |            |   |        |      |
| M vote in 1976                                         |                              |      |         |      |            |     |            |   |        |      |
| F vote in 1976                                         |                              |      |         |      |            |     |            |   |        |      |

Note: Selection of the best personal and household characteristic predictors of energy conservation activities was made by examination of iterations of a forward stepwise multiple regression procedure. Cells without applicable entries are noted by a dot. Correlation coefficients significant at  $p < .01$  are underlined.

<sup>a</sup>Personal characteristics preceded by an M refer to male respondent characteristics. Personal characteristics preceded by an F refer to female respondent characteristics.

<sup>b</sup>The socioeconomic index of the respondent's occupation was coded based on the Socioeconomic Index for Occupations developed by Reiss (1961).

head met the stepwise regression entry criteria and was positively (though not significantly,  $p > .01$ ) correlated with implementation level of the attic insulation and thermostat setback activities. The number of magazines read by the female household head, however, was significantly ( $p < .01$ ) *negatively* correlated with the storm window activity and was the only demographic variable which met the stepwise criteria for that activity.

The education level of the female household head was positively correlated ( $p > .01$ ) with the thermostat setback and save paper activities. However, education of the male household head was *negatively* correlated ( $p > .01$ ) with the save paper activity.

Household income was conspicuous in its absence as a predictor of energy conservation activity--in none of the five stepwise procedures did household income meet the criteria for entry into an equation.

The demographic characteristics of the sample accounted for considerably more activity variance than did the attribute ratings (Table III-13). The median multiple correlation coefficient of stepwise regression equations using demographic variables was .53 compared to .35 for equations using attribute predictors. Comparisons between attribute and demographic variable regression models must be tempered by an important difference in sample sizes. The average sample size from which demographic equations were based (average  $n = 45$ ) was less than half the size from which the attribute equations were generated (average  $n = 101$ ). This difference was largely due to the use of list-wise deletion in generating the regression equations; there were more missing demographic data than attribute ratings. The difference in

TABLE III-13  
COMPARISON OF BEST MULTIPLE REGRESSION EQUATIONS USING ATTRIBUTES AND PERSONAL  
AND HOUSEHOLD CHARACTERISTICS TO PREDICT ENERGY CONSERVATION ACTIVITY

| Predictor Variables | Activity Median<br>R (SE) | Energy Conservation Activity |        |               |       |                    |        |                    |        |            |        |
|---------------------|---------------------------|------------------------------|--------|---------------|-------|--------------------|--------|--------------------|--------|------------|--------|
|                     |                           | Attic Insulation             |        | Storm Windows |       | Thermostat Setback |        | Returnable Bottles |        | Save Paper |        |
|                     |                           | R                            | (SE)   | R             | (SE)  | R                  | (SE)   | R                  | (SE)   | R          | (SE)   |
| Attributes          | .35 (1.13)                | .33                          | (1.13) | .35           | (.44) | .                  | .      | .49                | (1.88) | .21        | (1.49) |
| Characteristics     | .53 (1.02)                | .57                          | (.83)  | .45           | (.41) | .49                | (1.88) | .                  | .      | .61        | (1.21) |

Note: Selection of the best attribute predictors of energy conservation activities was made by examination of iterations of a forward stepwise multiple regression procedure using the attribute perceptions of the household primary decision-maker for each activity (the P prediction model). Cells without applicable entries are noted by a dot. Correlation coefficients significant at  $p < .01$  are underlined.

sample sizes has an impact on the ratio of predictors to sample size. As this ratio increases, a larger proportion of variance can be accounted for by the resultant equation, but a larger multiple correlation coefficient is necessary for statistical significance. All but one of the regression coefficients displayed in Table III-13 were statistically significant at  $p < .01$ .

## CHAPTER IV

### DISCUSSION AND SUMMARY

#### Research Issues

Seven research issues were identified as the focus for the present investigation. In the summaries of findings which follow, research issues are numbered for convenient reference to previous discussions.

#### 1. Generalizability of Attribute Profiles

It was suspected that perceived attribute ratings of energy conservation activities would generalize across the three categories of energy conservation activities. Distinct attribute profile similarities among groups of activities could not be identified by either the factor analytic or stepwise multiple regression procedures used in the study.

Examination of attribute ratings among activities, however, was enlightening as a means of understanding the manner in which middle-class household primary decision-makers viewed energy conservation activities.

The cost, savings, and effort of activities were most notable for the variety of ratings they received across activities. Thermostat setback, for instance, was perceived as having low cost and requiring little effort, yet resulting in fairly high monetary savings for the household. On the other hand, it was perceived to lead to a decrease in the personal comfort of household members and required moderate cooperation to implement. The two activities requiring permanent installation of equipment to increase energy efficiency (attic insulation and storm windows) were perceived as having high cost, requiring

moderate effort, but resulting in the most dollar savings and the most increase in the personal comfort of household members of all activities.

Returnable bottles and paper saving, while conceptually distinct from the other three activities, displayed some intriguing similarities. Paper saving and attic insulation were perceived to be equally clean, to require about the same moderate amount of effort, and to be not very noticeable to people who visit the house. The amount of household member cooperation required to purchase beverages in returnable bottles was low and more similar to the cooperation required to install attic insulation and storm windows. Paper saving and thermostat setback tended to require more cooperation to accomplish.

There was little variability among the five activities on the ratings of the following attributes: Understandability, Energy, Social Opinion, Communication, and Environment. All activities were about equally easy to understand and were perceived to result in considerable energy conservation and benefit to the environment. Respondents had heard about all five activities fairly often and believed that friends and acquaintances would have slightly positive feelings about the respondents' doing the activities.

## 2. Multiple Regression Models versus Simple Summation Models

Results of comparing multiple regression models with simple summation models were quite clear: regression models were both more predictive of activity level and provided greater insight to the relative contributions of attribute perceptions to energy conservation activities. The advantage of regression models over summation models held for the

basic attribute ratings and for two transformations of the ratings.

The strength of the regression model lies in its more efficient use of available data; each predictor is weighted to take account of the variance it shares with the criterion and with other predictors. This strength must be tempered by consideration of the specific sample to which the model is applied. The regression equation is structured to maximize prediction of the dependent variable for the specific sample from which data were drawn. Application of the obtained equations to dissimilar samples will not produce the same high level of relationship between attribute ratings and energy conservation activities.

### 3. Normalized Attribute Ratings

Respondents perceived some attributes to be at about the same level for all activities; other attributes were perceived to change from activity to activity. A normalizing transformation of attribute ratings was used to account for this variability in scale use with the intention of improving the prediction of energy conservation activity levels. Improved prediction was not forthcoming. Explicit recognition of individual respondent variability in the use of attribute rating scales did not substantially improve the overall prediction of energy conservation activities. The lack of substantial improvement by consideration of individual respondent use of rating scales supports application of a parsimonious model involving nontransformed attribute ratings to predict energy conservation activities.

#### 4. Attribute Importance Ratings

The general importance assigned by a respondent to each attribute for making routine household decisions was multiplied by the specified attribute rating for each activity and used in a multiple regression model to predict implementation level of each activity. Previous research results about such an application had been mixed (Bass & Wilkie, 1973). The present study found similar mixed results; use of general importance ratings improved, had no effect, and suppressed the model's predictability. There was no particular pattern of impact regarding types of energy conservation activities. The overall effect, across activities, of including importance ratings was to slightly increase accountable variance.

#### 5. Attribute Subsets

Two separate statistical methodologies were employed to examine attribute subsets which may be either generalizable across activities or unique to specific activities--factor analysis and multiple regression. The direct comparison of factor analysis and multiple regression results is slightly misleading; there were distinct differences in both statistical techniques and research objectives. The factor analysis technique was used to examine the attribute intercorrelation matrices for relationships among attribute ratings and common factors were identified. The stepwise multiple regression technique used in this study was designed to isolate attribute ratings which, taken together, best predicted activity levels. It was found that prediction of each activity required a unique set of attributes.

The factor analysis method revealed four or five factors, depending on the activity, which accounted for a substantial amount of total attribute variance; between 59 and 68 percent of attribute variance was accounted for by the obtained factors. Four factors tended to be replicated across activities. The factor which was most clearly replicated across the five activities involved ratings on the Energy, Environment, and Communication attributes. Both energy conservation and environmental protection had received considerable publicity, often from the same organizations, for several years prior to the interviews. Respondents obviously perceived a strong relationship between energy and environmental concerns.

The second major factor included ratings on three attributes: Cooperation, Observability, and Effort. The common element of this factor was involvement of the other people in the activity. The third and fourth factors were weaker and less interpretable as underlying dimensions of respondent perceptions. The third factor, accounting for less total variance and emerging for only four of the five activities, included ratings in four attributes: Effort, Cost, Social Opinion, and Communication. The fourth factor was comprised of ratings on the Comfort and Savings attributes and only appeared for four activities. Other minor factors were found, but were activity-specific and could not be considered replicated across activities. These factors were considered undefined for the purposes of this study.

It is recognized that factor analysis results can be influenced to some degree by deliberate selection of variables in the correlation matrix. The selection of attributes in the study, however, was

accomplished in a highly objective manner. Attributes had been screened through two pilot studies to ensure, as much as possible, that each attribute was tapping a distinct conceptual dimension. The inclusion of 12 attributes allowed individual variability in the cognitive application of salient attributes. The factor analysis results confirmed previous research by Rogers and Shoemaker (1971) and Fishbein and Azjen (1975) which suggested that only about five attributes or groups of attributes are salient to consumers for making a decision about household activities.

Stepwise regression procedures failed to show a common set of attribute predictors across activities. No single attribute had consistently high correlations with activity levels; only one correlation, among 60 simple correlations between attributes and activities, was statistically significant ( $p < .01$ ). That one correlation was the perceived cost of storm windows: the lower the perceived cost, the larger the proportion of storm windows in the house.

Optimal prediction of each activity required a unique *combination* of attributes. The number of attribute ratings included in the best multiple regression equations resulting from the stepwise procedure ranged from zero for the thermostat setback activity to seven attributes for prediction of returnable bottle usage.

The factor analysis technique accounted for considerably more attribute variance than the multiple regression techniques accounted for activity variance. On the average, across five activities, the factor analytically derived factors accounted for 64 percent of total attribute variance. The five stepwise regression equations used to

identify attribute subsets for predicting activity levels accounted for an average of only 10 percent of activity variance (as measured by the coefficient of determination).

#### 6. Monetary Attributes versus Nonmonetary Attributes

When asked directly to rate the importance of each of the 12 attributes for making general household decision, respondents rated the two monetary attributes as most important. Closer examination of the impact of monetary attributes on prediction of energy conservation activity did not confirm the importance which respondents ascribed to them. The two monetary attributes were no more predictive of energy conservation activity level than the other 10 attributes, either in the full 12-attribute regression equations or in the best attribute set equations.

A factor analysis of attribute ratings for each activity failed to identify a monetary factor. In none of the five factor analyses did Cost and Savings serve as co-defining variables for a factor. None of the five simple correlations between the Cost and Savings attributes were significant ( $p < .01$ ). The attribute which was most closely related to Cost was Effort--how much effort is required to do the activity. The cost-effort relationship was noted in the Effort factor and in the attribute intercorrelation matrices.

Based on these data, it may be concluded that perceived costs involved in household energy conservation activities were not associated with the perceived savings which could result from the activities; perceived costs were more closely associated with perceived effort.

Further implications of these results are that cost and savings are considered by consumers in conjunction with other attributes which are at least as salient for making decisions about energy conservation activities. These other attributes should be given appropriate consideration in the design and application of energy conservation programs aimed at reducing residential energy conservation, as discussed in the concluding section.

### 7. Attribute Ratings versus Demographic Data

Attribute ratings were compared to demographic characteristics in separate stepwise regression models to examine the relative effectiveness of each set of variables for predicting energy conservation activity. It was found that both sets of variables produced statistically significant multiple correlation coefficients. The coefficients generated by the demographic variables, however, were considerably higher and accounted for more variance in the activity scores.

This finding illustrates a critical distinction between statistical significance and accountable variance. The advantage of demographic variables in accounting for activity variance (as measured by the coefficient of determination) was at least partially due to substantial differences in sample size. The regression equations using demographic variables were based on a sample size less than half the size of the sample used for the attribute equations. A fairer comparison of attribute ratings and demographic variables for predicting energy conservation activities would require larger and more similar sample sizes in the generation of multiple regression equations.

### Critique of the Study

Some general methodological concerns which were apparent in this research endeavor should be highlighted. The household implementation level of energy conservation activities was measured by self-report at the time of the interview. As a result, inferences of attribute ratings causing energy conservation activities cannot be made from this study. Attribute ratings could have been colored by the experiences households had with activities. Fishbein and Ajzen (1975) clarified this concern in their model by referring to descriptive beliefs based on direct experience and inferential beliefs founded more on logic and second-hand knowledge. Ostlund (1975) interpreted the two belief types in a cognitive dissonance framework: "Perceptions gathered after adoption are likely to be contaminated by whatever post decision dissonance may exist" (p. 29). The distinction between the two types of belief foundations is not clear-cut, but depends upon individual experiences with activities.

Consider, for example, a household which reported nine inches of insulation in the attic. While that household was operationalized in this study as having implemented the activity, the household may have had nothing to do with installing the insulation in the attic; it may have come with the house. On the other hand, the household head may have personally purchased and installed all nine inches of insulation. Further, a household which had purchased a home with sufficient attic insulation may have had personal experience with insulation from another source. One such household's head was an insulation contractor, with obvious experience, who purchased the house *because* it was

well-insulated, though he was not responsible for having it insulated. To assess these situations, respondents were asked a question to determine how much the household was responsible for each activity. Cross-referencing the activity level and the responsibility question to distinguish descriptive from inferential beliefs was attempted, but the results led to conflicting and missing data and were not feasible for subsequent analysis.

Self-reports of implementation level of energy conservation activities most likely were inflated. A study cited by Milstein (1977) compared self-reported average home temperatures with on-site temperature measurements of similar homes. The average reported and measured temperatures differed by five degrees, equivalent to about 10 percent difference in fuel consumption. This self-report bias could have been mitigated in the present study if it could have been assumed that all respondents uniformly erred by the same amount and in the same direction when reporting implementation levels. Such an assumption, unfortunately, was not realistic.

Respondents were aware of the energy conservation orientation of the interviewers and this probably biased household responses to survey items. The fairly high ratings given to the Energy and Environment attributes on the Q-sort exercise and in relation to each of the five activities supported this impression.

Over the eight-month period that interviews were conducted (spring to fall, 1977), seasonal variations and external events may have influenced responses. The possibility that the rated relationships between attributes and activities were different across time was investigated

by examining a plot of individual standardized residuals for each regression equation used to predict implementation level. No seasonal differences in prediction errors were noted in any of the equations.

### Implications for Research and Policy

The results of this study have research implications for social scientists applying multi-attribute models and policy implications for energy conservation program planners. Four suggested areas for further research are described below.

1. The present study examined the relationship of attribute perceptions and demographic characteristics with *current* energy conservation behavior in a household. An important alternative approach would require an experimental design where consumer attribute perceptions of specific activities are measured and *subsequent* behaviors are monitored. Such studies would lend support to a causal interpretation of attribute perceptions and behavior.

2. Application of composite criterion scores should be explored. The use of composite criterion scores was proposed by Fishbein and Ajzen (1975) as a means of increasing the correspondence between attitude and behavioral measures. Weigel and Newman (1976) used attitude measures to predict subsequent ecologically-oriented behaviors. They found that the correlation of attitudes with a comprehensive behavioral index composed of 14 distinct behaviors was substantially higher than correlations with single behaviors. The average of attitudes with single behaviors was .29 compared to .62 for the comprehensive behavioral index.

3. Composite predictors should also be considered. Sundstrom *et al.*

(1977) examined the relationship between attitudes toward a proposed nuclear power plant and 24 expected outcomes associated with it. Factor analysis of the 24 outcomes revealed five factors. The simple mean of outcome scores comprising each factor was used as a composite predictor in a stepwise multiple regression. Four of the five composite predictors accounted for over half of the attitude variance ( $R = .72$ ). The factor analysis results of the present investigation imply that composite prediction variables, such as described by Sundstrom *et al.* (1977) may be useful for predicting behavior from attribute factors.

4. Interactions of perceived attributes and demographic variables should be investigated to identify moderators of attribute-behavior relationships. Proper interpretation of interactions and moderator variables would provide a means for tailoring energy conservation programs to optimize impacts on selected populations.

The absence of any substantial correlations among the five energy conservation activities examined in this study (Table III-2, page 59) suggests that households do not respond to a general energy conservation ethic. Performance of one energy conservation activity around the home did not necessarily lead to another activity; there were no general energy conservation activity subsets. In addition, no common set of predictors was identified which could be applied across activities; there was no general strategy for predicting energy conservation activities.

Policy-makers should recognize that energy conservation programs with broad admonitions to save energy will not be as successful as programs aimed at encouraging households to perform specific activities.

Programs should be designed to address attributes relevant to carefully selected activities and targeted to populations most likely to respond to the energy conservation appeals. Programs should not focus on any one attribute or demographic variable, but should consider appropriate combinations applicable to the selected energy conservation activity.

For example, a program designed to increase the proportion of storm windows in households should emphasize low cost, cleanliness, and social opinion. Further, the significant negative correlation found in this study between proportion of storm windows and number of magazines read by the female household head indicated that advertising storm windows in female-oriented magazines would not be very effective. Programs promoting thermostat setback behavior need not consider attribute perceptions, but should focus on two demographic variables: the number of magazines read by the male household head and the education of the female household head--both variables were positively correlated with thermostat setback. No demographic variables were significantly related to purchase of beverage in returnable bottles. Returnable bottle purchase was best predicted by a combination of seven attributes: purchase behavior was negatively associated with perceived cost, savings, social opinion, and environmental effect; and positively related to understandability, comfort, and cleanliness.

The ultimate objective of energy conservation programs is to reduce demand for energy supplies. Millions of dollars have been and will be invested in energy conservation programs, in many cases without empirical evidence to support program decisions. Though the present study was limited to five energy conservation activities, the methodology

can be applied to other activities by researchers seeking to identify optimal combinations of behavior predictors related to residential energy consumers. Knowing more about whether consumers act with the explicit intention of conserving energy, saving money, improving personal comfort, or impressing friends will support wise decision-making and contribute to achieving the ultimate objective.

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## APPENDICES

APPENDIX A

SURVEY MATERIALS

### INFORMED CONSENT

I understand that this survey is being conducted for research purposes only and that the confidentiality of my responses is assured. I am also aware that I may refuse to answer any question which I feel violates my privacy and I am aware that I may end this survey at any time. I hereby attest that my participation in this survey is completely voluntary.

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Respondent

\_\_\_\_\_  
Signature of Respondent

\_\_\_\_\_  
Signature of Interviewer

Interviewer \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_

Respondent(s) \_\_\_\_\_

Address \_\_\_\_\_ Census Tract \_\_\_\_\_ Block No. \_\_\_\_\_

1. Race of respondent(s). CLASSIFY FROM OBSERVATION.

- 1 Caucasian  
2 Negro  
3 Other

2. What is your married status? ASK ONLY IF NOT ALREADY APPARENT.

- 1 Single  
2 Married  
3 Divorced/Separated  
4 Widowed

3. How many years have you lived in Knoxville?

\_\_\_\_ Male  
 \_\_\_\_ Female

4. Where were you born?

Male \_\_\_\_\_  
 Female \_\_\_\_\_

5. In what year were you born?

Male \_\_\_\_\_  
 Female \_\_\_\_\_

6. What is the highest level of regular school which you have completed?

Male Female

- |          |          |                                            |
|----------|----------|--------------------------------------------|
| <u>1</u> | <u>1</u> | Less than eighth grade                     |
| <u>2</u> | <u>2</u> | Some high school                           |
| <u>3</u> | <u>3</u> | Completed high school                      |
| <u>4</u> | <u>4</u> | Some college                               |
| <u>5</u> | <u>5</u> | Technical/vocational/junior college degree |
| <u>6</u> | <u>6</u> | Four year college degree                   |
| <u>7</u> | <u>7</u> | Some graduate work                         |
| <u>8</u> | <u>8</u> | Advanced degree                            |

7. What is your employment status?

Male Female

- |          |          |                                         |
|----------|----------|-----------------------------------------|
| <u>1</u> | <u>1</u> | Employed full-time                      |
| <u>2</u> | <u>2</u> | Employed part-time                      |
| <u>3</u> | <u>3</u> | Looking for or awaiting employment      |
| <u>4</u> | <u>4</u> | Not looking for employment (unemployed) |
| <u>5</u> | <u>5</u> | Retired                                 |

8. What is your occupation?

Male \_\_\_\_\_

Female \_\_\_\_\_

9. What is your religious affiliation?

Male Female

|          |          |                     |
|----------|----------|---------------------|
| <u>1</u> | <u>1</u> | Catholic            |
| <u>2</u> | <u>2</u> | Episcopal           |
| <u>3</u> | <u>3</u> | Presbyterian        |
| <u>4</u> | <u>4</u> | Southern Baptist    |
| <u>5</u> | <u>5</u> | United Methodist    |
| <u>6</u> | <u>6</u> | United Presbyterian |
| <u>7</u> | <u>7</u> | Other (specify)     |
| <u>8</u> | <u>8</u> | No preference       |

10. Did you vote in a public election in 1976?

Male Female

|          |          |     |
|----------|----------|-----|
| <u>1</u> | <u>1</u> | Yes |
| <u>2</u> | <u>2</u> | No  |

11. What magazines or periodicals do you read on a regular basis?

Male

Female

|                |                |
|----------------|----------------|
| <u>1</u> _____ | <u>1</u> _____ |
| <u>2</u> _____ | <u>2</u> _____ |
| <u>3</u> _____ | <u>3</u> _____ |
| <u>4</u> _____ | <u>4</u> _____ |
| <u>5</u> _____ | <u>5</u> _____ |

12. In what clubs, societies, or organizations are you presently an active member?

Male

Female

|                |                |
|----------------|----------------|
| <u>1</u> _____ | <u>1</u> _____ |
| <u>2</u> _____ | <u>2</u> _____ |
| <u>3</u> _____ | <u>3</u> _____ |
| <u>4</u> _____ | <u>4</u> _____ |

13. How many people, including yourself, live in the household? \_\_\_\_\_

ASK QUESTIONS 14, 15, and 16 ONLY IF THE RESPONSE TO QUESTION 13 INDICATES THAT CHILDREN LIVE IN THE HOUSEHOLD.

14. What are the sexes and ages of the children who live in your household on a regular basis? YOUNGEST TO OLDEST.

Sex

Age

|       |       |
|-------|-------|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

15. How many of the children in your household are active in scouting?  
\_\_\_\_\_
16. Have the children in your household ever suggested ideas to you for conserving energy?  
     1 Yes  
     2 No

### H O U S E H O L D    I N F O R M A T I O N

1. How many years have you lived at your present address? \_\_\_\_\_
2. Do you own or rent the house in which you currently live?  
     1 Own  
     2 Rent  
     3 Other (specify) \_\_\_\_\_
3. When was the house built?  
     1 1970 to present  
     2 1965 to 1969  
     3 1960 to 1964  
     4 1950 to 1959  
     5 1940 to 1949  
     6 1930 to 1939  
     7 Before 1930  
     8 Don't know
4. How many rooms are in the house? \_\_\_\_\_  
     [Include only whole rooms used for living purposes such as kitchen, dining room, finished recreation room, family room, and bedrooms. DO NOT count bedrooms, porches, halls, utility rooms, or storage space.]
5. What is the approximate size of the house in square feet?  
     1 Less than 1000 square feet  
     2 1000 to 1499 square feet  
     3 1500 to 1999 square feet  
     4 2000 to 2499 square feet  
     5 2500 to 2999 square feet  
     6 3000 to 3499 square feet  
     7 3500 square feet or more  
     8 Don't know

6. What is the approximate current value of the property, including both the house and the lot? EMPHASIZE RESPONSE RANGES.
- 1 Less than \$10,000
  - 2 \$10,000 to \$19,999
  - 3 \$20,000 to \$29,999
  - 4 \$30,000 to \$39,999
  - 5 \$40,000 to \$49,999
  - 6 \$50,000 to \$59,999
  - 7 \$60,000 or more
  - 8 Don't know
7. What was the approximate gross income of the household last year, considering all sources? EMPHASIZE RESPONSE RANGES.
- 1 Less than \$10,000
  - 2 \$10,000 to \$14,999
  - 3 \$15,000 to \$19,999
  - 4 \$20,000 to \$24,999
  - 5 \$25,000 to \$29,999
  - 6 \$30,000 to \$34,999
  - 7 \$35,000 to \$39,999
  - 8 \$40,000 or more
8. What kind of *fuel* is primarily used to heat the house?
- 1 Bottled, tank, or LP gas
  - 2 Coal or coke
  - 3 Electricity
  - 4 Fuel oil or kerosene
  - 5 Utility gas
  - 6 Wood
  - 7 Other fuel (specify) \_\_\_\_\_
  - 8 Don't know
9. What type of *heating equipment* is primarily used to heat the house?
- 1 Built-in electric room heaters
  - 2 Portable space heaters
  - 3 Steam or hot water (radiators)
  - 4 Warm air furnace
  - 5 Ceil Heat
  - 6 Heat pump
  - 7 Other (specify) \_\_\_\_\_
  - 8 Don't know
10. How many inches of insulation are on the hot water pipes?
- 1 None
  - 2 Less than one inch
  - 3 1 to 1.9 inches
  - 4 2 to 2.9 inches
  - 5 3 to 3.9 inches
  - 6 4 to 4.9 inches
  - 7 5 or more inches
  - 8 Don't know

11. What is the source of water for the household?

- 1 Public system or private company  
2 Individual well  
3 Other (specify) \_\_\_\_\_  
4 Don't know

12. What method of sewage disposal is used by the household?

- 1 Public sewer  
2 Septic tank or cesspool  
3 Other (specify) \_\_\_\_\_  
4 Don't know

13. How many of each of the following appliances are *used* by the household?

- \_\_\_ 1. Color television  
 \_\_\_ 2. Black and white television  
 \_\_\_ 3. Room air conditioner  
 \_\_\_ 4. Central air conditioner  
 \_\_\_ 5. Gas powered lawn mower  
 \_\_\_ 6. Electrically powered lawn mower  
 \_\_\_ 7. Automatic washing machine  
 \_\_\_ 8. Wringer washing machine  
 \_\_\_ 9. Electrically heated clothes dryer  
 \_\_\_ 10. Gas heated clothes dryer  
 \_\_\_ 11. Electrically heated clothes dryer  
 \_\_\_ 12. Gas heated stove  
 \_\_\_ 13. Microwave oven  
 \_\_\_ 14. Frost-free refrigerator  
 \_\_\_ 15. Manual defrost refrigerator  
 \_\_\_ 16. Freezer  
 \_\_\_ 17. Dishwasher with water heating unit  
 \_\_\_ 18. Dishwasher without water heating unit  
 \_\_\_ 19. Garbage disposal  
 \_\_\_ 20. Trash compactor

14. For each motor vehicle owned and used by members of the household, what is the year, model, and miles per gallon? LIST FROM NEWEST TO OLDEST.

|                       |  |  |  |  |  |
|-----------------------|--|--|--|--|--|
| Year                  |  |  |  |  |  |
| Model                 |  |  |  |  |  |
| MPG Road/City         |  |  |  |  |  |
| Source of Information |  |  |  |  |  |

15. From what source do you know the miles per gallon of each motor vehicle? USE THE FOLLOWING SCALE TO ENTER INFORMATION IN THE ABOVE TABLE:

- 1 = self-monitored  
 2 = monitored by someone other than those interviewed  
 3 = read about it  
 4 = guessed  
 5 = don't know

Q-SORT CODING SHEET

|                                   |                                                         |                                                         |                                   |
|-----------------------------------|---------------------------------------------------------|---------------------------------------------------------|-----------------------------------|
| <div><div></div><div></div></div> | <div><div></div><div></div><div></div><div></div></div> | <div><div></div><div></div><div></div><div></div></div> | <div><div></div><div></div></div> |
| 1                                 | 2                                                       | 3                                                       | 4                                 |
| LEAST                             |                                                         |                                                         | MOST                              |
| IMPORTANT                         |                                                         | IMPORTANT                                               |                                   |
| <u>HUSBAND</u>                    |                                                         |                                                         |                                   |

|                                   |                                                         |                                                         |                                   |
|-----------------------------------|---------------------------------------------------------|---------------------------------------------------------|-----------------------------------|
| <div><div></div><div></div></div> | <div><div></div><div></div><div></div><div></div></div> | <div><div></div><div></div><div></div><div></div></div> | <div><div></div><div></div></div> |
| 1                                 | 2                                                       | 3                                                       | 4                                 |
| LEAST                             |                                                         |                                                         | MOST                              |
| IMPORTANT                         |                                                         | IMPORTANT                                               |                                   |
| <u>WIFE</u>                       |                                                         |                                                         |                                   |

INSTALL AT LEAST 6 INCHES OF INSULATION IN THE ATTIC

1. How many inches of insulation are currently in the attic?

\_\_\_\_\_ 1. Don't know  
\_\_\_\_\_ 2. None  
\_\_\_\_\_ 3. Less than 2 inches  
\_\_\_\_\_ 4. 2 to 3.9 inches  
\_\_\_\_\_ 5. 4 to 5.9 inches  
\_\_\_\_\_ 6. 6 to 7.9 inches  
\_\_\_\_\_ 7. 8 to 9.9 inches  
\_\_\_\_\_ 8. 10 or more inches

2. How many inches of attic insulation was your household responsible for having installed?

\_\_\_\_\_ 1. All attic insulation came with the house  
\_\_\_\_\_ 2. Added less than 2 inches  
\_\_\_\_\_ 3. Added 2 to 3.9 inches  
\_\_\_\_\_ 4. Added 4 to 5.9 inches  
\_\_\_\_\_ 5. Added 6 to 7.9 inches  
\_\_\_\_\_ 6. Added 8 to 9.9 inches  
\_\_\_\_\_ 7. Added more than 10 inches

3. Who had (or would have) primary responsibility for having attic insulation installed?

\_\_\_\_\_ 1. Husband  
\_\_\_\_\_ 2. Wife  
\_\_\_\_\_ 3. Both husband and wife  
\_\_\_\_\_ 4. Another member of the household  
\_\_\_\_\_ 5. Someone outside the household

REDUCE ROOM TEMPERATURE THERMOSTAT SETTING AT NIGHT

1. How many degrees Fahrenheit are the household temperature control thermostat(s) set back at night?

☐ 1. Do not set back thermostat(s) at night  
☐ 2. 1 to 2 degrees  
☐ 3. 3 to 4 degrees  
☐ 4. 5 to 6 degrees  
☐ 5. 7 to 8 degrees  
☐ 6. 9 to 10 degrees  
☐ 7. More than 10 degrees  
☐ 8. Don't know

2. How many room temperature control thermostats are used in the house?

☐ 1. No thermostat units  
☐ 2. 1 thermostat unit  
☐ 3. 2 thermostat units  
☐ 4. 3 thermostat units  
☐ 5. 4 thermostat units  
☐ 6. 5 thermostat units  
☐ 7. 6 thermostat units  
☐ 8. More than 6 thermostat units

3. Are any automatic thermostat set back units used in the house?

☐ 1. Yes  
☐ 2. No  
☐ 3. Don't know

4. Who has (or would have) primary responsibility for reducing room temperature thermostat settings at night?

☐ 1. Husband  
☐ 2. Wife  
☐ 3. Both husband and wife  
☐ 4. Another member of the household  
☐ 5. Someone outside the household

USE STORM WINDOWS

1. How many exterior windows are in the house? (Enter exact number) \_\_\_\_\_

2. How many of the exterior windows in the house currently have storm windows?

(Enter exact number) \_\_\_\_\_

3. How many storm windows was your household responsible for having installed?

(Enter exact number) \_\_\_\_\_

4. Who had (or would have) primary responsibility for having storm windows installed?

☐ 1. Husband  
☐ 2. Wife  
☐ 3. Both husband and wife  
☐ 4. Another member of the household  
☐ 5. Someone outside the household

### BUY BEVERAGES IN RETURNABLE BOTTLES

1. How often does the household purchase beverages in returnable bottles, as opposed to disposables?

☐ 1. Only buy disposables  
☐ 2. Mostly disposables but occasionally some returnables  
☐ 3. Slightly more disposables  
☐ 4. About equal amounts of disposables and returnables  
☐ 5. Slightly more returnables  
☐ 6. Mostly returnables but occasionally some disposables  
☐ 7. Only buy returnables

2. On the average, what is the household consumption of beverages which are available in returnable bottles, such as cola and beer.

☐ 1. None  
☐ 2. Very low  
☐ 3. Quite low  
☐ 4. Somewhat low  
☐ 5. Somewhat high  
☐ 6. Quite high  
☐ 7. Very high

3. Who has (or would have) primary responsibility for buying beverages in returnable bottles?

☐ 1. Husband  
☐ 2. Wife  
☐ 3. Both husband and wife  
☐ 4. Another member of the household  
☐ 5. Someone outside the household

### SAVE PAPER FOR RECYCLING

1. How much paper does the household save for recycling?

☐ 1. None  
☐ 2. Very little  
☐ 3. A moderate amount  
☐ 4. Quite a lot  
☐ 5. All

2. In general, how much paper is used by the household?

☐ 1. None  
☐ 2. Very little  
☐ 3. A moderate amount  
☐ 4. Quite a lot  
☐ 5. A very large amount

3. Who has (or would have) primary responsibility for having paper saved for recycling?

☐ 1. Husband  
☐ 2. Wife  
☐ 3. Both husband and wife  
☐ 4. Another member of the household  
☐ 5. Someone outside the household

INSTALL AT LEAST 6 INCHES OF INSULATION IN THE ATTIC

118

Where have you heard about installing at least 6 inches of insulation in the attic? (Check as many as apply)

- ☐ 1. This is the first time
- ☐ 2. Friends
- ☐ 3. Family
- ☐ 4. Television and/or radio
- ☐ 5. School
- ☐ 6. General interest literature
- ☐ 7. Store displays
- ☐ 8. Energy conservation pamphlets
- ☐ 9. Other (Specify) \_\_\_\_\_

|                                                                                                                                           |                                       |   |   |                                              |   |   |                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---|---|----------------------------------------------|---|---|------------------------------------------|
| <u>COST</u> : How much money does it cost to do this activity?                                                                            | 1<br>No<br>cost                       | 2 | 3 | 4<br>Moderate<br>cost                        | 5 | 6 | 7<br>Great<br>cost                       |
| <u>SAVINGS</u> : How much money does this activity save the household?                                                                    | 1<br>No<br>savings                    | 2 | 3 | 4<br>Moderate<br>savings                     | 5 | 6 | 7<br>Great<br>savings                    |
| <u>EFFORT</u> : How much effort is required to do this activity?                                                                          | 1<br>Very<br>little<br>effort         | 2 | 3 | 4<br>Moderate<br>effort                      | 5 | 6 | 7<br>A lot<br>of effort                  |
| <u>UNDERSTANDABILITY</u> : How easy is it to understand how to do this activity?                                                          | 1<br>Not at<br>all easy               | 2 | 3 | 4<br>Moderately<br>easy                      | 5 | 6 | 7<br>Very<br>easy                        |
| <u>COMFORT</u> : How much does this activity effect the personal comfort of household members?                                            | 1<br>Great<br>decrease                | 2 | 3 | 4<br>No<br>effect                            | 5 | 6 | 7<br>Great<br>increase                   |
| <u>CLEANLINESS</u> : How clean is this activity?                                                                                          | 1<br>Not at<br>all clean              | 2 | 3 | 4<br>Moderately<br>clean                     | 5 | 6 | 7<br>Very<br>clean                       |
| <u>COOPERATION</u> : How much cooperation is required of household members to do this activity?                                           | 1<br>No<br>cooperation<br>required    | 2 | 3 | 4<br>Moderate<br>amount                      | 5 | 6 | 7<br>A lot of<br>cooperation<br>required |
| <u>OBSERVABILITY</u> : How noticeable/observable is this activity to people who may visit the house?                                      | 1<br>Not<br>noticeable/<br>observable | 2 | 3 | 4<br>Moderately<br>noticeable/<br>observable | 5 | 6 | 7<br>Very<br>noticeable/<br>observable   |
| <u>SOCIAL OPINION</u> : To what extent would friends and acquaintances have positive or negative opinions about your doing this activity? | 1<br>Very<br>negative                 | 2 | 3 | 4<br>Neutral                                 | 5 | 6 | 7<br>Very<br>positive                    |
| <u>COMMUNICATIONS</u> : How often have you heard about this activity?                                                                     | 1<br>Never<br>before                  | 2 | 3 | 4<br>Moderate<br>amount                      | 5 | 6 | 7<br>Very<br>often                       |
| <u>ENERGY</u> : How much would this activity conserve energy resources if everyone were to do it?                                         | 1<br>No<br>energy<br>conservation     | 2 | 3 | 4<br>Moderate<br>amount                      | 5 | 6 | 7<br>Great<br>energy<br>conservation     |
| <u>ENVIRONMENT</u> : How beneficial for the environment would this activity be if everyone were to do it?                                 | 1<br>Not at all<br>beneficial         | 2 | 3 | 4<br>Moderately<br>beneficial                | 5 | 6 | 7<br>Very<br>beneficial                  |

REDUCE ROOM TEMPERATURE THERMOSTAT SETTING AT NIGHT

119

Where have you heard about reducing the room temperature thermostat setting at night? (Check as many as apply)

- ☐ 1. This is the first time
- ☐ 2. Friends
- ☐ 3. Family
- ☐ 4. Television and/or radio
- ☐ 5. School
- ☐ 6. General interest literature
- ☐ 7. Store displays
- ☐ 8. Energy conservation pamphlets
- ☐ 9. Other (Specify) \_\_\_\_\_

|                                                                                                                                           |                                      |   |   |                                             |   |   |                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---|---|---------------------------------------------|---|---|------------------------------------------|
| <u>COST</u> : How much money does it cost to do this activity?                                                                            | 1<br>No<br>cost                      | 2 | 3 | 4<br>Moderate<br>cost                       | 5 | 6 | 7<br>Great<br>cost                       |
| <u>SAVINGS</u> : How much money does this activity save the household?                                                                    | 1<br>No<br>savings                   | 2 | 3 | 4<br>Moderate<br>savings                    | 5 | 6 | 7<br>Great<br>savings                    |
| <u>EFFORT</u> : How much effort is required to do this activity?                                                                          | 1<br>Very<br>little<br>effort        | 2 | 3 | 4<br>Moderate<br>effort                     | 5 | 6 | 7<br>A lot<br>of effort                  |
| <u>UNDERSTANDABILITY</u> : How easy is it to understand how to do this activity?                                                          | 1<br>Not at<br>all easy              | 2 | 3 | 4<br>Moderately<br>easy                     | 5 | 6 | 7<br>Very<br>easy                        |
| <u>COMFORT</u> : How much does this activity effect the personal comfort of household members?                                            | 1<br>Great<br>decrease               | 2 | 3 | 4<br>No<br>effect                           | 5 | 6 | 7<br>Great<br>increase                   |
| <u>CLEANLINESS</u> : How clean is this activity?                                                                                          | 1<br>Not at<br>all clean             | 2 | 3 | 4<br>Moderately<br>clean                    | 5 | 6 | 7<br>Very<br>clean                       |
| <u>COOPERATION</u> : How much cooperation is required of household members to do this activity?                                           | 1<br>No<br>cooperation<br>required   | 2 | 3 | 4<br>Moderate<br>amount                     | 5 | 6 | 7<br>A lot of<br>cooperation<br>required |
| <u>OBSERVABILITY</u> : How noticable/observable is this activity to people who may visit the house?                                       | 1<br>Not<br>noticable/<br>observable | 2 | 3 | 4<br>Moderately<br>noticable/<br>observable | 5 | 6 | 7<br>Very<br>noticable/<br>observable    |
| <u>SOCIAL OPINION</u> : To what extent would friends and acquaintances have positive or negative opinions about your doing this activity? | 1<br>Very<br>negative                | 2 | 3 | 4<br>Neutral                                | 5 | 6 | 7<br>Very<br>positive                    |
| <u>COMMUNICATIONS</u> : How often have you heard about this activity?                                                                     | 1<br>Never<br>before                 | 2 | 3 | 4<br>Moderate<br>amount                     | 5 | 6 | 7<br>Very<br>often                       |
| <u>ENERGY</u> : How much would this activity conserve energy resources if everyone were to do it?                                         | 1<br>No<br>energy<br>conservation    | 2 | 3 | 4<br>Moderate<br>amount                     | 5 | 6 | 7<br>Great<br>energy<br>conservation     |
| <u>ENVIRONMENT</u> : How beneficial for the environment would this activity be if everyone were to do it?                                 | 1<br>Not at all<br>beneficial        | 2 | 3 | 4<br>Moderately<br>beneficial               | 5 | 6 | 7<br>Very<br>beneficial                  |

Where have you heard about installing storm windows? (Check as many as apply)

- ☐ 1. This is the first time
- ☐ 2. Friends
- ☐ 3. Family
- ☐ 4. Television and/or radio
- ☐ 5. School
- ☐ 6. General interest literature
- ☐ 7. Store displays
- ☐ 8. Energy conservation pamphlets
- ☐ 9. Other (Specify) \_\_\_\_\_

|                                                                                                                                           |                                       |   |   |                                              |   |   |                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---|---|----------------------------------------------|---|---|------------------------------------------|
| <u>COST</u> : How much money does it cost to do this activity?                                                                            | 1<br>No<br>cost                       | 2 | 3 | 4<br>Moderate<br>cost                        | 5 | 6 | 7<br>Great<br>cost                       |
| <u>SAVINGS</u> : How much money does this activity save the household?                                                                    | 1<br>No<br>savings                    | 2 | 3 | 4<br>Moderate<br>savings                     | 5 | 6 | 7<br>Great<br>savings                    |
| <u>EFFORT</u> : How much effort is required to do this activity?                                                                          | 1<br>Very<br>little<br>effort         | 2 | 3 | 4<br>Moderate<br>effort                      | 5 | 6 | 7<br>A lot<br>of effort                  |
| <u>UNDERSTANDABILITY</u> : How easy is it to understand how to do this activity?                                                          | 1<br>Not at<br>all easy               | 2 | 3 | 4<br>Moderately<br>easy                      | 5 | 6 | 7<br>Very<br>easy                        |
| <u>COMFORT</u> : How much does this activity effect the personal comfort of household members?                                            | 1<br>Great<br>decrease                | 2 | 3 | 4<br>No<br>effect                            | 5 | 6 | 7<br>Great<br>increase                   |
| <u>CLEANLINESS</u> : How clean is this activity?                                                                                          | 1<br>Not at<br>all clean              | 2 | 3 | 4<br>Moderately<br>clean                     | 5 | 6 | 7<br>Very<br>clean                       |
| <u>COOPERATION</u> : How much cooperation is required of household members to do this activity?                                           | 1<br>No<br>cooperation<br>required    | 2 | 3 | 4<br>Moderate<br>amount                      | 5 | 6 | 7<br>A lot of<br>cooperation<br>required |
| <u>OBSERVABILITY</u> : How noticeable/observable is this activity to people who may visit the house?                                      | 1<br>Not<br>noticeable/<br>observable | 2 | 3 | 4<br>Moderately<br>noticeable/<br>observable | 5 | 6 | 7<br>Very<br>noticeable/<br>observable   |
| <u>SOCIAL OPINION</u> : To what extent would friends and acquaintances have positive or negative opinions about your doing this activity? | 1<br>Very<br>negative                 | 2 | 3 | 4<br>Neutral                                 | 5 | 6 | 7<br>Very<br>positive                    |
| <u>COMMUNICATIONS</u> : How often have you heard about this activity?                                                                     | 1<br>Never<br>before                  | 2 | 3 | 4<br>Moderate<br>amount                      | 5 | 6 | 7<br>Very<br>often                       |
| <u>ENERGY</u> : How much would this activity conserve energy resources if everyone were to do it?                                         | 1<br>No<br>energy<br>conservation     | 2 | 3 | 4<br>Moderate<br>amount                      | 5 | 6 | 7<br>Great<br>energy<br>conservation     |
| <u>ENVIRONMENT</u> : How beneficial for the environment would this activity be if everyone were to do it?                                 | 1<br>Not at all<br>beneficial         | 2 | 3 | 4<br>Moderately<br>beneficial                | 5 | 6 | 7<br>Very<br>beneficial                  |

BUY BEVERAGES IN RETURNABLE BOTTLES

Where have you heard about buying beverages in returnable bottles? (Check as many as apply)

- ☐ 1. This is the first time  
☐ 2. Friends  
☐ 3. Family  
☐ 4. Television and/or radio  
☐ 5. School  
☐ 6. General interest literature  
☐ 7. Store displays  
☐ 8. Energy conservation pamphlets  
☐ 9. Other (Specify) \_\_\_\_\_

|                                                                                                                                           |                                       |   |   |                                              |   |   |                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---|---|----------------------------------------------|---|---|------------------------------------------|
| <u>COST</u> : How much money does it cost to do this activity?                                                                            | 1<br>No<br>cost                       | 2 | 3 | 4<br>Moderate<br>cost                        | 5 | 6 | 7<br>Great<br>cost                       |
| <u>SAVINGS</u> : How much money does this activity save the household?                                                                    | 1<br>No<br>savings                    | 2 | 3 | 4<br>Moderate<br>savings                     | 5 | 6 | 7<br>Great<br>savings                    |
| <u>EFFORT</u> : How much effort is required to do this activity?                                                                          | 1<br>Very<br>little<br>effort         | 2 | 3 | 4<br>Moderate<br>effort                      | 5 | 6 | 7<br>A lot<br>of effort                  |
| <u>UNDERSTANDABILITY</u> : How easy is it to understand how to do this activity?                                                          | 1<br>Not at<br>all easy               | 2 | 3 | 4<br>Moderately<br>easy                      | 5 | 6 | 7<br>Very<br>easy                        |
| <u>COMFORT</u> : How much does this activity effect the personal comfort of household members?                                            | 1<br>Great<br>decrease                | 2 | 3 | 4<br>No<br>effect                            | 5 | 6 | 7<br>Great<br>increase                   |
| <u>CLEANLINESS</u> : How clean is this activity?                                                                                          | 1<br>Not at<br>all clean              | 2 | 3 | 4<br>Moderately<br>clean                     | 5 | 6 | 7<br>Very<br>clean                       |
| <u>COOPERATION</u> : How much cooperation is required of household members to do this activity?                                           | 1<br>No<br>cooperation<br>required    | 2 | 3 | 4<br>Moderate<br>amount                      | 5 | 6 | 7<br>A lot of<br>cooperation<br>required |
| <u>OBSERVABILITY</u> : How noticeable/observable is this activity to people who may visit the house?                                      | 1<br>Not<br>noticeable/<br>observable | 2 | 3 | 4<br>Moderately<br>noticeable/<br>observable | 5 | 6 | 7<br>Very<br>noticeable/<br>observable   |
| <u>SOCIAL OPINION</u> : To what extent would friends and acquaintances have positive or negative opinions about your doing this activity? | 1<br>Very<br>negative                 | 2 | 3 | 4<br>Neutral                                 | 5 | 6 | 7<br>Very<br>positive                    |
| <u>COMMUNICATIONS</u> : How often have you heard about this activity?                                                                     | 1<br>Never<br>before                  | 2 | 3 | 4<br>Moderate<br>amount                      | 5 | 6 | 7<br>Very<br>often                       |
| <u>ENERGY</u> : How much would this activity conserve energy resources if everyone were to do it?                                         | 1<br>No<br>energy<br>conservation     | 2 | 3 | 4<br>Moderate<br>amount                      | 5 | 6 | 7<br>Great<br>energy<br>conservation     |
| <u>ENVIRONMENT</u> : How beneficial for the environment would this activity be if everyone were to do it?                                 | 1<br>Not at all<br>beneficial         | 2 | 3 | 4<br>Moderately<br>beneficial                | 5 | 6 | 7<br>Very<br>beneficial                  |

Where have you heard about saving paper for recycling? (Check as many as apply)

- ☐ 1. This is the first time
- ☐ 2. Friends
- ☐ 3. Family
- ☐ 4. Television and/or radio
- ☐ 5. School
- ☐ 6. General interest literature
- ☐ 7. Store displays
- ☐ 8. Energy conservation pamphlets
- ☐ 9. Other (Specify) \_\_\_\_\_

|                                                                                                                                           |                                       |   |   |                                              |   |   |                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---|---|----------------------------------------------|---|---|------------------------------------------|
| <u>COST</u> : How much money does it cost to do this activity?                                                                            | 1<br>No<br>cost                       | 2 | 3 | 4<br>Moderate<br>cost                        | 5 | 6 | 7<br>Great<br>cost                       |
| <u>SAVINGS</u> : How much money does this activity save the household?                                                                    | 1<br>No<br>savings                    | 2 | 3 | 4<br>Moderate<br>savings                     | 5 | 6 | 7<br>Great<br>savings                    |
| <u>EFFORT</u> : How much effort is required to do this activity?                                                                          | 1<br>Very<br>little<br>effort         | 2 | 3 | 4<br>Moderate<br>effort                      | 5 | 6 | 7<br>A lot<br>of effort                  |
| <u>UNDERSTANDABILITY</u> : How easy is it to understand how to do this activity?                                                          | 1<br>Not at<br>all easy               | 2 | 3 | 4<br>Moderately<br>easy                      | 5 | 6 | 7<br>Very<br>easy                        |
| <u>COMFORT</u> : How much does this activity effect the personal comfort of household members?                                            | 1<br>Great<br>decrease                | 2 | 3 | 4<br>No<br>effect                            | 5 | 6 | 7<br>Great<br>increase                   |
| <u>CLEANLINESS</u> : How clean is this activity?                                                                                          | 1<br>Not at<br>all clean              | 2 | 3 | 4<br>Moderately<br>clean                     | 5 | 6 | 7<br>Very<br>clean                       |
| <u>COOPERATION</u> : How much cooperation is required of household members to do this activity?                                           | 1<br>No<br>cooperation<br>required    | 2 | 3 | 4<br>Moderate<br>amount                      | 5 | 6 | 7<br>A lot of<br>cooperation<br>required |
| <u>OBSERVABILITY</u> : How noticeable/observable is this activity to people who may visit the house?                                      | 1<br>Not<br>noticeable/<br>observable | 2 | 3 | 4<br>Moderately<br>noticeable/<br>observable | 5 | 6 | 7<br>Very<br>noticeable/<br>observable   |
| <u>SOCIAL OPINION</u> : To what extent would friends and acquaintances have positive or negative opinions about your doing this activity? | 1<br>Very<br>negative                 | 2 | 3 | 4<br>Neutral                                 | 5 | 6 | 7<br>Very<br>positive                    |
| <u>COMMUNICATIONS</u> : How often have you heard about this activity?                                                                     | 1<br>Never<br>before                  | 2 | 3 | 4<br>Moderate<br>amount                      | 5 | 6 | 7<br>Very<br>often                       |
| <u>ENERGY</u> : How much would this activity conserve energy resources if everyone were to do it?                                         | 1<br>No<br>energy<br>conservation     | 2 | 3 | 4<br>Moderate<br>amount                      | 5 | 6 | 7<br>Great<br>energy<br>conservation     |
| <u>ENVIRONMENT</u> : How beneficial for the environment would this activity be if everyone were to do it?                                 | 1<br>Not at all<br>beneficial         | 2 | 3 | 4<br>Moderately<br>beneficial                | 5 | 6 | 7<br>Very<br>beneficial                  |

This section contains three brief questionnaires regarding some of your general beliefs, attitudes about environmental quality, and general life satisfaction. Please read the specific instructions associated with each questionnaire before responding.

# GENERAL BELIEFS QUESTIONNAIRE

124

For each of the following pairs of statements place a checkmark (✓) in the box which indicates where your opinion is in relation to the two statements. For example, if you feel that your opinion is slightly close to the statement on the left, make a checkmark (✓) in the box number 2; or if you feel that your opinion is very close to the statement on the left, make a checkmark in box number 1. Similarly, check box numbers 3 if you feel that your opinion is slightly close, or number 4 if it is very close to the statement on the right.

1. Children get into trouble because their parents punish them too much.

|   |   |   |   |
|---|---|---|---|
|   |   |   |   |
| 1 | 2 | 3 | 4 |

The trouble with most children nowadays is that their parents are too easy with them

2. In the long run people get the respect they deserve in this world.

|   |   |   |   |
|---|---|---|---|
|   |   |   |   |
| 1 | 2 | 3 | 4 |

Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.

3. The idea that teachers are unfair to students is nonsense.

|   |   |   |   |
|---|---|---|---|
|   |   |   |   |
| 1 | 2 | 3 | 4 |

Most students don't realize the extent to which their grades are influenced by accidental happenings.

4. Becoming a success is a matter of hard work, luck has little or nothing to do with it.

|   |   |   |   |
|---|---|---|---|
|   |   |   |   |
| 1 | 2 | 3 | 4 |

Getting a good job depends mainly on being in the right place at the right time.

5. The average citizen can have an influence in government decisions.

|   |   |   |   |
|---|---|---|---|
|   |   |   |   |
| 1 | 2 | 3 | 4 |

This world is run by the few people in power, and there is not much the little guy can do about it.

6. In my case getting what I want has little or nothing to do with luck.

|   |   |   |   |
|---|---|---|---|
|   |   |   |   |
| 1 | 2 | 3 | 4 |

Many times we might just as well decide what to do by, flipping a coin.

7. Who gets to be the boss often depends on who was lucky enough to be in the right place first.

|   |   |   |   |
|---|---|---|---|
|   |   |   |   |
| 1 | 2 | 3 | 4 |

Getting people to do the right thing depends upon ability, luck has little or nothing to do with it.

8. Most people don't realize the extent to which their lives are controlled by accidental happenings.

|   |   |   |   |
|---|---|---|---|
|   |   |   |   |
| 1 | 2 | 3 | 4 |

There really is no such thing as "luck."

9. In the long run the bad things that happen to us are balanced by the good ones.

|   |   |   |   |
|---|---|---|---|
|   |   |   |   |
| 1 | 2 | 3 | 4 |

Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.

10. Many times I feel that I have little influence over the things that happen to me.

|   |   |   |   |
|---|---|---|---|
|   |   |   |   |
| 1 | 2 | 3 | 4 |

It is impossible for me to believe that chance or luck plays an important role in my life.

11. What happens to me is my own doing.

|   |   |   |   |
|---|---|---|---|
|   |   |   |   |
| 1 | 2 | 3 | 4 |

Sometimes I feel that I don't have enough control over the direction my life is taking.

## ENVIRONMENTAL QUALITY

*Please indicate the extent to which you agree or disagree with each of the following statements:*

| Very strongly agree | Strongly agree | Agree | Slightly agree | Slightly disagree | Disagree | Strongly disagree | Very strongly disagree |                                                                                                                   |
|---------------------|----------------|-------|----------------|-------------------|----------|-------------------|------------------------|-------------------------------------------------------------------------------------------------------------------|
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 1. The news media have exaggerated the ecological problem.                                                        |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 2. People should buy beverages only in returnable containers.                                                     |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 3. Every couple in America should try not to have more than two children.                                         |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 4. Commercial hunting of whales should be banned.                                                                 |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 5. If mankind is going to survive at all, environmental pollution must be stopped.                                |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 6. People should use less detergent than the manufacturer recommends.                                             |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 7. Overpopulation is a major source of environmental problems today.                                              |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 8. People should be allowed to pick flowers in a national park.                                                   |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 9. Although polluted environments may smell bad or be unsightly, they are usually not dangerous to health.        |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 10. There is nothing wrong with using electric can openers, electric pencil sharpeners, or electric toothbrushes. |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 11. I am worried about future children's chances of living in a clean environment.                                |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 12. Knoxville is a great place to live.                                                                           |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 13. People should try to recycle glass and paper.                                                                 |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 14. Science and technology will solve environmental problems before very long.                                    |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 15. Putting a brick in one's toilet to conserve water is a dumb idea.                                             |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 16. I get depressed on smoggy days.                                                                               |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 17. When I think of the ways industries are polluting, I get frustrated and angry.                                |
| 1                   | 2              | 3     | 4              | 5                 | 6        | 7                 | 8                      | 18. I feel people worry too much about pesticides on food products.                                               |



## APPENDIX B

### CHARACTERISTICS OF COMPLETED SAMPLE

## APPENDIX B

### CHARACTERISTICS OF COMPLETED SAMPLE

The following items were asked of each household during the first half of the interview. Both male and female heads of household responded verbally and, where there was disagreement on an item, reached consensus before the response was recorded. For each item, appropriate descriptive statistics are provided. Percentages are rounded to the nearest whole number. The data are based on 126 household interviews: 100 with both male and female respondents; 11 with only male respondents; and 15 with only female respondents.

#### 1. Race of respondent.

| <i>Response Categories</i> | <i>N</i> | <i>Percentage</i> |
|----------------------------|----------|-------------------|
| Caucasian                  | 226      | 100%              |
| Negro                      | 0        | 0                 |
| Other                      | 0        | 0                 |

#### 2. What is your marital status? [household response]

| <i>Response Categories</i> | <i>N</i> | <i>Percentage</i> |
|----------------------------|----------|-------------------|
| Single                     | 0        | 0                 |
| Married                    | 113      | 90%               |
| Divorced/separated         | 6        | 5                 |
| Widowed                    | 7        | 5                 |

#### 3. How many years have you lived in Knoxville?

| <i>Sex</i> | <i>N</i> | <i>Mean</i> |
|------------|----------|-------------|
| Male       | 110      | 31.8        |
| Female     | 115      | 29.8        |

## 4. Where were you born?

| <i>Response Categories<sup>a</sup></i> | <i>Male</i> |                   | <i>Female</i> |                   |
|----------------------------------------|-------------|-------------------|---------------|-------------------|
|                                        | <i>N</i>    | <i>Percentage</i> | <i>N</i>      | <i>Percentage</i> |
| Knoxville                              | 37          | 33%               | 32            | 27%               |
| Tennessee (excluding Knoxville)        | 26          | 23                | 30            | 26                |
| South Atlantic                         | 13          | 12                | 15            | 13                |
| South Central                          | 11          | 10                | 19            | 16                |
| Northeast                              | 10          | 9                 | 10            | 9                 |
| Central                                | 13          | 12                | 9             | 8                 |
| West                                   | 0           | 0                 | 1             | 1                 |
| Outside U.S.                           | 1           | 1                 | 1             | 1                 |

<sup>a</sup>Based on U.S. Census definitions, except "Knoxville" and "Tennessee."

## 5. In what year were you born? [Age of respondent was computed by subtracting year of birth from 1977.]

| <i>Sex</i> | <i>N</i>        | <i>Mean Age</i> |
|------------|-----------------|-----------------|
| Male       | 109 (2 missing) | 51.9            |
| Female     | 112 (3 missing) | 50.5            |

## 6. What is the highest level of regular school which you have completed?

| <i>Response Categories</i>                 | <i>Male</i>  |                   | <i>Female</i> |                   |
|--------------------------------------------|--------------|-------------------|---------------|-------------------|
|                                            | <i>N</i>     | <i>Percentage</i> | <i>N</i>      | <i>Percentage</i> |
| Less than eighth grade                     | 2            | 2%                | 2             | 2%                |
| Some high school                           | 4            | 4                 | 2             | 2                 |
| Completed high school                      | 10           | 9                 | 26            | 22                |
| Some college                               | 18           | 16                | 30            | 26                |
| Technical/vocational/junior college degree | 5            | 5                 | 15            | 13                |
| Four-year college degree                   | 38           | 34                | 26            | 22                |
| Some graduate work                         | 7            | 6                 | 5             | 4                 |
| Advanced degree                            | 27           | 24                | 11            | 9                 |
|                                            | (15 missing) |                   | (9 missing)   |                   |

## 7. What is your employment status?

| <i>Response Categories</i>              | <i>Male</i> |                   | <i>Female</i> |                   |
|-----------------------------------------|-------------|-------------------|---------------|-------------------|
|                                         | <i>N</i>    | <i>Percentage</i> | <i>N</i>      | <i>Percentage</i> |
| Employed full-time                      | 95          | 86%               | 33            | 28%               |
| Employed part-time                      | 2           | 2                 | 14            | 12                |
| Looking for/awaiting employment         | 0           | 0                 | 0             | 0                 |
| Not looking for employment (unemployed) | 1           | 1                 | 64            | 55                |
| Retired                                 | 13          | 12                | 6             | 5                 |

## 8(a). What is your occupation?

| <i>Response Categories<sup>a</sup></i> | <i>Male</i> |                   | <i>Female</i> |                   |
|----------------------------------------|-------------|-------------------|---------------|-------------------|
|                                        | <i>N</i>    | <i>Percentage</i> | <i>N</i>      | <i>Percentage</i> |
| Professional/technical/managerial      | 57          | 51%               | 16            | 14%               |
| Clerical/sales                         | 22          | 20                | 25            | 22                |
| Service                                | 1           | 1                 | 3             | 3                 |
| Farming/fishery/forestry               | 3           | 3                 | 2             | 2                 |
| Processing                             | 1           | 1                 | 0             | 0                 |
| Machine trades                         | 3           | 3                 | 0             | 0                 |
| Benchwork                              | 5           | 5                 | 0             | 0                 |
| Structural work                        | 2           | 2                 | 0             | 0                 |
| Miscellaneous                          | 4           | 4                 | 0             | 0                 |
| Retired                                | 13          | 12                | 6             | 5                 |
| Homemaker                              | 0           | 0                 | 55            | 48                |
| Missing/not codable                    | 0           | 0                 | 8             | 7                 |

<sup>a</sup>Based on Dictionary of Occupational Titles (1965) definitions, except "retired" and "homemaker."

## 8(b). Socioeconomic index of occupation (coded based on information about respondent's occupation using socioeconomic index developed by Reiss, 1961):

| <i>Sex</i> | <i>N</i>        | <i>Mean</i> |
|------------|-----------------|-------------|
| Male       | 93 (18 missing) | 63.3        |
| Female     | 44 (71 missing) | 57.7        |

## 9. What is your religious affiliation?

| <i>Response Categories</i> | <i>Male</i> |                   | <i>Female</i> |                   |
|----------------------------|-------------|-------------------|---------------|-------------------|
|                            | <i>N</i>    | <i>Percentage</i> | <i>N</i>      | <i>Percentage</i> |
| Catholic                   | 5           | 5%                | 7             | 6%                |
| Episcopal                  | 6           | 5                 | 5             | 4                 |
| Presbyterian               | 18          | 16                | 21            | 18                |
| Southern Baptist           | 34          | 31                | 35            | 30                |
| United Methodist           | 23          | 21                | 25            | 21                |
| United Presbyterian        | 6           | 5                 | 7             | 6                 |
| Other                      | 12          | 11                | 13            | 11                |
| No preference              | 7           | 6                 | 4             | 3                 |

## 10. Did you vote in a public election in 1976?

| <i>Response Categories</i> | <i>Male</i> |                   | <i>Female</i> |                   |
|----------------------------|-------------|-------------------|---------------|-------------------|
|                            | <i>N</i>    | <i>Percentage</i> | <i>N</i>      | <i>Percentage</i> |
| Yes                        | 105         | 95%               | 105           | 91%               |
| No                         | 5           | 5                 | 10            | 9                 |

11. What magazines or periodicals do you read on a regular basis?  
[Only the number was recorded.]

| <i>Category</i> | <i>N</i> | <i>Mean</i> |
|-----------------|----------|-------------|
| Male            | 111      | 3.05        |
| Female          | 115      | 3.25        |

12. In what clubs, societies, or organizations are you presently an active member? [Only the number was recorded.]

| <i>Category</i> | <i>N</i>        | <i>Mean</i> |
|-----------------|-----------------|-------------|
| Male            | 110 (1 missing) | 1.38        |
| Female          | 115 (0 missing) | 1.22        |

13. How many people, including yourself, live in the household?

| <i>Response</i> | <i>N</i> | <i>Percent</i> |
|-----------------|----------|----------------|
| 1               | 6        | 5%             |
| 2               | 52       | 41             |
| 3               | 28       | 22             |
| 4               | 26       | 21             |
| 5               | 13       | 10             |
| 6               | 1        | 1              |
| Mean = 2.93     |          |                |

14. What are the sexes and ages of the children who live in your household on a regular basis? [Listed from youngest to oldest.]

| <i>Response Categories</i> | <i>Male</i> |             |           | <i>Female</i> |             |           |
|----------------------------|-------------|-------------|-----------|---------------|-------------|-----------|
|                            | <i>N</i>    | <i>Mean</i> | <i>SD</i> | <i>N</i>      | <i>Mean</i> | <i>SD</i> |
| Youngest child             | 40          | 14.08       | 8.08      | 24            | 12.33       | 6.26      |
| Second youngest child      | 18          | 15.33       | 6.61      | 20            | 15.30       | 7.21      |
| Third youngest child       | 8           | 17.13       | 7.97      | 6             | 14.80       | 4.79      |
| Fourth youngest child      | 0           |             |           | 0             |             |           |
| Fifth youngest child       | 0           |             |           | 0             |             |           |

15. How many children in your household are active in scouting?

| <i>Response Categories</i> | <i>N</i> | <i>Percent</i> |
|----------------------------|----------|----------------|
| 0                          | 48       | 38%            |
| 1                          | 15       | 12             |
| 2                          | 0        | 0              |
| 3                          | 1        | 1              |
| Missing/not applicable     | 62       | 49             |

16. Have the children in your household ever suggested ideas to you for conserving energy?

| <i>Response Categories</i> | <i>N</i> | <i>Percentage</i> |
|----------------------------|----------|-------------------|
| Yes                        | 32       | 25%               |
| No                         | 33       | 26                |
| Missing/not applicable     | 61       | 48                |

17. How many years have you lived at your present address?

*N:* 126  
*Mean:* 14.27

18. Do you own or rent the house in which you currently live?

| <i>Response Categories</i> | <i>N</i> | <i>Percentage</i> |
|----------------------------|----------|-------------------|
| Own                        | 122      | 97%               |
| Rent                       | 3        | 2                 |
| Other                      | 1        | 1                 |

19. When was the house built?

| <i>Response Categories</i> | <i>N</i> | <i>Percentage</i> |
|----------------------------|----------|-------------------|
| 1970 to present            | 4        | 3%                |
| 1965 to 1969               | 8        | 6                 |
| 1960 to 1964               | 23       | 18                |
| 1950 to 1959               | 59       | 47                |
| 1940 to 1949               | 10       | 8                 |
| 1930 to 1939               | 10       | 8                 |
| Before 1930                | 9        | 7                 |
| Don't know                 | 3        | 2                 |

20. How many rooms are in the house? Include only whole rooms used for living purposes such as kitchen, dining room, finished recreation room, family room, and bedrooms. *DO NOT* count bathrooms, porches, halls, utility rooms, or storage spaces.

*N:* 125 (1 missing)  
*Mean:* 7.10

21. What is the approximate size of the house in square feet?

| <i>Response Categories</i> | <i>N</i> | <i>Percentage</i> |
|----------------------------|----------|-------------------|
| Less than 999 square feet  | 4        | 3%                |
| 1000 to 1499 square feet   | 14       | 11                |
| 1500 to 1999 square feet   | 25       | 20                |
| 2000 to 2499 square feet   | 29       | 23                |
| 2500 to 2999 square feet   | 19       | 15                |
| 3000 to 3499 square feet   | 13       | 10                |
| 3500 or more square feet   | 4        | 3                 |
| Don't know                 | 17       | 14                |
| Missing                    | 1        | 1                 |

22. What is the approximate current value of the property, including both the house and the lot? [Interviewers were instructed to emphasize response ranges, not exact figures.]

| <i>Response Categories</i> | <i>N</i> | <i>Percentage</i> |
|----------------------------|----------|-------------------|
| Less than \$10,000         | 0        | 0%                |
| \$10,000 to \$19,999       | 3        | 2                 |
| \$20,000 to \$29,999       | 11       | 9                 |
| \$30,000 to \$39,999       | 30       | 24                |
| \$40,000 to \$49,999       | 22       | 18                |
| \$50,000 to \$59,999       | 28       | 22                |
| \$60,000 or more           | 21       | 17                |
| Don't know                 | 11       | 9                 |
| Missing/refused to answer  | 0        | 0                 |

23. What was the approximate gross income of the household last year, considering all sources? [Interviewers were instructed to emphasize response ranges, not exact figures.]

| <i>Response Categories</i> | <i>N</i> | <i>Percentage</i> |
|----------------------------|----------|-------------------|
| Less than \$10,000         | 3        | 2%                |
| \$10,000 to \$14,999       | 11       | 9                 |
| \$15,000 to \$19,999       | 15       | 12                |
| \$20,000 to \$24,999       | 22       | 18                |
| \$25,000 to \$29,999       | 13       | 10                |
| \$30,000 to \$34,999       | 18       | 14                |
| \$35,000 to \$39,999       | 8        | 6                 |
| \$40,000 or more           | 17       | 14                |
| Missing/refused to answer  | 19       | 15                |

24. What kind of *fuel* is primarily used to heat the house?

| <i>Response Categories</i> | <i>N</i> | <i>Percentage</i> |
|----------------------------|----------|-------------------|
| Bottled, tank, or LP gas   | 1        | 1%                |
| Coal or coke               | 0        | 0                 |
| Electricity                | 88       | 70                |
| Fuel oil or kerosene       | 12       | 10                |
| Utility gas                | 25       | 20                |
| Wood                       | 0        | 0                 |
| Other                      | 0        | 0                 |
| Don't know                 | 0        | 0                 |

25. What type of *heating equipment* is primarily used to heat the house?

| <i>Response Categories</i>     | <i>N</i> | <i>Percentage</i> |
|--------------------------------|----------|-------------------|
| Built-in electric room heaters | 12       | 10%               |
| Portable space heaters         | 7        | 6                 |
| Steam or hot water (radiators) | 3        | 2                 |
| Warm air furnace               | 38       | 30                |
| Ceiling Heat                   | 46       | 37                |
| Heat pump                      | 17       | 14                |
| Other                          | 1        | 1                 |
| Don't know                     | 0        | 0                 |
| Missing                        | 2        | 2                 |

26. How many inches of insulation are on the hot water pipes?

| <i>Response Categories</i> | <i>N</i> | <i>Percentage</i> |
|----------------------------|----------|-------------------|
| None                       | 66       | 52%               |
| Less than 1 inch           | 8        | 6                 |
| 1 to 1.9 inches            | 14       | 11                |
| 2 to 2.9 inches            | 10       | 8                 |
| 3 to 3.9 inches            | 5        | 4                 |
| 4 to 4.9 inches            | 1        | 1                 |
| 5 or more inches           | 1        | 1                 |
| Don't know                 | 21       | 17                |

27. What is the source of water for the household?

| <i>Response Categories</i>       | <i>N</i> | <i>Percentage</i> |
|----------------------------------|----------|-------------------|
| Public system or private company | 126      | 100%              |
| Individual well                  | 0        | 0                 |
| Other                            | 0        | 0                 |
| Don't know                       | 0        | 0                 |

28. What method of sewage disposal is used by the household?

| <i>Response Categories</i> | <i>N</i> | <i>Percentage</i> |
|----------------------------|----------|-------------------|
| Public sewer               | 121      | 96%               |
| Septic tank or cesspool    | 5        | 4                 |
| Other                      | 0        | 0                 |
| Don't know                 | 0        | 0                 |

29. How many of each of the following appliances are used by the household?

| <i>Appliances</i>                 | <i>Mean<sup>a</sup></i> | <i>Percentage of Each Number of Appliances<sup>a</sup></i> |     |     |    |    |
|-----------------------------------|-------------------------|------------------------------------------------------------|-----|-----|----|----|
|                                   |                         | 0                                                          | 1   | 2   | 3  | 4  |
| Color television                  | 1.19                    | 8%                                                         | 66% | 25% | 1% | 0% |
| Gas powered lawn mower            | 1.02                    | 11                                                         | 77  | 11  | 1  | 0  |
| Automatic washing machine         | .99                     | 1                                                          | 99  | 0   | 0  | 0  |
| Electric stove                    | .98                     | 4                                                          | 94  | 2   | 0  | 0  |
| Electric clothes dryer            | .93                     | 7                                                          | 93  | 0   | 0  | 0  |
| Frostfree refrigerator            | .90                     | 16                                                         | 79  | 6   | 0  | 0  |
| Freezer <sup>c</sup>              | .83                     | 26                                                         | 65  | 9   | 0  | 0  |
| Black and white television        | .79                     | 43                                                         | 40  | 14  | 2  | 1  |
| Room air conditioner              | .77                     | 62                                                         | 14  | 13  | 8  | 3  |
| Central air conditioning          | .62                     | 41                                                         | 57  | 2   | 0  | 0  |
| Dishwasher w/water heating unit   | .57                     | 43                                                         | 57  | 0   | 0  | 0  |
| Garbage disposal                  | .40                     | 60                                                         | 40  | 0   | 0  | 0  |
| Manual defrost refrigerator       | .32                     | 69                                                         | 30  | 1   | 0  | 0  |
| Microwave oven                    | .20                     | 80                                                         | 20  | 0   | 0  | 0  |
| Dishwasher w/o water heating unit | .18                     | 82                                                         | 18  | 0   | 0  | 0  |
| Trash compactor                   | .12                     | 88                                                         | 12  | 0   | 0  | 0  |
| Gas stove                         | .04                     | 96                                                         | 4   | 0   | 0  | 0  |
| Electric lawn mower               | .04                     | 96                                                         | 4   | 0   | 0  | 0  |
| Gas clothes dryer                 | .03                     | 97                                                         | 3   | 0   | 0  | 0  |
| Wringer washing machine           | .00                     | 100                                                        | 0   | 0   | 0  | 0  |

<sup>a</sup>There were no missing data on this item. All percentage figures are based on a sample size of 126 households.

<sup>b</sup>For the reader's convenience, appliances have been rank-ordered by the mean number used by households in the sample.

<sup>c</sup>At least one interviewer misinterpreted this item and permitted the freezer section of a refrigerator to be coded as a separate freezer unit.

- 30(a). For each automobile used by members of the household, what is the year, model, and miles per gallon?
- (b). From what source do you know the miles per gallon of each automobile? [List automobiles from newest to oldest.]

| <i>Response<br/>Categories</i>    | <i>Automobile</i> |          |          |          |               |
|-----------------------------------|-------------------|----------|----------|----------|---------------|
|                                   | <i>Newest</i>     | <i>2</i> | <i>3</i> | <i>4</i> | <i>Oldest</i> |
| Number                            | 126               | 98       | 27       | 5        | 0             |
| Average age <sup>a</sup>          | 2.71              | 5.96     | 6.93     | 9.80     | -             |
| <i>N of each Model</i>            |                   |          |          |          |               |
| 1 = subcompact                    | 20                | 25       | 5        | 0        | 0             |
| 2 = compact                       | 15                | 14       | 4        | 0        | 0             |
| 3 = midsize                       | 33                | 18       | 6        | 2        | 0             |
| 4 = large                         | 36                | 25       | 7        | 2        | 0             |
| 5 = luxury                        | 5                 | 4        | 1        | 0        | 0             |
| Missing                           | 17                | 40       | 103      | 122      | 126           |
| Average miles/gallon              | 16.1              | 17.2     | 15.7     | 13.8     | -             |
| <i>N of source of information</i> |                   |          |          |          |               |
| 1 = self-monitored                | 96                | 68       | 14       | 2        | 0             |
| 2 = monitored by other            | 0                 | 0        | 0        | 0        | 0             |
| 3 = read about it                 | 1                 | 1        | 0        | 0        | 0             |
| 4 = guessed                       | 23                | 21       | 8        | 2        | 0             |
| 5 = don't know                    | 5                 | 6        | 4        | 1        | 0             |
| Missing/NA                        | 1                 | 30       | 100      | 121      | 126           |

<sup>a</sup>Age of automobile was computed by subtracting year of automobile from 1977.

## APPENDIX C

### RESPONSES TO ENERGY CONSERVATION ACTIVITY ITEMS

## APPENDIX C

### RESPONSES TO ENERGY CONSERVATION ACTIVITY ITEMS

The following items were asked of each household to determine the level of implementation of each activity. Both male head and female head of household responded verbally and, where there was disagreement on an item, reached consensus before the response was recorded. For each item, appropriate descriptive statistics are provided. Percentages are rounded to the nearest whole number. The data are based on 126 household interviews: 100 with both male and female respondents; 11 with only male respondents; and 15 with only female respondents.

#### Install at Least Six Inches of Insulation in the Attic:

1. How many inches of insulation are *currently* in the attic?

| <i>Response Categories</i> | <i>N</i> | <i>Percentage</i> |
|----------------------------|----------|-------------------|
| Don't know                 | 12       | 10%               |
| None                       | 2        | 2                 |
| Less than 2 inches         | 2        | 2                 |
| 2 to 3.9 inches            | 11       | 9                 |
| 4 to 5.9 inches            | 34       | 28                |
| 6 to 7.9 inches            | 47       | 39                |
| 8 to 9.9 inches            | 6        | 5                 |
| 10 or more inches          | 8        | 6                 |

2. How many inches of attic insulation was your household responsible for having installed?

| <i>Response Categories</i>              | <i>N</i> | <i>Percentage</i> |
|-----------------------------------------|----------|-------------------|
| All attic insulation came with the home | 83       | 68%               |
| Added less than 2 inches                | 4        | 3                 |
| Added 2 to 3.9 inches                   | 4        | 3                 |
| Added 4 to 5.9 inches                   | 12       | 10                |
| Added 6 to 7.9 inches                   | 18       | 15                |
| Added 8 to 9.9 inches                   | 1        | 1                 |
| Added more than 10 inches               | 0        | 0                 |

### Reduce Room Temperature Thermostat Setting at Night

1. How many degrees Fahrenheit are the household temperature control thermostat(s) set back at night?

| <i>Response Categories</i>                | <i>N</i> | <i>Percentage</i> |
|-------------------------------------------|----------|-------------------|
| Do not set back thermostat(s)<br>at night | 53       | 43%               |
| 1 to 2 degrees                            | 6        | 5                 |
| 3 to 4 degrees                            | 23       | 19                |
| 5 to 6 degrees                            | 24       | 19                |
| 7 to 8 degrees                            | 6        | 5                 |
| 9 to 10 degrees                           | 4        | 3                 |
| More than 10 degrees                      | 7        | 6                 |
| Don't know                                | 1        | 1                 |

2. How many room temperature control thermostats are used in the house?

| <i>Response Categories</i>   | <i>N</i> | <i>Percentage</i> |
|------------------------------|----------|-------------------|
| No thermostat units          | 6        | 5%                |
| 1 thermostat unit            | 64       | 52                |
| 2 thermostat units           | 8        | 6                 |
| 3 thermostat units           | 3        | 2                 |
| 4 thermostat units           | 4        | 3                 |
| 5 thermostat units           | 4        | 3                 |
| 6 thermostat units           | 11       | 9                 |
| More than 6 thermostat units | 24       | 19                |

### Use Storm Windows

1. How many exterior windows are in the house?

| <i>N</i> | <i>Mean</i> | <i>Standard<br/>Deviation</i> |
|----------|-------------|-------------------------------|
| 126      | 15.40       | 5.17                          |

2. How many of the exterior windows in the house currently have storm windows?

| <i>N</i> | <i>Mean</i> | <i>Standard<br/>Deviation</i> |
|----------|-------------|-------------------------------|
| 126      | 6.56        | 8.14                          |

### Buy Beverages in Returnable Bottles

1. How often does the household purchase beverages in returnable bottles, as opposed to disposables?

| <i>Response Categories</i>                            | <i>N</i> | <i>Percentage</i> |
|-------------------------------------------------------|----------|-------------------|
| Only buy disposables                                  | 9        | 7%                |
| Most disposables, but occasionally some returnables   | 20       | 16                |
| Slightly more disposables                             | 2        | 2                 |
| About equal amounts of disposables and returnables    | 11       | 9                 |
| Slightly more returnables                             | 12       | 10                |
| Mostly returnables, but occasionally some disposables | 35       | 28                |
| Only buy returnables                                  | 35       | 28                |

2. On the average, what is the household consumption of beverages which are available in returnable bottles, such as cola or beer?

| <i>Response Categories</i> | <i>N</i> | <i>Percentage</i> |
|----------------------------|----------|-------------------|
| None                       | 7        | 6%                |
| Very low                   | 28       | 23                |
| Quite low                  | 27       | 22                |
| Somewhat low               | 31       | 25                |
| Somewhat high              | 19       | 15                |
| Quite high                 | 8        | 6                 |
| Very high                  | 4        | 3                 |

### Save Paper for Recycling

1. How much paper does the household save for recycling?

| <i>Response Categories</i> | <i>N</i> | <i>Percentage</i> |
|----------------------------|----------|-------------------|
| None                       | 50       | 40%               |
| Very little                | 15       | 12                |
| A moderate amount          | 18       | 14                |
| Quite a lot                | 24       | 19                |
| All                        | 19       | 15                |

2. In general, how much paper is used by the household?

| <i>Response Categories</i> | <i>N</i> | <i>Percentage</i> |
|----------------------------|----------|-------------------|
| None                       | 3        | 2%                |
| Very little                | 17       | 14                |
| A moderate amount          | 63       | 50                |
| Quite a lot                | 29       | 23                |
| A very large amount        | 14       | 11                |

## APPENDIX D

### MULTIPLE REGRESSION EQUATIONS USING 12 ATTRIBUTE PREDICTORS

## APPENDIX D

### MULTIPLE REGRESSION EQUATIONS USING 12 ATTRIBUTE PREDICTORS

Multiple regression equations were computed to predict level of implementation of five household energy conservation activities using all 12 attributes in the model. Within each activity, three predictor variable formats were used, producing 15 separate equations. The multiple regression equations are tabled by energy conservation activity. The standard partial regression coefficients (beta) and zero-order correlation of each attribute with the activity level are presented for each predictor variable format. Results are presented in Tables D-1 through D-5.

PREDICTION OF NUMBER OF INCHES OF ATTIC INSULATION:  
COMPARISON OF REGRESSION EQUATIONS USING  
ALL 12 ATTRIBUTE PREDICTORS

| Attributes        | Model <sup>a</sup> |      |           |             |           |             |
|-------------------|--------------------|------|-----------|-------------|-----------|-------------|
|                   | P                  |      | NP        |             | PI        |             |
|                   | R = .40            |      | R = .53   |             | R = .54   |             |
|                   | SE = 1.16          |      | SE = 1.11 |             | SE = 1.13 |             |
|                   | N = 89             |      | N = 81    |             | N = 68    |             |
|                   | Beta               | r    | Beta      | r           | Beta      | r           |
| Cost              | 04                 | 00   | 14        | 09          | - 17      | - 02        |
| Savings           | 14                 | 13   | 09        | 14          | 11        | 09          |
| Effort            | - 05               | - 13 | - 03      | - 13        | - 02      | - 14        |
| Understandability | 05                 | 13   | 00        | 17          | - 25      | - 22        |
| Comfort           | - 05               | .08  | - 07      | 07          | 23        | .26         |
| Cleanliness       | 13                 | 12   | 11        | 12          | 13        | 13          |
| Cooperation       | - 24               | - 24 | - 34      | <u>- 30</u> | - 21      | - 16        |
| Observability     | 04                 | - 07 | 03        | - 02        | 01        | 03          |
| Social Opinion    | - 21               | - 15 | 05        | - 01        | - 32      | <u>- 33</u> |
| Communication     | 17                 | 18   | 32        | <u>31</u>   | - 06      | - 08        |
| Energy            | - 14               | 05   | - 18      | 02          | - 01      | 15          |
| Environment       | 12                 | 06   | 22        | 19          | 02        | 04          |

Note: Coefficients significant at  $p < .01$  are underlined. Decimal points have been omitted.

<sup>a</sup>The following models were compared:

P: Multiple regression analysis using all 12 attribute ratings of the household primary decision-maker for each activity.

NP: Multiple regression analysis using the normalized transformation of all 12 attribute ratings of the household primary decision-maker for the *specific* activity being considered.

PI: Multiple regression analysis using the product of the general importance rating of each attribute and the activity-specific rating of each attribute by the household primary decision-maker for each activity.

TABLE D-2

PREDICTION OF PERCENTAGE OF STORM WINDOWS: COMPARISON  
OF REGRESSION EQUATIONS USING ALL  
12 ATTRIBUTE PREDICTORS

| Attributes        | Model <sup>a</sup> |            |      |     |      |           |
|-------------------|--------------------|------------|------|-----|------|-----------|
|                   | P                  |            | NP   |     | PI   |           |
|                   | R =                | .41        | R =  | .42 | R =  | .42       |
|                   | SE =               | .45        | SE = | .45 | SE = | .45       |
|                   | N =                | 103        | N =  | 91  | N =  | 80        |
|                   | Beta               | r          | Beta | r   | Beta | r         |
| Cost              | -25                | <u>-27</u> | -20  | -14 | -16  | -19       |
| Savings           | 04                 | 00         | 12   | 07  | 07   | -04       |
| Effort            | 09                 | -02        | 07   | 01  | 03   | -09       |
| Understandability | -03                | 07         | -03  | 02  | -01  | 01        |
| Comfort           | 14                 | 14         | 24   | 21  | 21   | 19        |
| Cleanliness       | 19                 | 20         | 13   | 09  | 27   | <u>28</u> |
| Cooperation       | -11                | -12        | -17  | -17 | -02  | -08       |
| Observability     | 07                 | -02        | -12  | -07 | 04   | 03        |
| Social Opinion    | -16                | -12        | -13  | -09 | -06  | -03       |
| Cooperation       | -01                | 00         | -10  | -08 | -05  | -03       |
| Energy            | -18                | -03        | -11  | 04  | -29  | -11       |
| Environment       | 12                 | 09         | 14   | 18  | 07   | 04        |

Note: Coefficients significant at  $p < .01$  are underlined. Decimal points have been omitted.

<sup>a</sup>The following models were compared:

P: Multiple regression analysis using all 12 attribute ratings of the household primary decision-maker for each activity.

NP: Multiple regression analysis using the normalized transformation of all 12 attribute ratings of the household primary decision-maker for the *specific* activity being considered.

PI: Multiple regression analysis using the product of the general importance rating of each attribute and the activity-specific rating of each attribute by the household primary decision-maker for each activity.

TABLE D-3

PREDICTION OF DEGREES OF THERMOSTAT SETBACK: COMPARISON  
OF REGRESSION EQUATIONS USING ALL  
12 ATTRIBUTE PREDICTORS

| Attributes        | Model <sup>a</sup> |     |           |     |           |     |
|-------------------|--------------------|-----|-----------|-----|-----------|-----|
|                   | P                  |     | NP        |     | PI        |     |
|                   | R = .26            |     | R = .36   |     | R = .42   |     |
|                   | SE = 1.93          |     | SE = 1.84 |     | SE = 1.93 |     |
|                   | N = 102            |     | N = 94    |     | N = 72    |     |
|                   | Beta               | r   | Beta      | r   | Beta      | r   |
| Cost              | -19                | -12 | -19       | -13 | -20       | -12 |
| Savings           | -06                | 01  | 01        | 15  | 05        | 07  |
| Effort            | 03                 | -03 | 03        | 01  | 01        | 00  |
| Understandability | -01                | 04  | -14       | -08 | -18       | -11 |
| Comfort           | -02                | 00  | -15       | -04 | 19        | 16  |
| Cleanliness       | -01                | 04  | -02       | 04  | 14        | 21  |
| Cooperation       | -17                | -16 | -16       | -06 | -15       | -15 |
| Observability     | -04                | 08  | 08        | 02  | -09       | -11 |
| Social Opinion    | -10                | -10 | -14       | -06 | -15       | -18 |
| Communication     | 09                 | 04  | -01       | 09  | -13       | -10 |
| Energy            | 06                 | 02  | 27        | 21  | -06       | 11  |
| Environment       | 04                 | 01  | 08        | 17  | 14        | 07  |

Note: None of the coefficients were significant at  $p < .01$ . Decimal points have been omitted.

<sup>a</sup>The following models were compared:

P: Multiple regression analysis using all 12 attribute ratings of the household primary decision-maker for each activity.

NP: Multiple regression analysis using the normalized transformation of all 12 attribute ratings of the household primary decision-maker for the *specific* activity being considered.

PI: Multiple regression analysis using the product of the general importance rating of each attribute and the activity-specific rating of each attribute by the household primary decision-maker for each activity.

TABLE D-4

PREDICTION OF USE OF RETURNABLE BOTTLES: COMPARISON  
OF REGRESSION EQUATIONS USING ALL  
12 ATTRIBUTE PREDICTORS

| Attributes        | Model <sup>a</sup> |             |        |             |        |             |
|-------------------|--------------------|-------------|--------|-------------|--------|-------------|
|                   | P                  |             | NP     |             | PI     |             |
|                   | R =                | <u>.52</u>  | R =    | <u>.46</u>  | R =    | <u>.45</u>  |
|                   | SE =               | <u>1.89</u> | SE =   | <u>2.03</u> | SE =   | <u>2.12</u> |
|                   | N = 109            |             | N = 96 |             | N = 77 |             |
|                   | Beta               | r           | Beta   | r           | Beta   | r           |
| Cost              | -19                | -20         | -14    | -15         | -23    | -23         |
| Savings           | -23                | -08         | -09    | -09         | -01    | 02          |
| Effort            | 08                 | -07         | 07     | -03         | 01     | -11         |
| Understandability | 19                 | 13          | 21     | 12          | -13    | -08         |
| Comfort           | 26                 | 15          | 29     | 22          | 06     | 09          |
| Cleanliness       | 23                 | 09          | 21     | 10          | 03     | 07          |
| Cooperation       | -09                | -12         | -09    | -06         | -23    | -14         |
| Observability     | 11                 | 02          | -06    | -02         | 10     | 01          |
| Social Opinion    | -37                | -12         | -27    | -13         | -17    | -10         |
| Communication     | 03                 | 11          | 11     | 13          | -12    | -07         |
| Energy            | -12                | 01          | -08    | -07         | 10     | 14          |
| Environment       | 39                 | 19          | 10     | 10          | 24     | 26          |

Note: Coefficients significant at  $p < .01$  are underlined. Decimal points have been omitted.

<sup>a</sup>The following models were compared:

P: Multiple regression analysis using all 12 attribute ratings of the household primary decision-maker for each activity.

NP: Multiple regression analysis using the normalized transformation of all 12 attribute ratings of the household primary decision-maker for the *specific* activity being considered.

PI: Multiple regression analysis using the product of the general importance rating of each attribute and the activity-specific rating of each attribute by the household primary decision-maker for each activity.

TABLE D-5

PREDICTION OF SAVE PAPER FOR RECYCLING: COMPARISON  
OF REGRESSION EQUATIONS USING ALL  
12 ATTRIBUTE PREDICTORS

| Attributes        | Model <sup>a</sup> |     |           |     |           |            |
|-------------------|--------------------|-----|-----------|-----|-----------|------------|
|                   | P                  |     | NP        |     | PI        |            |
|                   | R = .40            |     | R = .36   |     | R = .56   |            |
|                   | SE = 1.48          |     | SE = 1.56 |     | SE = 1.41 |            |
|                   | N = 104            |     | N = 93    |     | N = 72    |            |
|                   | Beta               | r   | Beta      | r   | Beta      | r          |
| Cost              | -14                | -13 | -08       | -08 | -13       | -17        |
| Savings           | 02                 | 03  | -05       | -03 | 13        | 11         |
| Effort            | -07                | -21 | -11       | -19 | -35       | <u>-33</u> |
| Understandability | 03                 | 10  | -05       | 00  | 02        | 16         |
| Comfort           | -06                | 02  | -03       | -04 | -19       | -15        |
| Cleanliness       | 15                 | 21  | 13        | 13  | -19       | 02         |
| Cooperation       | -09                | -16 | -07       | -13 | 02        | 02         |
| Observability     | -08                | -14 | -12       | -13 | -08       | -09        |
| Social Opinion    | -17                | -01 | -11       | -06 | -19       | -01        |
| Communication     | 15                 | 19  | 21        | 22  | 09        | 17         |
| Energy            | 03                 | 12  | 06        | 09  | 42        | 29         |
| Environment       | 18                 | 18  | 02        | 07  | -17       | 10         |

Note; Coefficients significant at  $p < .01$  are underlined. Decimal points have been omitted.

<sup>a</sup>The following models were compared:

P: Multiple regression analysis using all 12 attribute ratings of the household primary decision-maker for each activity.

NP: Multiple regression analysis using the normalized transformation of all 12 attribute ratings of the household primary decision-maker for the *specific* activity being considered.

PI: Multiple regression analysis using the product of the general importance rating of each attribute and the activity-specific rating of each attribute by the household primary decision-maker for each activity.

## APPENDIX E

### INTERCORRELATIONS AMONG ATTRIBUTE RATINGS

TABLE E-1

## INTERCORRELATIONS AMONG ATTRIBUTE RATINGS FOR THE INSULATE ATTIC ACTIVITY

| Attributes               | Attributes |      |      |      |      |      |      |      |      |      |      |      |
|--------------------------|------------|------|------|------|------|------|------|------|------|------|------|------|
|                          | 1          | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
| Cost                     |            |      |      |      |      |      |      |      |      |      |      |      |
| Savings                  | 25         |      |      |      |      |      |      |      |      |      |      |      |
| Effort                   | 21         | 04   |      |      |      |      |      |      |      |      |      |      |
| Understandability        | -11        | 14   | -26  |      |      |      |      |      |      |      |      |      |
| Comfort                  | 25         | 51   | -12  | -10  |      |      |      |      |      |      |      |      |
| Cleanliness              | 26         | 34   | -07  | 12   | 28   |      |      |      |      |      |      |      |
| Cooperation              | 10         | 12   | 32   | -35  | 21   | 19   |      |      |      |      |      |      |
| Observability            | 14         | 21   | 24   | -31  | 10   | 31   | 55   |      |      |      |      |      |
| Social Opinion           | -17        | 01   | -28  | 19   | -01  | 12   | 13   | 16   |      |      |      |      |
| Communication            | -07        | 11   | -26  | 07   | 35   | 28   | -03  | 06   | 16   |      |      |      |
| Energy                   | 19         | 46   | 06   | 17   | 25   | 37   | 04   | 09   | 05   | 24   |      |      |
| Environment              | 10         | 34   | 02   | 04   | 23   | 16   | 24   | 30   | 13   | 20   | 54   |      |
| Mean Rating <sup>a</sup> | 4.43       | 4.81 | 3.72 | 5.66 | 5.36 | 4.69 | 3.16 | 2.47 | 4.81 | 5.55 | 5.87 | 5.43 |
| Standard Deviation       | .91        | 1.21 | 1.53 | 1.54 | 1.05 | 1.67 | 1.86 | 1.75 | 1.33 | 1.34 | 1.23 | 1.70 |

Note: The correlations presented in this table are based on a sample size of 97 household primary decision-makers. Coefficients significant at  $p < .01$  are underlined. Decimal points have been omitted.

<sup>a</sup>Attribute ratings were made on a 7-point scale with attribute-specific anchors where "1" was less of the attribute and "7" was more of the attribute.

TABLE E-2  
INTERCORRELATIONS AMONG ATTRIBUTE RATINGS FOR THE STORM WINDOW ACTIVITY

| Attribute                | Attributes |      |      |      |      |      |      |      |      |      |      |      |
|--------------------------|------------|------|------|------|------|------|------|------|------|------|------|------|
|                          | 1          | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
| Cost                     |            |      |      |      |      |      |      |      |      |      |      |      |
| Savings                  | 16         |      |      |      |      |      |      |      |      |      |      |      |
| Effort                   | 31         | -06  |      |      |      |      |      |      |      |      |      |      |
| Understandability        | -17        | 14   | -10  |      |      |      |      |      |      |      |      |      |
| Comfort                  | -03        | 53   | 05   | 15   |      |      |      |      |      |      |      |      |
| Cleanliness              | -04        | 12   | -18  | 25   | 29   |      |      |      |      |      |      |      |
| Cooperation              | 13         | 08   | 32   | -18  | 07   | -10  |      |      |      |      |      |      |
| Observability            | 09         | 40   | -05  | 08   | 29   | 02   | 12   |      |      |      |      |      |
| Social Opinion           | 07         | 20   | -11  | 06   | 28   | 18   | 12   | 41   |      |      |      |      |
| Communication            | 05         | 18   | -03  | 09   | 34   | 16   | 05   | 10   | 30   |      |      |      |
| Energy                   | 07         | 56   | -09  | 20   | 50   | 23   | 07   | 29   | 25   | 22   |      |      |
| Environment              | -09        | 28   | -01  | 14   | 37   | 25   | 19   | 17   | 20   | 21   | 66   |      |
| Mean Rating <sup>a</sup> | 5.60       | 5.02 | 4.70 | 5.20 | 5.52 | 5.59 | 3.21 | 4.67 | 4.89 | 5.57 | 5.84 | 5.35 |
| Standard Deviation       | .97        | 1.08 | 1.49 | 1.60 | .96  | 1.39 | 1.65 | 1.70 | 1.15 | 1.37 | 1.26 | 1.72 |

Note: The correlations presented in this table are based on a sample size of 103 household primary decision-makers. Coefficients significant at  $p < .01$  are underlined. Decimal points have been omitted.

<sup>a</sup>Attribute ratings were made on a 7-point scale with attribute-specific anchors where "1" was less of the attribute and "7" was more of the attribute.

TABLE E-3  
INTERCORRELATIONS AMONG ATTRIBUTE RATINGS FOR THE THERMOSTAT SETBACK ACTIVITY

| Attributes               | Attributes |      |      |      |      |      |      |      |      |      |      |      |
|--------------------------|------------|------|------|------|------|------|------|------|------|------|------|------|
|                          | 1          | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
| Cost                     |            |      |      |      |      |      |      |      |      |      |      |      |
| Savings                  | -13        |      |      |      |      |      |      |      |      |      |      |      |
| Effort                   | 26         | -02  |      |      |      |      |      |      |      |      |      |      |
| Understandability        | -30        | -13  | -33  |      |      |      |      |      |      |      |      |      |
| Comfort                  | 16         | 01   | -12  | -28  |      |      |      |      |      |      |      |      |
| Cleanliness              | -10        | 07   | -07  | 41   | -02  |      |      |      |      |      |      |      |
| Cooperation              | -16        | 15   | 17   | -02  | -09  | 01   |      |      |      |      |      |      |
| Observability            | -02        | 16   | 13   | -05  | -07  | -06  | 42   |      |      |      |      |      |
| Social Opinion           | -17        | 13   | -24  | -02  | -07  | 00   | 22   | 12   |      |      |      |      |
| Communication            | 00         | 29   | -06  | -01  | 09   | 19   | 15   | 31   | 13   |      |      |      |
| Energy                   | 04         | 66   | -15  | -09  | 26   | 23   | 05   | 11   | 17   | 27   |      |      |
| Environment              | 11         | 54   | 03   | -16  | 19   | 17   | 10   | 12   | 15   | 32   | 71   |      |
| Mean Rating <sup>a</sup> | 1.86       | 4.39 | 1.78 | 6.23 | 3.82 | 5.88 | 4.35 | 3.90 | 4.57 | 5.71 | 5.64 | 5.32 |
| Standard Deviation       | 1.36       | 1.34 | 1.14 | 1.24 | 1.24 | 1.39 | 1.70 | 1.67 | 1.09 | 1.24 | 1.42 | 1.62 |

Note: The correlations presented in this table are based on a sample size of 104 household primary decision-makers. Coefficients significant at  $p < .01$  are underlined. Decimal points have been omitted.

<sup>a</sup>Attribute ratings were made on a 7-point scale with attribute-specific anchors where "1" was less of the attribute and "7" was more of the attribute.

TABLE E-4  
INTERCORRELATIONS AMONG ATTRIBUTE RATINGS FOR THE RETURNABLE BOTTLE ACTIVITY

| Attributes               | Attributes |      |      |      |      |      |      |      |      |      |      |      |
|--------------------------|------------|------|------|------|------|------|------|------|------|------|------|------|
|                          | 1          | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
| Cost                     |            |      |      |      |      |      |      |      |      |      |      |      |
| Savings                  | 07         |      |      |      |      |      |      |      |      |      |      |      |
| Effort                   | 37         | 04   |      |      |      |      |      |      |      |      |      |      |
| Understandability        | -08        | 10   | -01  |      |      |      |      |      |      |      |      |      |
| Comfort                  | 04         | 13   | -01  | -26  |      |      |      |      |      |      |      |      |
| Cleanliness              | -06        | 12   | -33  | 17   | 05   |      |      |      |      |      |      |      |
| Cooperation              | 09         | -17  | 17   | -12  | -05  | -08  |      |      |      |      |      |      |
| Observability            | 07         | 11   | 02   | -11  | 18   | 05   | 31   |      |      |      |      |      |
| Social Opinion           | -11        | 13   | -06  | 16   | 07   | 41   | 00   | 20   |      |      |      |      |
| Communication            | -10        | 00   | -22  | 02   | 12   | 09   | 01   | 15   | 28   |      |      |      |
| Energy                   | 01         | 22   | 00   | -09  | 04   | 12   | 17   | 21   | 23   | 37   |      |      |
| Environment              | -11        | 27   | -02  | 06   | -07  | 05   | -01  | 12   | 27   | 36   | 61   |      |
| Mean Rating <sup>a</sup> | 2.37       | 3.39 | 2.82 | 6.10 | 4.06 | 5.26 | 3.50 | 2.76 | 4.26 | 5.36 | 4.91 | 5.72 |
| Standard Deviation       | 1.54       | 1.59 | 1.66 | 1.53 | .67  | 1.53 | 1.61 | 1.71 | 1.25 | 1.46 | 1.67 | 1.53 |

Note: The correlations presented in this table are based on a sample size of 111 household primary decision-makers. Coefficients significant at  $p < .01$  are underlined. Decimal points have been omitted.

<sup>a</sup>Attribute ratings were made on a 7-point scale with attribute-specific anchors where "1" was less of the attribute and "7" was more of the attribute.

TABLE E-5  
INTERCORRELATIONS AMONG ATTRIBUTE RATINGS FOR THE SAVE PAPER ACTIVITY

| Attributes               | Attributes |      |      |      |      |      |      |      |      |      |      |      |
|--------------------------|------------|------|------|------|------|------|------|------|------|------|------|------|
|                          | 1          | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
| Cost                     |            |      |      |      |      |      |      |      |      |      |      |      |
| Savings                  | 01         |      |      |      |      |      |      |      |      |      |      |      |
| Effort                   | 19         | -10  |      |      |      |      |      |      |      |      |      |      |
| Understandability        | -17        | 02   | -04  |      |      |      |      |      |      |      |      |      |
| Comfort                  | -07        | 44   | -23  | -05  |      |      |      |      |      |      |      |      |
| Cleanliness              | 00         | 20   | -31  | 21   | 22   |      |      |      |      |      |      |      |
| Cooperation              | 05         | -08  | 51   | -15  | -01  | -22  |      |      |      |      |      |      |
| Observability            | -02        | 13   | 13   | -28  | 12   | -18  | 22   |      |      |      |      |      |
| Social Opinion           | 04         | 32   | -10  | 24   | 08   | 19   | -03  | 06   |      |      |      |      |
| Communication            | 05         | 10   | -26  | 04   | 22   | 11   | 03   | -02  | 28   |      |      |      |
| Energy                   | 19         | 28   | -04  | -04  | 10   | 03   | 13   | 11   | 33   | 39   |      |      |
| Environment              | 11         | 19   | 02   | 03   | 00   | 15   | 09   | 13   | 37   | 31   | 74   |      |
| Mean Rating <sup>a</sup> | 1.47       | 1.62 | 3.57 | 6.29 | 4.13 | 4.71 | 4.18 | 2.51 | 4.49 | 5.05 | 5.24 | 5.72 |
| Standard Deviation       | .97        | 1.16 | 1.72 | 1.24 | .70  | 1.58 | 1.56 | 1.54 | 1.16 | 1.38 | 1.29 | 1.25 |

Note: The correlations presented in this table are based on a sample size of 104 household primary decision-makers. Coefficients significant at  $p < .01$  are underlined. Decimal points have been omitted.

<sup>a</sup>Attribute ratings were made on a 7-point scale with attribute-specific anchors where "1" was less of the attribute and "7" was more of the attribute.

## VITA

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Prior to entering the doctoral program at UT, he served four years in the U. S. Air Force conducting personnel research on officer and enlisted performance appraisal systems. While completing requirements for the Ph.D., he was employed part-time as a personnel research consultant at the Oak Ridge National Laboratory. From 1977 through 1979 he designed and implemented an extensive program evaluation for the Energy Extension Service in Tennessee. He is currently Director of Research, Development, and Evaluation for the Michigan Energy Administration in Lansing, Michigan.