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Energy conservation attitudes, intentions, and behaviors of homeowners in Staten Island, New York

Wentworth, W. R., Ph.D.

City University of New York, 1988

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ENERGY CONSERVATION ATTITUDES, INTENTIONS, AND BEHAVIORS OF HOMEOWNERS IN STATEN ISLAND, NEW YORK

by

W. R. WENTWORTH

A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

1988

This manuscript has been read and accepted for the Graduate Faculty in Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

April 25, 1988
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Abstract

ENERGY CONSERVATION ATTITUDES, INTENTIONS, AND BEHAVIORS OF HOMEOWNERS IN STATEN ISLAND, NEW YORK

by

W. R. Wentworth

Advisor: Professor Gary H. Winkel

A questionnaire assessing attitudes and self-reported intentions and behaviors was administered to a sample of homeowners in Staten Island, New York. Factor analysis of attitudinal data yielded 5 common factors which accounted for nearly half of the total variance associated with all of the attitudinal items: perceived energy conservation competence, comfort / convenience, percieived efficacy of conservation measures, and two factors concerning perceived response costs associated with energy conservation. Individuals' attitude factor scores were correlated with their conservation behaviors and intentions, and multiple regression analyses were performed to further clarify the nature and direction of interrelationships. The analyses revealed similarities and differences with previous

research. In contrast with previous research, which found attitudes concerning comfort and convenience to be the major attitudinal predictor of conservation behavior, this study found that perceived energy conservation competence was the predominant attitudinal predictor of such behavior. Homeowners' attitudes concerning perceived response costs involving expense, time, trouble, and ease of installation of conservation measures was the major attitudinal predictor of intentions to conserve. Contrary to predictions, little carry over was observed between completion of various conservation measures and intentions to complete others. Possible explanations for the findings are discussed, as are their potential implications for theory and practice. Specific implications for residential energy audit and conservation programs are addressed.

Acknowledgments

I am indebted to the three City University of New York faculty who served on the dissertation committee under whose direction this study was carried out. Professor Gary Winkel of the Environmental Psychology Program, thesis advisor, provided invaluable guidance at every stage of the work, including conceptualization, research design, statistical analysis and final editing. Dr. Marc Eichen of the Queens College Academic Computer Center provided pivotal suggestions regarding the conduct and interpretation of the research, and brought the benefit of his own research in energy conservation to the project. He also assisted with data processing issues and was consistently supportive. Professor Glenn Hass, of the Social and Personality Psychology Program at the City University Graduate Center and the Brooklyn College Department of Psychology, graciously agreed to join the project during its critical formative stages. His expertise in attitude research filled an important role on the advisory team.

A number of individuals assisted with the pretesting and development of the research instrument. They included Mary Brennan, formerly Assistant Commissioner of the Office

of Energy Conservation of the New York City Department of Housing Preservation and Development; John Reese, Director of Residential Conservation Programs at the New York State Energy Office, and Linda Freedland, also of that office. Their extensive practical experience in developing and overseeing energy education programs made their suggestions especially useful.

Dr. Leonard Rodberg of the Queens College Center for the Study of Biological Systems, and Dr. Robert Wirtshafter of the Urban Studies Program and Director of the Energy Center of the University of Pennsylvania, who served as outside readers, both offered penetrating comments which enhanced the interpretation of the findings. I am privileged to have had the benefit of their extensive experience in the areas of energy conservation theory and practice.

In addition to the rich diversity of expertise provided by the aforementioned, I wish to acknowledge the support and assistance of my family. Anita Nager, colleague, companion and wife extraordinaire, made key suggestions regarding the conduct of the work and carried more than her fair share of extra-research obligations for longer than either of us cares to remember. Finally, I owe a debt of gratitude to Kara, our daughter, for her patience and understanding during this long process, and to Daniel, our son, who is too young to understand but helped in his own way.

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I. BACKGROUND AND GENERAL PROBLEM STATEMENT

Energy conservation has been called the key energy source of our times (Yergin, 1979). Although the precise amount of energy that could be saved by conservation is a matter of debate, a reasonable estimate is that overall energy consumption in the United States could be reduced by 30% to 50% through conservation alone (Hayes, 1976; Yergin, 1979). Ross and Williams (1976) have estimated that residential energy use could be cut fully 50% by conservation.

Moreover, conservation offers significant advantages over other energy sources. Compared with coal, oil or nuclear power, conservation is benign in its environmental and health impacts (Hayes, 1976). And because it utilizes technology that is often simpler, more reliable and more cost effective than such ''alternative'' energy sources as solar or wind power, conservation is generally considered a first priority by advocates of such renewable sources of energy (e.g. Christianson, 1979).

Although some increases in energy conservation in the U.S. have been noted recently (Home Energy Use, 1981), per

capital energy consumption in this country remains among the highest in the world (Schipper, 1979). Studies of residential conservation in America have consistently shown that most individuals have adopted only a small portion of the cost effective conservation actions potentially available to them (Milstein, 1977; Harris, Keith and Wilhelm, note 1). Since residential energy constitutes 20% of total U.S. energy consumption (Large, 1973), the magnitude of waste involved in such non-use of energy conservation techniques is serious.

The non-use of energy conservation techniques is largely a social sciences problem. As Yergin (1979, p. 168) noted, ''the barriers to the potential savings through conservation are very great, but they are rarely technological. Although some of the barriers are economic, they are in most cases institutional, political and social." Sommer (1980) has cited energy conservation as one of the most important contemporary issues for the field of Environmental Psychology. Ittelson, Proshansky, Rivlin and Winkel (1974) have described energy conservation as a specific example of the more general problem of environmental conservation. The underlying value assumption of conservation as explicated by Ittelson et al. (1974, p. 305) is that,

> we must recognize our interdependence with the environment in which we live, cease assuming that technology will be able to solve all the problems

> arising from unenlightened environmental exploitation, adopt the approach of a steward over natural resources, and generally refrain from treating the environment as an endlessly exploitable resource, separate and apart from ourselves.

In this context, the problem of energy conservation is a central issue for the field of Environmental Psychology.

Probably the most widely employed and least understood social science approach to increasing conservation is the dissemination of information. Is this reliance on information, as Heberlein (1971) has charged, merely a naive ''cognitive fix'' social scientists and government energy administrators have drawn upon recently to replace the technological fix that has contributed to many environmental problems? Or is information both a necessary and potentially effective conservation strategy in and of itself? The proposed research is does not attempt to answer such questions directly, but it does provide some data bearing on such issues.

Energy conservation information interventions often assume, either explicitly or implicitly, a link between energy conservation information, attitudes and behaviors. As will be discussed in subsequent chapters, research and theory in the past several years has begun to identify a number of

the elements of successful energy conservation information efforts. However, the relationship between such energy information interventions and attitude and behavior change are not well understood. Before more effective energy information approaches can be developed, a number of questions must be addressed regarding how information approaches affect energy attitudes, what energy attitudes are most important with regard to conservation behavior, and how these attitudes are related to actual conservation behavior in every day situations. It is these questions which constitute the focus of the present research.

Before addressing the specific roles of energy information, attitudes and behavior, a brief overview of the social science work on energy conservation will be useful in establishing the context for the present research.

OVERVIEW OF SOCIAL/PSYCHOLOGICAL RESEARCH ON ENERGY

In recent years, social scientists have begun to address the problem of the limited use of conservation techniques. This body of work on psychosocial approaches to energy conservation has been reviewed by a number of authors (Aronson, 1980; McClelland and Canter, 1980; Carlyle and Geller, note 3; Ellis and Gaskell, 1978; Geller, 1981; Lipsey, 1977; Milstein, 1977; Shippee, 1980; Stern and Gardner, 1981; Winett and Neale, 1979.) Without attempting

to duplicate these efforts, I will summarize some of the major findings and concepts from this work that form the context for the present research.

In discussing this material, I will use the framework developed by Lipsey (1977) and used by Ellis and Gaskell (1978). The basic framework follows:

ANTECEDENT FACTORS

1. Predisposition:
   - Demographics
   - Attitudes, Values, Knowledge
   - Activities and Experiences
   - Personality

2. Ability

3. Motivation

FACILITATION (Interventions)

The variables listed in this framework will be discussed in the following pages. The antecedent variables will be discussed first, but I will deviate slightly from the above order for convenience.

PREDISPOSITION

Demographics. Among demographic variables, age, education, income and political orientation have been found correlated with environmental concern (Tognacci, Weigel, Wideau and Vernon, 1972). However, the relationship between income and environmental concern is complex: Ellis and Gaskell (1978) cite studies suggesting that ''middle income groups are the most likely to conserve''. (These authors note that while higher income groups could potentially save the most energy, they also have the least economic motivation.) Hummel, Levitt and Loomis (1978), however, found demographic variables only weak predictors of specific behavioral intentions (which, according to Fishbein and Ajzen, (1975) should be better indicators of subsequent behavior.) Hummel et al. found perceived personal impact of the energy crisis a much stronger predictor of intentions to conserve. A reasonable interpretation of these apparently conflicting data is that income is correlated with environmental concern but that personal experience with effects of the energy problem is a better predictor of specific conservation behavioral intentions.

Attitudes and Experience. Despite the general methodological and conceptual problems which preclude

establishing a clear and consistent relationship between attitude and behavior (Kelman, 1974) some key attitudes associated with conservation intentions and/or behavior have been identified.

Seligman, Kriss, Darley, Fazio, Becker and Pryor (1979) found that attitudes about the effects of conservation on comfort and health were strong predictors of summer energy consumption. Becker, Seligman, Fazio and Darley (1979) confirmed that attitudes about comfort and convenience were also predictors of winter energy consumption. They found that residents who felt that their comfort and health required being cool during summer or warm during winter used more electricity for cooling. These findings have clear implications for conservation informational programs (Seligman et al., 1979). Specifically, they argued that rather than exhorting residents to make sacrifices, information programs should emphasize how to save energy and be comfortable simultaneously. Somewhat surprisingly, Seligman et al. found individual belief that the energy crisis was legitimate was not correlated with consumption, a finding confirmed by Perlman and Warren (1978). In general, researchers have had greater success in establishing relationships between energy attitudes and energy consumption when they have examined very specific, rather than global, attitudes about energy conservation. For example, in addition to the examples cited, Leonard-Barton

(1979) found that adoption of energy conservation practices of California homeowners was correlated with specific attitudes about individual energy measures such as perceived convenience, cost-effectiveness and feasibility.

Murray, Minor, Bradburn, Cotterman, Prankel and Pisarski (1974) found that individuals who considered the energy shortage ''an important national problem'' were only slightly more likely to report reduced driving than those who did not, but if they had personally experienced difficulty obtaining gasoline, they were 1.7 times more likely to report such conservation action. This finding could lead to the pessimistic conclusion that people will only respond to the energy shortage when it reaches a level of severity at which they are significantly inconvenienced. However, Lipsey (1977) suggested that various other types of experiences and activities may facilitate the development of ecological attitudes, a point to which I will return later.

Further clarification of the functional significance of attitudes about the legitimacy of the energy shortage has been provided by Hummel, Levitt and Loomis (1978). They found that behavioral intention to support clean air actions were highly correlated with the perception that the individual energy consumer was responsible for the energy crisis, a finding which seems consistent with Darley and Latane's (1968) model of socially responsible crisis behavior. While Hummel et al's. findings appear to have

important implications for conservation strategies, how such perceptions are acquired, and the extent to which they could be developed by informational and/or other interventions remain open questions.

Personality. Lipsey (1977) noted that although numerous personality variables have been investigated in relationship to ecological attitudes, the total amount of research involved remains small and lacks standardization of measures. However, Lipsey cited two variables of particular relevance to the present research: locus of control (Rotter 1966) and personal competence (Anderson and Cunningham, 1972). Presumably, individuals who believe themselves, as opposed to external forces, in control of their situations would be more likely to support energy conservation. Lipsey noted similar correlations between I.E. (internal/external locus of control) score and participation in other ecological actions (Levenson, 1974). Unfortunately, Lipsey noted that few such variables "...have been used in more than one study, making it difficult to confidently identify the key personality factors associated with ecologically responsible actions" (Lipsey, 1977, p11).

Knowledge. The need for knowledge about appropriate conservation actions as a prerequisite to effective energy saving is perhaps obvious. It is less clear precisely what

types of knowledge are required and how well existing information sources satisfy these needs. These issues will be discussed at length in subsequent sections.

ABILITY

Among several types of ability Lipsey (1977) cited as necessary for ecological action, economic, physical and cognitive abilities variables appear the most relevant for energy conservation. Economic resources are important for residential conservation because of the relatively high cost of some measures. Since some measures may require self-installation or paying more for professional installation, not all home owners will be capable of certain conservation improvements.

MOTIVATION

Economics. The motivation to save money has frequently been shown to be a primary determinant of conservation behavior (e.g., Perlman and Warren, 1978; Milstein, 1977; Winett and Nietzel, 1975; Hayes and Cone, 1977). However, social scientists have cautioned that a purely rational-economic model is inadequate for understanding conservation behavior (Aronson, 1980; Ellis and Gaskell, 1978). One

problem with the economic-rational model is the model's erroneous assumption of a direct linear relationship between size of incentive and amount of conservation. In practice very large incentives have been found necessary to motivate behavior change. Some studies have had to use incentives of more than double the level of monthly utility bills (Winett, Kagel, Battalio, and Winkler, 1978) to produce substantial reductions on consumption.

Non-Economic. Comfort and health were discussed above as important attitudinal variables associated with motivation. Carlyle and Geller (undated, p. 8) have emphasized the behavioral significance of convenience, which they consider,

> probably the most common (and influential) reinforcer for maintaining high rates of energy... it is rather inconvenient to turn off the light switch when leaving a room, or to turn down the air-cooling thermostat every time the temperature drops outside... the immediate pleasure for emitting energy-wasteful behaviors is often comfort and/or convenience. Such behaviors are strengthened by such consequences and often increase in frequency.

Further apparent confirmation of the significance of convenience is the reluctance of most individuals to adopt

car pooling or other serious modifications in life style (Murray et al., 1974, p. 258).

The general persistence of existing energy consumption patterns has been explained by sociologists using very different models from that of Carlyle and Geller. As Heberlein (1975) noted in his structural analysis of energy consumption,

> ...we often forget that individual users of energy operate within a system of constraints and that this microscopic social structure may have more influence on behavior than either personality or attitudes. An individual consumer lives in a family group of a certain size, has schedules determined by work and other social roles, has cultural conventions and limited alternatives for food preparation, and is not in a position to determine how much electricity he is using (p. 106).

Warren and Clifford (1975) have noted that local social norms appear to support various patterns of energy use. Both Warren and Clifford's and Heberlein's analyses suggest that external interventions to change energy behavior will be most effective when they deal with the structural supports to existing consumption behavior.

Perhaps the best known sociological explanation of motivational barriers to individual energy consumption is Platt's (1973) social trap analysis. According to this

model, individuals in a group faced with limited resources will tend to act to further their own short term individual interests rather than the longer term interests of the group. In this view, the motivational problem is to convince individuals that they will be better off if they act in the long term interest of the group.

The social trap model is useful in pointing out the dangers of present consumption trends and in suggesting how to modify some of the structured forces (e.g., the governmental policies) that support them. But it is alone inadequate to generate recommendations to fully motivate people to act in the long-range public interest since it assumes rationality and socially responsible values.

Aronson (1980) has recently called attention to several other social-psychological motivational processes that hold promise in conservation interventions. While these phenomena are generally well established, Aronson notes that they have been underutilized in energy conservation interventions. One such process is social diffusion, the process by which individuals' adoption of technological innovation is accelerated when they have personal contact with socially valued peers who have successfully adopted the innovation.

Two other important motivational processes identified by Aronson as particularly useful but underutilized in energy conservation work are cognitive consistency and public

commitment. In addition, Aronson emphasizes the importance of perceived control (Langer and Rodin, 1978) and free choice (Brehm, 1966), noting that ''heavy handed attempts to influence behavior through prohibitions or large tangible incentives may be counter productive''.

EXTERNAL INTERVENTIONS

Aside from some limited use of such social science concepts or technological diffusion, public commitment, control, voluntary compliance and modelling (Aronson, 1980), the bulk of field experimental work on energy conservation has involved one or more of four major approaches: incentives, feedback, goal setting and information.

Incentives. A variety of types and sizes of incentives has been tested including individual financial rewards, group contingencies, rebates (Slavin, Wodarski, and Blackburn, in press; Hayes and Cone, 1977; Winett et al., 1978), group contests (McClelland and Belsten, 1979-80), and social commendation (Seaver and Patterson, 1976), usually in conjunction with information and/or feedback of some form. The results have generally shown incentives to be successful in reducing energy consumption, at least in the short term,

and to be relatively more effective in this regard than either feedback or information when compared experimentally with these interventions. These results have led some reviewers to conclude that incentives are the most promising of the psychological approaches tested to date (e.g., Shippee, 1980).

However, financial incentives involve a number of fundamental problems. As Aronson (1980) pointed out, one of the most serious practical problems with the approach is the relatively large size of incentive required to achieve reasonable reductions in consumption. Despite the high cost of incentives relative to feedback or information, Carlyle and Geller (undated), in their extensive review of the literature, conclude that incentives are the most cost effective approach of the three. However, this conclusion appears premature for several reasons. Efficient automated feedback devices which reduce the administrative costs of providing feedback have only recently been introduced, and the cost effectiveness of self-monitoring has not been conclusively established since this promising approach has not been extensively tested (Winett, Neale, and Grier, 1979). Moreover, as will be discussed below, there is reason to believe that most informational techniques that have been tested to date do not represent the best that is possible, and that the general approach has thus not been given a fair test. Finally, as Aronson noted, incentives must be

continued in order to maintain conservation behavior; once payments stop, conservation behaviors will tend to extinguish unless other supports exist to maintain them. And an extensive body of research indicates that individuals tend not to change their attitudes concerning a behavior if they have been paid to do it. If internalizing conservation attitudes is assumed to be an important goal of conservation programs and prerequisite to long range behavior change, incentive approaches may be counter productive (Aronson, 1980).

Feedback. The importance of energy consumption feedback derives from three considerations. The first involves theory and research on learning and the concept of the feedback loop. Seligman and Darley (1977) have noted that if the house is considered a man-machine system, performance feedback should produce increased performance, as it has been shown to do in other systems. They cite an extensive body of learning theory and research going back to Thorndike (1927) that has documented the effects of informational feedback on improving task learning.

The second consideration that suggests the special importance of feedback on energy consumption is the inherent invisibility and intangibility of energy. As the Fitchburg Action to Conserve Energy (FACE) final report (1980, p. 9)

observed, ''energy, because of the complexity and controversy surrounding it, is commonly conceived only on an abstract, untested level''.

This problem is compounded by existing utility billing procedures which provide consumption information infrequently and in a format that is often difficult to understand or relate to actual consumption behavior. Winett and Neale (1979, p. 109) observed that,

> of several hundred persons in studies that the senior author has conducted, virtually no-one knew how many KWH they used per month or day; most people did not know where their electricity meter was located.

For such reasons, a variety of types of feedback approaches have been tested. Shippee (1980), reviewing several such studies, distinguished between the types of feedback on the basis of the frequency (short term vs. long term) and mode of providing the information (mechanical vs. nonmechanical). Feedback has generally been combined with another intervention such as incentives, rendering the effects of feedback alone somewhat unclear (Shippee, 1980, p. 302). However, Winett and Neale (1979, pp. 109-110) have drawn the following conclusions from reviewing this literature:

1. It appears that...feedback must be given at least several times per week to promote conservation...

2. Frequent (almost daily) feedback has yielded reduction in residential electricity use of from about 10% to 20% for periods up to an entire peak use (seasonal) period...

3. Having consumers pick goals, particularly difficult but achievable goals, apparently increases the effectiveness of feedback in decreasing energy use...

4. The information fed back must be credible. If consumers do not understand (or agree with how their use is weather corrected) feedback may be ineffective.

A promising but so far little explored approach involves the role of self-monitoring feedback. Winett et al. (1979) trained residents to reliably read their own electrical meters and monitor their electrical consumption, with resulting increased conservation. Unfortunately, the possible role of behavioral involvement per se in

contributing to this result, and the potential to capitalize on such involvement for longer term conservation attitude and/or behavior change were not discussed by the authors. These issues will be discussed further in a later section.

Recent developments in the design and manufacture of inexpensive energy monitoring devices hold promise for making feedback highly cost effective (Shippee, 1980). In conjunction with programs to share savings from energy conservation among tenants in mass metered residential dwellings, feedback has been shown highly effective (McClelland, 1980). Thus, it appears that improved feedback could become an increasingly important component of future broad scale energy conservation efforts.

Feedback, however, has two crucial limitations which are evident from consideration of Ellis and Gaskell's antecedent variables discussed above. First, in order for it to be effective, people must be motivated to conserve. Becker, Seligman, and Darley (1979) have likened feedback to a bathroom scale--it provides a gauge of progress, but it alone does not make people take action. To be maximally effective, feedback probably requires some additional motivational component. Although nonfinancial motivation has been successfully used with feedback (Erez, 1977), in most studies to date, motivation has been provided by financial incentives; for reasons cited above, this may be counter productive.

Another major limitation of feedback is suggested by Lipsey's framework discussed previously: individuals must have the necessary knowledge of how to conserve if they are to respond effectively to feedback. Thus, ultimately all feedback approaches, like incentive approaches, require some form of information on how to conserve. In the next section, I will discuss evidence suggesting that such information has been the weakest link in the psychological research on energy conservation.

II. CONSERVATION INFORMATION

Individuals must have a reasonable understanding of the household energy system and how to improve its operational efficiency before they can take effective conservation actions (Ellis and Gaskel, 1978). Numerous studies (Rappeport, 1975; Harris, Keith and Wilhelm, 1980; Olsen and Cluett, 1979) have found a serious lack of such knowledge and considerable misunderstanding among residents interviewed. These considerations have led some researchers and numerous government agencies (apparently assuming that people are rational and would be motivated to save money through conservation if they only knew how) to develop information programs ranging in scale from modest to massive. According to a recent U.S. survey by the International City Management Association (Clearinghouse for Community Energy Efficiency, 1981, p. 6),

> ...65 percent of 1,277 cities and 62 percent of 233 counties... have programs which encourage or require energy conservation in the community at large. Most of these programs are limited to education and awareness efforts...

Despite such widespread commitments to educational programs, conservation information remains perhaps the most disappointing and least understood type of social-psychological energy intervention tested. Without for the moment questioning the underlying assumptions of these efforts, I will review the types of information approaches tested and some of the findings this work has yielded.

TYPES OF INFORMATION

In addition to feedback information, which was discussed separately above, McClelland and Canter (1980) have distinguished between several different types of energy information including the following:

1. 'how-to-save' information (i.e., information on specific behaviors or actions that may be adopted such as turning down thermostats, installing insulation or purchasing an energy efficient car)

2. explanations of economic or noneconomic (e.g., health, comfort) benefits that can be realized through conservation within existing energy price and distribution systems

3. explications of long term social costs of consumption

4. attitude change information (McClelland and Canter consider such information as separate from the more ''pure information'' approaches above; in practice, persuasive appeals often incorporate the other types of information.)

Another approach that has been tested involves information prompts. Prompts are generally defined as very short, specific reminders or requests to take a certain action (e.g., ''Please turn out the light''.)

When information interventions not using feedback have been compared with incentives and/or feedback, they have generally been found the least effective of the three approaches (Shippee, 1980). However, McClelland and Canter (1980, p. 6) have noted that studies have often failed to provide proper non-information group controls, making assessments of the independent effects of information alone impossible. Particularly since some reviewers have concluded from such studies that information is among the least promising of the approaches tested, it is important to distinguish exactly what information efforts have and have not accomplished, and to examine carefully the reasons for these mixed results.

Ellis and Gaskell (1978), reviewing the American and English literature on conservation information concluded that American studies have shown information successful in increasing awareness of and belief in the energy problem, and in increasing professed willingness to conserve, but unsuccessful in changing conservation behavior.

In some cases (Heberlein, 1975; Winett et al., 1978; Kohlenberg, 1976; Hayes and Cone, 1977), information has been found to have no measureable effects. However, there are some exceptions to these generally disappointing results, and they offer hope that information can be effective. Harris et al. (1980) found that provision of self-administered, computer-analyzed home energy audits appeared to be effective in leading to reduced energy consumption. However, since participants were not randomly assigned to experimental and control conditions, it is possible these results are an artifact of self-selection (Harris et al., 1980).

Another test of the potential of energy information was conducted by Olsen and Cluett (1979) in selected neighborhoods in Seattle, Washington. Three information programmatic variables were tested: neighborhood based literature dissemination, street block energy workshops and home energy checks. Residents who exposed themselves to all three conditions showed the most change on an index of self-reported conservation actions. Those who received the home energy audit conducted by utility personnel scored twice as

high on the self-reported conservation action index and also reduced consumption significantly more than individuals who did not have such audits. However, problems with validity of their conservation action index (Olsen and Cluett, 1979, p. 102), and the possible confounding effects of self-selection render these findings inconclusive.

Evaluations of the British ''SAVE IT'' campaigns suggest that energy education programs can be effective if they provide the appropriate type of information (Ellis and Gaskell, 1978, p. 55). The SAVE IT campaigns used television and newspaper media to communicate information on how residents could conserve. It emphasized a marketing approach aimed at informing residents of appropriate types of insulation, weatherstripping, etc. that they could purchase to reduce consumption. Although no experimental evaluation was possible, longitudinal surveys of reported conservation purchases suggest that the information resulted in increases in purchases of efficiency items such as water heater and roof insulation, and some changes in self-reported conservation behavior. Correlational data also suggest that overall trends in consumer energy consumption were more directly associated with the information campaigns than with variations in energy prices (Ellis and Gaskell, 1978, pp. 57-58).

While these findings must be interpreted cautiously, Ellis and Gaskell believe they constitute important support

for the strategy of providing ''how to information''. They note that U.S. information programs have generally failed to do this. (The work of Olsen and Cluett (1979), Harris et al., (1980) and Zuiches (1978) is exempt from this criticism and thus deserves careful attention despite methodological problems mentioned.) Ellis and Gaskell did not define in detail the specific types of ''how to'' information required. Certainly, such material should explain technical and behavioral aspects of energy conservation, as some educational efforts have. However, in view of the significance of economic considerations, both as motivators and, as has been repeatedly documented, as perceived barriers preventing individuals from carrying out conservation changes, it appears that most information fails to provide adequate ''how to'' information on financing residential energy improvements. Specifically, better information on how to take advantage of tax incentives, secure adequate improvement loans, and how to use savings from low cost/no cost techniques to finance more costly improvements in subsequent years would seem badly needed.

In addition to this problem, Ellis and Gaskell (1978) pointed out that much of the information tested has been of the wrong type, a number of other possible causes of the limited effectiveness of information efforts exist. McClelland and Canter (1980) have noted, for example, that most of the information used has not been well designed.

Specifically, they suggest that the information must command attention, must be understandable, must not overload individuals with too much information, and should ideally be tailored to the individual's own situation. These criteria would seem to explain at least in part Zuiches's (1978) success in creating responsive attitudes to conservation by using individual infrared thermograms of residents' homes.

In addition, the information must come from a credible source (Craig and McCann, 1978); as McClelland and Canter (1980) observed, most government agencies, businesses and utilities are not credible sources. In the U.S., consumer groups are considered more reliable sources of energy information (Milstein, 1977), but most of the conservation information tested to date has not emanated from such sources.

One implication of Heberlein's (1975) social structure conceptualization of the energy problem is that greater emphasis on changing the institutionally maintained energy use contingencies, either through pricing or mandating, should be emphasized. However, for reasons cited above, economic strategies are limited, and non-voluntary conservation actions would be expected to produce little long term attitude change; for this reason, voluntary approaches are preferable. Information is a necessary part of any such approach.

A second implication that has been drawn from the social structure conceptualization of the energy problem is that change efforts should be focused on the key actors and peer group processes that represent and maintain social norms (Aronson, 1980). Typically, this emphasis has taken the form of neighborhood-based group meetings and workshops with face-to-face peer interaction around the subject of energy conservation (e.g., Pallack and Cummings, 1976). While this approach can facilitate commitment and diffusion processes (Aronson, 1980), it may also be prohibitively costly and may therefore not be feasible on a wide scale. One solution to this problem is the use of voluntary personnel to organize and staff energy counseling workshops (Fitchberg Action to Conserve Energy Final Report, 1980) but this may not always be feasible.

Probably the most fundamental limitation of information approaches, implied in the above discussion of necessary antecedents to conservation, is that information alone is generally not motivating. While most energy information programs tested to date have not adequately dealt with this problem, this need not be the case.

Stern and Gardner (1981) have presented a more general conceptual critique of the social and psychological work on energy conservation. They have suggested a distinction between conservation actions and conservation behaviors. By actions they refer to essentially one time efficiency

improvements such as adding insulation, installing storm windows or purchasing energy efficient appliances. Conservation behaviors, on the other hand, according to Stern and Gardner, generally require frequent repetition (e.g., setting back the thermostat at night, turning off lights not in use, or car pooling), and further, are often associated in the minds of consumers with curtailment. They argued that the greatest potential savings involve one time efficiency actions and that social scientists, by focusing the bulk of their efforts on changing energy conservation behaviors, have seriously limited their contribution to solving the energy problem.

While Stern and Gardner's critique is provocative and there is certainly much validity to their observations, their analysis has been sharply criticized by Winett and Geller (1981) as overly simplistic and misleading. The latter authors point out that many conservation strategies involve both efficiency changes and repeated behaviors (e.g., the efficient use of home thermostats and using energy efficient modes of transportation). Winett and Geller asserted that the efficiency action vs. repeated behavior distinction is inaccurate and draws attention from the fact that future energy efficient society will require committment to living patterns involving both physical efficiency and behavior changes (e.g., recycling). Moreover, they claim, the implicit association of repeated behaviors with curtailment

is questionable--many energy conservation behaviors involve noneconomic benefits that for some at least would outweigh potential concerns with sacrifice (e.g., walking or cycling).

Winett and Geller's observation that energy efficient life styles must ultimately be developed that rely on both efficiency actions and repeated behaviors suggests another danger of artifically trying to separate the two: behavioral involvement may be a necessary part of the process of changing attitudes and hence, also, of changing conservation behavior. By focusing primarily on one shot efficiency actions as Stern and Gardner suggested (some of which could be delegated to outside experts), we may achieve immediate reductions in energy consumption but exclude the individual from participation in conservation behaviors to the extent that potentially more important longer term attitude and life style changes are less likely. These considerations have important implications for energy information: they suggest that in addition to the requirements noted above, effective information approaches should address both one shot efficiency actions and repeated behaviors if long term changes in behavior are a goal.

Since few of the information approaches tested to date have met even a portion of the many requirements outlined above, it seems premature at this point to draw any final conclusions about the potential contribution of information. Also, because it is the least costly of the major types of

psycho-social interventions available, only a slight degree of success would render it cost effective. And since all other approaches require some form of effective information, it is likely to continue to be the most extensively utilized type of social science energy conservation intervention in the foreseeable future. Moreover, if successful information techniques could be developed for energy conservation, they would be directly relevant on a wide range of other environmental problems. For these reasons, the pessimistic judgements of some critics of information approaches notwithstanding, further systematic research aimed at the development of more effective information approaches appears badly needed. In a later section, I will outline a field experiment drawing on the considerations and requirements discussed above, to futher clarify the potential of this intervention approach. Since motivation is so critical to the process of information approaches, I will first examine some theory and research that suggest how this necessary antecedent can be built into information strategies.

III. THEORIES OF BEHAVIOR AND ATTITUDE CHANGE

The generally disappointing results of passive information approaches to changing energy conservation behavior and the theoretical limitations of approaches that do not at the same time deal with motivation have led some researchers (Aronson, 1980; Stern and Gardner, 1981) to suggest that such information might be more effective if it included some form of active involvement. By maintaining a passive subject-object relationship between the individual and the information presented, most energy education approaches may have missed an important opportunity to build motivation through active participation. Lipsey (1977, p. 13) noted that:

> Undoubtedly there are experiences and activities in which individuals participate, willingly or not, that have the effect of sensitizing them to the severity of ecological problems, informing them of the need to act, or otherwise predisposing them to ecologically responsible behavior.

Lipsey cited three such experiences: ''recurring exposure to noxious effects of environmental problems, personal experience with shortages of basic commodities, and voluntary activities that bring one into contact with the environment''. For purposes of developing effective environmental education approaches, voluntary activities are potentially the most interesting of the three types of experiences. Although Lipsey concluded that ''the limited results support only speculation'' on the relationship between participation in environmental activities and facilitation of ecological behavior, Aronson (1980) and Stern and Gardner (1981) have noted special cases in which the relationship has been documented.

These authors cited the ''foot-in-the-door'' technique as applied in a recycling campaign by Arbuthnot, Tedeschi, Wayner, Turner, Kressel and Rush (1976-1977) and public commitment to conserve energy (Pallack, et al. 1980) as promising examples of strategies using active involvement. Arbuthnot et al. (1976-1977) found that subjects who participated in multiple actions related to recycling (completing a survey, saving cans for one week and sending a letter to a local government representative in support of recycling) were more likely to comply with a final request for recycling than were those who participated in only one or none of these activities. Over 80% of the multiple compliance participants reported recycling behavior at two month

and eighteen month follow-up points. No behavioral verification was performed; however, even if these self-reported rates overstated actual conservation behaviors they would be impressive.

As noted previously, several non-experimental energy information programs have included some form of active participation on the assumption that this would facilitate changing conservation attitudes and/or behavior. However, the impacts of these programs have rarely been carefully studied and the work is generally atheoretical. Since this lack of theoretical grounding is a major problem with the limited work testing active involvement approaches to energy conservation to date, an examination of the theoretical basis for such work--past and future--is in order here.

A consideration of the possible theoretical bases for a relationship between active involvement and changing energy conservation attitudes and behavior leads inevitably to one of the most central issues in psychology, that of the relationship between behavior and cognition. Although the apparent centrality of this issue might suggest the existence by this time of a reasonably well developed theoretical understanding of the behavior-cognition relationship, such is not the case. It is instructive to review some of the reasons for the current state of the art.

Mancuso (1970) has noted that the virtual domination of American psychology by the behaviorist school effectively

suppressed the development of cognitive concepts from the field for much of its history. Even as cognitive work began to emerge thereafter, the artificial disciplinary compartmentalization within psychology presented obstacles to those who would study processes that cut across disciplinary boundaries, as does the behavior-cognition relationship.

Other reasons for the limited development of theory on the behavior-cognition relationship involve limitations of the empirical work dealing with this issue. Wicker (1969), reviewing research on the correlation between attitudes and behavior, noted a pattern of weak or no correlations. Fishbein and Ajzen (1975) and Kelman (1974), in separate reassessments of such work, have pointed out problems with conceptualization and methodology which they maintain, if properly taken into account, allow strong positive correlations. Kelman (1974) cautioned that it is a mistake to expect a complete correlation between attitude and behavior since social context or other variables are often more powerful determinants in situations than are attitudes. In any case, the lack of clearer results on the behavior-attitude link has inhibited theory development.

The dominant body of work on the attitude-behavior relationship in Social Psychology is that of cognitive consistency. In this approach, individuals are seen as changing their attitudes to maintain consistency with their actions or statements, which may be induced by external

forces such as social pressure. This work is impressive in volume and has contributed importantly to an understanding of the issues. However, it has been criticized for its underlying model of people as strivers for minimum cognitive tension (Freedman, 1968). Work growing out of the alternative model of people as seekers of novelty has been less well developed, with resulting serious gaps in existing theories on the attitude-behavior relationship. With the above considerations in mind, I will discuss some specific conceptualizations of the role of active involvement in education and attitude change.

Information Attention

The effectiveness of active participation in focusing attention on information has been established by educational psychologists. To the extent that specific participatory tasks could be structured to enhance attention to information needed for individuals to carry out a range of conservation behaviors, their inclusion would be expected to improve the usefulness of educational strategies. Since energy conservation is an area characterized by considerable misunderstanding and myth (Yergin, 1979) attention to information that would correct such inaccurate perceptions should be especially effective. However, simply structuring tasks to provide information-attention does not guarantee that

individuals will be sufficiently motivated to carry out the learning tasks or subsequent conservation behaviors.

Competence

White's (1959) concept of competence or effectance motivation suggests that in certain circumstances active participation in exploratory behaviors can be essentially self-motivating. White's conceptualization is derived from Hebb's (1949) notion of optimal levels of stimulation, which, unlike previous stimulus reduction models, posited that organisms ''will always act so as to produce an optimal level of excitation'' (Hebb and Thompson, 1954, p. 551). The concept of competence appears to account for a wide range of everyday behavior not explained by other models--White cited common stimulus seeking behavior such as driving at high speed and active exploration as examples. Aronson (1980) has suggested that this sort of fascination with mastering more exotic conservation technologies should be exploited in outreach efforts as an inducement to learning about the more basic conservation measures.

While the competence concept is a compelling alternative to more deterministic models, it is not yet a fully developed theory. Although White has suggested some of the general conditions necessary for effectance motivation, a more precise specification of the critical variables is needed.

The notion of ''playful exploration'' in particular requires development. In addition, the notion of an optimal level of stimulation, derived from Hebb's work suggests a purely quantitative model, but the quality and not merely the quantity of stimulation would be expected to be important; this remains to be clearly defined. More specifically, competence theory does not specify what types of behaviors are likely to lead to attitude change. Indeed, the relationship between competence development and attitude change is only vaguely implied (e.g., positive competency developing activities would presumably increase general positive feelings about the phenomena or objects so experienced.)

Control

Aronson (1980) has noted that the concept of sense of control, as developed by Langer and Rodin (1978), offers special usefulness for energy conservation strategies. Since energy is invisible and intangible and existing production distribution and billing systems do little to clarify these relationships, efforts to increase individual consumer's sense of control over their energy consumption should be effective. Unfortunately, existing theory on sense of control does not adequately clarify the conditions necessary for such a process to occur.

Cognitive Dissonance

Since the work on cognitive dissonance represents the most extensive exploration of attitude change through behavioral change, it is instructive to consider its potential contributions to and limitations for developing energy conservation strategies based on active involvement.

According to Festinger, ''two elements are in a dissonant relation if... the obverse of one element would follow from the other.'' (Festinger, 1957, p. 13.) The major hypothesis is that,

> The existence of dissonance, being psychologically uncomfortable, will motivate the person to try to reduce the dissonance and achieve consonance...The strength of the pressure to reduce dissonances is a function of the magnitude of the dissonance (Festinger, 1957, p. 3).

Kelman (1974) noted that the notion of the ''discrepant action'' which has developed from dissonance theory may be its most significant contribution. A discrepant action can be defined logically as indicated by Festinger's definition of dissonance, but it can also be defined probabilistically (Fishbein and Ajzen, 1975). Discrepant actions have been found to be most effective in inducing attitude change when they are voluntarily chosen (Aronson, 1980) and when they

relate directly to the individual's self-image (Aronson, 1968).

Critics of dissonance theory, while often acknowledging at least mixed empirical support for the phenomenon, have questioned the relative importance of the assumed consistency motivation as opposed to complexity or novelty seeking motivations (Freedman, 1968; McGuire, 1966). Freedman (1968, p. 501) has noted that many of the dissonance studies have employed such contrived experimental conditions that their generalizability is dubious.

In addition, for the applied researcher, dissonance theory presents a troublesome paradox: in order for attitude change to occur, a behavior that represents a strong discrepancy with an individual's self-concept must be induced, yet in the absence of esoteric experimental conditions, this may be extremely difficult and unlikely. Again, this problem suggests a basic flaw in the theory: how could attitudes ever change if the conditions required are so unlikely?

Self-Perception Theory

One way out of the dilemma is provided by Bem's (1965) self-perception theory. Bem's position is that the attitude changes produced by dissonance researchers are real but that

they occur because of a process other than dissonance reduction. Specifically, Bem (1965, p. 2) has argued that:

> Individuals come to ''know'' their own attitudes, emotions, and other internal states partially by inferring them from observations of their own overt behavior and/or the circumstances in which the behavior occurs. Thus, to the extent that internal cues are weak, ambiguous, or uninterpretable, the individual is functionally in the same position as an outside observer.

Kelman (1974) has argued that Bem's radical behaviorist attempt to eliminate cognitive concepts was a failure, since the acceptance of attitude as a dependent variable acknowledges that attitude is more than epiphenomenon. However this aside, Bem's theory is important because of what it implies about the behaviors that are likely to induce attitude change: unlike Festinger's dissonance theory which states that such behaviors must represent maximum cognitive discrepancy in order to induce tension that will result in attitude changes to reduce this dissonance, Bem's theory opens the way for change through a series of behaviors of graduated discrepancy. The foot-in-the-door technique that has been studied from a self-perception theory perspective employs such a gradation approach. Since, as noted above, recent reviewers of social science energy conservation

literature have recommended the foot-in-the-door technique as among the most promising approaches for involving people in energy conservation, it is appropriate to review some of the experimental work that has employed it.

Freedman and Fraser (1966) established the general foot-in-the-door paradigm in their studies to test the idea that ''once a person has been induced to comply with a small request he is more likely to comply with a larger demand.'' In one experiment, subjects were asked to either put up a small sign or sign a petition supporting safe driving or against littering. A few days later they were asked to put up a large ''Drive Carefully'' sign on their front lawn. Freedman and Fraser found that subjects were more likely to comply with the second request if they had been asked to perform the similar first request. Surprisingly, even initial compliance with the dissimilar request produced more participation in the larger task than was observed in controls who had not been requested to perform any prior task. The researchers concluded that ''what may occur is a change in the person's feelings about getting involved or about taking action'' (Freedman and Fraser, 1966, p. 201).

Pliner, Hart, Kohl and Saari (1971) replicated Freedman and Fraser's work, varying the size of the initial task. They found that even a relatively trivial behavior (wearing a

daffodil pin to publicize a cancer society fund raising drive) was successful in inducing compliance with a subsequent request (contribution to the campaign).

Cann, Sherman and Elkes (1975) varied size of initial request and timing of second request. They found that a small initial request was effective in inducing a second, larger request when the second request followed immediately or up to ten days later.

Arbuthnot et al. (1976-1977), in a recycling study mentioned previously, found that multiple prior tasks were more effective than a single request. They also found that the foot-in-the-door approach could induce active, long-lasting behaviors. Previous final requests had generally involved passive, one shot behaviors.

Stern and Gardner (1981) have observed that successful practical applications of public commitments and self-perception approaches have depended upon personal contact. They cited this dependence on personal contact as a serious barrier to their application in wide scale energy conservation efforts. The foot-in-the-door studies reviewed above employed personal contact and hence were subject to this limitation; however, two other studies in this tradition (Schmidt, 1973; Lowman, 1973) included both personal and impersonal requests. As expected, both of these studies found the impersonal requests less effective than personal requests. However, neither provides conclusive data

regarding the feasibility or cost-effectiveness of the impersonal request approach alone. Zuiches (1978) reported no difference in response to an energy outreach program whether the information was mailed or delivered in person.

Reliance on social pressure in the foot-in-the-door technique is a mixed blessing. Such social pressure causes people to carry out more discrepant, and hence, more attitude-changing behaviors, but it reduces individual freedom to choose actions (voluntary actions have been found to increase attitude change). One approach to the problem of personal contact in inducing attitude changing behaviors is to de-emphasize the compliance aspects of the foot-in-the-door paradigm and place greater emphasis on freely chosen, self-rewarding exploratory behaviors as would be suggested by a competence theory model. By reducing the need for compliance, it might be feasible to develop effective mailed information and activity kits that would facilitate such behaviors. This approach would involve some sacrifice in control of the specific behaviors in which people would participate, and reduction of social pressure of the compliance model might reduce the discrepancy of behavior that could be induced (Kelman, 1974) but it would presumably yield greater long term attitude change by increasing participant's choice. Another possibility is to supplement mailed packets with telephone contact. (This approach has

been found highly successful and cost effective in studies of telephone vs. personal interviews.)

A major limitation of the foot-in-the-door work to date is its generally atheoretical approach to selection of behavioral tasks employed using the paradigm. So far selection of the behaviors has been limited by focusing on rather vague notions of similarity of initial and final requests and ''size of request''. While this atheoretical approach is not surprising given the roots of the work in Bem's radical behaviorist tradition, it is neither necessary nor desirable. Although the approach has been used effectively to induce specific target behaviors, it is not surprising that few of the studies reviewed above that measured attitude change found any as a result of the experimental manipulation, since the behaviors chosen by the researchers were not explicitly selected to represent cognitively discrepant actions in the Festingerian sense.

It should be clear from the above discussion of the theories of Bem, Festinger and White that the behavior-cognition change phenomena under study cut across the boundaries of the individual theories, and that a more integrative approach is required to understand the processes involved.

Kelman's Functional Theory

Kelman (1974) has proposed a model that accommodates both dissonance reduction and competence seeking. In his view, attitude

> ...is not an entity that can be separated--functionally or temporally--from the flow of action, but is an integral part of action. Attitude and action are linked in a continuing reciprocal process, each generating the other in an endless chain. Action is the ground upon which attitudes are formed, tested, modified and abandoned. (Kelman, 1974, p. 171)

(Further, Kelman emphasized that ''the attitude the person forms is grounded in the particular functional significance that the situation has for him.'') Both stability and change forces operate in this process, according to Kelman, and which predominates depends upon the situation, the existing attitude and the information available.

Consistent with dissonance theory, he believed that sharply discrepant actions in the Festingerian sense are most likely to initiate forces toward attitude change. To the extent that the attitude change process Kelman describes incorporates a self-reflective participant in action sequences, it is consistent with Bem's general idea, with the important exception, noted earlier, that Kelman, unlike Bem,

sees attitude as a real phenomenon. Kelman's theory is also compatible with information processing models, as is clear from the ways in which action and attitude are interlinked in his functional theory. According to Kelman, attitude review and revision processes are set into motion by contemplation at three stages: in the process of deciding to act, after the act has been initiated and after the act has been completed as its consequences become known. Kelman believes that at this point, the most important theoretical issue is the clarification of the conditions and processes associated with these three aspects of the action-attitude change relationship.

In order to account for why people would take discrepant actions that might lead to attitude change in everyday situations, Kelman introduced the concept of ''range of commitment.'' According to this notion, all potential actions a person might take can be described by the individual's commitment to the action (roughly equivalent to likelihood of taking the action). In a given situation the individual's commitment to an action interacts with the particular social pressures inherent in the situation to produce an outcome of taking the action or not. Thus, a person might take an action to which he/she would normally have low commitment if the social forces in the situation were great enough, or the person might carry out an action to which he/she was

moderately committed, if the situation provided only slight social pressure to act.

Kelman also noted the importance of consequences of behaviors to attitude change. In particular, he pointed out that behaviors that involved commitment to new roles may have powerful attitude change implications, an observation supported by previous dissonance theory research. Kelman (1974) noted that rewards resulting from specific behaviors may affect attitude change simultaneously with dissonance reduction processes. In this connection, one would expect that energy conservation behaviors that were perceived to result in substantial gains in energy savings or comfort would be expected to increase pro-conservation attitude change. Thus, while Kelman's theory begins to suggest a relationship between counter-attitudinal and competency processes, it stops short of elaborating that relationship. Another variable cited as important by Kelman is level of involvement. According to Kelman, "Discrepant action is more likely to generate justification processes conducive to attitude change, the greater the individual's personal involvement in the action (p. 319)."

However, in view of research suggesting that most people appear willing to make only minor life style changes to conserve energy (Hine and Gerlach, 1970) one must presume that the practical limits on potential level of involvement for energy conservation efforts in which most people are

willing to participate are very serious, if unspecifiable at this time. Defining these limits of ''optimal'' levels of involvement would be one valuable contribution of research in this area.

Kelman's theory is important for the current investigation for several reasons. Unlike previous, more unidimensional theories, it does greater justice to the complexity of the behavior-attitude change relationship. It offers a framework for examining action and attitude change outside of highly improbable laboratory situations typical of many dissonance studies. And it turns the research focus from such philosophical questions as whether people are essentially competence or consistency seeking to an examination of the conditions under which each of these processes may occur outside of the laboratory.

However, Kelman's theory is limited by its predominant emphasis on social processes and its largely stimulus reduction model of motivation. It fails to account adequately for motivational processes associated with competence development, which are presumably important in environmental and technological education. Moreover, the social process emphasis of Kelman's model does not account for an additional characteristic of some environmental actions: they may cause perceptible environmental changes that can serve as cues about one's self-image (i.e.,

installing a windmill or weatherstripping would be expected to strengthen one's self-image as an energy conserver.)

SUMMARY

To summarize, I have attempted above to identify aspects of counterattitudinal and competency theories that are applicable to the problem of understanding the relationship between ecological behaviors and attitude change. I have also indicated that although historically these processes have often been viewed as opposed because of their different underlying models of people, more recent theorists have shown that these processes can be viewed as complementary. In particular, Kelman's (1974) model was discussed as a useful beginning toward an integration of counter-attitudinal and competency phenomena.

However, Kelman's model is also limited. Although it begins to suggest a connection between counter-attitudinal actions and consequences of the actions for competency development, the major foci of the model are social and counter-attitudinal processes. Specifically, Kelman did not consider that competency seeking processes might lead to discrepant actions without social compliance pressures. But if White's (1959) competency theory is valid, it should be possible to establish the conditions to induce discrepant actions through voluntary exploratory behaviors.

More specifically, one could postulate the following general preliminary hypotheses regarding the relationships between competency behaviors and counter-attitudinal behaviors in the context of attitude processes:

1. Effects of active involvement on attitude change: Although many types of active involvement may facilitate information attention, not any type of involvement will result in attitude-change. Specifically, participation in activities that represent discrepant or competency developing behaviors will result in greater attitude change than will participation that does not include such behaviors.

2. Combined effects of competence developing and discrepant behaviors:

   a. Under conditions that facilitate competency developing and discrepant behaviors, individuals will engage in more discrepant behaviors than under conditions in which competency

developing activities are not facilitated.

b. Under conditions that facilitate competency developing behaviors plus discrepant actions, personal contact will be less necessary to induce counter-attitudinal behaviors than would be the case without such competency conditions.

c. Conditions that facilitate both competency developing and discrepant actions will result in greater attitude change than will conditions that facilitate only one of these types of behaviors.

IV. SOME IMPLICATIONS OF COMPETENCE AND DISSONANCE THEORIES FOR APPLIED ENERGY INFORMATION PROGRAMS

In order to test the usefulness of the theoretical approaches outlined previously for developing and understanding applied energy information programs, the implications for competence and dissonance theory for specific energy conservation activities must be further examined. This analysis, as will be seen, will result in a classification of energy behaviors based on their cognitive implications that is quite different from Stern and Gardner's (1981) classification based only on the physical efficiency of energy measures.

Competence Theory and Energy Behaviors.

According to White's (1959) theory, the subjective sense of competence that is essential to self-motivation results from manipulative and exploratory behaviors that produce effects upon the environment; this process is called "effectance motivation" (Williams, 1979, pp 168-169.) The concept of effectance motivation, which emphasizes the motivational significance of behavioral consequences, appears compatible

with the model of the diffusion of energy conservation proposed by Darley and Benniger (1981), which underscored the significance of the specific effects of conservation behaviors. They emphasized the need for "trialability ... the degree to which an innovation can be tested for effectiveness on a cost or scope-limited basis."

Darley and Benniger cited two types of barriers to energy conservation that relate to competence theory:

> One set involves low certainty that the innovations can produce savings, coupled with the fact that the innovation costs are payable prior to any demonstration of achieved savings. A second set of barriers arises from the fact that people frequently think that they do not have the skills to install specific innovations or to diagnose what innovations make sense for them (Darley and Beniger, 1981, p 169, underlining mine)

This analysis, if valid, has enormous implications for energy conservation theory and practice that have not been widely recognized. One important implication of Darley and Benniger's analysis is that rather than recommending residential energy measures strictly on the basis of their physical efficiency as Stern and Gardner's (1981) model suggests, energy conservation advocates should encourage

activities that would enable residents to develop a sense of competence (and confidence) and allow graduated commitment. (As noted, this approach is also consistent with the foot-in-the-door approach to attitude change.)

Further insights regarding the competence issues important in effective energy information programs are suggested by Stapp's (1971) analysis of the behavioral requirements of an active environmental education program. Stapp's approach is based upon providing a sequence of environmental encounters. "...which assures the student of a familiarity with the problem solving approach" (Stapp, 1971, p 276.) The key steps in this process as identified by Stapp are the following: "(1) identifying and defining the environmental issue or problem; (2) collecting data relating to the problem; (3) determining the alternative solutions to the problem; (4) evaluating the solutions and selecting the best one; (5) developing a plan of action; and (6) implementing the plan of action." (Stapp, 1971, p 276.)

This approach has at least two implications for developing competence based energy information programs: first, it may be as important to provide information to facilitate development of general energy conservation problem solving skills as to provide detailed information about residents' specific energy situations at a particular time; and second, the particular skill of developing a plan of

action to implement appropriate conservation solutions may be critical in bridging the gap between analysis and action. Many energy conservation outreach programs have provided home energy audits presenting information on appropriate measures, but they often fall short of assisting residents in developing a plan of action for carrying out the recommended measures in a way that enables them to graduate their economic risk and schedule the implementation over a comfortable time period.

These considerations, taken together, suggest a number of competence skills that should be addressed if energy information programs are to be successful:

1. how to identify the major sources of energy waste in the individual's residence
2. how to determine the most cost effective and appropriate conservation measures and behaviors
3. how to develop a plan of action to implement appropriate measures and behaviors in a way that permits some "trialability" or incremental testing and graduated financial commitment
4. how to develop an effective financing plan to carry out needed work

5. how to implement appropriate efficiency measures oneself or how to locate a reliable contractor to do the work
6. how to monitor fuel consumption to verify effectiveness of the energy measures and behaviors

If the preceding analysis is correct, information programs incorporating active involvement in behaviors that facilitate the development of a sense of competence with regard to these skills should be particularly effective. While it cannot be accurately determined a-priori how individuals will experience participation in various energy behaviors in terms of perceived competence development, the above analysis does provide a useful framework for a rough classification of energy behaviors according to their general implications for energy competence. The table following this section represents a preliminary classification of energy behaviors along these lines.

Dissonance Theory and Discrepant Energy Behaviors.

The previous section elaborated upon the implications of competence theory for energy behaviors. In the following analysis, I will present a parallel development of the implications of dissonance theory for understanding and classifying energy behaviors. The concept of discrepant

behavior is central to this analysis. I will examine this idea from the traditional dissonance theory perspective and from the "key beliefs" viewpoint proposed by Fishbein and Adjzen (1975).

Discrepant Behaviors: Traditional Dissonance Theory Approach. According to Festinger, a dissonant relationship occurs when "... the obverse of one element would follow from the other... x and y are dissonant if not x follows from y" (Festinger, 1957). However, this definition has been criticized as being imprecise (Fishbein and Adjzen, 1975). Aronson (1968) has suggested that dissonance can be more precisely defined in terms of expectancy (Fishbein and Ajzen, 1975). From this perspective, the degree of cognitive discrepancy associated with any particular energy behavior would depend upon the extent to which the behavior violated an expectancy about oneself vis a vis energy conservation. Thus, for individuals who had been relatively uninvolved in conservation activities previously, participation in behaviors they associated with energy conservation would be discrepant behaviors, independent of the actual effectiveness of such measures.

This point is particularly significant in view of research indicating that the public is poorly informed regarding the relative effectiveness of various energy measures. Kempton, Harris, Keith and Weihl (1982) for

example, reporting on a survey of 3,000 Michigan households, noted that individuals "...overestimate the savings potential of management and sacrifice, and underestimate the potential of efficiency investments." These data suggest that measures such as manually reducing the thermostat, taking shorter showers, turning off lights, etc. are part of the public's expectations of what energy conservers do, and would therefore be potential discrepant behaviors to someone not currently very involved in conservation activities.

In order for behaviors to create cognitive dissonance, they must have direct implications for self image (Festinger, 1957). Thus, energy behaviors that result in a publicly visible change to individuals' residences should be effective discrepant behaviors, in view of research linking appearance of the home and self-image (Cooper, 1971). In this connection, the installation of storm windows, solar collectors or exterior window shades would be expected to produce greater cognitive discrepancy than essentially private energy behaviors.

Other behaviors related to energy conservation self image that could be effective discrepant behaviors include joining a conservation organization, writing a letter in support of conservation to an elected representative, or making a public commitment (see Yates and Aronson, 1983 for other suggestions regarding conservation actions related to self-image).

Discrepant Behaviors: Key Beliefs Approach.

A second approach to defining discrepant behaviors derives from Fishbein and Ajzen's (1975) analysis of the role of "key beliefs". According to those authors, attitudes can be changed effectively by focusing on the key beliefs underlying those attitudes. While broadly consistent with a traditional cognitive dissonance approach, Fishbein and Ajzen's model permits a more precise specification of discrepant behaviors that are likely to lead to attitude change.

Fhaner and Hane (1975) successfully applied a key beliefs approach in an information program aimed at changing seat belt usage. In that study, seat belt attitudes and use in Sweden were changed significantly by an information program aimed at changing two specific underlying beliefs that had previously been shown to predict seat belt usage. Fhaner and Hahne's information interventions consisted of presenting phamphlets and a color movie, practice in seat belt use, and discussion. (It is interesting, in light of research discussed elsewhere in this paper, that the two key beliefs identified by Fhaner and Hahne concerned comfort/convenience and perceived effectiveness of the use of seat belts; similar concerns about comfort and efficacy have, as noted, been linked to conservation behavior.)

As indicated previously, research on energy conservation attitudes has identified several key beliefs related to conservation attitudes. Olsen's (1981) recent review provides a useful summary of this literature. Existing research does not allow an accurate assessment of the relative contribution of each of the key beliefs in determining actual conservation behavior; however, it does indicate that the beliefs identified below are associated with conservation attitudes and behavior:

1. <u>The belief that one will experience direct personal consequences from the energy shortage</u> (Hummel et al., 1978). Although direct personal experiences such as waiting in line for gasoline appear to affect conservation attitudes, it is difficult to imagine behaviors that would both address this key belief in future personal consequences of the energy shortage and be suitable for inclusion in a participatory energy information program. However, environmental educators might successfully employ some participatory exercises that would clarify and underscore the direct impacts the energy supply situation currently had on individuals through its effects on the

economy, the construction of nearby nuclear generating plants and the rising percentage of their housing dollars spent on fuel in the past several years.

2. The belief that conservation requires sacrifice in comfort, convenience or health (Seligman et al., 1979) Behaviors that would be appropriate for addressing this belief would clearly be those that increase-or at least cause no sacrifice in comfort or health, eg. installation of weatherstripping, caulking, storm windows, radiator reflectors, and other improvements to reduce drafts or improve heat distribution as opposed to reducing the thermostat setting in winter.

3. The belief that conservation works and is cost-effective (Olsen, 1981. p 114-120; Ellis and Gaskell, 1978.) This belief could best be addressed through behaviors involving low cost measures with observable consequences such as installation of weatherstripping, caulking and interior storm windows since

such measures are typically among the most cost-effective.

4. The specific belief that it is not possible to finance energy improvements so that one could pay less annually for fuel plus conservation improvements than one would pay for fuel alone without such improvements (or that energy investments seemed reasonably attractive compared to alternative investment options -- see Frieden and Baker, 1983, p 442). Behaviors dealing with this belief would emphasize energy conservation financial planning, how to utilize conservation tax incentives and phased implementation of conservation measures using low cost measures to generate savings to finance subsequent more costly improvements. Opening a separate bank account for setting aside savings to finance later work is a related behavior that could be incorporated into a participatory conservation information program.

5. The belief that the energy problem will be solved by individuals rather than by government or technology (Hummel et al., 1978). Olsen has concluded that such beliefs "... may have side effects on one's decisions about saving energy in the home but this influence is slight and variable" (p 123). It is possible that if people demonstrate to themselves that they as individuals can substantially reduce their fuel consumption they will tend more strongly to believe that individuals collectively can have an impact on the energy problem, and that this belief will lead them to engage in further conservation efforts. Since the behaviors that would most appropriately address the key belief in the role of individuals in solving the energy problem would be the same ones that would yield a sense of competence as discussed above no specific additional behaviors need be incorporated to address this belief per se.

6. Belief in basic ecological values. Olsen (1981) concluded that belief in such values as 'eco-consciousness', 'voluntary simplicity' vs. consumerism, the 'conservation ethic ' and the more specific belief that individuals have a social duty to save energy are important determinants in individuals' decisions to conserve energy. Olsen (1981) therefore suggested that persuasive appeals to conserve energy should take advantage of these values to motivate people to conserve energy. However, for the present research, since these beliefs appear to involve fundamental values that would be expected to be less immediately amenable to change through active information approaches than other beliefs discussed above, no specific attempt will be made here to assess such deeply held ecological value beliefs.

It should be clear from the above discussion that conservation behaviors do not fit neatly into the categories of discrepant behavior or competence behavior; even within the general category of discrepant behavior, the sub-

categories of discrepant with self image or with key beliefs are not distinct but overlap. In some cases, a behavior that may seem appropriate for engendering a sense of competence and a self image as energy conserver may actually reinforce a key belief associated with non-conservation. For example, lowering the thermostat to 55 in the evening may lead to a sense of energy competence, support a self image as conserver of energy and yield convincing evidence of the cost-effectiveness of energy conservation, but if it is perceived as requiring sacrifice this could reinforce the key belief that conservation requires sacrifice in comfort.

Although the categories presented above are overlapping and not mutually exclusive, this does not mean that the cognitive implications of energy behaviors should be ignored in favor of a system that classifies energy measures strictly in terms of their physical efficiency as Stern and Gardner (1981) suggested. In this connection, it should be noted that in a later publication, Stern and Aronson (1984) list several specific recommendations for active behavioral involvement of homeowners in preliminary conservation activities appropriate for incorporation with home energy audit procedures, as did Yates and Aronson (1983).

At this point, the classification of energy behaviors in terms of the cognitive issues discussed may not be absolute, but it will be useful if it generates more effective energy information programs and research. With

these considerations in mind, I will present a tentative classification of a number of energy conservation related behaviors in terms of whether they appear to involve energy conservation competence, self-image or key beliefs (see Table 1). This preliminary classification will then be used as a framework to critique some previous energy conservation approaches. Following that, the framework will be used to refine the general hypotheses stated previously for the purupose of defining the present research.

Implications Of The Cognitive Analysis Of Energy Behaviors For Applied Information Programs

The classification of energy behaviors presented in this preceding section provides a tentative guide for evaluating existing information programs and for designing new programs based on a cognitive analysis of energy behaviors. However, before considering these problems, it will be useful to summarize some general criteria for an effective energy program as suggested by the forgoing analysis. These criteria can be briefly stated as follows:

1. it should facilitate the development of competence in the six essential energy conservation skills identified in the previous section.

Table 1

Hypothesized Implications of Various Energy Conservation Activities for Specific Attitudinal Variables

	Attitudinal Variables				
Activity	Compe-tence	Self-Concept	Comfort/ Conven-ience	Effi-cacy	Cost-Effec-tiveness
Self-audit	++	++	?	+	?
Professional Energy Audit	+	+	?	+	?
Caulk	+	++	+	+	+
Weather-strip	+	++	+	+	+
Install Low-Flow Shower Head	?	+	?	?	?
Set Thermo-stat to 55 F Nightly	0	+	-	?	+
Have Burner/ Furnace Tested & Serviced	?	++	?	+	?
Reduce Water Temp. to 120 F	+	+	?	?	?
Insulate Heat Pipes	+	+	0	?	?
Insulate Roof	+	++	?	?	?

Note: Expected strength of relationships:
++ = very strong; + = strong; 0 none expected;
? = unknown

2. it should provide individuals with experiences and information that will facilitate development of the most important of the key beliefs identified previously.

3. it should engage individuals in discrepant behaviors related to their self-image vis a vis energy conservation.

4. it should allow phased involvement or, in Darley and Benniger's (1981) terms, "trialability" of measures coordinated with graduated financial commitment.

These criteria suggest that one effective information approach would be to first emphasize low cost and no cost measures that would increase comfort, demonstrate the cost effectiveness of energy conservation and facilitate development of essential energy competence skills; after these issues were addressed, the program would emphasize more comprehensive and costly conservation measures and related skills.

While elements of such a program have been widely incorporated in various energy outreach programs, to my knowledge, no mass information program has combined these

elements systematically using active involvement as suggested here. A brief review of some applied information programs will illustrate that such programs can use essential elements noted above but often produce disappointing results if the elements are not combined systematically.

Consider, for example, the widely disseminated federal Department of Energy publication, In The Bank or Up the Chimney: A Dollars and Cents Guide to Energy- Saving Home Improvements (U.S. Department of Housing and Urban Development, 1975). Although this booklet has contributed significantly to the distribution of useful energy information, it presents only four pages of"low cost/no cost" measures in the first section of a 75 page document[1] (additional material on such measures appears later in the text.) A more effective approach would be to place greater emphasis on the low cost/no cost measures at the outset, and address the more ambitious measures later after appropriate involvement is established.

Another widely employed public information approach is the energy audit offered by utilities to consumers under the Residential Conservation Service program. Under this program, utilities provide energy audits free or at nominal

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[1]. One of the first measures recommended is setting back the thermostat, a behavior which, as the classification presented previously indicates, may be perceived as a sacrifice in comfort or convenience and produces no immediately noticeable effect.

cost; in some cases they also provide assistance with financing by arranging below market interest rate loans, and assist with locating reliable contractors to carry out recommended work. Some utilities also guarantee proper installation of improvements and inspect completed work. Such comprehensive programs would seem to be a major improvement over the mere provision of passive information. Yet a recent study (Stern and Aronson, 1984) has indicated that typically, only a small percentage of eligible residents take advantage of the energy audits, and an even smaller proportion who get the audits actually implement the recommended measures. The low response rate results in a very poor cost/successful audit ratio, causing higher utility rates for all utility customers since financing for the programs derives from all ratepayers' monthly utility bills. Again, the programs appear logical from an engineering perspective, but they fail to meet the criteria discussed previously. For example, such programs often de-emphasize low cost/no cost conservation measures, focusing mostly on capital-intensive improvements to be carried out by outside professionals. Residents' involvement is largely passive or analytical-until it is time to write the check for contracted work.

Low cost/no cost programs, on the other hand, have addressed many of the important issues concerning involvement in appropriate initial energy activities but have often not

provided the necessary experiences and the competence skills and motivation required for participants to implement the more costly and extensive energy measures.

Neither the analysis presented above nor the cognitive classification of specific energy behaviors offered previously can generate the design for an energy information program guaranteed to succeed. As previous researchers have noted, there are many obstacles involved and many other subtleties that must be taken into account. Although the general conceptual approach discussed here could provide a potentially useful starting point for generating the design of more useful information programs, additional information is necessary about the relationship of energy conservation behaviors, intentions and attitudes before such an approach can be implemented with confidence. The following chapter will outline a study intended to shed additional light on these relationships.

V. RESEARCH DESIGN AND METHODOLOGY

In previous chapters I have outlined a case for the interrelationship between energy conservation attitudes and behaviors, suggested hypotheses concerning the attitudinal implications of specific conservation behaviors and speculated about the implications of these relationships for energy information program design. Since these hypotheses were necessarily based upon limited literature and research, it would be desirable to test some of the hypotheses empirically before proceeding further with theory development.

Hypotheses

The previous literature review suggested the major hypothesis that energy conservation behaviors are related to key beliefs in three areas: comfort/convenience, competence and efficacy/risk. To test this hypothesis, pretests of

early versions of the research instrument to be used were conducted on three separate small samples of middle income homeowners (see Appendix A.) The samples averaged only about thirty subjects and factor analysis of the resulting data must be considered suggestive; however, for heuristic purposes such analyses were carried out, leading to the working model described as Model III in Appendix A.

This model will be taken as the starting point for hypothesis testing. That is, the first major working hypothesis is that this model reasonably represents homeowners' attitudes regarding energy conservation. The second major hypothesis is that these attitudes will be related to conservation behaviors and intentions. More specifically, it is hypothesized that homeowners who score high on items involving the emergent major attitudinal factors will have completed more conservation measures than those who score lower on those factors, and will have completed more of the specific behaviors which are related to the various individual factors.

With regard to competence, it is hypothesized that individuals who score high on general/theoretical energy conservation competence but low on competence regarding specific conservation actions will have completed (or planned to complete) more such actions than residents who score low

on both general and specific competence. Residents who score high on both general and specific competence factors are expected to have completed or planned to complete the highest number of conservation actions.

Research Design

For the purposes of an exploratory investigation to ascertain the existence of hypothesized interrelationships between attitudes and behaviors, a cross-sectional design at one point in time is adequate. Therefore, the energy conservation attitude instrument developed in pretests was administered, in conjunction with an appropriate energy action and intentions index, to a sample of middle income homeowners at a single point in time. This design permits a test of whether the types of relationships hypothesized here exist and can provide some clarification regarding the nature of such interrelationships.

The major limitation of the design is that it cannot permit definitive conclusions regarding the causal basis of the observed relationships. Where correlations are found between energy attitudes and behaviors as hypothesized, it would be unclear whether the attitudes lead to the behaviors,

vice versa or both, or whether some other undefined variable was at work. This design can however provide some suggestive data concerning the underlying causal processes. This is due to the specificity of the attitudes, intentions and behaviors to be measured. If conservation behaviors were due to variables other than those being measured in the study, there is no reason to expect the clear relationships between specific energy attitudes and related behaviors which are hypothesized. To the extent that attitude-behavior relationships are found to be less precise, on the other hand, interpretations regarding causality would be less conclusive.

Sample

For the proposed study, a geographical area with moderately cold winters is desirable since in very cold climates most homeowners are likely to have already performed many conservation measures and in very mild climates they would have little reason to do so. Similarly, an appropriate target area is one which has had a sufficient level of energy conservation information dissemination so that most homeowners are moderately aware of it as an issue, but has

not had such an intense information campaign that people are highly motivated and knowledgeable regarding conservation.

In addition, the sample should meet the following criteria:

- o income: upper moderate to middle income (approximately $22,000-$60,000/year total family income)
- o education: high school graduate to graduate degree
- o age: 25-65
- o sex: approximately 50% male and female
- o home ownership: must own a private home or an apartment in a small co-op (under 10 units)
- o fuel type: gas or oil heat (at least 30% each)

An area with a population meeting the sample criteria outlined and which is readily accessible for this research is Staten Island, New York. Since it is separated by a twenty minute ferry ride (plus train, bus and/or automobile rides for most commuters) and has a high proportion of middle income residents (about half are blue collar and half white collar workers) with single family detached homes, it is in many ways representative of other suburban areas, despite its straight line proximity to Manhattan. The area also has both gas and oil heated homes, which could affect motivation to conserve due to fuel price differences. Table 2 summarizes some of the key demographic characteristics of residents.

Approximately one third of all Staten Island residents

Table 2.

Staten Island, NY Demographic Data (As of Fall 1983)*

Income	
$40,000 or more	25%
30,000-39,999	22%
20,000-29,999	27%
10,000-19,999	17%
under 10,000	9%
Median Age	31.4 Yrs.
Homeowners	75%
Renters	26%
Dwelling Type	
One Family Home	60%
Multi Dwelling	39%
Occupations (Chief wage earner)	
White Collar	51%
Blue Collar	49%
Working Women	
Employed	47%
Not Employed	52%
Education	
Part College or More	39%
High School Grad	43%
Part High School	15%
Voter Registration (5/84)	
Democrat	57%
Republican	24%
Conservative	3%
Liberal	1%
Unknown	15%

*. Adults 18 years and older; source: Statistical Guide, Staten Island Chamber of Commerce, Staten Island, N.Y. 1984.

commute to work by public transportation, including the Staten Island Ferry, which carries approximately 21 million passengers annually. Although it is evident that a substantial proportion of Staten Island residents commute to Manhattan jobs via the ferry, the extent to which those commuting via the ferry are representative of the general working population of Staten Island has not been determined.

Pretesting of the survey instrument on the Staten Island Ferry indicated the setting to be ideal in some respects since very large numbers of Staten Island commuters were in one public place where they were accessible and in a relatively unhurried quiet transition where they could be approached and where they could complete the questionnaire. However, since using a setting such as this for sampling inevitably involves some self-selection which in turn has implications for the internal and external validity of the study, data on education, income, zip code, etc. were collected during sampling to permit monitoring of selection biases related to some of the key variables in the research.

The following systematic sampling procedure was used: surveys were administered three evenings per week to passengers on Staten Island bound ferries (Tuesdays, Wednesdays and Fridays; the first and last weekdays were found in pretests to yield poor return rates). As soon as the ferry departed, two surveyors began distributing the surveys to every fifth passenger they walked past who met the

sample criteria and agreed to complete the survey. The surveyors distributed as many surveys as possible within the first ten minutes after departure of each ferry, allowing all participants time to complete the questionnaire. They then returned and collected completed questionnaires just before arrival at Staten Island.

Ferries leaving Manhattan between 4 p.m. and 7:30 p.m. were sampled. Data collection was spread approximately evenly throughout this time range in order to obtain a reasonable range of different types of workers with different work hours. Data collection began June 10, 1987 and continued through July 10, 1987. Total sample size, after screening for sample criteria (eg. to ensure that respondents were Staten Island residents, owned their own homes, etc.) and completeness of returned questionnaires, was 195. The characteristics of this sample are described in the following chapter.

Research Variables

In view of the two-way interactive relationships hypothesized between energy conservation attitudes, intentions and behaviors, the traditional notion of dependent and independent variables seems inappropriate. Therefore,

the major relevant variables in this research will simply be listed and discussed below as independent/dependent variables and subject variables.

Independent/Dependent variables

1. Energy Conservation Beliefs

This research explicitly assumes that at least some of the key beliefs identified previously can be changed by a combination of information and behavioral involvement, and that such change in beliefs will in turn lead to changes in conservation intentions and behaviors. Accordingly, beliefs concerning comfort, convenience and effectiveness of energy conservation techniques were be measured using an instrument developed specifically for this study. Some items were adapted from the scale developed by Becker et al., (1979).

2. Energy Conservation Competence

A major theoretical assumption of this study is that competence development is a potentially important

motivator that has not been systematically explored in connection with energy education. Therefore, to assess the role of competence, energy competence items dealing with general and specific aspects of energy conservation have been included in the research instrument. Also, one item concerning perceived competence to find a reliable contractor or other skilled person to implement conservation items was included.

3. General Home Repair/Handyperson Competence

The ability to perform basic home-related mechanical tasks is a potential variable influencing some conservation actions (Ellis and Gaskell, 1978). Perhaps more importantly, the perception that conservation tasks require such skills could make this a significant factor for many participants. Therefore, a few items were included to attempt to assess participants' perceived competence concerning use of basic home repair tools and materials.

4. Energy Conservation Behaviors

To assess the relationships between conservation beliefs and behaviors, an index of ten conservation measures appropriate to most homes in the New York area has been

developed, based on previous indices of energy conservation behaviors (Olsen and Cluett, 1979.)

5. Energy Conservation Intentions

Consistent with Fishbein's (1966, p. 212) suggestion that "good estimates of attitude (can be achieved) by considering the sum of an individual's behavioral intentions," intentions to perform a variety of energy conservation actions were ascertained. Specifically, intentions to implement conservation behaviors was assessed for each conservation measure on the energy behaviors index. The response format allowed homeowners to indicate the probability that they would implement the specific measures within six months according to a five point scale from "very likely" to "very unlikely".

Subject Variables

In addition to standard demographic variables (age, sex, income, occupation, education), the questionnaire included items on home ownership vs. renter and cooperatives vs. private ownership, size of co-op, fuel type, zip code, etc. The complete research instrument is included in Appendix B.

VI. FINDINGS

Sample Description.

The sample procedure described in the preceding chapter yielded a sample of 195 homeowners living within the sample area. The characteristics of this sample are summarized in Table 3.

A comparison of the characteristics of this sample with those of the overall Staten Island population (see Table 2) indicates that the sample is somewhat older (median age of sample = 39.5 vs. 31.4 for Staten Islanders at large), better educated (nearly two thirds of the sample had some college vs. approximately one third for Staten Islanders overall) and better off financially (over 50% of the sample had incomes of $40,000 or more in 1986 vs. only 25% of Staten Islanders in that income range as of 1983.) These differences should be kept in mind in considering the extent to which the findings to be discussed may be generalized beyond the present sample.

Table 3.

Sample Characteristics.

1. Mean Age and Education.

	Mean	Range	Standard Deviation	Standard Error
Age	40.9	20-75	11.54	0.81
Years of School	14.5	8-21	2.43	0.127

2. Frequency Distribution of Total Household Income Before Taxes.

	Frequency	Percent	Cumulative Percent
Less than $30,000	27	14.3	14.3
$30,000 - $39,000	30	15.9	30.2
$40,000 - $49,000	35	18.5	48.7
$50,000 - $59,000	44	23.3	72.0
$60,000 - $69,000	16	8.5	80.4
$70,000 or more	37	19.6	100.0
(missing data	6)		
Total	195	100.0	

3. Frequency Distribution of Education in Total Years of School.

Years of School	Frequency	Percent	Cumulative Percent
8	2	1.1	1.1
9	1	0.5	1.6
10	5	2.7	4.3
12	45	23.9	28.2
13	10	5.3	33.5
14	39	20.7	54.35
15	7	3.7	58.0
16	47	25.0	83.0
17	13	6.9	89.9
18	10	5.3	95.2
20	8	4.3	99.5
21	1	0.5	100.0
(missing data	7)		
Total	195	100.0	

Table 3., cont.

4. Gender

	Frequency	Percent
Male	121	62.4
Female	73	37.6
(missing data	1)	
Total	195	100.0

5. Fuel Type

	Frequency	Percent
Gas	142	73.2
Oil	49	25.3
Coal or Elect.	3	1.5
(missing data	1)	
Total	195	100.0

Completion of and Intentions to Complete Energy Conservation Measures.

The homeowners completed a mean of 3.8 of the ten energy conservation measures (ECMs) examined in this study (standard deviation = 3.18.) Table 4 indicates the number of homeowners who reported completing or intending to complete the various measures. The number who reported completing specific ECMs ranged from a low of 43 (22.2%) who had had a free utility energy audit to a high of 85 (43.8%) who had installed a low flow shower head; this was followed closely by 84 homeowners who had added attic or roof insulation. Since the frequencies of completion of the various items do not correspond to a ranking of the items in terms of either their cost effectiveness or their impact on comfort, these data suggest that homeowners may have been influenced by considerations other than energy related issues. For example, weatherstripping ranks near the top of most energy analyses in terms of cost effectiveness and comfort enhancement, but more homeowners installed roof insulation than weatherstripping, suggesting that some homeowners may have been responding to persuasive advertising for insulation. (It is possible that those homeowners had already installed storm windows, which would have obviated the need for weatherstripping and caulking.)

Table 4

Number of Homeowners Who Completed or Intended to Complete Energy Conservation Measures (n=195)

Energy Conservation Measure	Completed Item	Intend To Do Item[a]	Do Not Intend To Do[b]	Undecided	Does Not Apply[c]
30. Weatherstrip doors/windows	60 31%	82 42%	33 17%	10 5%	9 5%
31. Caulk air leaks	58 30%	87 45%	32 16%	13 7%	5 3%
32. Add exterior glass or inter. plastic storms	79 41%	48 25%	33 17%	8 4%	27 14%
33. Have furnace tested/serviced	63 32%	63 32%	40 21%	19 10%	9 5%
34. Have a free energy audit	43 22%	37 19%	71 37%	33 17%	10 5%
35. Install separate water heater	81 42%	15 8%	54 28%	11 6%	33 17%
36. Add attic/ roof insulation	84 43%	41 21%	35 18%	11 6%	24 12%
37. Reduce hot water temp. to 120 F.	93 48%	26 13%	37 19%	28 14%	10 5%
38. Insulate heat pipes/ ducts	54 28%	35 18%	65 34%	20 10%	19 10%
39. Install low flow shower head	85 44%	38 20%	47 24%	11 6%	13 7%

[a]Sum of those indicating they were likely or very likely to perform these items.
[b]Sum of those indicating they were unlikely or very unlikely to perform items.
[c]Items were already carried out by builder or former owner(s) or were not technically feasible.

Homeowners may well have had rational reasons for their conservation decisions but this is not always apparent from the standpoint of energy consequences alone. In the context of such decisions, the fact that having a free utility energy audit was the least frequent of all of the measures studied is unfortunate, since one of the main functions of the audits is to provide information to enable homeowners to make more informed conservation decisions. For this sample at least, it appears that many homeowners could have benefited from the types of information such energy audits can provide, but that the energy audit program had not succeeded in reaching a large portion of them (it should be noted that the New York State Public Services Commission, which oversees the audit program in this area, has indicated an awareness of this problem and has worked with the utilities who conduct the audits to increase the percentage of customers reached by the audit program in recent years.)

Table 4 also indicates homeowners' intentions to complete the conservation measures which they had not completed. This table indicates that having an energy audit was cited most often as a measure homeowners did not intend to engage in, with 71, or just over one-third of the sample so reporting. Taken by itself, this would seem to imply either some rather strong negative attitudes about the audits or a lack of awareness about them on the part of homeowners. Costanzo, Archer, Aronson and Pettigrew (1986) cited recent

data indicating that while nearly 57% of California respondents surveyed claimed to understand home energy audits, only 1.4% were found upon further questionning to have an accurate understanding of the audits. However, on a more optimistic note, energy audits were most often cited as a measure about which homeowners were undecided in the present study, suggesting that there is a pool of homeowners who might consider having the audits if they were exposed to stronger outreach efforts.

Figures 1 through 10 provide a graphic representation of the homeowners' responses to questionnaire items 30-39 (these frequency charts include responses of both homeowners who completed and did not complete the items; these groups are indicated under the vertical bars for each energy measure, as are the relative proportions of respondents indicating various degrees of intentions to complete the measures.) For many of the measures, homeowners either had completed the measures, or, if they had not, were about equally likely to do so or not to do so (eg, items #32, install interior plastic or exterior glass storms; #36, add attic or roof insulation.) However, for some low cost items, respondents who had not completed them tended more often to indicate they were likely or very likely to complete the measures than not to (eg, #30, weatherstrip doors or windows; #31, caulk air leaks on the interior or exterior of the house.) For some high cost items, it appears that people have either done

Figure 1.

ECM #30, Weatherstrip Doors or Windows: Frequency Bar Chart

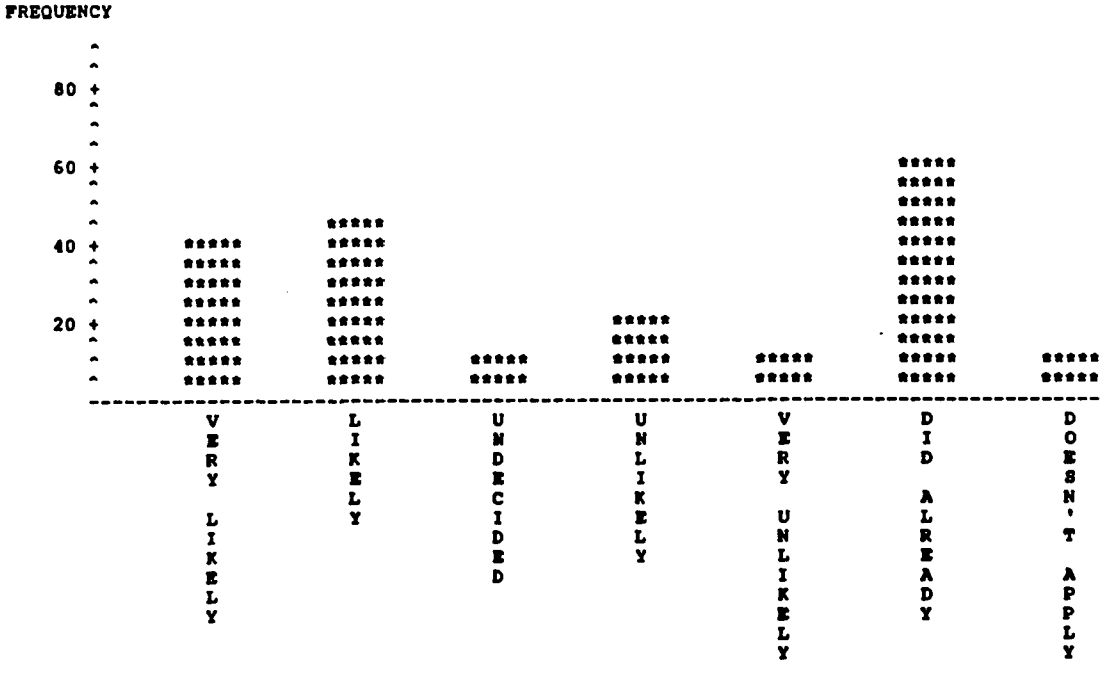


Figure 2.

ECM #31, Caulk Air Leaks: Frequency Bar Chart

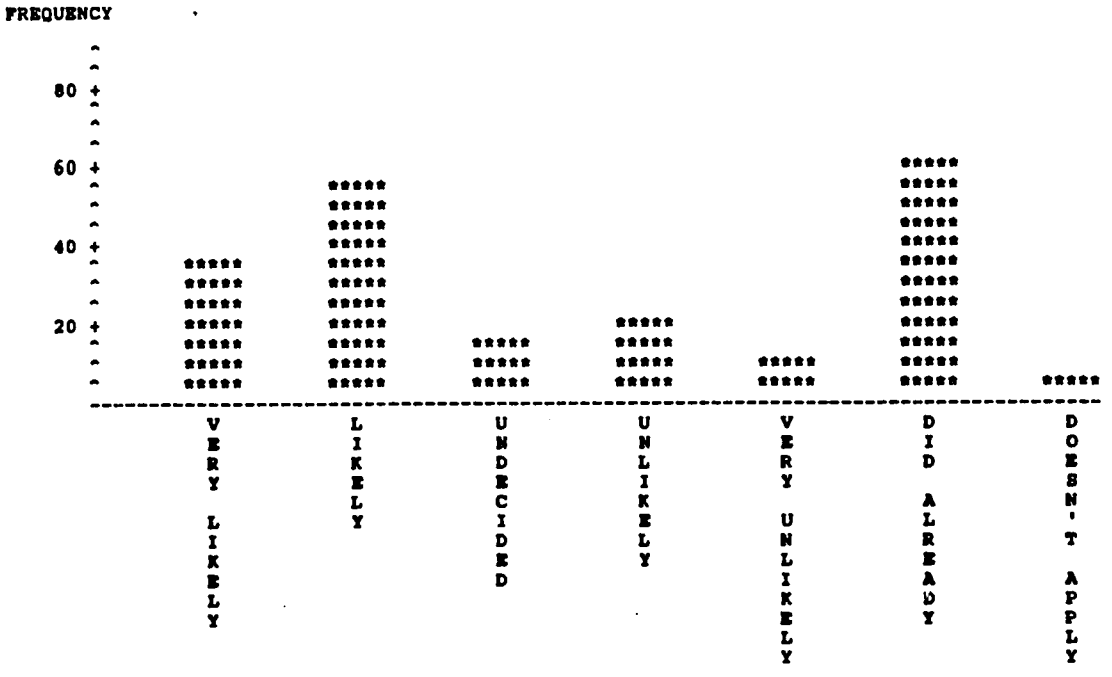


Figure 3.

ECM #32, Install Interior Plastic or Exterior Glass Storm Windows: Frequency Bar Chart

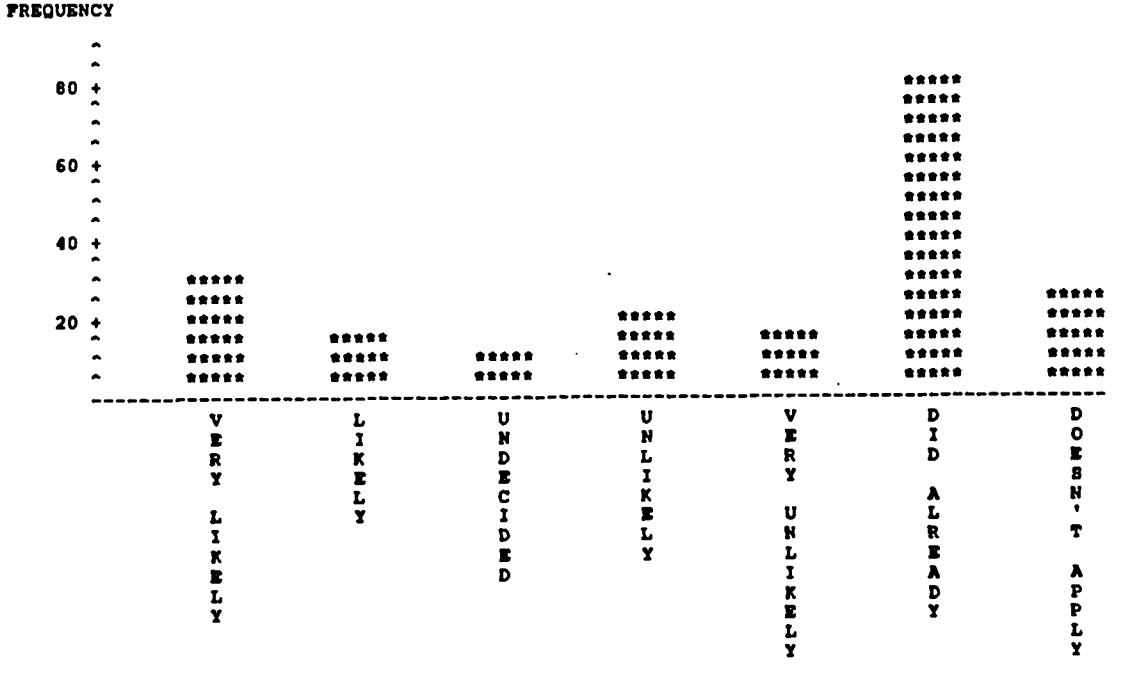


Figure 4.

ECM #33, Have Burner/Furnace Tested, Serviced: Frequency Bar Chart

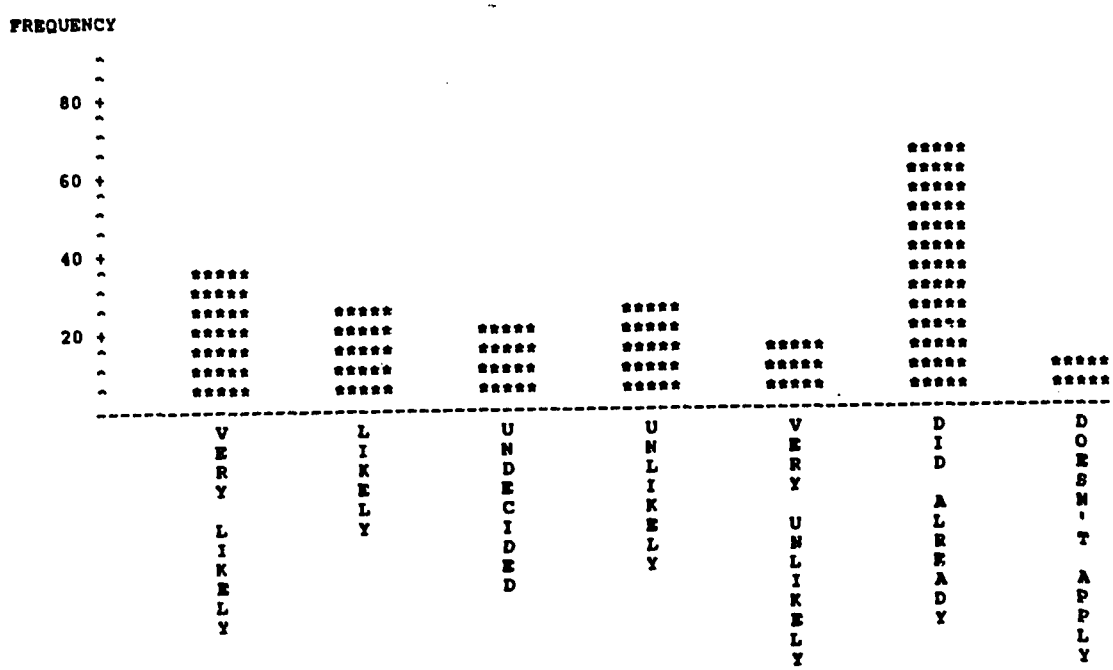


Figure 5.

ECM #34, Have a Free Utility Energy Audit: Frequency Bar Chart

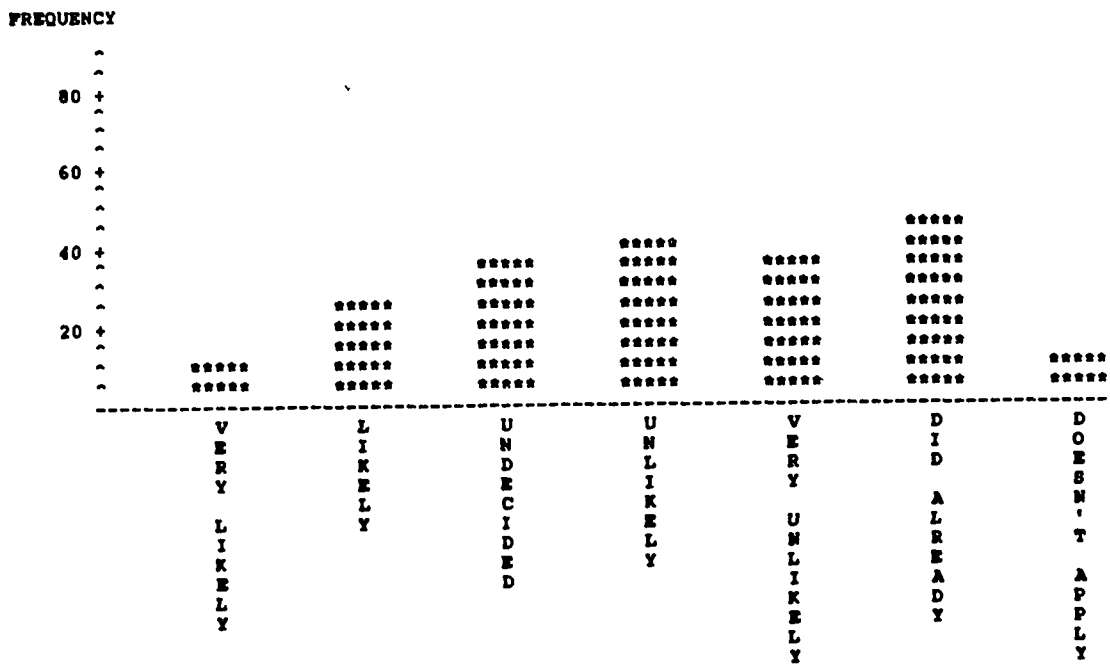


Figure 6.

ECM #35, Install Separate Hot Water Heater: Frequency Bar Chart

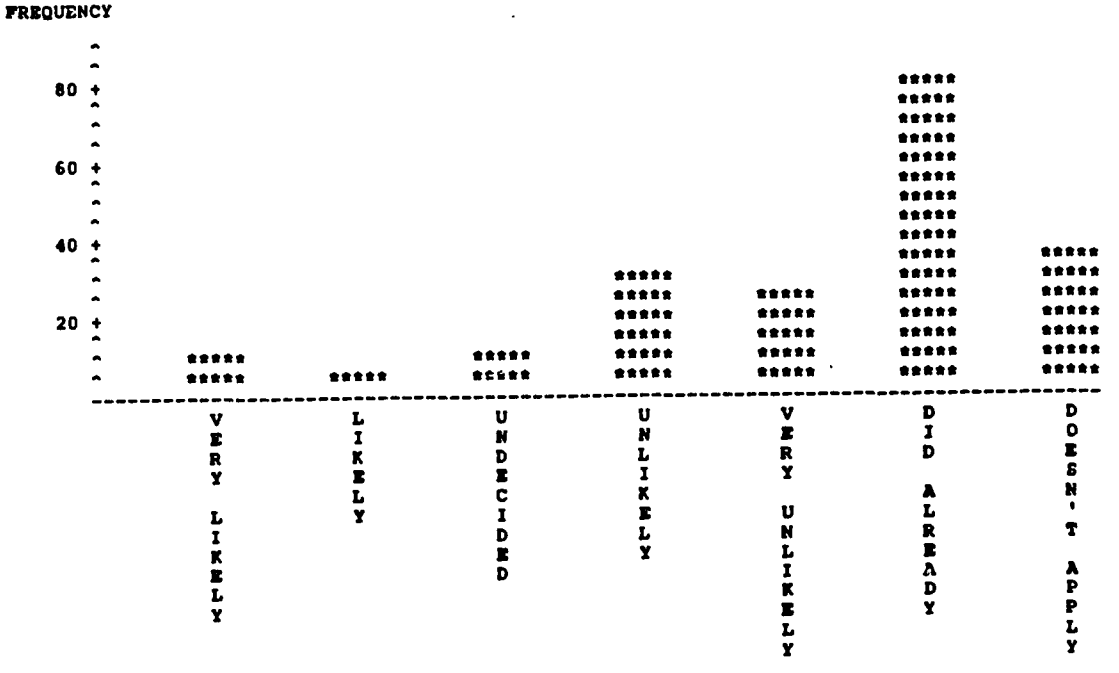


Figure 7.

ECM #36, Add Attic or Roof Insulation: Frequency Bar Chart

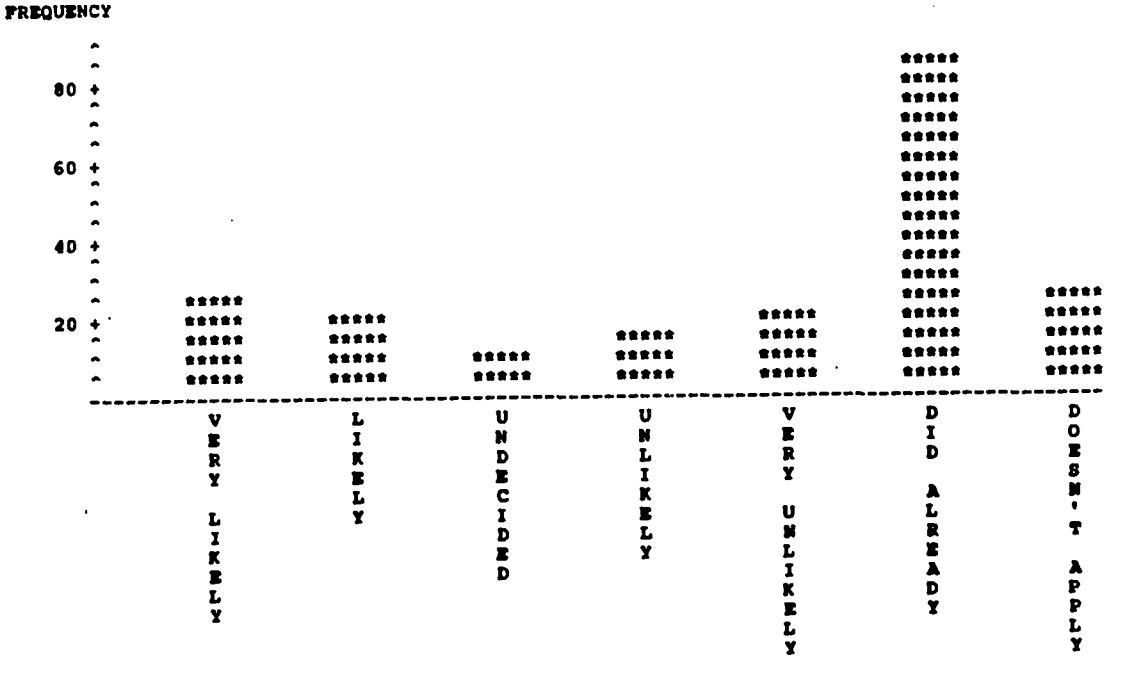


Figure 8.

ECM #37, Reduce Hot Water Temperature to 120° F: Frequency Bar Chart

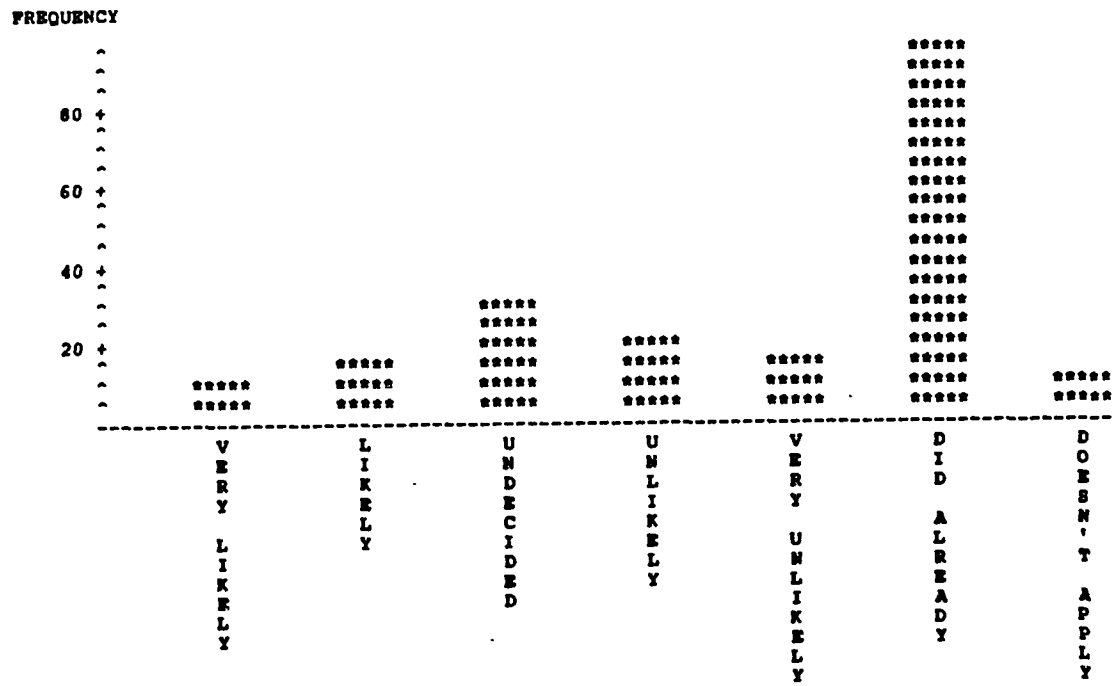


Figure 9.

ECM #38, Insulate Heat Pipes or Ducts: Frequency Bar Chart

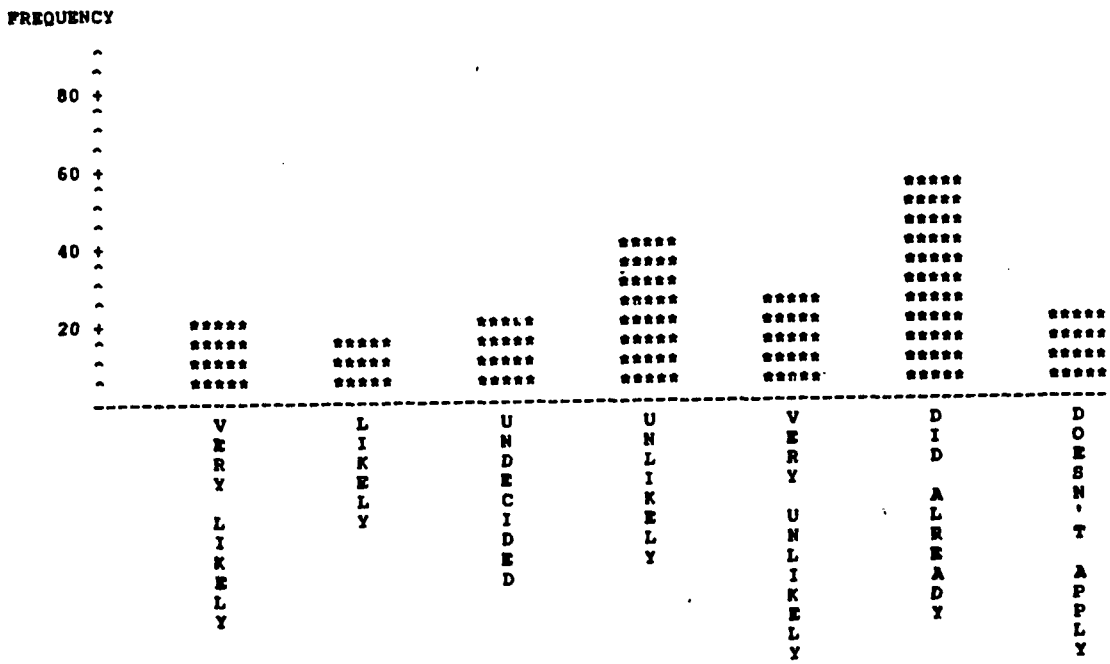
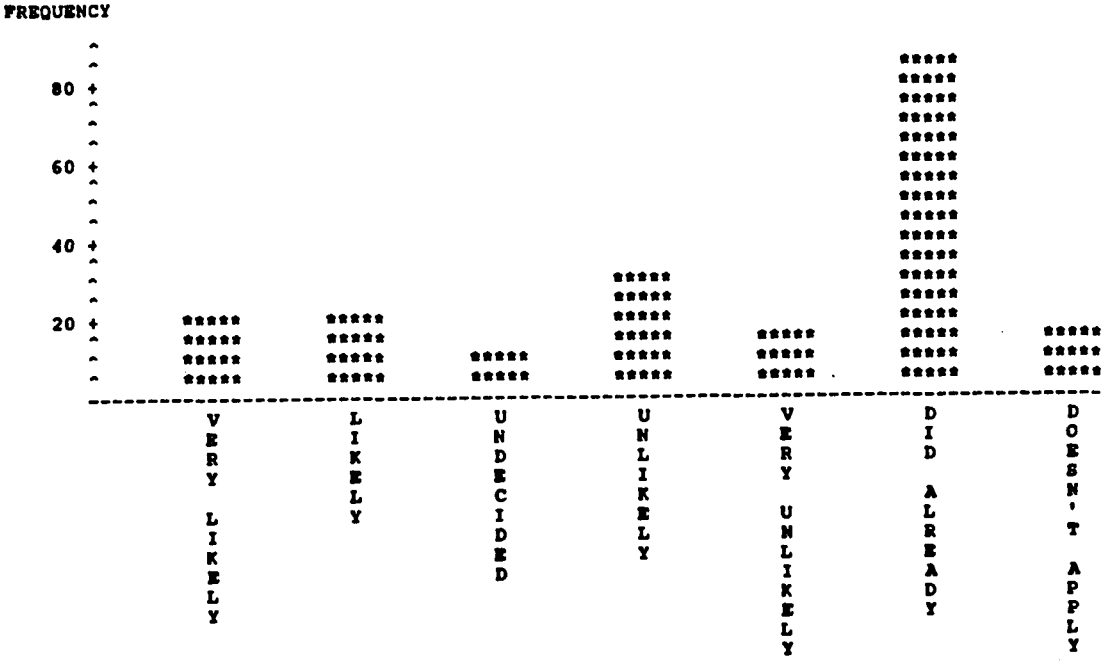


Figure 10.

ECM #39, Install a Low Flow Shower Head: Frequency Bar Chart



them, or, if not, are generally unlikely to do so - eg, #35, install a separate hot water heater.[2]

In subsequent sections, I will discuss findings which bear on some of the reasons underlying homeowners' conservation decisions. However, first it is appropriate to review the major research hypotheses.

Hypotheses.

The previous chapter outlined several hypotheses regarding energy conservation attitudes, intentions and behaviors. These can be restated as follows:

1. homeowners' attitudes regarding energy conservation would be characterized by key beliefs regarding the following:

a. Energy conservation competence. It was further hypothesized that this variable would involve two categories of competence - general energy conservation competence and specific skills and knowledge.

b. Response cost. It was further hypothesized that this

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[2]. It has been noted elsewhere that conservation behavior is directly correlated with rising energy costs. The patterns of conservation behavior found in this study are therefore likely to be a reflection in part of the relatively depressed energy prices which have prevailed in the past few years in this area.

attitudinal variable would involve two subtypes, one related to comfort/convenience and the other to financial issues.

c. Efficacy of energy conservation measures. It was further hypothesized that homeowners would also view this variable in terms of the two issues of comfort/convenience and financial matters.

2. the key beliefs outlined above would be related to conservation actions. With regard to energy competence, it was specifically hypothesized that completion of energy actions would be highest for those scoring high on both general and specific competence, intermediate for those scoring high on general but low on specific competence, and lowest for those scoring low on both types of competence. It was hypothesized further that the relationship between actions and attitudes would be two - way, i.e., that certain attitudes would tend to lead to certain conservation actions and that conservation actions would also influence attitudes (this assumption was an integral part of the theoretical perspective of the research and was further indicated in Model III, Appendix A., which was cited in the preceding chapter as the starting point for hypothesis testing in this exploratory research.)

3. the key beliefs outlined above would be related to conservation intentions. It was also hypothesized that the

expected general and specific competence variables would be related to energy conservation intentions in a pattern analogous to the above hypothesized relationship between these two types of competence and conservation actions.

4. energy conservation attitudes, intentions and actions would be interrelated (again, this is implicit in the theoretical framework upon which the study is based and is suggested by Model III, Appendix A.)

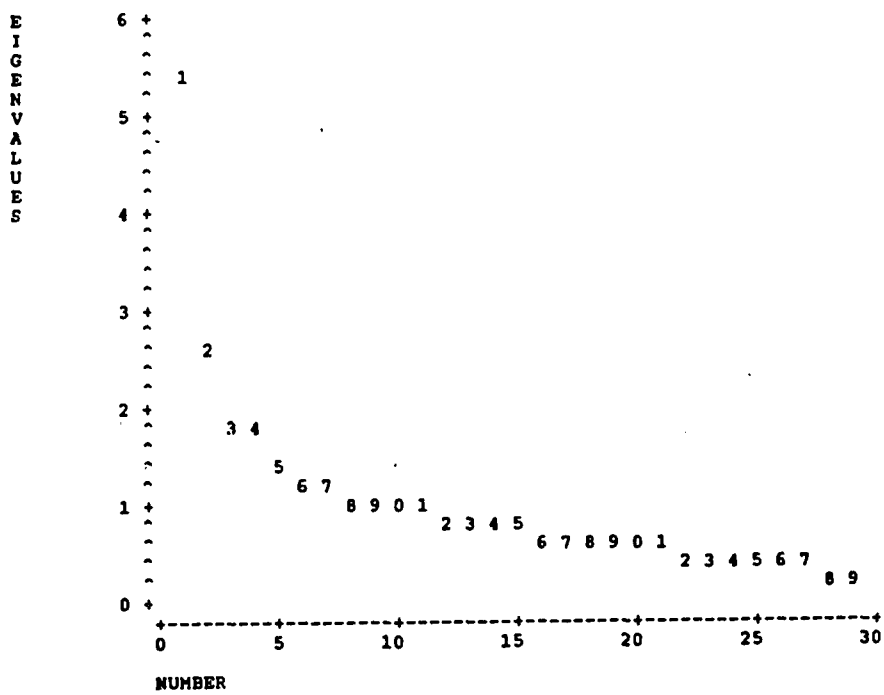
The findings bearing on these hypotheses will now be discussed, in the approximate order of the hypotheses presented above.

Hypothesis 1.: Energy Conservation Attitudes.

A factor analysis was performed on the energy attitude questions (questions 1-29). A scree plot of all seven unrotated factors with eigenvalues of 1.0 or more (figure 11) indicated that the amount of variance explained by these factors diminished markedly after the first four or five factors were extracted. A preliminary decision was made to retain 5 factors. An oblique rotation was performed on these first five common factors. The resulting factors are

Figure 11.

Scree Plot of Eigenvalues for Attitudinal Factors



summarized in Table 5, which identifies all individual items with factor loadings of .45 or greater for each factor. These five factors accounted for 45% of the total variance associated with all 29 attitudinal items.

As it did in the three previous pretests, general energy conservation competence emerged as a powerful factor, accounting by itself for 18% of the total variance related to all items. Efficacy also again emerged as an issue but in this case it split into two factors: factor 2, involving efficacy regarding comfort and convenience; and factor 3, concerning efficacy pertaining to low cost vs. high cost energy improvements. (Factor 3 can be interpreted as efficacy regarding financial aspects of conservation, a conceptualization consistent with Model III from the pretest analyses-see Appendix A.) Response cost, identified in the pretests and in previous research as salient, emerged again but it also split into two factors: Factor 4, response cost regarding expense, time, trouble and ease of implementation; and Factor 5, response cost related to worry, time, need for repeated behaviors and ease of finding reliable workers to perform home repairs.

In sum, the factors which emerged from analysis of these data are quite consistent with those predicted by Hypothesis 1. The major discrepancy between the attitudes hypothesized and those actually found is that energy competence did not

Table 5.

Rotated Factor Structure Loadings: Attitude Factors.

Factor 1: General Energy Conservation Competence

Question		Correlation
5.	I don't think I could explain to others what energy conservation is about	.5628
7.	We don't really know how well most energy conservation techniques work.	.5476
12.	I would not know how to identify the best energy saving measures for my home.	.7411
14.	I would not know how and where to insulate to best cut heat loss.	.7604
19.	I feel capable of locating major sources of energy waste in my home.	-.7202
20.	I feel capable of finding and plugging air leaks in my home.	-.6657
22.	Energy conservation is pretty mysterious to me.	.6046
27.	I am unclear as to how energy is lost through my house to the outside.	.7557

Factor 2: Perceived Efficacy Re: Comfort/Convenience

Question		Correlation
8.	Energy conservation measures can increase your comfort	.6148
15.	You can save a great deal of energy in the home	.7097
21.	If you do the right energy efficiency improvements you won't have to give up comfort or convenience.	.6392
24.	You don't have to change your daily lifestyle to save a lot of energy.	.6497

Note: Coding of all attitude questions: 1=strongly agree, 7= strongly disagree.

Table 5., Cont.

Rotated Factor Structure Loadings: Attitude Factors.

Factor 3: Efficacy of Low Cost Measures

Question	Correlation
11. You can't do much to cut home energy consumption except install storm windows or insulation.	.4889
17. Low cost energy saving treatments for windows are unattractive.	.6498
23. Low cost energy conservation measures could not eliminate uncomfortable cold spots in my house.	.6383

Factor 4: High Response Cost Re: Expense, Time, Trouble, Ease of Implementation

Question	Correlation
2. Improving your home's energy efficiency is inexpensive	.6739
13. Saving energy requires a minimal amount of time and trouble.	.6644
28. Low cost energy conservation measures are quite easy to implement.	.5865

Factor 5: Low Response Cost Re: Worry, Time, Repeated Behaviors, Ease of Finding Reliable Workers

Question	Correlation
1. Worrying about saving energy requires too much time for the average person.	.4718
4. Energy conservation is like flossing your teeth- you have to really work at it every day if you want results.	.6509
29. Getting someone reliable to do home repairs is a major problem.	.4812

split into two factors - general and specific types - as it did in the small sample pretests. Thus it would appear that the pretest findings of two subtypes of competence may have been an artifact of the small samples used for the pretests. However, the failure of the hypothesized subtypes of energy competence to emerge is less important than the validation of energy competence as a major factor in the large sample study.

In comparing these findings with concepts reviewed in energy conservation literature (from which the research instruments used in this study were in part derived), one notes both differences and similarities. Without a doubt, the most important difference concerning the present attitude factor analysis vs. the Seligman et al. (1979) and Becker et al. (1979) findings involves Factor 1, energy conservation competence.

Competence was not an issue of theoretical interest in Seligman et al.'s (1979) research, nor is it likely to have been a pressing issue in their study, since that study focused on energy attitudes in relation to summmer electrical consumption. The conservation measures most people think about in connection with summer electrical useage involve items such as reducing the use of air conditioning, opening windows to cool the house at appropriate times, and reducing the use of certain electrical appliances. Although some of the same measures which improve a homes' space heating

efficiency can also increase its summer cooling efficiency, (eg., insulation, caulking and weatherstripping and other measures to increase the "tightness" of the shell of the house), most people in the northeast tend not to associate these measures with summer energy efficiency. Therefore, in the context of Seligman et al.'s (1979) research, the types of energy competence examined here would be expected to be less of an issue, although as their research documented, improving summer electrical efficiency required certain specific knowledge about conservation, and it probably involved somewhat different types of competence. Homeowners in Seligman et al.'s (1979) study may well have felt that there was little more they could do to control energy use except to regulate thermostats and air conditioners plus other repeated measures such as opening windows to facilitate cooling, restricting use of electrical appliances, etc. Indeed, the energy conservation information provided by Becker (1978) to families in a subsequent study of different homeowners in the same planned development emphasized precisely such repeated energy saving measures. Measures such as these generally involve less technical competence than the physical energy improvements which typical homeowners, including those in the present study, had to implement, so the type of competence explored here would not be expected to be as important to the Princeton homeowners.

Becker's followup study on the winter heating fuel consumption, involved some of the same homeowners in the Seligman et al. study, as well as additional homeowners from the same planned unit development. Becker et al. (1979) essentially confirmed Seligman et al.'s (1979) finding of the importance of comfort/convenience (but not competence). Since competence was not an issue of interest to the researchers - their study was described as a followup to test whether the attitude - consumption relationships previously established by Seligman et al. (1979) would also characterize winter patterns, it is not surprising that competence did not emerge as a factor of interest.

Competence can be seen as related to the concept of "ability" incorporated in Lipsey's (1977) theoretical framework, or more accurately, to perceived ability. As Ellis and Gaskell (1978) have noted, the inclusion of "how to" information in the British "SAVE IT" campaign was based upon the assumption that such knowledge was a prerequisite to homeowner's implementation of the measures; such knowledge appears to be one component of the concept of energy conservation competence which emerged in the present analysis. An examination of the items correlated with Factor 1 shows that energy conservation competence seems to involve more than simply knowledge of how to perform conservation measures, however. It also includes such issues as understanding how heat is lost in one's home, how to identify

sources of energy waste, how to identify appropriate conservation measures and, apparently, some basic principles of energy conservation (see item 5).

This concept of energy conservation competence may have important implications. It should be noted that since the Federal Government, previously a major disseminator of conservation information, has drastically cut its support for such activity, much of the energy conservation material now available is provided by either private manufacturers of individual conservation products (eg.,weatherstripping) or by the utilities, neither of which can be assumed to be entirely objective sources of information since their profits are partly dependent upon the marketing of certain conservation products or services. Therefore, except for the information provided by utilities through the energy audit program (the effectiveness of which has been questioned) and other energy conservation information offered by state and local agencies, much of the information now available to homeowners is fragmentary (ie. related to one or a few specific products or services), potentially biased and/or confusing (eg., the extensive claims made by gas and oil industries in this area in recent years regarding the advantages of converting to gas or oil.) One result of the type and manner of information presented to homeowners through these sources may be that many homeowners receive information in a fragmentary way,

making it difficult to develop the types of general understanding and competence suggested by Factor 1.

Factors 2, 3, 4 and 5 concern efficacy, comfort/convenience and response cost, which were identified as important attitudinal factors by Becker et al. (1979). Although the best conceptualization of these factors might be debated, their emergence in the present study, based upon a middle income homeowner sample living in a much more diverse housing stock than the all gas heated townhouses of residents in the Seligman et al. (1979) study can be seen as further validation of the existence of such attitudinal factors.

Hypothesis 2: Relationships Between Energy Conservation Attitudes and Behaviors

In order to determine the correlations between energy conservation attitudes and behaviors, attitude factor scores were calculated on attitude factors 1-5 for all homeowners. In addition, energy conservation action scores were calculated as follows: For the first nine energy conservation measures (questionnaire items 30-39), if homeowners did or could have done the measures, the items were assigned a value of 1 if they reported completing the actions and a value of 0 if they reported not completing them (i.e., in the latter case, homeowners had some degree of

intention to perform the measure, from "very likely" to "very unlikely".) If the residents reported that a given action had already been implemented in their houses before they moved in, or if it did not otherwise apply to their situation, their response for that particular conservation measure was dropped in this analysis.

The resulting conservation action scores for the nine conservation items were correlated with attitude factor scores for the 181 homeowners with complete attitude questionnaire data. In addition, two other variables were correlated with conservation attitude factor scores: a summary variable, "NUMACTNS", which was calculated by summing the number of actions each subject had completed[a]; and the average night time temperature homeowners reported maintaining during the previous winter (item #41).

Table 6 shows the results of these correlations, along with the direction of the expected correlations. Since the number of homeowners who did or could have done each of the nine conservation measures varied, the number of cases in each cell of the correlation matrix also varies. Two patterns are immediately clear from this table: first, all the statistically significant relationships found are in the predicted directions, and second, attitude factor 1, energy conservation competence, is significantly correlated with

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[a]. This summary variable was created to provide an indicator of the total number of actions each homeowner had complete

Table 6

Correlations of Energy Conservation Attitude Factors and Energy Conservation Actions

Energy Conservation Measure (ECM)	Attitude Factors 1 Competence	2 Comfort/ Conven.	3 Efficacy	4 Resp. Cost[a]	5 Resp. Cost[b]
30. Weatherstrip doors, windows	.16* (+)	-.06 (-)	.07 (+)	-.10 (-)	.11 (+)
31. Caulk air leaks	.21** (+)	-.07 (-)	.02 (+)	-.13 (-)	.06 (+)
32. Install storm windows	.20* (+)	.01 (-)	.06 (+)	-.05 (-)	.08 (+)
33. Furnace tested and serviced	.20* (+)	.00 (-)	.00 (+)	.08 (-)	.07 (+)
34. Have free energy audit	.24** (+)	.08 (-)	-.08 (+)	-.01 (-)	.17* (+)
35. Install hot water heater	.15 (+)	-.02 (-)	-.04 (+)	-.03 (-)	.08 (+)
36. Insulate attic or roof	.08 (+)	-.03 (-)	-.03 (+)	.05 (-)	.00 (+)
37. Reduce hot water temp.	.25** (+)	.06 (-)	.01 (+)	.04 (-)	.00 (+)
38. Insulate heat pipes/ducts	.09 (+)	-.04 (-)	.12 (+)	-.03 (-)	.03 (+)
39. Low flow shower head	.18* (+)	-.11 (-)	-.02 (+)	.07 (-)	.03 (+)

Note: Expected directions of correlations are indicated in parentheses below actual correlations. See Table 5 for coding of attitude factor items.

a. Response cost regarding expense, time, trouble, ease of implementation.

b. Response cost regarding worry, time, repeated behaviors, ease of finding reliable repair workers.

*p<.05. **p<.005

Table 6, Cont.

Correlations of Energy Conservation Attitude Factors and Energy Conservation Actions

Energy Conservation Measure (ECM)	Attitude Factors 1 Compe-tence	2 Comfort/ Conven.	3 Effi-cacy	4 Resp. Cost	5 Resp. Cost
41. Average night temperature	-.23** (-)	.09 (+)	-.14 (-)	.15* (+)	.06 (-)
Total no. of ECMs performed (NUMACTNS)	.29** (+)	-.04 (-)	.07 (+)	.00 (-)	.01 (+)

nine out of the twelve energy conservation measure variables, including all but three of the nine conservation actions plus the total number of conservation actions, NUMACTNS, and the average night time temperature. Although the individual correlations range from low to moderate, the pronounced overall pattern of correlations between attitude factor 1 and the conservation actions is strong confirmation for the hypothesis of a relationship between energy conservation competence and behavior. This may be one of the most important findings of this study, and its implications will be discussed in a later section in some detail.

Next to the strong pattern of significant correlations between energy conservation competence (attitude factor 1) and conservation actions, the most dramatic overall characteristic observable in table 4 is the almost complete lack of correlations between attitude factors 2-5 and most of the conservation measures. In view of the findings of Seligman et al. (1979) and Becker et al. (1979), in which very clear correlations between residents' attitudes concerning comfort and convenience and their actual energy conservation behavior were found, the apparent absence of such a relationship in the present study is striking. This pattern is, however, consistent with the previously described differences in the theoretical approaches of this study and the two previous studies. In addition, there are important

methodological differences between the present study and the two previous studies.

It was previously noted that Becker et al.'s (1979) study of summer electrical use involved a narrower range of conservation actions than those which were the focus of this study. That was probably also the case with regard to Seligman et al.'s (1979) winter study, but for a different reason. One of Seligman et al.'s (1979) explicit rationales for selecting the particular planned unit development as a research site was that many of the homes were "physically identical...the community is an excellent site for the testing of psychological techniques; the variance in energy consumption due to nonpsychological factors is sharply reduced.[4] But such homogeneity is also a disadvantage if it is associated with an unusually limited amount of variance in conservation behavior and this is taken to be representative of homeowners at large. Moreover, the reduced variance in conservation behavior compared to what one might expect to find in a broader range of house types would be expected to lead to statistically weaker correlations between attitudes and behavior.[5]

[4]. Seligman et al.(1977), p. 364.

[5]. Another methodological difference between the studies of Seligman et al. and Becker et al. and the present study should be noted. The previous studies used energy consumption as the dependent variable correlated with energy attitudes, whereas the present study used self reported conservation behavior. Therefore, the differences in findings could be partially due to the different measures

Despite these differences between the present research and these previous studies, some parallels did occur which confirm the importance of comfort and convenience in relation to conservation behavior as one part of the overall picture concerning relationships between energy conservation attitudes and behavior. As indicated in Table 6, the night temperature reportedly maintained by homeowners was significantly correlated not only with energy conservation competence, but also with attitude factor 4, two items of which involved convenience (item 13, "Saving energy requires a minimal amount of time and trouble", and item 28, "Low cost energy conservation measures are quite easy to implement"). It is unclear why attitude factor 2, three of whose four items involved thermal comfort, was not significantly correlated with reported night temperature settings. It is possible that a stronger relationship might have been found if an independent, objective indicator of homeowners' actual temperature controlling behavior had been used instead of

employed.

[6]. Engineers from Princeton had been conducting research in the same planned unit development used for Becker et al.s' and Seligman et al.'s research since 1977. It is possible that some of their findings were publicized, either through local media coverage (their research is among the most cited in the field of energy conservation) or through the social networks that others have documented as important in facilitating the diffusion of energy conservation technology. If this had occurred, it could have had the result of further reducing the range of conservation behavior in the development by calling attention to a few measures that these experts found effective.

the self reported temperature settings. Milstein (1977) has noted that self-reports can be unreliable indicators of actual behavior in this area.

The very predominance of the overall pattern of correlations between competence and most of the energy actions investigated leads to the question of how to explain the exceptions to it. Two of the conservation measures which were not significantly correlated with attitude factor 1 involved installation of a separate hot water heater (item 35) and addition of attic or roof insulation (item 36). These measures are more costly than all of the other conservation measures examined, with the possible exception of item 32, "install interior plastic or exterior glass storm windows". If this item was interpreted by respondents to refer to exterior storm windows, the measure would be one of the most costly. In addition to their relatively high cost, both items (particularly when one assumes the interpretation of item 32 to refer to exterior storm windows) are often performed by private contractors rather than the homeowners themselves. Therefore, competence would not be expected to be as important a factor as for many of the other measures, which homeowners are more likely to do themselves. Given these considerations, one might expect that the installation of separate hot water heaters, roof insulation and exterior storm windows would be a function of variables other than energy conservation competence.

The lack of a correlation between energy conservation competence and item 38, involving insulation of heat pipes or ducts, is more difficult to explain. This measure may have been carried out by contractors who installed the space or hot water heating systems, precluding many homeowners from involvement in this measure. It is also possible that implementing this measure is so simple that very little conservation competence is required to perform it or would result from doing it, especially in view of the pre-molded foam pipe insulation products available in recent years[7].

Finally, table 6 shows one other correlation which deserves comment. Attitude factor 5, concerning perceived response costs associated with energy conservation measures, was significantly correlated with having had a free utility energy audit. People who had had an energy audit tended to be less concerned that energy conservation would require too much time or daily effort, or to feel that finding reliable home repair contractors was "a major problem". Although one cannot be sure of the existence or direction of a causal relationship between conservation attitudes and behaviors from a cross sectional study such as this, one possible explanation of the correlation observed between attitude factor 5 and having an energy audit is that having the energy

[7]. If a hot air heating system was involved, insulating the ducts could be difficult and expensive. Insulation of steam pipes can also be infeasible due to lack of access to major portions of the pipes in some installations.

audit may have identified a number of one-time conservation actions which homeowners felt were reasonable. (Some utilities also offer homeowners referrals for contractors whom the utility has pre-screened for reliability.) Since identifying cost effective measures is one of the main objectives of the energy audit programs, these data could be interpreted as evidence that - at least with regard to this specific function - the utility audits were succeeding. We will later see whether the energy audits were as effective in influencing actual conservation behavior.

Factor Analysis of Conservation Measures

In order to explore the relationships between attitudes and behaviors further, responses from homeowners who indicated that they had completed one or more of the energy conservation measures described in questions 30-39 plus question 41 (reported night time temperature) were factor analyzed using an oblique rotation. These factors with the resulting factor loadings of items associated with each are listed in Table 7. These factors will hereafter be referred to as ECM factors or energy conservation measure factors to distinguish them from the previously discussed attitudinal factors.

Table 7.

Rotated Factor Structure Loadings: Energy Conservation Measures (ECMs)

Item	ECM Factor 1: Infiltration Measures	Correlation
30.	Weatherstrip doors or windows	.9265
31.	Caulk air leaks on interior or exterior of house	.8903
32.	Install interior plastic or exterior glass storm windows	.8246
	ECM Factor 2: Hot Water/ Heat Distribution /Roof Insulation	
35.	Install a separate hot water heater	.8305
36.	Add attic or roof insulation	.8260
37.	Reduce hot water temperature to 120 F.	.7239
38.	Insulate heat pipes or ducts	.5435
39.	Install a low flow shower head	.5861
	ECM Factor 3: Heating Plant Service/ Energy Audit	
33.	Have burner or furnace efficiency tested and servicing performed	.7833
34.	Have a free utility energy audit	.8218

ECM Factor 1 appears to involve items perceived as reducing drafts or cold spots, thus potentially improving thermal comfort. Items 30 and 31, weatherstripping and caulking, are both low cost draft (air infiltration) reduction measures. Due to the wording of item 32, it is unclear whether most respondents who indicated they had completed this measure were referring to interior plastic (inexpensive) or exterior glass (quite expensive) windows.

ECM Factor 2 includes installing a hot water heater, adding attic or roof insulation, reducing hot water temperature, insulating heat pipes or ducts, and installing a low flow shower head. Two of the five are moderately expensive. All but one item involve heat or hot water production or distribution, as opposed to the items in factor 1 which pertain to the "envelope" of the home. These are all items which, while saving energy, generally do not result in immediate and dramatic improvements in thermal comfort compared with items in ECM Factor 1.

Installation of low flow shower heads has been recommended in numerous publications on residential energy conservation but recently there has been some debate as to its effectiveness as an energy conservation action. This item has also been publicized as a water conservation measure in the New York metropolitan area in connection with the water shortages that have plagued the region in recent years. Therefore, it is likely that some homeowners who installed

low flow shower heads did so for this reason. It should also be noted that many of the shower heads advertised as being low flow models produce a shower which many would consider inferior because they reduce the pressure of the spray or produce a fine spray that might be less desirable compared to their original equipment.

ECM Factor 3 includes two measures provided by the fuel utilities in New York State- burner or furnace combustion efficiency testing and servicing of the heating plant, and a free energy audit (mandated by the Home Insulation and Energy Conservation Act or HIECA). The fuel utilities are required to provide combustion efficiency tests as a part of their free energy audits, and the tests are also available through many fuel vendors as a part of their heating plant maintenance service. It is therefore not surprising that these measures are highly correlated.

Item 41, average night time temperature, is the only measure examined in the present study which could be considered to require potential daily action or attention.[a] This is certainly true for any homeowners with manually set thermostats (i.e., those units without pre set night setback temperature levels.) But even homeowners with fully automatic thermostats would need to adjust their thermostats

[a]. This variable was excluded in the ECM factor analysis described previously since preliminary factor analyses indicated that item 41 did not emerge as part of a common factor with any of the other ECMs examined.

periodically, unless their schedules seldom varied. Thus, unlike items 30-39, which are essentially one time improvements or actions required only once every year or two at most, item 41 can be seen as a potential "repeated behavior" in Stern and Gardner's (1981) theoretical dichotomy between repeated behaviors and one time efficiency actions discussed previously (see Chapter II.)

The correlations between the three ECM factors and homeowners' conservation attitude factors are indicated in Table 8. They hold no surprises after the previous review of correlations of attitude factors with individual conservation actions (see table 6). Energy competence was correlated with all three of the action factors at the .06 level or better. None of the other attitude factors correlated significantly with these conservation action factors.

Although the correlation of ECM factors and attitudes failed to reveal much that was not already apparent from the correlation of individual ECMs and attitudes, the factor analysis of conservation actions is useful in terms of the questions it suggests about the nature of the relationships between conservation actions and attitudes. This factor analysis of actions suggests that there may be some relatively distinct groups of conservation measures which homeowners implement. It would be useful to know whether people tended to do certain groups of measures first, and if so, in what sequence (such information would presumably be

Table 8

Correlations of Energy Conservation Attitude Factors and Energy Conservation Action Factors

Energy Conservation Action Factor	Attitude Factors 1 Competence	2 Comfort/ Conven.	3 Efficacy	4 Resp. Cost[a]	5 Resp. Cost[b]
1. Infiltration Measures (Weatherstrip, caulk, add storm windows)	.17* (+)	-.12 (-)	.11 (+)	.14 (-)	-.08 (+)
2. Hot Water/ Heat Distribution/ Roof Insulation	.21** (+)	-.04 (-)	.01 (+)	.07 (-)	.01 (+)
3. Furnace Serviced Energy Audit	.29*** (+)	.10 (-)	.06 (+)	.07 (-)	.12 (+)

Note. Expected direction of correlations indicated in parentheses.

[a]Response cost regarding expense, time, trouble, ease of implementation.

[b]Response cost regarding worry, time, repeated behaviors, ease of finding reliable home repair workers.

*p<.05. **p<.06 **p<.005

helpful in designing outreach programs to facilitate conservation as well as aiding in understanding the processes involved in residents' conservation activities.) This question is of special interest in view of the theoretical framework suggested earlier, in which attitudes are viewed as both contributing to, and resulting from, conservation behaviors. While these data do not permit conclusions regarding the sequence in which homeowners undertook various measures, the factor analysis does suggest that homeowners perform them in groups having certain characteristics or influences in common. I will explore some of these other variables that seem to influence homeowners' completion of these groups of measures in a later section.

Hypothesis 3: Relationships Between Energy Conservation Attitudes and Intentions.

In order to explore the relationships between energy conservation attitudes and intentions, homeowners' intentions to complete each of the nine conservation measures which they had not already completed but which applied to them were scaled on a 5 point scale. The resulting intention scores for the nine measures were then correlated individually with the conservation attitude scores previously calculated for

each homeowner who intended to complete one or more of the nine measures.

In addition, an analytical variable was established to count the number of conservation measures each subject intended to perform. This was done by assigning a value of 1 to each measure homeowners indicated they were "likely" or "very likely" to complete and a value of 0 to each measure about which they reported being "undecided" or "unlikely" or "very unlikely" to perform. These values were then added, yielding a value for the total number of intentions for each subject, NUMINTS. (In the case of conservation actions which did not apply or which homeowners had already completed, their responses for those items were dropped.) Homeowners' scores on NUMINTS were then correlated with their energy conservation attitude factor scores.[9]

The correlations of homeowners' attitude factor scores and both their intentions to complete the nine separate measures and the total number of measures they intended to complete, NUMINTS, are presented in Table 9. Once again, all of the statistically significant correlations are in the

[9]. In carrying out this correlation analysis, if any subject had a missing value for any of the nine conservation intention variables used to calculate the summary variable NUMINTS, the statistical package employed dropped the entire observation; therefore, homeowners who were left in the analysis for the correlation of attitude factor scores and NUMINTS comprised a small group of only 34 homeowners who had completed none of the nine conservation actions and for whom all items applied. This group cannot be assumed to be representative of all the homeowners in the sample.

Table 9

Correlations of Energy Conservation Attitude Factors and Energy Conservation Intentions

Intentions to Perform Energy Conservation Measure (ECM):[a]	Attitude Factors 1 Competence	2 Comfort/ Conven.	3 Efficacy	4 Resp. Cost[b]	5 Resp. Cost[c]
30. Weatherstrip doors, windows	-.27** (-)	.10 (+)	-.11 (-)	.31** (+)	-.11 (-)
31. Caulk air leaks	-.28** (-)	.02 (+)	-.04 (-)	.23* (+)	-.01 (-)
32. Install storm windows	-.03 (-)	.02 (+)	-.12 (-)	.17 (+)	.04 (-)
33. Furnace tested and serviced	-.13 (-)	.13 (+)	-.15 (-)	.20* (+)	-.13 (-)
34. Have free energy audit	-.04 (-)	.01 (+)	.00 (-)	.31** (+)	-.04 (-)
35. Install hot water heater	.08 (-)	-.13 (+)	-.13 (-)	.35** (+)	.00 (-)
36. Insulate attic or roof	-.05 (-)	.01 (+)	-.05 (-)	.28* (+)	.00 (-)
37. Reduce hot water temp	.00 (-)	.04 (+)	-.01 (-)	.21* (+)	.06 (-).
38. Insulate heat pipes/ducts	-.18* (-)	-.06 (+)	.04 (-)	.32** (+)	-.05 (-)
39. Install low flow shower head	.06 (-)	-.09 (+)	.04 (-)	.30** (+)	.03 (-)
Total no. of ECM intentions (NUMINTS)[d]	.16 (+)	-.04 (-)	.04 (+)	-.46* (-)	.06 (+)

Note. Expected direction of correlations indicated in parentheses. [a]Coding of intentions: 1= very likely, 5= very unlikely. [b]Response cost regarding expense, time, trouble, ease of implementation. [c]Response cost regarding worry, time, repeated behaviors, ease of finding reliable home repair workers. [d]Coding for NUMINTS: 1= very likely or likely; 0= undecided, unlikely or very unlikely.
*p<.05. **p<.005

expected direction. As was the case with correlations between attitudes and actions, attitude factor 1, competence, is significantly correlated with a number of the measures, but in the case of intentions to perform the ECMs, only three measures are correlated with competence. By contrast, attitude factor 4, concerning response cost regarding time, trouble, expense and ease of implementation, was significantly correlated with intentions to perform eight of the nine ECMs as well as with the number of ECMs which the 34 homeowners who had not done any of the measures intended to do. The overall pattern of correlations in this table is thus quite different from that of table 4 concerning attitudes and actual behaviors.

Correlations of Energy Attitude Factors and Subgroups of Conservation Intentions.

Performing a factor analysis of homeowners' intentions, as was done for their actions, was problematical since, as noted, there were only 34 residents who had not completed any actions and to whom all of the ECMs applied (all other cases would be dropped in a factor analysis of intentions to perform the ten items since the statistical procedure only uses observations with complete data for each variable in the analysis.) Therefore, instead of correlating factor scores of homeowners' intentions with their attitude factor scores, the

attitude factor scores were correlated with homeowners' intentions to perform subgroups of ECMs, in which the conservation items in each subgroup corresponded to the items which made up the three energy action factors described previously. More specifically, in order to perform this analysis, three analytical variables were defined as follows:

INTGR1 = the sum of items from ECMs 30, 31 and 32 which homeowners intended to perform.

INTGR2 = the sum of items from ECMs 35, 36 and 37 which homeowners intended to perform.

INTGR3 = the sum of items from ECMs 33 and 34 which homeowners intended to perform.

Homeowners' scores on these three summary variables for the subgroups of intentions were then individually correlated with attitude factor scores, yielding the results indicated in Table 10. This analytical strategy yielded cell sizes for the correlations ranging from 43 to 93 instead of the only 34 which would have been possible with a factor analysis of intentions, and is therefore based upon a better cross section of the sample than would otherwise have been

Table 10

Correlations of Energy Conservation Attitude Factors and Energy Conservation Intention Group Scores

Energy Conservation Intention Group	Attitude Factors 1 Competence	2 Comfort/ Conven.	3 Efficacy	4 Resp. Cost[a]	5 Resp. Cost[b]
1. Infiltration Measures: Weatherstrip, caulk, add storm windows (INTGR1)[c]	.27* (+)	.01 (-)	.02 (+)	-.27* (-)	-.06 (+)
2. Hot Water/ Heat Distribution/ Roof Insulation (INTGR2)[d]	-.04 (+)	.11 (-)	.17 (+)	-.48** (-)	.15 (+)
3. Furnace Serviced/ Home Energy Audit (INTGR3)[e]	.18 (+)	-.06 (-)	.17 (+)	-.21* (-)	.11 (+)

Note. Expected direction of correlations indicated in parentheses.

[a]Response cost regarding expense, time, trouble, ease of implementation.

[b]Response cost regarding worry, time, repeated behaviors, ease of finding reliable home repair workers.

[c]INTGR1 = sum of intentions re: energy measures #30, 31, 32.

[d]INTGR2 = sum of intentions re: energy measures #35, 36, 37.

[e]INTGR3 = sum of intentions re: energy measures #33, 34.

*$p<.05$. **$p<.005$

possible. The resulting analysis essentially confirms the pattern identified previously in connection with the correlations of attitude factors and individual intentions: attitude factor 4, response cost, is significantly correlated with intentions to complete all of the groups of ECMs, and attitude factor 1 is correlated with intentions to complete ECMs in group one (caulking, weatherstripping and installation of storm windows.)

There are at least two possible explanations for this overall pattern of differences in which competence is most consistently correlated with the completion of many measures whereas perceived response cost is most consistently correlated with intentions to complete the measures. One possible explanation is that in the process of deciding to plan to do energy measures, people somehow minimize the response cost, perhaps as a result of dissonance reduction processes. Once having decided for some reason that they will do the measures, homeowners might downgrade the response cost involved, since they know that they will now have to pay for and implement the measures and they want to believe that doing so will not be too difficult, inconvenient or costly. Perhaps the different patterns of correlations between attitudes and intentions and attitudes and actions results from a process whereby, once believing that response cost is relatively low, people may decide that they will do the measures. Finally, people may simply be unaware of what the

true response costs will be, either because they have seen encouraging educational and promotional material or because they have never done the measures and hence, could not make an accurate estimate of the actual response costs involved. The energy conservation industry has certainly had its share of false advertising.

Once having decided to perform the measures and in the process of preparing in detail to carry them out and then in actually implementing them, homeowners may substantially increase their sense of competence regarding energy conservation - this is indeed one of the main hypotheses of this study. At the same time, in the process of preparing to do the measures and in actually carrying them out, homeowners might get a more realistic sense of the actual response costs involved. This process would account for the different patterns of correlations between attitudes, intentions and actions observed.

Another possible explanation for these differences in patterns of correlations between attitudes and behaviors as opposed to those between attitudes and intentions is that a certain level of competence is necessary before homeowners could convert their intentions to perform conservation measures into actions. (Consistent with this interpretation is the finding from multiple regression analyses, which will be discussed later, indicating that income is not correlated with intentions to complete energy measures, thus ruling out

the possibility that this demographic variable was responsible for the correlations observed between attitudes and intentions.) This formulation is also consistent with the theoretical literature discussed previously. The data from this study do not permit any strong conclusions regarding the degree to which each of these processes may have occurred. It seems likely that both were operating to some degree.

One of the assumptions of this study was that relationships between energy attitudes and behaviors was bi-directional. The correlations discussed previously suggest that energy competence probably led to the completion of conservation actions. Additional data from a regression analysis with energy competence as the dependent variable indicate that the number of actions completed by homeowners was a statistically significant predictor of competence (see Table 11). This model shows that the number of energy measures completed accounts for the greatest portion of variance explained by the model, followed by gender. These data seem to indicate that that energy attitudes are indeed a consequence as well as a precursor of conservation behavior.[10]

[10]. The number of years of school experienced by homeowners contributes a small and statistically marginal amount of explanatory value to the model. The role of gender may have important implications which will be discussed in the following chapter.

Table 11.

Summary of Stepwise Multiple Regression Analysis for Dependent Variable = Energy Competence (ATDFACT1)

Independent Variable	B Value	F	Prob.>F	R Square
NUMACTNS	.09	11.06	0.0012	0.11
Gender	.51	6.72	0.0109	0.17
Yrs. School	.07	3.49	0.0644	0.20

Notes.

1. The starting model included gender, education (Yrs_Schl), income and NUMACTNS as independent variables. No other demographic variables were correlated with the dependent variable at the .1 level of significance or better.

2. The R square represents the value for the model when each independent variable is added; all other values indicated refer to the final model with all independent variables listed in the table above included.

Hypothesis 4: Relationships Between Energy Conservation Attitudes, Actions and Intentions.

Correlations Between Energy Conservation Actions and Intentions.

Based upon the theoretical approach and data discussed previously, we would expect that active participation in carrying out some ECMs would influence homeowners' key beliefs and intentions to perform other measures. To test this assumption, homeowners'energy conservation actions and their intentions regarding the ten ECMs described previously, as well as average night temperature maintained (item #41) and the number of actions completed (NUMACTNS) were correlated (see Table 12).

Three findings stand out in these data. The first of these is the nearly total lack of significant correlations between completion of specific actions and intentions to complete others. Of the nine significant correlations indicated in this table, only two were in the expected direction. In view of the theoretical assumptions of this study, this general lack of correlations between energy actions and intentions is an important finding and its implications will be discussed in some detail in the following chapter.

Table 12

Correlations of Energy Conservation Actions and Intentions

Energy Conservation Measure (ECM) Performed[b]	Intentions to Perform ECMs[a] # 30.	# 31.	# 32.	# 33.	# 34.
30. Weatherstrip doors, windows	.00	.07	.02	-.09	-.10
31. Caulk air leaks	.08	.00	-.04	-.04	-.03
32. Install storm windows	-.05	-.01	.00	-.11	.08
33. Furnace tested and serviced	-.03	.04	.07	.00	.05
34. Have free energy audit	-.05	-.11	.05	-.05	.00
35. Install hot water heater	.02	-.03	.09	-.12	-.07
36. Insulate attic or roof	-.04	.05	.17	.06	.08
37. Reduce hot water temp.	-.05	-.11	.08	-.08	-.04
38. Insulate heat pipes/ducts	-.24*	-.21*	-.05	-.12	-.02
39. Install low flow shower head	.01	-.07	-.03	.14	.15
41. Average night temperature	.02	.01	.12	.08	-.05
Total no. of ECMs performed (NUMACTNS)	-.11	-.12	.02	-.10	.00

[a]Coding of intentions: 1= very likely; 5= very unlikely.
[b]Coding of ECMs performed: 1= completed; 0= did not complete
*p<.05 **p<.005

Table 12, Cont.

Correlations of Energy Conservation Actions and Intentions

Energy Conservation Measure (ECM) Performed	Intentions to Perform ECMs # 35.	# 36.	# 37.	# 38.	# 39.
30. Weatherstrip doors, windows	.06	-.12	.25*	-.01	.15
31. Caulk air leaks	.02	-.02	.18	.07	.16
32. Install storm windows	.16	.03	.26*	.14	.29**
33. Furnace tested and serviced	.02	.03	.17	.06	.33**
34. Have free energy audit	.12	.03	-.09	-.10	-.05
35. Install hot water heater	.00	-.04	.12	.05	.16
36. Insulate attic or roof	.14	.00	.27*	.17	.25*
37. Reduce hot water temp.	.14	.12	.00	.01	.19
38. Insulate heat pipes/ducts	.04	-.06	.03	.00	.13
39. Install low flow shower head	.11	.08	.10	.21	.00
41. Average night temperature	-.10	.13	.08	.01	-.08
Total no. of ECMs performed (NUMACTNS)	.10	.04	.21	.14	.24

A second major finding indicated in Table 12 is that having a free utility energy audit (#34) was not significantly correlated with intentions to perform any of the ten conservation measures studied here. While it is possible that homeowners who had received the audit may have taken energy actions not studied, the items examined here represent for the most part the most cost effective measures that would typically be appropriate in the study area, including a sampling of both low cost and more costly items. Therefore, despite the possible effects on energy attitudes which may have resulted from the energy audits, the findings indicated in Table 12 could be interpreted as presenting a rather bleak picture of the effectiveness of the energy audits. (I will elaborate on the implications of these findings in the next chapter.)

A third potentially interesting finding indicated in Table 12 involves two sets of relationships within this table which seem paradoxical. Homeowners who had completed weatherstripping (#30), or caulking (#31), or the installation of interior plastic storm windows (#32), or adding attic or roof insulation (#36) were less likely to indicate an intention to reduce hot water temperature (#37) than were those who had not completed any of these measures. In addition, homeowners who had installed interior plastic or exterior glass storm windows (#32), or had burner or furnace tested and serviced (#33), or added roof insulation (#36)

were less likely to indicate an intention to install a low flow shower head than were those who had not completed these measures. These two patterns are not what one would expect according to the theoretical assumption that successful participation in some conservation actions leads to favorable changes in key beliefs, which in turn increase the likelihood of additional conservation actions. However, a closer look at these two patterns of relationships reveals that in both cases the measures performed are actions which improve energy efficiency and/or comfort with no sacrifice in comfort or convenience. The two measures these homeowners indicated a low probability of performing, however - installing flow restricting shower heads and reducing hot water temperature - could have been perceived as involving a potential sacrifice in comfort level. Thus, it appears that this subset of homeowners, whether consciously or not, may have been behaving in a manner consistent with important concepts in the conservation literature. They concentrated on one time energy efficiency actions (consistent with Stern and Gardners' recommendation) which may have improved comfort (identified as important by Seligman et al.) and avoided perceived sacrifice.[11]

[11]. These findings are consistent with the suggestion that practitioners and policy makers who attempt to combine conservation recommendations involving perceived curtailment with those that improve - or at least do not require perceived sacrifice in - comfort, may run the risk of "turning off" many homeowners to energy conservation (see Becker, 1979).

Overall, the findings indicated in Table 12 suggest that, contrary to expectations based on theoretical assumptions of this study, there appears to be little carry over from completion of most of these energy actions to intentions to complete others. In particular, it seems surprising that completion of ECMs which could noticeably improve comfort - eg., caulking, weatherstripping or adding storm windows, did not appear to increase the liklihood that homeowners would do other ECMs. One possible explanation is that homeowners may allocate a fixed portion of their budgets to energy costs and tend not to implement conservation measures unless these energy costs exceed the limits they consider normal; since, as noted, energy costs were relatively depressed during the time prior to the study, this could account for the lack of greater carry over from completion of certain measures and intention to complete others. In any case, these findings suggest that conservation intentions are influenced to a considerable extent by variables outside of those examined here, as has been shown by Leonard-Barton (1979). This issue will be discussed further in the following section.

Multiple Regressions of Demographic Variables and Energy Conservation Attitudes, Intentions and Behaviors.

Up until this point in discussing the findings, the relationships described have primarily involved energy conservation attitudes, intentions and actions. However, previous researchers have found that demographic variables, particularly income and education, have been related to energy conservation attitudes and behaviors. It is therefore important to examine the influence of these variables in the context of the major variables already discussed in order to determine if the basic relationship established here between attitudes, intentions and actions hold up in the face of such demographic variables.

Tables 13-15 indicate Pearson correlations between the demographic variables investigated and energy conservation attitude factors, action factors and intention groups previously described. Correlations between demographic variables and individual ECM actions and intentions are indicated in Appendix C, and intercorrelations between demographic variables are indicated in Appendix D for the interested reader.

In order to clarify further some of the interrelationships suggested by findings presented in the preceding pages, several stepwise multiple regression

Table 13

Correlations of Demographic Variables and Attitude Factors

Attitude Factor	Demographic Variables[a]					
	Gender	Fuel Type	Education	Income	Zip Area	Age
1. Competence	.35**	.09	.21**	.16**	-.01	.02
2. Comfort/ Convenience	.03	.13*	-.02	.08	.06	-.06
3. Efficacy	-.19**	-.05	.09	.09	.06	.03
4. Response Cost[b]	.15**	-.08	.09	.07	.06	-.02
5. Response Cost[c]	.10	.10	.00	.10	.00	-.10

[a]Coding of demographic variables for analysis: Gender: male=1, female=0; Fuel type: oil=0, gas=1; Education= actual total years of school; Income: $0-$29,999=1, $70,000 or more =7; Age= actual age.

[b]Response cost regarding expense, time, trouble, ease of implementation.

[c]Response cost regarding worry, time, repeated behaviors, ease of finding reliable home repair workers.

*p<.1 **p<.05

Table 14

Correlations of Demographic Variables and Energy Conservation Action Factors

Energy Conservation Action Factor	Demographic Variables*					
	Gender	Fuel Type	Education	Income	Zip Area	Age
1. Infiltration Measures: Weatherstrip, Caulk, Add Storm Windows (ACTFACT1)	.06	.03	-.03	.23*	.13	.13
2. Hot Water/ Heat Distrib./ Roof Insulation (ACTFACT2)	.08	.05	.10	.32**	-.11	.11
3. Furnace Serviced/ Energy Audit (ACTFACT3)	.04	-.11	.09	.20*	.00	.04
No. of Actions (NUMACTNS)	.08	.00	.07	.34**	.00	.12

*Coding of demographic variables for analysis: Gender: male=1, female=0; Fuel type: oil=0, gas=1; Education= actual total years of school; Income: $0-$29,999=1, $70,000 or more =7; Age= actual age.

*p<.05 **p<.005

Table 15

Correlations of Demographic Variables and Energy Conservation Intention Groups

Energy Conservation Intention Group	Demographic Variables[a]					
	Gender	Fuel Type	Education	Income	Zip Area	Age
1. Infiltration Measures: Weatherstrip, Caulk, Add Storm Windows (INTGR1[b])	-.16	.12	-.13	.04	-.02	.04
2. Hot Water/ Heat Distrib./ Roof Insulation (INTGR2[c])	.01	-.17	-.30*	-.02	.12	-.03
3. Furnace Serviced/ Energy Audit (INTGR3[d])	-.07	-.11	-.21**	-.12	-.08	.03

[a]Coding of demographic variables for analysis: Gender: male=1, female=0; Fuel type: oil=0, gas=1; Education= actual total years of school; Income: $0-$29,999=1, $70,000 or more =7; Age= actual age.

[b]INTGR1 = sum of intentions re: energy measures #30, 31, 32.

[c]INTGR2 = sum of intentions re: energy measures #35, 36, 37.

[d]INTGR3 = sum of intentions re: energy measures #33, 34.

*p<.1 **p<.05

analyses were performed, using as dependent variables various variables concerning energy conservation attitudes, intentions and actions. Tables 16-22 summarize the models resulting from these analyses. In defining preliminary models, independent variables were chosen which met the following criteria: there was a theoretical reason to justify including them; they were correlated at the .1 level or better with the dependent variable and they were either uncorrelated or only moderately correlated with other independent variables in any given model.[12]

These models will be discussed in the following pages. In considering all of these models it should be kept in mind that the labeling of variables as independent or dependent for the purposes of the analyses is a matter of analytical convenience; in some cases, a given variable could be either, given the theoretical framework of this study.

1. Dependent variable: NUMACTNS (Table 16)

This model is of considerable theoretical and practical interest. It indicates that for this sample, income and energy competence were the most significant variables

[12]. Independent variables were retained in the models at the .1 level of significance or better. Given the exploratory nature of these analyses and their purpose in aiding in understanding the phenomena involved rather than predicting them, this level of significance was considered appropriate. All regression analyses were run using a stepwise multiple regression procedure which selected models with maximum R2 for the number of variables at each step.

involved in explaining the variance in completion of ECMs, together accounting for approximately 20% of the variance in the number of energy measures homeowners completed; the rest of the variance was apparently due to forces outside those studied here. Income accounted for well over half of the total variance explained by the model, with energy conservation competence accounting for the remaining, smaller portion.

This finding is generally consistent with Leonard-Barton's (1979) finding that energy attitudes accounted for a relatively small percentage of variance in conservation measures performed by California homeowners, as compared with the variance explained by other independent variables. Since the attitudinal variable used in this model (competence) is different from those used in Leonard-Barton's analysis (which involved primarily individual perceptions of specific ECMs), this finding does not suggest that energy competence by itself would be a dramatically more powerful predictor of ECMs than those attitudinal variables examined by Leonard-Barton. Nor do the findings of the present model suggest a more optimistic view of the potential role of attitude change in affecting changes in energy practices than did Leonard-Barton's. However, as she noted, in exploratory research of this type, it is often an achievement to be able to identify even relatively weak relationships; the degree of explanatory power of models derived from such research may be more of a

Table 16.

Summary of Stepwise Multiple Regression Analyses for Dependent Variable NUMACTNS

Independent Variable	B Value	F	Prob.>F	R Square
Income	.61	13.58	0.0004	0.14
ATDFACT1	.77	8.80	0.0037	0.20

Notes.

1. The starting model included income and ATDFACT1 as independent variables. No other demographic variables were correlated with the dependent variable at the .1 level of significance or better.

2. The R square represents the value for the model when each independent variable is added; all other values indicated refer to the final model with all independent variables listed in the table above included.

reflection of limitations in theory and methodology of the research at this stage of refinement than of the actual strength of such relationships in the phenomena being studied.

2. Dependent variables: ACTFACT1 - ACTFACT3. (Tables 17-19)

Table 17 indicates that income accounts for nearly half of the variance explained by the model for dependent variable ACTFACT1, the ECM factor involving weatherstripping, caulking and installation of interior or exterior storm windows. Since at least two of the three measures associated with ACTFACT1 are typically performed by homeowners themselves, the emergence of the response cost variable in the model for dependent variable ACTFACT1 could be expected. It is less clear why income should be a major variable in a model related primarily to low cost measures and why it should account for nearly two-thirds of the explained variance. However, as noted, other studies have found that income correlates with the performance of conservation measures in general; apparently cash flow is perceived to be an important consideration for even many low cost conservation items. (It is also possible that many of the homeowners who indicated that they had installed interior plastic or exterior glass storm windows had in fact installed the latter, which would make it the most expensive of the ECMs studied here.)

Table 17.

Summary of Stepwise Multiple Regression Analyses for Dependent Variable ACTFACT1

Independent Variable	B Value	F	Prob.>F	R Square
Income	.15	7.62	0.0068	0.06
Atdfact4	-.18	4.28	0.0410	0.10
Act34	.46	5.29	0.0234	0.13

Notes.

1. The starting model included income, ATDFACT1, ATDFACT4 and Act34 as independent variables. No other demographic variables were correlated with the dependent variable at the .1 level of significance or better.

2. The R square represents the value for the model when each independent variable is added; all other values indicated refer to the final model with all independent variables listed in the table above included.

Table 17 also indicates that Act34, having a home energy audit, is a statistically significant predictor of the energy measures associated with ACTFACT1, two out of three items of which are low cost measures. This finding is consistent with those of an evaluation of utility energy audit programs in New York State indicating that the programs appear to have succeeded in encouraging adoption of low cost conservation measures (New York State Public Service Commission, 1987).

Table 18 indicates that having the energy audit was also a statistically significant predictor of homeowners' completion of ECMs associated with ACTFACT2. These included installation of a separate hot water heater, adding attic or roof insulation, reducing hot water temperature, insulating heat pipes and installing a low flow shower head. Thus, it appears that homeowners who elect to have the audits respond to the information offered with regard to a range of both low cost and more expensive efficiency improvements.

It was noted previously that energy competence and having an energy audit were correlated but that the direction of causality in this relationship was not entirely clear. Table 19 shows that energy competence is a statistically significant predictor of ACTFACT3, one of two items of which is having the energy audit (the other item involved having the oil burner or furnace tested and serviced.) This finding suggests that ironically, homeowners must acquire a certain level of sophistication and feeling of competence regarding

Table 18.

Summary of Stepwise Multiple Regression Analyses for Dependent Variable ACTFACT2

Independent Variable	B Value	F	Prob.>F	R Square
Income	.20	16.14	0.0001	0.14
Act34	.58	9.13	0.0031	0.21

Notes.

1. The starting model included income, ATDFACT1 and Act34 as independent variables. No other demographic variables were correlated with the dependent variable at the .1 level of significance or better.

2. The R square represents the value for the model when each independent variable is added; all other values indicated refer to the final model with all independent variables listed in the table above included.

Table 19.

Summary of Stepwise Multiple Regression Analyses for Dependent Variable ACTFACT3

Independent Variable	B Value	F	Prob.>F	R Square
ATDFACT1	.26	8.67	0.004	0.09
Income	.10	2.94	0.089	0.11

Notes.

1. The starting model included income and ATDFACT1 as independent variables. No other demographic variables were correlated with the dependent variable at the .1 level of significance or better.

2. The R square represents the value for the model when each independent variable is added; all other values indicated refer to the final model with all independent variables listed in the table above included.

energy conservation matters before requesting an energy audit. This finding may have important policy implications in view of the difficulty utilities have had in achieving widespread participation in energy audit programs.[13]

3. Dependent variables: INTGR1 - INTGR3. (Tables 20-22)

Attitude factor 1, energy competence, was significant at the criterion level in two of the three models. Again, we see that this variable emerged as an important part of the overall picture involving energy attitudes, behaviors and intentions. Attitude factor 4, response cost, was significant in each of the three models for the dependent variables INTGR1- INTGR3 (i.e., intentions to perform the ECMs associated with ACTFACT1 - ACTFACT3). Education (YRS_SCHL) also emerged as explanatory variables in two of the three models.

In addition to providing further indication of the important role of competence, Tables 20-22 also show that response cost is a major consideration for homeowners contemplating energy conservation measures. Regardless of the specific measure being planned, and for two of the three groups of measures, response cost was the most powerful of the variables studied. The differences in relative weighting

[13]. Stern and Aronson (1984) noted that studies of residential energy audit programs have typically found participation rates on the order of 5%.

Table 20.

Summary of Stepwise Multiple Regression Analyses for Dependent Variable INTGR1

Independent Variable	B Value	F	Prob.>F	R Square
ATDFACT1	.26	4.56	0.0366	0.09
ATDFACT4	-.20	2.31	0.1335	0.12

Notes.

1. The starting model included ATDFACT1, ATDFACT4 and NUMACTNS as independent variables. No other demographic variables or attitudinal variables were correlated with the dependent variable at the .1 level of significance or better.

2. The R square represents the value for the model when each independent variable is added; all other values indicated refer to the final model with all independent variables listed in the table above included.

Table 21.

Summary of Stepwise Multiple Regression Analyses for Dependent Variable INTGR2

Independent Variable	B Value	F	Prob.>F	R Square
ATDFACT4	-.49	12.16	0.0012	0.22
YRS_SCHL	-.15	5.69	0.0220	0.32

Notes.

1. The starting model included YRS_SCHL and ATDFACT4 as independent variables. No other demographic or attitudinal variables were correlated with the dependent variable at the .1 level of significance or better.

2. The R square represents the value for the model when each independent variable is added; all other values indicated refer to the final model with all independent variables listed in the table above included.

Table 22.

Summary of Stepwise Multiple Regression Analyses for Dependent Variable INTGR3

Independent Variable	B Value	F	Prob.>F	R Square
ATDFACT4	-.15	4.01	0.0484	0.06
ATDFACT1	.16	4.06	0.0470	0.09
YRS_SCHL	-.07	3.36	0.0704	0.12

Notes.

1. The starting model included YRS_SCHL, ATDFACT1, ATDFACT3 and ATDFACT4 as independent variables. No other demographic or attitudinal variables were correlated with the dependent variable at the .1 level of significance or better.

2. The R square represents the value for the model when each independent variable is added; all other values indicated refer to the final model with all independent variables listed in the table above included.

of response cost and energy competence for the models for INTGR1 vs. INTGR3 are consistent with what one would expect given the different degrees of competence required of homeowners for these groups of measures.

The role of education in these models could be an indication of the "wary consumer" phenomenon. As noted elsewhere, not only are there few unbiased and credible sources of energy conservation available to most homeowners, but the field of energy conservation has also often been characterized by overly optimistic estimates regarding energy savings expected from various conservation measures.

Summary and Conclusions.

The findings discussed in the preceding pages provide at least partial confirmation for each of the four major research hypotheses. Yet there were also some important unexpected findings. With regard to the first hypothesis, three of the four expected key beliefs, involving energy conservation competence, perceived response costs of energy conservation, and perceived efficacy emerged as attitudinal factors. Comfort/convenience also emerged as a clear factor, consistent with the findings of Seligman et al. (1979) and Becker et al. (1979).

Regarding the second hypothesis, that the energy attitude factors would be related to conservation actions, there was strong confirmation of the hypothesis but the dominant relationship between energy conservation competence and conservation actions was striking in view of previous research. The third hypothesis, that conservation attitudes would be related to intentions also received some confirmation, with competence emerging at the criterion level of significance in two of the three predictive regression analyses performed. Perceived response cost was also an important predictor of intentions in these regression models. Finally, the fourth hypothesis, that energy conservation attitudes, intentions and behaviors would be interrelated, received mixed support from the findings: there was evidence of the hypothesized bi-directional relationship between energy competence and completion of conservation measures, but the expected carry over between completion of energy measures and intentions to complete others did not occur.

The lack of any correlation between having had an energy audit and intentions to complete other conservation measures was noted as a specific example of this general lack of carry over between actions and intentions, and one with potentially important policy implications. On the other hand, the multiple regression analyses indicate that having had the audits was a significant predictor of a range of low

cost and more expensive conservation measures. This suggests that after having the audits, homeowners make decisions about what measures they will carry out and then proceed to implement them; having completed these measures, there appears to be little or no longer term continuing of effort with regard to further efficiency actions.

The predominance of energy conservation competence in this study in contrast with the salience of comfort/convenience as an attitudinal factor predictive of conservation behavior in the Seligman et al. (1979) research was explained in terms of the different theoretical perspectives, methodologies and research contexts of these studies. The context of this study - middle income homeowners whose houses were more physically diverse than those in the more homeogeneous planned unit development studied by Seligman et al. (1979) and Becker et al. (1979) would seem far more representative of the situation of most homeowners in this country. For this reason, the findings of this study would seem to be more generalizable to the average homeowner

The implications of these and other findings will be discussed in the following chapter.

VII: IMPLICATIONS

The findings presented in the previous chapter have significant implications for energy conservation theory and practice. In this chapter I will discuss some of the major implications, following approximately the order in which the findings were presented; however, the intent here is not to consider the possible implications of every finding in this study but, rather, to focus primarily on those findings which seem of most importance.

Energy Conservation Attitudes.

With regard to homeowners' attitudes about energy conservation, perhaps the most striking findings to emerge from the study involve the recurring relationships between energy conservation competence, actions and intentions. One must conclude from the present findings that certain previously identified attitudinal variables are not by themselves adequate for an understanding of homeowners' energy conservation attitudes; energy conservation competence must also be taken into account. Since the findings upon which this conclusion is based are perhaps the most important findings regarding energy attitudes in the present study, their implications should be elaborated. It should be acknowledged at the outset that these findings are

consistent with much of the previous literature in the sense that previous theorists have emphasized the role of knowledge as a pre-requisite to energy conservation (Ellis and Gaskell, 1978; Seligman et al., 1979; Leonard-Barton, 1979). In view of this fact, one might ask what, if anything, the concept of energy conservation competence adds to energy conservation theory or practice beyond such previous conceptualizations.

The answer to this question lies partly in understanding the difference between knowledge and competence. As noted previously in the literature review, numerous energy conservation programs have been designed on the assumption that a major barrier to energy conservation was lack of information. Once energy users were provided with sufficient and appropriate information, they would be motivated to conserve, either by existing motivators such as energy costs or desire to increase comfort, or by externally imposed incentives. It has also been noted that information by itself is not motivating (Aronson, 1980). By contrast, energy conservation competence - the psychological sense that one is mastering (or has mastered) aspects of a body of knowledge and skills about energy conservation - was seen to be a potentially important motivator in the theoretical framework of this study. The finding that energy competence was a statistically significant predictor of intentions to complete items typically performed by homeowners such as caulking and weatherstripping supports this hypothesis. The

emergence of this attitudinal factor in the present study, and its role in predicting intentions to perform certain measures, therefore, provides important support for a concept of potentially great theoretical and practical significance.

The research design limits conclusions regarding the importance of energy conservation competence; longitudinal research will be necessary to clarify further the causal relationships between energy competence and behavior. Nevertheless, having established the existence of this potentially important factor, it is reasonable to speculate about some of the implications of the factor, assuming that its predictive validity can be confirmed by such longitudinal research.

It should be noted that the concept of energy conservation competence in no way invalidates previous recommendations regarding the need for more and better energy information. Clearly, we cannot expect homeowners to take effective conservation actions if they are laboring under the illusion that turning off a few 60 watt electric light bulbs is more effective than such measures as having their furnace cleaned and tuned occassionally, using air conditioners more wisely, etc. (Millstein, 1977). However, the competence concept suggests that it is not simply the provision of factual information that is important, but rather, the type and manner of presentation of the information, and its effect

on energy users' sense of competence regarding conservation that is critical.

In this connection, several points are relevant regarding theory. First, as noted in a previous chapter, competence is important because it indicates one possible way that attitude change can occur in real world situations. Although dissonance theorists have demonstrated that attitudes can be changed in laboratory and artificial field situations involving behaviors which are extremely discrepant with subjects' preexisting cognitions, this theoretical approach has been criticized as offering a poor representation of everyday attitude change. The competence perspective, on the other hand, suggests a process by which attitude change could occur under more typical conditions. According to this approach, competence seeking would motivate homeowners to take a series of actions leading up to a behavior sufficiently discrepant from their original cognition that it could result in significant changes in their attitudes about energy conservation; moreover, this process would occur in the absence of such highly atypical conditions as have typified much of the attitude change work associated with dissonance theory. And the lack of such a competence approach in much of the previous work on the effects of energy information could help to explain the often dissappointing results of such work.

On another level, the competence concept suggests that the theoretical dichotomy offered by Stern and Gardner (1981) between one time efficiency actions versus repeated behaviors, though clearly useful, may be somewhat misleading. According to their model, energy conservation programs are most effective when they focus on one time efficiency actions such as insulating one's house rather than on repeated behaviors such as turning off lights. If one important purpose of energy conservation programs is to encourage behaviors and experiences which facilitate competence development, it would seem that the need to provide homeowners with technically sound recommendations about the cost effectiveness of conservation measures should be balanced with the need to provide experiences and information that facilitate energy competence, even if that means doing some measures first which may be of relatively low priority from a technical perspective[14] (this point will be discussed further with regard to the energy audits in a later section). Since the ultimate long term goal might well be to enlist homeowners' participation in precisely such technically effective one time measures as Stern and Gardner recommended,

[14]. Of course, one cannot assume that competence by itself will be sufficient to motivate people to conserve, at least not beyond some nominal level, and the regression analyses from this study as well as Leonard-Barton's (1979) discussed previously make it clear that attitudes about energy conservation account for only a portion of the variance in conservation behavior.

the competence appoach need not be incompatible with their theoretical framework.

Viewed from such a perspective, the concept of energy conservation competence which emerged in this study would appear to provide an important criterion for evaluating energy conservation programs. Indeed, one of the most important implications of this study may be the establishment of an instrument which can be adapted for use in program evaluation and further research. For example, from an evaluation perspective, if competence development is assumed to be an important goal of energy education programs, it would seem useful to have some means for measuring such competence. Such an instrument could also be used in a comparative evaluation of progams or interventions which differed in some theoretically interesting way. Although the validity of this instrument remains to be fully established, it could provide a useful jumping off point for further work in this area.

The concept of energy conservation competence raises a number of potentially important research issues. These include, for example, the causal relationship between energy competence and behavior, how the sense of competence is acquired (i.e., what experiences and/or information contribute most to it and how homeowners typically encounter these experiences), and what other aspects of energy

competence besides those investigated here, if any, are important.

Energy Conservation Attitudes and Intentions.

The major new finding with regard to energy attitudes and intentions involved the role of competence as a predictor of intentions. This suggests that the theoretical assumption that competence is a potentially important motivator is indeed valid. This finding has implications as well for the design of conservation information programs; these will be discussed later in connection with the home energy audit program.

A second major finding concerning attitudes and intentions involves the predominant pattern of correlations between response cost involving time, trouble and ease of implementation of ECMs, and intentions to perform every one of the ECMs studied except installation of interior plastic or exterior glass storm windows. One interpretation of this finding is that once homeowners have reached the point that they consider themselves likely to do particular ECMs, the perceived response costs associated with the measures may be the major attitudinal barrier to their actually carrying out the measures. If this interpretation is correct, the efforts of some manufacturers of energy conservation products to develop easy to install items would appear to be highly appropriate. Some examples of this include self-adhesive

plastic weatherstripping, caulking which is in a continuous piece that is pressed into cracks (as opposed to the extremely messy method of applying it from a tube with a caulking gun) and pre-formed foam pipe insulation.

In a more general sense, the importance of response cost considerations supports the suggestion of Stern and Aronson (1984) that homeowners may view energy improvements much like they view numerous other home improvements or maintenance projects that may be competing for their limited time and personal energy. If homeowners view energy improvements much like any other home improvement, perhaps conservation programs should focus on the contribution of energy measures to increasing the value of the home rather than strictly on their energy and cost savings aspects. Thus, to fully understand homeowners' decisions about energy conservation, it may be necessary first to examine how they make decisions about such other home improvement and maintenance endeavors. It may well be the case that the home improvement industry has conducted studies that could be very useful in this connection, and it is possible that energy reseachers and this industry could both benefit from sharing of information and expertise.

Energy Conservation Attitudes and Actions.

Before discussing the implications of findings regarding the relationships between attitudes and actions, some

comments on the patterns observed in homeowners' conservation actions are in order. The major finding here was that homeowners appeared to do the ECMs in three groups, as indicated by the factor analysis of ECMs. These groups included items which could reduce drafts and improve thermal comfort (caulking, weatherstripping and storm windows); moderate to high cost efficiency improvements (hot water heater installation and roof insulation) plus other items; and measures typically performed by a utility or fuel provider (utility energy audit plus burner servicing). At the very least, this pattern indicates that homeowners are not doing energy measures in random order. Their choices concerning which items to perform at any point in time are influenced by specific types of considerations regarding the perceived need for, and expected benefits of, particular measures; the response costs involved in carrying out various efficiency options, and financial considerations. For some measures, homeowners appear to have been primarily influenced by income and their sense of energy competence (ie, having a free utility energy audit, having burner or furnace tested and serviced); for other measures, they appear to have been influenced also by having the energy audit itself (eg., weatherstripping, caulking, installation of separate hot water heater, adding attic or roof insulation); some of the groups of measures involved items homeowners could perform themselves while others are almost always performed by

professionals; some involve significant investments and may be viewed as primarily home improvements as opposed to energy saving measures.

Perhaps the major conclusion to be drawn from these patterns of conservation actions is that energy theorists and program designers might benefit from attempting far more agressively to understand the complexity of homeowners' own perceptions and conceptualizations of energy measures, as well as their motivations for performing or not performing various measures. As noted, often the theoretical conceptualizations of energy measures underlying energy conservation research and programs (either explicitly or implicitly) are based upon objective technical considerations which may bear only a partial relationship to homeowners' own conceptualizations of energy measures. For example, it may be relatively meaningless to present homeowners simply with detailed cost benefit rankings of potential energy measures for their homes, as most energy audits do, if these homeowners are primarily concerned about comfort or ease of implementation, or perhaps even about the potential opportunity various measures present for mastery regarding energy conservation, although such cost benefit information may well be an important part of an overall energy information package.

Although this exploratory study has only begun to scratch the surface of homeowners' conceptualizations of

energy measures, it does suggest that the factor analytic methodology employed here can be a useful tool in further illuminating this issue. Although this technique has been applied to energy attitudes, it has been underutilized in analyzing homeowners' conservation behaviors. One interesting application of this methodology would be to apply factor analysis to a more comprehensive and representative list of home improvements completed by homeowners, including energy items such as examined in this study. This could provide an indication of how homeowners acted upon and perceived energy improvements in relationship to other home improvements. Another useful approach might be to take ECM factor analysis results such as obtained in this study and then conduct followup interviewing with the same homeowners to clarify some of the considerations and assumptions underlying their conservation actions (the essential questions of interest here would be why homeowners tended to do certain measures but not others, in what sequence were they performed, etc.[15])

[15]. The sequence of conservation actions is of interest since the successful completion of some measures might be expected to lead homeowners to attempt others. Although the present study found little evidence to confirm this assumption, this study is scarcely a definitive test of the proposition. Since the clustering of certain ECMs together in factor analyses does little to clarify the temporal order of completion of the different measures, specific follow-up questions about the sequence of homeowners' completion of the measures and their experiences in carrying them out would be necessary to clarify these issues.

With regard to the relationships between completion of ECMs and homeowners' attitudes, the most important finding was the correlation of energy conservation competence with almost all of the ECMs studied except those that are usually performed by contractors. This finding, as noted, is consistent with the theoretical assumption of this study that energy attitudes generally, and competence specifically, are to some extent both necessary for and the result of conservation actions. The correlation between competence and most ECMs does not clarify to what extent the causal relationships between these variables may be predominantly in one or the other direction- this is perhaps one of the most important questions for future research on this concept (the finding that competence was a predictor of intentions to conserve established that the relationship was bidirectional but did not determine the relative strength of the relationships.) Another question is whether there are certain minimal levels of competence before which people are able to carry out the various measures and how those levels can best be achieved.

Assuming that some degree of energy competence is a pre-requisite to completing most of the ECMs here, the finding that such competence is correlated with gender has significant policy implications. Clearly, if energy conservation programs are going to be maximally effective, they must be designed to encourage the development of such

competence among females to a far greater extent. One consequence of traditional gender roles with regard to skills related to home improvements and energy issues is that a very large proportion of the population is not being mobilized to participate fully and most effectively in decisions about - and implementation of -energy conservation measures. In this regard, programs to begin orienting children of both sexes to principles of energy conservation at an early age (eg., the Council on the Environment of New York City's programs in schools) would appear to have great potential, although the benefits of such programs may take many years to become apparent.

In addition, it would seem wise for energy practitioners to target female audiences more effectively through popular media oriented to this population. For example, although magazines oriented primarily to males (Popular Mechanics, etc.) often carry articles on energy conservation, it is doubtful whether magazines targeted to women carry as many such articles. This tendency is probably self-perpetuating to a large extent since writers submit articles to publications based upon the publishers' history of publishing certain types of materials in the past. Particularly in view of findings discussed earlier suggesting that homeowners may view energy improvements much like other improvements and may place great importance on the impact of such improvements on home value, the marketing of

energy conservation as a separate technical type of improvement apart from the context of other home improvements and to a disproportionately male audience may be a serious mistake. Here would seem to be an opportunity for non-profit and government organizations involved in energy education (eg., the New York State Energy Office) to fill an important need in presenting conservation in the context of other home improvements to a broader male and female population.

The lack of correlation between energy conservation actions and attitudes regarding comfort and convenience (attitude factor 2) is paradoxical in view of previous research. It is possible that thermal comfort is more important with regard to temperature regulation (ie, setting of thermostats and air conditioner controls) than it is with regard to efficiency investments. It may be that the most important consideration regarding convenience of implementing the latter measures involves ease of obtaining reliable energy audits, hiring reliable contractors and securing favorable financing (see Stern, Black and Elworth, 1982.) The importance of response cost (attitude factor 4) as a predictor of conservation intentions which was noted previously would seem to support this interpretation.

Interrelationships between Energy Conservation Attitudes, Intentions and Behaviors.

In view of the theoretical assumptions of this study, one of the most surprising findings was the general lack of correlations between completion of most ECMs and homeowners' intentions to perform others. There are at least four possible explanations for this apparent anomaly. One explanation concerns the research design and the timing of the interviews, which were conducted in early summer. It is possible that homeowners, having recently gone through a winter in the northeast, were encountered by the surveyors at a time when they preferred not to think about issues related to winter and were focused on activities other than energy conservation. It seems likely that many homeowners tend to think seriously about energy conservation for the next winter season later in the summer or in early fall. Indeed, it is sometimes difficult to find conservation products displayed prominently in hardware stores in the area during early or mid summer. Therefore, at the time of the interview, homeowners' conservation intentions may have been rather vague and undefined. If so, it is possible that some carry over between completion of certain ECMs and intentions to complete others did occur, but happened during the later part of the summer or fall of the previous year (and hence, would

already be reflected in the ECMs participants reported completing).

Another explanation for the general lack of carry over observed between actions and intentions also seems possible and consistent with other findings in the study. Although we cannot be sure of the timing of homeowners' completion of the various items in each of the groups of items that emerged from the factor analysis of conservation actions, the patterns of these groups of ECMs does seem to imply that some rather different considerations were involved in decisions to complete the various measures. This phenomenon is highlighted by two unanticipated findings concerning relationships between actions and intentions which were noted previously: homowners who had completed weatherstripping, caulking, storm window installation or attic or roof insulation reported less likelihood of reducing domestic hot water temperature than did other homeowners; and those who had installed storm windows, had their burners or furnaces tested and serviced, or installed roof or attic insulation reported less likelihood of installing a low flow shower head than did other homeowners. These findings suggest that homeowners approach energy conservation decisions with some fairly well defined limits regarding tradeoffs or sacrifices they may perceive to be involved in certain actions.

In this context, it is perhaps not so surprising that more carry over was not observed between completion of ECMs

and intentions to complete others. The obvious implication of this phenomenon for the theoretical model hypothesized in this study as well as for program design is that such carry over between energy actions and intentions may not occur for certain types of ECMs without concerted interventions to overcome such pre-existing ideas about tradeoffs involved for certain ECMs. One such intervention which will be discussed shortly involves more intensive models of delivering the energy audits; another approach suggested by Darley and Benninger (1981) involves trying to tap into existing social networks which serve as channels for the diffusion of technology within communities.

A third explanation for the lack of greater carry over between actions and intentions has been suggested by Rodberg (1988), who noted that many homeowners may be motivated by, "...a desire to pay someone else to get the job done, do it, and be done with it, rather than either ... (doing) the work themselves ... or (making) it a continuing drawn out process of putting caulking, weatherstripping, etc. on every year or two, as these usually require..." This interpretation is consistent with Stern, Black and Elworth's finding (1982), mentioned elsewhere, regarding the success of conservation programs which provide a package of services, thereby reducing the demands on the homeowner to become involved in numerous details associated with implementing energy improvements.

Finally, there is a fourth explanation for the general lack of carry over between actions and intentions observed in this study. Leonard-Barton (1979) noted that energy conservation attitudes accounted for only about 10% of the variance found in California homeowners' adaptation of energy measures (such variables as social norms and mechanical ability accounted for additional variance). In view of this, it is possible that any potential carry over between actions and intentions in the present study may have been overshadowed by such other influences.

The relative importance of energy attitudes vs. social norms in influencing conservation behavior remains an open question at this point. Some studies have suggested that attitudes appear more influential while others have suggested that social norms such as a broad conservation ethic or felt sense of civic duty to conserve may be more influential in determining conservation behavior (Leonard-Barton and Rogers, 1981; Olsen, 1981). More recently, Black, Stern, and Elworth (1985) have offered data suggesting that social norms appear to have greater influence on no cost measures such as thermostat regulation, whereas attitudes appear to have more influence on investment related measures.

Leonard-Barton noted that her finding of the relatively small contribution of attitudes and social norms to the variance in conservation actions might suggest a pessimistic picture of the feasibilty of changing energy

conservation behavior through communications media. However, as the New England No Cost/Low Cost Demonstration Project (U.S. Department of Energy, 1980) showed, it is possible to influence a wide range of energy conservation behaviors through a well organized outreach program with an intensive media effort and the use of graduated active involvement. It may be that under typical conditions, energy attitudes play a relatively small part in determining conservation actions, but with an intensive and well designed programatic intervention, the effect of attitudes in influencing behavior could be much greater. Also, the key beliefs included in Leonard-Barton's analysis may not have been sufficiently representative of important attitudes involved. Specifically, for example, it may be that had competence been included in her study a substantially greater proportion of variance in conservation behavior could have been explained.

Although the general carry over between attitudes and behavior and vice versa is of general theoretical and practical interest, the relationship between one specific energy behavior and energy attitudes and intentions deserves special consideration because of the important policy and programatic implications involved. The findings reviewed previously indicate that having a home energy audit was in part predicted by energy competence. Since one of the purposes of the audits should be to promote energy competence, this finding poses a dilemma. However, viewed in

another light, it could be seen as offering a partial explanation for the rather low residential energy audit program participation levels that have been found in the past. If homeowners require a certain level of energy competence in order to realize the value of the energy audits then it may be necessary to redesign outreach efforts promoting the audits to create some minimal level of energy competence on the part of homeowners prior to their participation in the audit program; it may not be enough simply to advertise the availability of the free audits and assume that people, as rational - economic individuals, will be motivated to partake of the audits (the fallacy of this model of human behavior in describing energy conservation motivation has been discussed in a previous chapter.)

The findings regarding the impacts of the energy audits on those homeowners who did have them were mixed. As noted, having the audit was a significant predictor of completing energy measures associated with two of the three ECM factors examined. Having the audit was also correlated with competence, suggesting that the audits may have contributed to competence. However, the audits were not correlated with intentions to perform a single energy measure of those studied. The possible explanations presented in preceding pages regarding the general lack of carry over from energy actions to intentions could apply to the energy audits. However, the findings of this study suggest a number of other

possible explanations for the lack of such carry over involving characteristics of the audits themselves.

The utility energy audits represent the presentation of energy conservation information alone, with all the limitations of this approach discussed previously. In addition, the information presented is derived from technical engineering calculations regarding costs and benefits of various ECMs; as noted, the information does not address such important issues as comfort/convenience or response cost regarding time, trouble and ease of installation. Moreover, although the audits may have contributed to homeowners' sense of energy competence, it would seem that the audits could be better designed to exploit the opportunity to facilitate homeowners' energy competence. More specifically, the audits might be made more effective in educating homeowners regarding issues related to general energy competence discussed in the previous chapter, and also provide information and perhaps even active experiences that would involve homeowners and contribute to the development of specific types of conservation skills. Such experiences might include activities as simple as measuring the tap temperature of the domestic hot water, installing small amounts of weatherstripping or an interior plastic storm window in a particularly drafty room, etc.[16]

[16]. Such an approach to actively involving the homeowner in participating in conservation behaviors was suggested by Stern and Aaronson (1984, p 84) as a way to make conservation

The computer analyzed audit which is used in the HIECA program in New York State is efficient from an engineering and administrative standpoint but removes the homeowner from participating in the process of identifying the most cost effective measures for his or her house. In this regard, the goals of the program might be reconsidered to assess whether it might be a better strategy to give homeowners less technically comprehensive information but involve them more actively in the process of mastering energy conservation in their homes over a period of time as their finances and other constraints allow. It should be noted that the Public Service Commission has made some efforts to encourage the utility auditors to talk with the homeowners more as they do the audits, and to require that the auditors have some skills as communicators as well as technicians in order to expand their role as energy educators.

The findings of this study also suggest that rather than trying to reach as many homeowners as possible with a single, standardized audit, it might be more effective to focus on segments of the population which appear willing or likely to consider certain types of ECMs (perhaps through the use of a brief survey instrument) and then deal with those ECMs and the specific types of concerns these homeowners have about them. Again, this might require a re-examination of program

information in energy audits more vivid and effective than mere presentation of information to a passive homeowner.

goals. For example, rather than trying to reach as many homeowners in the state as possible with the audit program, it might be worth trying to go back to a portion of homeowners who have already had the audit and implemented certain measures and try to develop a technical assistance effort to encourage those homeowners to do additional measures (this again suggests that it would be useful to know why they did only the measures they did and not others.)

In connection with the approach of tailoring conservation services more closely to homeowners' perceived needs, the present findings also suggest a very different approach for the energy audits which should be considered. The problem of using the energy audits to encourage conservation actions can be seen as stemming from the focus of the audits on providing a needs assessment of the <u>home</u>; the present findings, however, suggest that what may be needed first is a needs assessment of the <u>homeowner</u> regarding energy conservation issues. In such a user-oriented approach, rather than providing a comprehensive and technically complete analysis of energy measures that homeowners 'should' consider, the energy auditor (better viewed as an energy education specialist) would first assess homeowners' perceived energy conservation related needs and then provide information (and preferably relevant active involvement) related to these needs and interests. Once this has been accomplished, additional information and assistance

with other ECMs could be provided, either at that time if the homeowners appeared receptive, or in a followup contact.

In this connection, it is not at all clear that a one time energy audit is the ideal approach for achieving broader changes in homeowners' conservation patterns. The finding that having the audit predicted completion of two of three groups of ECMs studied but was not correlated with intentions to perform any measures suggests the need for some sort of followup. A more effective alternative than that of the one time energy audit might be to establish an ongoing technical assistance and educational relationship with homeowners and provide information in modules that included some involvement on the part of homeowners. The approach of some energy cooperatives which have provided an ongoing service with materials and advice to homeowners tailored to their needs and interests is worth noting, since such a model seems far better suited for facilitating the types of competence that emerged in this research than does the single shot audit approach, although the audit may be an important component of an overall conservation program.

Since it is unclear whether most utilities in New York State have either the capabilities or interest in carrying out an approach such as suggested above, it might be necessary for the state Public Service Commission's HIECA program which oversees the audits in New York State to establish relationships between institutions and

organizations other than the utilities. The question regarding whether the utilities represent the best institutional arrangements for carrying out the energy audit program has been hotly debated in New York State in recent years. While some of the loudest critics of the utility audit program have included private energy conservation representatives with a financial interest in picking up some of the energy audit business, more dispassionate observers have pointed out that utilities have had low credibility compared to other institutions (Stern and Aronson, 1984) and others have noted that the utilities often perceive a lack of a financial incentive for encouraging conservation. Without entering the fray of this battle, I would simply point out that perhaps the use of the utilities and other institutions or organizations in carrying out the energy audit program are not mutually exclusive, and that if the approach suggested here has merit, the use of intermediaries other than the utilities on at least a supplementary basis should be seriously considered. Such arrangements might include, for example, prior educational outreach to homeowners who had recently requested an energy audit, followup technical assistance to homeowners who had received an audit, etc.. Such outreach or technical assistance could be provided through a number non-profit community energy or environmental organizations, educational institutions, etc.

The more intensive and sustained educational and technical assistance approaches suggested here might involve a higher cost per household served in the short term. But if the service was perceived to be more useful and credible by homeowners, they might be wiling to pay a reasonable fee for it to offset costs, and the service could presumably attract many more customers. Ultimately, customers pay for the service whatever form it takes since it is funded out of utility rates; presumably, the more effective the program, the more likely homeowners would be to support this charge.

An alternative approach which has been found effective in conservation programs in the Northeast, mentioned earlier, involves packaging services such as energy audits, financing, contractor screening and independent inspections of contractors' work (Stern, Black and Elworth, 1982). In the context of such packaged programs with strong consumer protection features, the role of competence would be expected to be somewhat different than was indicated by the present study. Such programs have chosen to reduce the technical competence required of homeowners, consistent with the suggestion of Rodberg (1988). However, the present study indicated that some degree of competence appeared necessary to enable homeowners to take advantage of residential energy audit programs; moreover, even in the context of more comprehensive, packaged programs, it may well be that other aspects of energy conservation competence besides those

identified here would be important. This might include such issues as how to take best advantage of the program, how to follow-up with additional improvements that might become feasible at a later time (eg., if energy prices rose above a certain level, if the homeowner's financial situation changed, or if other home improvements were contemplated in the future), how to maintain certain improvements, and how to assess the effectiveness of improvements over time.

Finally, it should be kept in mind that this study was not designed as an evaluation of the energy audit program, but rather as an exploratory study of energy attitudes, intentions and behaviors. Although the data bearing upon the energy audit program are interesting and in some respects unique, the methodological limitations of the study and the suggestive nature of some of the findings underlying the implications presented here should be noted. Clearly, we need to know much more about many of these issues before reliable predictions about policies and programs are possible. However, current policy in this area is based upon theoretical assumptions that are probably no better grounded, and there is a clear need for more innovative approaches in this area. Hopefully, this study has offerred some ideas which can contribute to the development of such approaches.

APPENDIX A

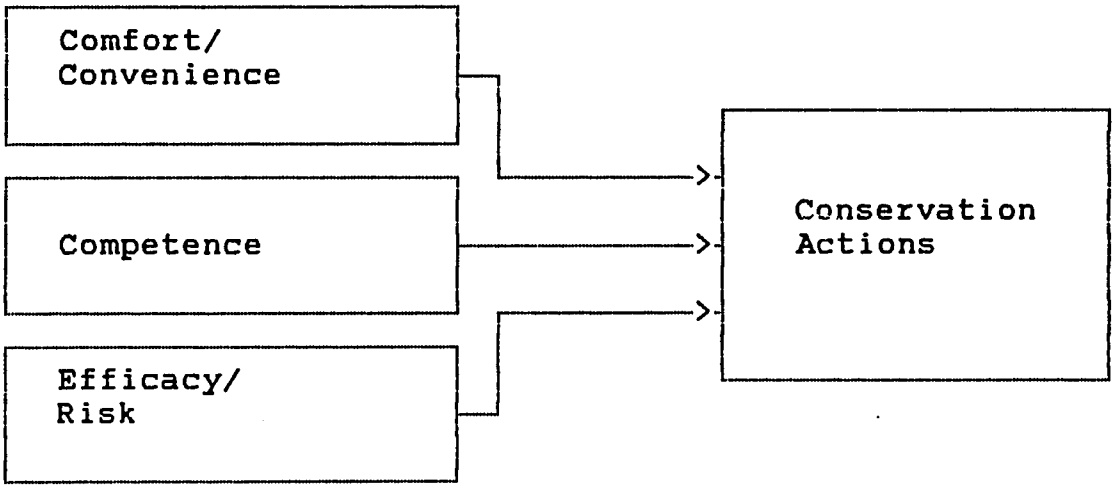
Based on the literature review and conceptual framework discussed elsewhere in this document, an energy attitude questionnaire was developed that included questions that seemed to represent three key energy belief areas thought to be related to energy conservation behaviors (see Model I, Figure 23.)

Pretest 1.

The preliminary energy attitude questionnaire based on model I was pretested on a small sample of middle income homeowners (attendees at energy conservation workshops conducted by the N.Y.C. Dept. of Housing Preservation and Development's Office of Energy Conservation.) The Likert analysis procedure was performed to identify individual items that correlated most highly with the sum of scores for each of the three predefined concepts. In order to verify that the concepts that had been derived from the literature were in fact reasonably consistent with subjects' own concepts of

Figure 23.

Model I



energy conservation, a factor analysis was performed on data from the first pretest. Essentially, it confirmed that items expected to be related to energy conservation competence were generally perceived as related by respondents. However, beyond that, the factor pattern was relatively undifferentiated. The questionnaire was reworked, changing some items to try to better capture the full range of issues that seemed associated with the 3 key belief concepts from Model I. Also, the response format was changed from five choice points to seven in hopes that this might normalize the previously somewhat skewed responses and permit a cleaner factor pattern to emerge.

Pretest 2.

Using the revised questionnaire, a second pretest was conducted, with subjects recruited at the Big Apple Fix-Up, a homeowners' fair held at Madison Square Garden. Factor analysis of the data again produced a pattern lacking clear definition.

Given the lack of an existing scale appropriate for assessing the energy attitudes relevant to the study and the questionnable validity of the instrument being developed at that point, it was concluded that before the research could proceed, it would be necessary to develop a more satisfactory scale.

Since comfort and health were among the most important attitude factors to emerge from the Princeton studies of energy attitudes, the failure of comfort/convenience to emerge as a stronger factor in pretests 1 and 2 was puzzling. A further review of the literature and pretest data suggested that comfort/convenience and efficacy/risk might more usefully be conceptualized as a response cost: efficacy ratio involving both comfort/convenience and financial issues (see Model II, Figure 24.) Based upon this reconceptualization, the questionnaire was revised to include items to sample the concepts of competence, response cost and efficacy.

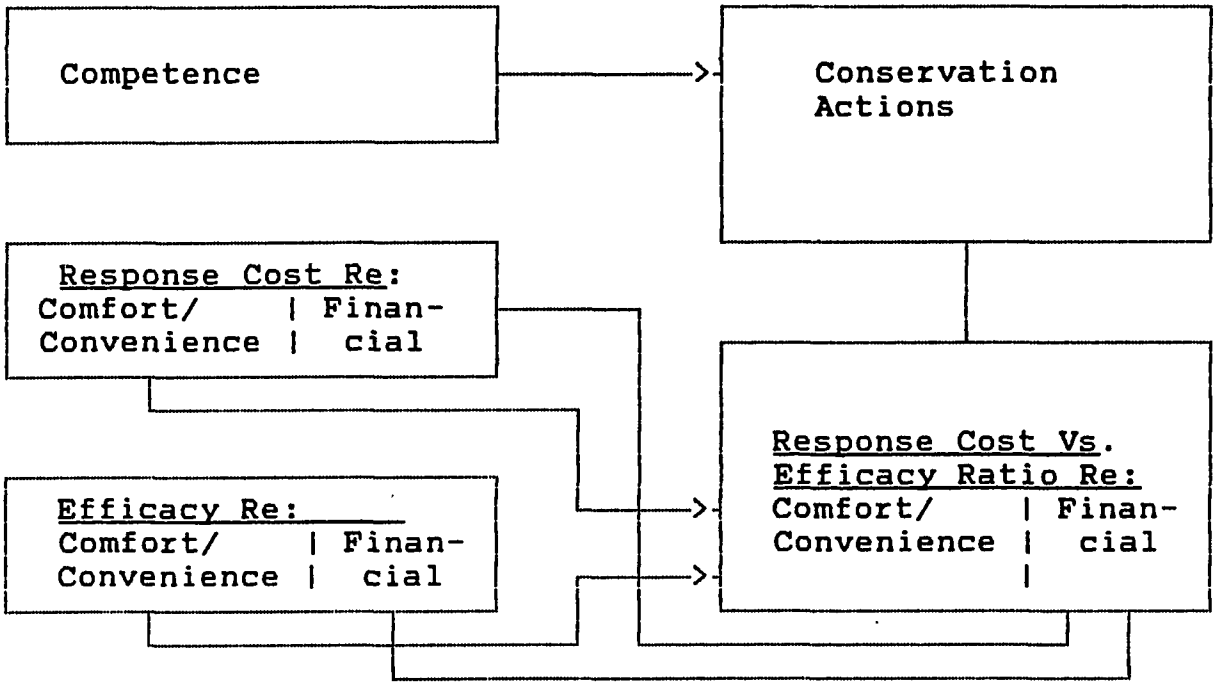
Pretest 3.

The revised questionnaire was reviewed by staff of the New York State Office of Energy Conservation in Albany, revised further, and then tested on another small sample of about 30 homeowners. The respondents for the third pretest were recrutied from systematically sampling passengers on the Staten Island Ferry in order to obtain a more representative cross section of homeowners.

Factor analysis of the resulting data revealed a much clearer factor pattern than those obtained in the first two pretests - over half of the total variance was explained by just four factors; approximately 71% of the total variance was explained by the first six factors. Although the

Figure 24.

Model II.



interpretation of some factors is open to debate, in other cases the interpretation seems reasonably clear. The major factors, as described from my initial interpretation, are listed below:

Factor 1. Competence re: general energy conservation theory.

Factor 2. Competence re: specific energy conservation skills and knowledge.

Factor 3. Economic efficacy of energy conservation.

Factor 4. Perceived major (or unknown) financial and behavioral committment and risk.

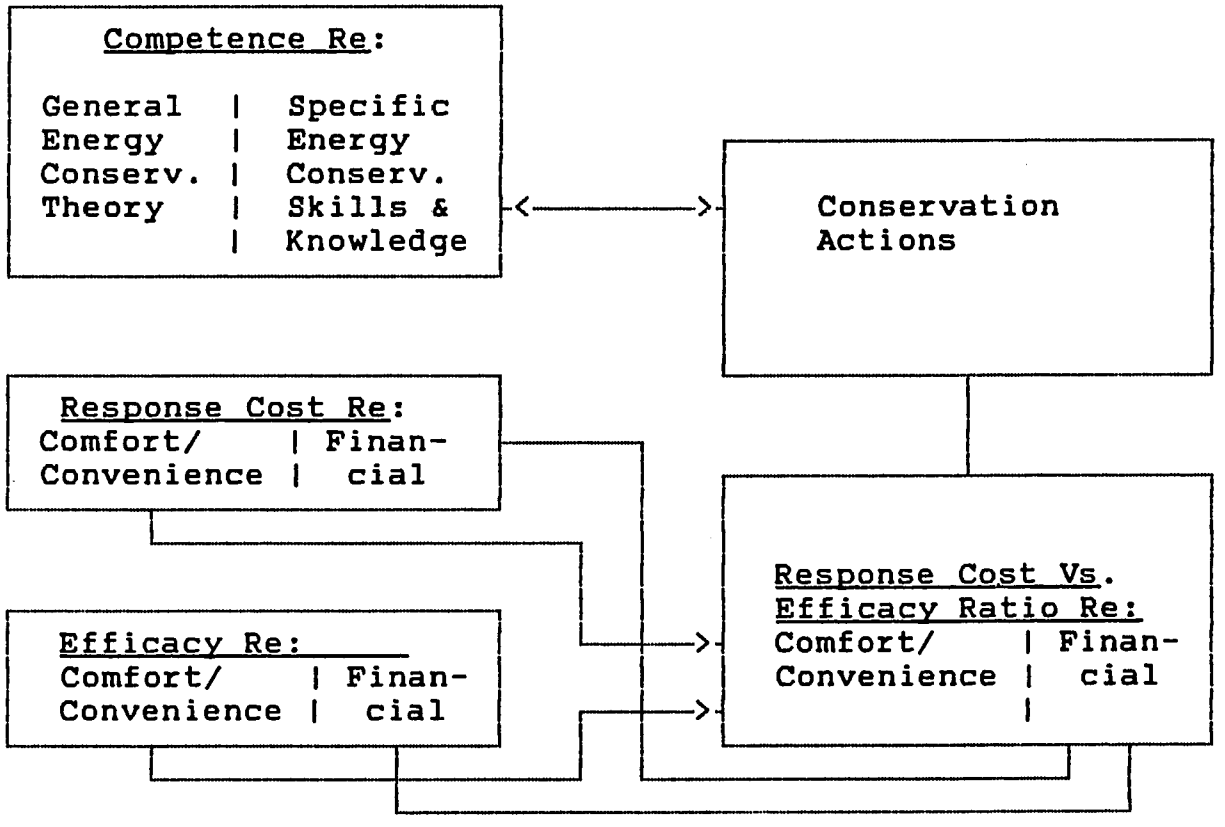
Factor 5. Comfort/convenience re: general lifestyle.

Factor 6. Comfort/convenience re: time and worry, thermal comfort (or response cost re: time and worry, comfort, expense.)

The factors that emerged from this analysis are generally consistent with the concepts proposed in Model II but suggested that the concept of competence might best be separated into two levels-one involving general energy conservation theory and issues and one involving competence with regard to specific conservation skills and knowledge. This refinement is indicated in Model III (see Figure 25.).

Figure 25.

Model III.



Conclusions:

Since the samples in the three pretests were very small (approximately 30 in each of the pretests), the factor analyses reported here must be considered at best suggestive. However, they appeared to have been useful for heuristic purposes. Based on these preliminary data, it was tentatively concluded that the attitude questionnaire used in pretest 3 appeared to be a potentially useful energy conservation attitude instrument. The resulting data seemed consistent with some of the major findings of the Princeton research (Seligman et al., 1979) but also appeared to differ in some important respects. However, to establish the validity of the instrument, it was necessary to correlate scores on this questionnaire with some criterion. To accomplish this, an energy conservation action and intentions index, derived partly from previous such indicies (see methodology chapter), was added to the energy attitude questionnaire used in pretest 3. This instrument, with some revisions, is the basic instrument used in collecting the data for the main study reported here; Model III, which grew out of these pretest findings, served as an important reference point for the hypotheses of the main study.

APPENDIX B. RESEARCH INSTRUMENT

The following is a list of statements about energy conservation. Please indicate your agreement or disagreement with each by checking the choice that best corresponds to your beliefs.

1. Strongly Agree
2. Agree
3. Agree Somewhat
4. Undecided
5. Disagree Somewhat
6. Disagree
7. Strongly Disagree

1. Worrying about saving energy requires too much time for the average person.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2. Improving your home's energy efficiency is inexpensive.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
3. If all Americans conserved energy at home, there would probably be a real impact upon the nation's overall energy consumption.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
4. Energy conservation is like flossing your teeth-you have to really work at it every day if you want results.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
5. I don't think I could explain to others what energy conservation is about.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
6. I understand how heat is produced and distributed in my house.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
7. We don't really know how well most energy conservation techniques work.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
8. Energy conservation measures can increase your comfort.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
9. Few energy conservation measures can make a large difference in household fuel bills.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
10. I am good at using hand tools and handy at home improvements.	(1)	(2)	(3)	(4)	(5)	(6)	(7)

11. You can't do much to cut home energy consumption except install storm windows or insulation.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
12. I would not know how to identify the best energy saving measures for my home.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
13. Saving energy requires a minimal amount of time and trouble.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
14. I would not know how and where to insulate to best cut heat loss.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
15. You can save a great deal of energy in the home without uncomfortable or unhealthy room temperatures.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
16. Improving your home's energy efficiency will not increase its resale value significantly.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
17. Low cost energy saving treatments for windows are unattractive.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
18. To save energy in winter you have to turn down the thermostat to cooler temperatures than you'd like.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
19. I feel capable of locating major sources of energy waste in my home.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
20. I feel capable of finding and plugging air leaks in my home.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
21. If you do the right energy efficiency improvements you won't have to give up comfort or convenience.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
22. Energy conservation is pretty mysterious to me.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
23. Low cost energy conservation measures could not eliminate uncomfortable cold spots im my house.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
24. You don't have to change your daily lifestyle to save a lot of energy.	(1)	(2)	(3)	(4)	(5)	(6)	(7)

25. In view of the conflicting claims about energy conservation products, the average homeowner has to take a big financial risk when investing in energy conservation measures.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
26. Low cost energy conservation measures are cost effective.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
27. I am unclear as to how energy is lost through my house to the outside.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
28. Low cost energy conservation measures are quite easy to implement.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
29. Getting someone reliable to do home repairs is a major problem.	(1)	(2)	(3)	(4)	(5)	(6)	(7)

PART II

For each of the energy conservation actions listed below, please check the appropriate choice to indicate how likely it is you will do the action within the next 6 months.

(a) Very Likely
(b) Likely
(c) Undecided
(d) Unlikely
(e) Very Unlikely
(f) Did It Already
(g) Does not apply to my house or done before I moved in

30. Weatherstrip doors or windows.	(a)	(b)	(c)	(d)	(e)	(f)	(g)
31. Caulk air leaks on interior or exterior of house.	(a)	(b)	(c)	(d)	(e)	(f)	(g)
32. Install interior plastic or exterior glass storm windows.	(a)	(b)	(c)	(d)	(e)	(f)	(g)
33. Have burner or furnace efficiency tested and servicing performed.	(a)	(b)	(c)	(d)	(e)	(f)	(g)
34. Have a free utility energy audit.	(a)	(b)	(c)	(d)	(e)	(f)	(g)
35. Install a separate hot water heater.	(a)	(b)	(c)	(d)	(e)	(f)	(g)
36. Add attic or roof insulation.	(a)	(b)	(c)	(d)	(e)	(f)	(g)
37. Reduce hot water temperature to 120° F.	(a)	(b)	(c)	(d)	(e)	(f)	(g)

38. Insulate heat pipes or ducts. (a) (b) (c) (d) (e) (f) (g)

39. Install a low flow shower head. (a) (b) (c) (d) (e) (f) (g)

40. For questions #30-39, please circle the numbers corresponding to those actions which you did - or plan to do - yourself.

41. What was the average night time temperature you usually maintained in your home during the past winter? _____°F.

42. Approximately how much did you spend in the past 12 months on energy conservation materials or services for your home (not counting fuel or utilities)? _____

BACKGROUND INFORMATION (Please do not give your name)

Age____ Sex: ()M ()F Occupation: _____

Type of fuel used for heating: ()Gas ()Oil ()Other: _____

Are you a: ()renter ()homeowner: If homeowner, is it a: ()private home ()coop

If coop owner, # of apts. in your building: _____

How many years of school have you completed? ____

Approx. total household income last year before taxes:

() less than $10,000
() $10,000-$19,999
() $20,000-$29,999
() $30,000-$39,999
() $40,000-$49,999
() $50,000-$59,999
() $60,000-$69,999
() $70,000 or more

Did you take an energy credit deduction on your 1985 tax returns?()Yes ()No

Your ZIP code area? _____

Thank you for your participation.

APPENDIX C.

Correlations of Demographic Variables Vs. Energy Conservation Intentions.

Intention To Do Energy Measure (ECM)	Demographic Variables* Gender	Fuel Type	Education	Income	Zip Area	Age
30. Weatherstrip doors, windows	.13	.00	.17	.07	-.02	.01
31. Caulk air leaks	.11	-.06	.05	.10	.07	-.10
32. Install storm windows	.17	.04	-.04	.04	.11	.09
33. Furnace tested and serviced	.11	.31**	.05	.03	.08	-.03
34. Have free energy audit	.08	-.09	.13	.14	.03	-.04
35. Install hot water heater	.09	.08	.13	.08	-.14	.07
36. Insulate attic	.07	.03	.13	.03	-.02	-.03
37. Reduce hot water temp.	.02	-.02	.29*	.31**	-.02	-.07
38. Insulate heat pipes/ducts	.01	-.11	-.07	.10	-.05	.06
39. Install low flow shower head	.22*	-.03	.17	.18	.06	-.04

*Coding of demographic variables for analysis:
Gender: male=1, female=0; Fuel type: oil=0, gas=1; Education= actual total years of school; Income: $0-$29,999=1, $70,000 or more=7; Age= actual age.
*$p \leq .05$ **$p \leq .005$

APPENDIX C, cont.

Correlations of Demographic Variables Vs. Energy Conservation Actions.

Energy Conservation Action (ECM)	Demographic Variables[a] Gender	Fuel Type	Education	Income	Zip Area	Age
30. Weatherstrip doors, windows	.00	.06	-.01	.05	.12	.06
31. Caulk air leaks	-.01	.12	-.02	.08	.05	.05
32. Install storm windows	.13	-.04	.00	.11	.06	.10
33. Furnace tested and serviced	.04	-.15*	.10	.08	.04	.02
34. Have free energy audit	.10	.12	.14	.07	-.02	.00
35. Install hot water heater	.07	.13	.13	.33**	-.16*	.13
36. Insulate attic	.02	-.02	.09	.11	-.01	-.03
37. Reduce hot water temp.	.06	.07	.06	.18*	.00	.17
38. Insulate heat pipes/ducts	.19*	-.04	.10	.05	-.16	.02
39. Install low flow shower head	-.08*	-.02	-.06	.16*	-.05	.05
41. Avg. night temperature	.08	.20*	-.12	.00	.05	.03

[a]Coding of demographic variables for analysis: Gender: male=1, female=0; Fuel type: oil=0, gas=1; Education= actual total years of school; Income: $0-$29,999=1, $70,000 or more=7; Age= actual age.
*$p \leq .05$ **$p \leq .005$

APPENDIX D

Intercorrelations of Demographic Variables*.

	Gender	Fuel Type	Education	Income	Zip Area	Age
Gender	1.0	.08	.20*	.13	.10	.02
Fuel Type	.08	1.0	-.07	.08	.22*	.02
Education	.20*	-.07	1.0	.25**	-.08	-.18*
Income	.13	.08	.25**	1.0	.02	-.05
Zip Area	.10	.22*	-.08	.02	1.0	.03
Age	.02	.02	-.18*	-.05	.03	1.0

*Coding of demographic variables for analysis:
Gender: male=1, female=0; Fuel type: oil=0, gas=1; Education= actual total years of school; Income: $0-$29,999=1, $70,000 or more=7; Age= actual age.

*p.$\leq$.05 **p$\leq$.005.

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