ENERGY CONSERVATION AND PUBLIC POLICY:

THE MEDIATION OF INDIVIDUAL BEHAVIOR [1]

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Abstract. Efforts to influence individual behavior frequently assume, explicitly or not, that behavior is determined by individual attitudes and rational decision-making. New survey data on energy conservation show that the attitude and rational theoretical models are severely flawed. These data indicate there are three different forms of conservation behavior (habits, devices, and solar) rather than one alone, and that none of the three can be explained by simple formulations of attitudes and rational decision-making. These findings cast serious doubt on the utility of many current conservation policies and programs. Evidence on the factors that do affect conservation behavior is presented, and more promising paradigms for energy conservation policy are indicated.

Introduction

Energy conservation constitutes an important enigma for public policy. Broad analyses of the persistent "energy crisis" have concluded that conservation is indispensable to any solution (Stobaugh and Yergin, 1979), and studies of public opinion indicate pervasive concern about energy and widespread support for conservation (Olsen, 1981). Despite these auspicious premises, energy conservation remains an area in which concrete

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accomplishments are distinctly underwhelming.

Actual levels of energy consumption continue to defy simple formulations based on architecture (Socolow, 1978; Seligman, Becker, and Darley, 1978), suggesting that the unique qualities of individual consumers are more important than the inherent energy efficiency of a given building. At the same time, the factors that govern individual consumption levels remain largely unknown. Surveys commonly find that energy behavior is not readily explained by individual attitudes toward energy and conservation (Anderson and Lipsey, 1978) and, partly as a result, public policies and experimental programs designed to further energy conservation have reflected a confusing, atheoretical patchwork of approaches (Stern and Gardner, 1981; Morrell, 1981).

In the context of this fundamental uncertainty about the antecedents and "causes" of energy conserving behavior, it is not surprising that even the most costly and ambitious energy conservation programs have shown modest results (Seligman and Hutton, 1981; Archer, Aronson, Pettigrew, Condelli, Curbow, McLeod, White, 1983; Condelli, Archer, Aronson, Curbow, McLeod, Pettigrew, White, and Yates, 1983). Some of the most extensive of these programs have been conducted by large utility companies. Reviews of these programs have criticized design features that undermine the effectiveness of a program or make its evaluation impossible (White, Archer, Aronson, Condelli, Curbow, McLeod, Pettigrew, and Yates, 1983).

The "Attitude" and "Rational" Theoretical Models

In addition to important methodological defects, many of the largest energy conservation programs have relied, explicitly or not, on two vague theories concerning conservation behavior. The first might be called the attitude model of conservation behavior--the assumption that favorable attitudes lead to conservation behavior. This model further assumes that making people's attitudes more favorable will make them more likely to practice conservation.

The second vague theory might be called the rational model of conservation behavior--the assumption that people will perform conservation behaviors if these behaviors are economically advantageous and, further, that increasing fiscal incentives will make these behaviors more probable. According to the rational model, decision-making results from an informed assessment of costs and benefits.

Although rarely stated in precisely this form, these two theoretical premises pervade energy conservation programs. Influenced by the attitude model, utility companies have pursued extensive and costly advertising programs to induce consumers to conserve (Archer *et al.*, 1983; White *et al.*, 1983; Condelli *et al.*, 1983). Influenced by the rational model, the federal government, individual states, and specific utility companies have enacted tax credits, product rebates, and low or zero-interest loans to promote conservation and the acquisition of conservation devices (e.g., California Energy Commission, 1981).

These two theoretical premises are intuitively reasonable, and it is scarcely surprising that they have provided the foundation for so much public policy and so many conservation programs. Like all theories, of course, these two pervasive models imply testable propositions about real people and their behavior. In this paper, aspects of these two theoretical models are tested using new survey data. The emphasis in these data is on problematic links between policy efforts to encourage conservation, on the one hand, and the acts of individual consumers on the other. On the basis of this analysis, more pragmatic and theoretically more promising approaches to energy conservation policy are suggested.

Attitudes and the Limits of the Attitude Model

As a test of whether these conceptions implicit in public policies correspond to actual behavior, we conducted a telephone survey of a probability sample of households in Santa Cruz County of California between November, 1981 and March, 1982. The random-digit-dialing (RDD) method was used to ensure reaching unlisted as well as listed residential phones (Groves and Kahn, 1979; Waksberg, 1978). We completed 642 interviews for a satisfactory response rate of 73.2%, with most interviews requiring between 10 and 15 minutes. A thoroughly bilingual interviewer, using a Spanish-language version of the survey, questioned all respondents who wished to be interviewed in Spanish.

On all grounds, this coastal California county is an optimal site for an energy conservation survey. The county includes a major university campus, a community college, and other "progressive" institutions. Environmental concerns appear to be strong in this county, and the abundant sunshine combined with cool maritime temperatures makes alternative fuels such as solar highly practical.

At the attitude level, there is every indication that the potential for energy conservation is extremely strong. Our survey data indicate the energy situation is widely perceived as a serious and burgeoning crisis. When asked, "How serious do you think this country's energy situation is right now?," 43.1% of our respondents report that it is "extremely serious" and another 41.9% think it is "somewhat serious." When asked whether they feel the energy situation will improve, remain the same, or become worse in the next ten years, more than half (54.5%) believe it will become worse. These two survey items are significantly related to one another (chi-square = 36.33, $p < .001$). Those who think the energy situation is serious also say it will worsen. This grim expectation characterizes roughly half of our respondents; 49.2% indicate they believe the energy situation is presently serious and will become worse.

The somber outlook found in our data is comparable to nationwide survey results. In a review of six studies, for example, Olsen (1981) discovered that between 40 and 60 percent of survey respondents believe that we are faced with an energy crisis that is both serious and chronic. In our survey data, this belief varies somewhat by demographic and other background variables, as shown in Table 1. As the figures in this table indicate, the perceived seriousness of the energy crisis is related to three variables: education, age, and gender. In addition, expectations for the future are related to age and home ownership.

At face value, these attitudes seem extremely auspicious for energy conservation. Given these high levels of concern, one might well expect actual conservation behaviors to be widespread. The attitude model of conservation behavior implies a direct relationship between attitudes about the energy situation and actual conservation behavior. Specifically, as peoples' views of the current and future energy situations become more severe, this model assumes they will engage in more conservation behaviors. This theoretical model seems eminently plausible, and many energy policies and programs have been predicated on improving attitudes toward energy conservation (Archer et al., 1983; White et al., 1983; Condelli, et al., 1983).

Despite the apparent reasonableness of the attitude model, the research literature from social psychology suggests that the attitude-behavior link is rarely consistent, direct, or very strong (Ajzen and Fishbein, 1977; McGuire, 1968; Olsen, 1981). Consistent with these somewhat counter-intuitive findings, our survey data contain no evidence of an impressive relationship between energy-related attitudes and conservation behaviors. Individuals more concerned about the energy crisis or more likely to believe that the situation would become worse did not differ in general from other respondents in terms of their energy conservation behaviors. This attitude-behavior disjunction has obvious significance, since conservation behaviors (and not attitudes) are the energy policy goals of consequence.

As a test for an attitude-behavior relationship in our energy data, analyses of variance were performed separately for the two attitude variables, each coded in three levels: (1) the perceived seriousness of the current energy situation (not serious, somewhat serious, extremely serious) and (2) belief in the likely future of the energy situation (will improve, remain the same, will get worse). Each three-level attitude variable was combined with home ownership (own, rent) to form two 3x2 factorial designs. Using each of these two 3x2 designs, four ANOVAs were run for the following four behavioral measures (described later in this paper): (1) the respondent's self-reported effort put into energy conservation; (2) a Guttman scale of four self-reported conservation habits (closing drapes, conserving hot water, turning off lights, and recycling); (3) a Guttman scale of four self-reported one-shot device installing behaviors (installing insulation, weatherstripping, low-flow shower heads, and hot-water heater blankets); and (4) the total number of pieces of solar equipment installed in the home.

A total of eight ANOVAs were run, with a sample size of over 600. Despite the considerable statistical power and also the inflated alpha values in this analysis, only two significant effects (both weak in absolute size) were found for the attitude variables. Respondents who felt the energy situation was extremely serious self-reported greater effort toward energy conservation ($F=3.47$, $df=2,636$ and $p < .05$). In addition, respondents who said they thought the energy situation would improve reported higher levels of conservation habits ($F=5.20$, $df=2,636$ and $p < .01$).

Even though eight ANOVAs were performed with this large sample, no other attitude differences even approached significance. In addition, there are reasons to be circumspect in assessing the two modest attitude differences that were found. For example, questions about self-reported habits tend to be value-laden and therefore invite bias (e.g., "Do you conserve hot water while showering?"). Finally, it should be noted that the practical significance of these relatively minor conservation habits seems doubtful. Evaluations of the relative importance of different conservation strategies consistently find that such habits have little effect on energy consumption and, in addition, are difficult to sustain (Stern and Gardner, 1981).

As a second test for a possible attitude-behavior relationship, respondents were asked an open-ended question about the <u>reasons</u> for their expectations that the energy situation would improve, worsen, or remain the same. Answers were coded into several categories ("oil companies will find more energy", "government policies will change", "coal or nuclear will become more important", "individuals will conserve", etc.). Again, there is little evidence for the attitude model. People who cited conservation as the most important factor in the energy future were, in fact, no more likely to practice it. These respondents did not differ from others on <u>any</u> of our conservation measures.

In summary, there appear to be no important relationships between respondents' attitudes toward the energy crisis and actual conservation behaviors. This null result raises serious doubts about the efficacy of energy conservation programs and policies predicated on the attitude model.

<u>Public Understanding and the Limits of the Rational Model</u>

Public understanding is a key element in rational theories of energy conservation. This theoretical model assumes that people need an <u>awareness</u> of and an <u>understanding</u> about conservation incentives to determine whether a given device or change is cost-effective for them. Understanding also seems implied by the attitude model since this model assumes that even if individuals are favorable to conservation, they need to be <u>aware</u> of conservation programs in order to take advantage of them. Implicit in both theories, therefore, is the notion that high levels of public awareness and understanding are indispensable to widespread conservation. These theories also posit several other variables (favorable attitude, substantial personal energy costs, disposable income, etc.), but both theories regard awareness and understanding as <u>necessary</u> for successful conservation.

Our survey data indicate that this apparently reasonable assumption also contains serious flaws. Consider first the apparent poverty of public understanding. Even in an energy-conscious area in which attitudes toward conservation are highly favorable, levels of public understanding remain problematic. Table 2 presents data on public awareness and understanding of four conservation programs. Data are given on both "claimed awareness" (the respondent's stated familiarity with a given conservation program) and "accurate information" (the respondent's ability to provide concrete information about this program). This difference is similar to the distinction in marketing research between "claimed recall" and "proven recall"--in the latter case, the respondent is asked to provide some minimal evidence that the claimed awareness is genuine. In coding respondent answers, we sought to be generous. For example, in a question about the solar tax credit of 55%, any answer between 45% and 65% was accepted as accurate.

The evidence suggests that the difference between claimed awareness and accurate information is substantial. Between roughly one-half and three-quarters of all respondents <u>claimed</u> familiarity with four conservation programs: (1) <u>Peak Load</u> usage and efforts to encourage use of electric appliances in non-peak hours, (2) <u>Home Audits</u> of household energy consumption and needed conservation improvements, (3) <u>Graduated Rate Structure</u> of utility charges to encourage conservation, and (4) <u>Solar Credits</u> that returned up to 55% of the cost of solar devices to the consumer in the form of tax credits.

As shown in Table 2, however, <u>accurate</u> or proven information about these programs was much more rare and, in some cases, negligible. In the case of three conservation programs, fewer than one respondent in eight understood the nature of the program, even using generous criteria for accurate understanding. This contrast in Table 2 demonstrates that studies of public understanding of policies and programs must include measures that tap <u>genuine</u> information levels, not merely claimed information levels.

In part, this apparent contradiction may reflect the well-known problem of "social desirability" (Crowne and Marlowe, 1964; Rosenthal and Rosnow, 1969)--in this case, the understandable desire of respondents to appear well-informed. This interpretation is supported by the relationship between awareness and background variables. Claimed awareness is more strongly related to the background variables in Table 2 (Median *c* = .18) than is accurate awareness (Median *c* = .12). This suggests that higher status respondents may have felt, more than lower status people, a need to appear well-informed.

The contrast between levels of claimed awareness and proven awareness is not only interesting but also consequential. Studies using only measures of *claimed* familiarity run the clear danger of greatly *over-estimating* the degree to which a policy has been successfully communicated. Since such measures are in common use in research on energy policy and energy conservation (Archer *et al*., 1983; Condelli *et al*., 1983; White *et al*., 1983), the *evidence* in this table has obvious implications for evaluation research.

The principal implication of these data for energy policy concerns the apparent potential for successful conservation programs. Our data suggest that accurate public awareness and understanding of conservation programs are in fact minimal. In terms of attitude and rational theories of energy conservation, public understanding is a link that is largely missing, even if it is as vital a link as these theories imply. Coming on the heels of extensive utility advertising, and obtained in a region characterized by strongly pro-conservation attitudes, these survey data reflect surprisingly scant evidence of widespread public understanding of conservation programs.

If public awareness of conservation programs is indispensable to effective conservation, as attitude theory and rational theory both seem to imply, the evidence presented in Table 2 presents a dim prospect. These theories assume accurate understanding is directly tied to conservation behavior, and that low levels of the former necessarily are associated with low levels of the latter. This formulation implies other, more dynamic assumptions as well--for example, that *increasing* public understanding will also *increase* conservation behaviors. This assumes that a link between understanding and behavior exists and, further, that this relationship is causal rather than merely associative.

Judging from our survey data, the link between understanding and conservation behavior is more tenuous and complicated than this simple formulation implies. In the case of several major conservation behaviors, there is little evidence that an understanding of conservation incentives and policies is a necessary condition, or even particularly important. For example, if one examines the decision to purchase four types of major solar equipment (a solarium, solar hot water heater, solar space heater, solar pool or spa heater), the role played by accurate understanding is far from clear. For each of these four major solar purchases, ownership of a solar device was only weakly related to accurate understanding of the solar tax credit (median *phi* = .05), and the relationship was in fact negative in one instance--solarium owners knew less about the solar tax credit than non-owners.

A small effect for accurate understanding does appear if one eliminates renters from the analysis. For this smaller subsample, 27.9% of the home owners who have a major solar device understand the solar tax credit, while 13.9% of the home owners who do not have a major solar device understand the solar credit. This relationship is statistically significant (*chi square* = 4.71, *p* = .03) but weak (*phi* = .12). In addition, this finding shows that approximately three-quarters of the home owners with a major solar device did *not* have even a crudely accurate understanding of the solar tax credit.

This result appears to contradict a *central* tenet of the rational model: that people determine whether important conservation devices are cost-effective, and that they make this rational calculation by weighing relevant information about costs. Our data suggest that information indispensable to even gross cost calculations was, in fact, absent. It is possible, of course, that respondents forgot important details of conservation programs following their major purchase, or that a member of the household other than the respondent made the decision to invest in costly solar equipment. At the very least, however, this finding raises serious questions about the relationship between policy awareness and conservation behavior.

Note that this test of the rational model errs, if anything, in favor of the model. For one thing, far from assuming full and sophisticated information, we have coded respondent answers using extremely lenient criteria for accuracy. In addition, we have made no effort to correct or subtract for the effects of guessing. Respondents were invited to provide answers to each question and, as is the case in a multiple-choice question, some would have produced a correct answer by guessing alone. For these reasons, it is clear that we have measured *minimal* information and have been generous in deciding whether respondents possess it. In the case of major solar purchases, for example, it is difficult for rational theory to explain how people could have made these major expenditures without even the essential cost information requested in our survey.

This analysis errs in favor of rational theory for a second reason. Our data are cross-sectional and, from the point of view of conservation device purchases, *post hoc*. Even in the infrequent cases in which respondents with solar devices were well-informed about solar tax incentives, therefore, we cannot eliminate the possibility that they became well-informed *after* their purchases. Rational theories of energy conservation imply that individuals understand relevant incentives *prior to* purchasing conservation devices, and that this understanding plays a role in calculating cost-effectiveness. Since our survey data are cross-sectional, critics of the rational model can argue the purchase led to the understanding, rather than the other way around (Ehrlich, Guttmann, Schonbach, and Mills, 1957). From these results, we conclude that the rational model does not provide a convincing or powerful explanation of how people decide to undertake energy conservation.

Alternative Theories About Energy Conservation Behavior

If attitudes and policy awareness are not strongly associated with conservation behavior, the simple relationships implied by attitude and rational theories of conservation do not exist. In their absence, it becomes important to ask whether there are any predictors that are linked with conservation behaviors. At the outset, many conceptions of energy conservation understate its complexity. Treatments of this subject often speak of "increasing conservation" or "encouraging conservation" as if a single act is involved. This simplification seems unwarranted, and Table 3 lists the diverse forms of conservation addressed in our survey. These data indicate that conservation incidence varies markedly between homeowners and renters, and across different types of conservation.

Conservation habits such as turning off lights and closing drapes and shades are performed most often. These actions require no capital investment and small inconvenience, but must be performed on a habitual basis to produce any energy savings. Other conservation habits, such as recycling and using alternate modes of transportation, are performed less often. These actions are more inconvenient and, therefore, require higher levels of commitment to be effective.

Although there are a few exceptions, homeowners and renters report similar levels of these habitual actions. Homeowners are more likely to report they conserve hot water, presumably because homeowners own more clotheswashers and dishwashers, and renters more often live in master-metered dwellings. Renters are more likely to use alternate modes of transportation because they are less likely to have the money to own and operate an automobile. Indeed, the median annual family income of renters in our survey was nearly $9,000 less than that of homeowners ($10,400 vs. $19,250).

Device-oriented actions, such as installing insulation or a water heater blanket, are performed less often. These "one-shot" efficiency behaviors require some initial capital investment, but do not require a commitment to change one's lifestyle or acquire new habits. For this reason, conservation devices are more likely to produce substantial energy savings than conservation habits (Stern and Gardner, 1981). Once the device is installed, energy savings accrue independent of the resident's motivational level. Homeowners are much more likely to install these devices, presumably because they benefit financially from home improvements while renters do not. There is only a single conservation device on which renters and owners do not differ--low-watt bulbs, which require little cost and no permanent improvement of the dwelling.

Solar devices, such as a solarium or solar water heater, are found far less frequently in our sample. This is not surprising, since many solar devices require the outlay of considerable capital. For example, the "first costs" of a solar hot water heater are approximately $2500, although tax rebates and utility incentives could make the final cost of such a system as little as $700 during the period of our survey. Other solar devices, such as skylights, are much less costly, but are still relatively uncommon in our sample. Again, homeowners are more likely to take these actions, although the differences are not large.

Three Types of Conservation Behavior

Rather than one coherent dimension, the evidence suggests that the general rubric of "energy conservation" contains at least three independent factors. Three different measures were constructed from the items in Table 3. Table 4 shows the item orders, marginals, and coefficients for two small Guttman Scales: the Conservation Habits Scale and the Conservation Devices Scale.

For each measure, one of the five items listed in Table 3 was dropped and two others were combined to form three-item cumulative scales. For the Habits Scale, the alternative transportation item revealed only low associations with the other habit items and was omitted from the Scale. This item was also strongly related to SES, with poorer, less educated respondents reporting more use of transportation forms other then the private car. Hence, bike and bus riders in our sample may avoid the use of cars for economic reasons apart from energy considerations. Consistent with this interpretation, observe in Table 3 that this was the only item that yielded a significantly greater response from renters than homeowners.

For the Devices Scale, the low-watt lightbulbs item also was omitted because of modest relationships with the remaining items. Indeed, Table 3 shows it to be the only one of the five Devices items that failed to uncover a significant difference between renters and owners. This may mean the item is strongly influenced by "social desirability," and the high marginals provide support for this interpretation. In addition, we may have erred by defining low-wattage at 60 watts or less; a reduced wattage definition - say, 40 watts or less - might have proved more discriminating.

These two short Guttman scales yield similar coefficients. Both have a reproducibility of .88, approximating Guttman's recommended standard of .90. For scalability, the coefficients are .63 and .66, slightly higher than the recommended standard of .60. With these acceptable characteristics, the Conservation Habits and Conservation Devices Scales constitute two of our three primary measures of energy conservation behavior.

Solar adoption is the third conservation measure, though its items do not allow scaling. Solar devices are still uncommon even in California's sunny Santa Cruz County. Only three members of the sample of 642 reported as many as four of the solar devices listed in Table 3 - a mere 0.5%. Only 14 more (2.2%)

reported three devices, 31 (4.8%) reported two, and 87 (13.6%) reported one. The vast majority (79%) reported no solar devices. Moreover, Table 3 reveals the lower-cost items (skylights and greenhouse windows) predominated, with homeowners listing many more solar devices than renters. We use the Solar Devices measure in two ways: as a continuous variable with a square-root transformation (to reduce the effect of wild scores), and as a three-way categorical variable (none = 79%, one device = 13.6%, and two or more devices = 7.4%).

These three measures of energy conservation behavior (Habits, Devices, and Solar) are logically separable; they measure contrasting strategies of conserving energy. In addition to this conceptual distinctiveness, empirical analysis indicates the three measures are essentially independent. Table 5 provides the Pearson correlation coefficients among the three conservation measures, and these relationships are shown separately for homeowners and renters.

For both groups, there is no relationship between the Conservation Habits Scale and the measure for Solar Devices--indicating that high levels of conservation habits are not systematically associated with solar energy. This finding shows that these two major conservation strategies are unrelated. This suggests the existence of two very different orientations: one stressing the efficiency of conventional energy use (i.e., changing minor energy habits), and another stressing alternative fuels (i.e., solar).

For both owners and renters, there is a small and statistically significant positive relationship between the Conservation Devices Scale and the Solar Devices measure. This indicates that individuals who own non-solar conservation devices are slightly more likely to own solar devices as well. This finding could mean that individuals decide to acquire different types of conservation equipment simultaneously. Alternately, this finding raises the intriguing possibility that adoption of any conservation device may make the adoption of additional devices more likely.

The third relationship, between the Habits and Devices Scales, differs between owners and renters. Among renters, for whom conservation devices often are installed and owned by landlords, there is no correlation between the scales. Among owners, there is a small but statistically significant positive correlation between the two strategies of energy conservation. This difference reflects not only the greater income of owners but also the fact that owners are, more than renters, free to implement energy conservation. Lacking ownership, renters have few or no incentives to install many conservation devices, and this structural condition makes a consistency between habits and devices improbable for this group.

The principal message of Table 5 is not the three significant coefficients so much as the general absence of covariance between the measures. From this general lack of relationships, we conclude that energy conservation is best conceptualized as involving three essentially unrelated types of behavior and two contrasting populations - renters and homeowners. This framework guides the remainder of our analysis.

Predictors of Three Types of Conservation Behavior

We conducted a series of stepwise regression analyses to discover the structural, demographic, and attitudinal predictors of the three types of conservation behavior. Based on zero-order correlation matrices, a total of 34 independent variables from different survey items were entered in the initial regressions. The Guttman scales for Conservation Habits and Conservation Devices were used as dependent variables along with an additive scale (with a square-root transformation) as the measure of Solar Devices. Since these three dependent variables were analyzed separately for owners and renters, a total of six regressions were performed. Table 6 summarizes the predictors of conservation habits, Table 7 the predictors of conservation devices, and Table 8 the predictors of solar devices in the home.

The best predictor of conservation habits is the respondent's self-reported effort to conserve energy (Table 6). This is logical but also somewhat tautological since the habits involved obviously require some effort. For renters, self-reported effort was the only significant predictor. This variable was an important predictor for owners as well, but the picture is more complicated. For owners, a high score on the habits scale also was associated with a reported seeking of information about energy conservation; a belief that utility companies should promote conservation by distributing energy-conserving devices (e.g., water heater insulation blankets) free of charge; and a belief that America's energy situation is worsening. Finally, the amount of the last energy bill (using a natural log transformation) is positively correlated with conservation habits.

Table 7 reveals a different pattern of predictors. While reported conservation habits are associated with various beliefs and preferences, the major predictors of device installations are structural and demographic. When owners and renters are aggregated, home ownership accounts for 14% of the variance, and socio-economic status (SES) accounts for an additional 8%--specifically, high SES homeowners are more likely to install energy-conserving devices. This is undoubtedly because these devices require a financial investment that is both more affordable and more practical for high-income homeowners than for any other group.

The predictors of device installations are slightly different for owners and renters. The best predictor for both groups is SES, followed by a tendency to seek information about energy conservation. High information-seekers were likely to know about the home energy audit program, to report they read informational bill inserts, and to request a copy of our survey results. It appears that these people are interested in and favorably predisposed toward energy conservation. The presence of a household member capable of performing automotive and home appliance repairs was also predictive among owners. The availability of a "handyperson" reduces installation and maintenance costs of conservation devices and renders such devices more comprehensible. Self-reported effort made to conserve energy is the final predictor of device installations--people who have installed energy-conserving devices perceive themselves as having made a relatively large effort to conserve.

The pattern is similar among renters in that SES and information-seeking emerge as major variables. However, two additional predictors emerge for renters: knowledge of financial incentive programs for conservation and ownership of home technologies. This second variable was constructed from a question that asked about five consumer products: microwave ovens, home computers, home video games, video recorders, and hot tubs. This "hi-tech" variable can be interpreted in two ways. It could be that people who own these types of non-energy technology are favorably disposed to all forms of technical innovation, including energy conservation devices. In addition, this variable may also be a measure of a unique and highly specialized form of disposable income. The "high-tech" variable may reflect a tendency and the financial capacity for non-essential expenditures on innovative technical systems and equipment.

Table 8 summarizes the best predictors for solar devices. Consistent with network theory (Darley and Beniger, 1981), the strongest predictor was whether the respondent mentioned a friend or other personal contact as a source of information about solar. It is interesting that this "personal contact" variable is a significant predictor, while the mention of mass media information about solar was not. This finding emphasizes the pivotal importance of <u>social networks</u>, and suggests that solar technology may show a pattern of <u>social diffusion</u> similar to that observed for other innovations (Rogers and Shoemaker, 1971).

The installation of many types of solar equipment requires substantial initial investment and therefore favors people with high incomes. As a result, our analysis shows that SES was the second strongest predictor of solar equipment. Ownership of home technologies, a measure we conceive as reflecting a special form of disposable income, was the third best predictor. Again, this "high-tech" measure of disposable income suggests that people who find technology appealing in general are especially likely to be early adopters of solar technology.

The last three predictors of solar devices for owners are knowledge and opinion variables. Solar users tended to know the tax credits available for the installation of solar equipment. Of course, we do not know whether the solar users in our sample learned about the tax credits before or after they installed solar equipment. In addition, solar users mention few economic disadvantages of solar energy and are able to list a relatively large number of uses for solar in the home.

Better Models for Energy Policies

The evidence examined in this paper suggests that two influential paradigms for changing behavior are seriously flawed and, as a result, that energy policies based on these paradigms are ill-conceived. The first of these theoretical paradigms, the attitude model, errs in its key assumption that attitudes bear fruit in behavior, and that making attitudes toward energy conservation more favorable will make conservation behaviors more likely. The second paradigm, the rational model of individual decision-making, overstates greatly the degree to which people possess and understand even the most elementary forms of vital cost information. These flaws appear to be fundamental, suggesting that policies predicated only on changing attitudes or creating incentives are likely to fail.

In addition to evidence contrary to the attitude and rational paradigms, this paper explores briefly the nature of more promising alternatives. The survey results discussed show that there are three distinct types of conservation rather than one alone. These three types of conservation behavior--habits, devices, and solar-constitute contrasting strategies of energy conservation and are essentially unrelated. Our findings indicate that some significant correlates of conservation, such as social class and home ownership, are relatively fixed structural variables--suggesting that more than a single energy policy may be required. As an example, the factors that prompt conservation by homeowners are clearly unlike those that affect renters, and equitable energy policies must be designed to impact both groups.

The analysis also identifies other important predictors of conservation behavior, including several variables that are more promising in their implications for policy. Three examples are the findings that "high" conservers have: (1) a household member capable of making minor repairs, (2) friends or acquaintances who introduced them to energy information and devices, (3) other relatively costly technical devices and equipment. While the details of conservation programs necessarily vary across jurisdictions, these findings suggest promising policies could be developed that (1) offer to provide or arrange conservation device installation in individual homes, (2) use "social diffusion" and networks to introduce homeowners to specific conservation devices and alternative fuel devices such as solar systems, and (3) identify potential "high" conservers from the ranks of individuals who purchase other items of high technology equipment.

These are just three examples, but policies such as these would correspond more faithfully to the ways in which individuals make energy decisions. As a result, they would be much more likely to bear fruit in increased conservation.

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Table 1

Attitudes Toward the Energy Situation

Characteristic (n)		Percent who said the energy situation is serious (a)	Percent who said the energy situation will become worse
Education			
H.S. or less	(291)	79.4 ***	49.8 *
College	(276)	88.8	58.0
Grad School	(75)	93.3	60.0
Age			
18-24	(94)	84.0 ***	59.6 **
25-34	(172)	89.5	62.8
35-44	(120)	92.5	57.5
45-54	(52)	84.6	44.2
55-64	(79)	83.5	54.4
Over 65	(95)	69.5	37.9
Gender			
Female	(339)	89.4 ***	56.3
Male	(205)	77.6	54.6
Home Ownership			
Rent	(254)	87.0	61.0
Own	(388)	83.8	50.3
Family Income			
Under $15,000	(318)	82.7	54.1
$15,000-30,000	(192)	86.5	55.2
Over $30,000	(132)	88.6	54.5

(a) Includes those who responded "somewhat serious" and "extremely serious."
* Chi-square significant, $p < .05$; ** $p < .01$; *** $p < .001$.

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Table 2

Public Understanding of Energy Conservation Programs: Claimed Awareness vs. Accurate Information (a)

	Program			
Awareness vs. Accurate Information	Peak Load	Home Audit	Graduated Rate	Solar Credit
Per Cent "Aware"	78.1	56.7	44.1	72.0
Rent	79.8	43.8	29.7	67.5
Own	77.3	64.8	53.8	75.0
High School	72.7	51.0	36.4	55.1
College	82.4	61.1	47.3	85.5
Grad. School	86.3	71.1	67.1	94.7
Under $15,000	71.9	50.9	32.4	63.8
$15,000 - $30,000	81.5	58.9	47.9	80.2
Over $30,000	89.1	67.4	65.6	86.4
Per Cent Accurate	41.3	1.4	14.3	13.2
Rent	42.2	0.0	9.6	10.0
Own	40.7	2.3	17.6	15.5
High School	38.8	0.0	11.0	6.8
College	42.8	1.8	16.4	17.0
Grad. School	47.4	5.3	21.1	23.7
Under $15,000	39.8	0.5	7.7	5.9
$15,000 - $30,000	47.4	1.6	19.3	15.6
Over $30,000	42.4	2.3	23.5	24.2

(a) Accuracy levels are generous. Respondents were given credit for an item if they were even partly correct - e.g., for the 55% solar tax credit, estimates between 45% and 65% were counted as correct.

Table 3

Self-Reported Incidence Rates

For Three Different Kinds of Energy Conservation

	Own	Rent	
Conservation Habits [a]			
Close all window drapes and shades at night	83.1 %	85.2 %	
Turn off lights when you leave the room	77.4	78.0	
Conserve hot water when showering, washing the dishes or clothes	59.8	50.2	*
Recycle some products	41.7	36.4	
Use transportation other than car	13.1	23.7	**
Conservation Devices [b]			
Insulation	78.4	37.4	**
Lo-watt lightbulbs (60 watts or less)	74.2	70.5	
Weatherstripping	73.2	44.9	**
Lo-flow showerhead	57.0	41.7	**
Water heater insulation blanket	38.9	13.8	**
Solar Devices [b]			
Skylights	17.5	7.9	**
Greenhouse window	6.2	2.0	*
Solar water heater	4.9	1.6	*
Greenhouse/solarium	4.4	1.6	
Solar heater for pool or hot tub	3.1	1.2	
Solar space heater	1.5	0.4	
Other solar equipment	4.1	1.6	

[a] Includes those who responded "almost always."
[b] Includes those who installed the device and those living in a home in which the device was already installed.
* These two proportions are significantly different at the .05 level; ** Proportions significantly different at the .01 level.

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Table 4

Conservation Scales

Conservation Habits Guttman Scale

Item	Item Description	Percentage Agreement
Item A:	Recycles Products AND Turns Off Lights	32%
Item B:	Conserves Hot Water	55
Item C:	Closes Window Drapes and Shades	82

Scale Types 4 = Items A + B + C = 19%
3 = Items B + C = 40
2 = Item C = 32
1 = No Items = 9

Total...............=100%

Coefficient of Reproducibility = .88
Coefficient of Scalability = .63

Conservation Devices Guttman Scale

Item	Item Description	Percentage Agreement
Item A:	Water Heater Insulation Blanket	29%
Item B:	Low-Flow Showerhead	51
Item C:	Home Insulation OR Weatherstripping (or both)	77

Scale Types 4 = Items A + B + C = 18%
3 = Items B + C = 36
2 = Item C = 32
1 = No Items = 14

Total...............=100%

Coefficient of Reproducibility = .88
Coefficient of Scalability = .66

Table 5

Pearson Correlations Between Three Types of Conservation

By Renters and Homeowners

	Conservation Habits Scale	Conservation Devices Scale
<u>Renters</u> <u>(N = 254)</u>		
Conservation Devices Scale	+ .01	---
Solar Devices (1)	.00	+.12* (+.13)(2)
<u>Homeowners</u> <u>(N = 388)</u>		
Conservation Devices Scale	+ .14** (+.16)(2)	---
Solar Devices (1)	- .01	+.14** (+.16)(2)

* p < .05
** P < .01

(1) Solar devices are measured as the square root of the number of solar devices reported by the respondent.

(2) Coefficients corrected for coarse grouping (5 categories for each variable).

Table 6

Variables Predicting Conservation Habits Scale

	BETA	Change in R-Square	Statistics
<u>Homeowners</u>			
Self-report of effort made to conserve energy.	.23***	.05	Constant= 1.34
Seeks information about energy conservation.	.14**	.02	Multiple R= .34
Belief that Utilities should give away energy-conserving devices free.	.13**	.02	R-square= .11
Belief that America's situation is improving.	-.13**	.02	
Natural log of amount of last utility bill.	.10*	.01	
<u>Renters</u>			
Self report of effort made to conserve energy.	.32***	.10	Constant= 1.77 Multiple R= .32 R-square= .10

Table 7

Variables Predicting Conservation Devices Scale

	BETA	Change in R-Square	Statistics
Homeowners			
SES	.28***	.08	Constant= 1.11
Seeks information about energy-conservation.	.22***	.05	Multiple R= .39
Household member able to do home repairs.	.15**	.02	R-square= .15
Self report of effort made to conserve energy.	.10*	.01	
Renters			
SES	.34***	.12	Constant= .22
Seeks information about energy conservation.	.24***	.06	Multiple R= .48
Knows about financial incentive programs for energy conservation.	.16**	.02	R-square= .23
Ownership of home technologies.	.16**	.02	
Self report of effort made to conserve energy.	.13*	.02	

Table 8

Variables Predicting Solar Devices in the Home (1)

	BETA	Change in R-Square	Statistics
Homeowners			
Mentions friend or other personal contact as source of knowledge about solar.	.28***	.08	Constant= .83
SES	.19***	.03	Multiple R= .42
Ownership of home technologies.	.16***	.02	R-square= .17
Accurately reports tax credits for solar.	.14**	.02	
Number of economic disadvantages cited for use of solar.	-.11*	.01	
Number of uses cited for solar energy in the home.	.11*	.01	
Renters			
Ownership of home technologies.	.17**	.03	Constant= 1.01
Number of uses cited for solar energy in the home.	.16**	.02	Multiple R= .23 R-square= .05

(1) The criterion variable for this set of analyses was the square root of an additive measure of solar devices in the home.

* p<.05

** p<.01

*** p<.001