Improving Utility Conservation Programs: Outcomes, Interventions, and Evaluations

Larry Condelli, Dane Archer, Elliot Aronson, Barbara Curbow, Beverly McLeod, Thomas F. Pettigrew, Lawrence T. White, and Suzanne Yates

Energy Conservation Research Group, Stevenson College, University of California, Santa Cruz

Abstract. Four major California utility companies have active energy conservation programs mandated by the State's Public Utilities Commission (CPUC). These companies evaluate their programs and send reports of the evaluations to the CPUC. A review of 213 of these reports revealed a marketing research approach toward promoting conservation. Advertising and informational campaigns characterize most programs, and attitudes and self-reported behavior were the major outcome measures. This approach is shown to be ineffective. Suggestions for improvement include: (1) the use of actual energy consumption as the primary outcome measure in evaluating conservation programs; (2) the abandonment of conventional advertising, and the use of it only for the promotion of "hard" interventions; (3) increased use of social diffusion methods to disseminate information; (4) the design of more effective educational material by incorporating cognitive social psychological principles; and (5) the utilization of "hard" interventions that have a direct, verifiable link to conservation.

Introduction

Since 1975, the California Public Utilities Commission (CPUC) has required the State's energy utilities to implement extensive conservation programs. The utilities must demonstrate that they have successfully achieved conservation as part of the rate hearings process. Each of the State's four major utilities regularly submits reports of their activities to the CPUC.

The CPUC asked our research group to assess 213 reports of this research conducted by the four utilities during 1977-1980.

This research was made possible by a contract to Archer, Aronson, and Pettigrew from the California Public Utilities Commission and by funds from the Systemwide Energy Research Institute of the University of California. An earlier version of this paper appeared in Energy, 1984, 9, 6, 485-494.

Our charge was to determine if the research evaluating the conservation programs was conducted properly, whether they had demonstrated energy savings, and ways in which future research could be improved. We uncovered numerous problems with these studies. Our purpose here is (1) to identify the most (and least) promising approaches to this body of research; (2) to describe common problems encountered in the implementation of these programs; and (3) to identify approaches that deserve high priority for future energy conservation programs.

The Nature of Utility Research

The research conducted by the California utility companies relies on the marketing research approach. In a marketing framework, advertising and other forms of public education are employed to produce changes in perceptions and knowledge about a product. This new information presumably results in more favorable attitudes that may lead to subsequent purchase of the product. Thus, the advertising or informational campaign is considered successful at least partly to the degree that attitudes and perceptions are enhanced or changed.

The California utilities treat conservation as a product to "sell." The vast majority of their conservation programs used advertising and such educational materials as bill inserts to promote favorable attitudes toward conservation. Conservation behaviors, such as retrofitting or lowering the thermostat, are assumed to result. The programs are considered successful if customers report favorable attitudes toward conservation or report implementing, or intending to implement, conservation measures.

Two typical programs illustrate this approach. One utility has several conservation centers located in shopping malls throughout its service area. These centers provide free information to consumers on the benefits of conservation and ways to make their homes energy efficient. To evaluate their effectiveness, the utility drew a sample of visitors who had left their name and address with the center and interviewed them by phone. The respondents were asked their reactions to the center, and if they had taken any conservation measures as a result of their visit.

A second utility undertook an advertising program in the summer of 1980 to motivate participation in two conservation programs: a pilot light turn-off and a peak load reduction program. To evaluate campaign effectiveness, consumer attitudes about the energy situation, conservation, and the utility were measured before and after the campaign. Advertising recall and whether the respondent reported having taken the recommended conservation actions also were recorded after the campaign.

The evaluations of these and similar conservation programs contain numerous methodological flaws. For example, no control groups were used in either of these studies, so the effects of secular changes cannot be ruled out. Further, in the evaluation of the conservation centers, the sample used was entirely self-

selected. Thus, based on these studies, we cannot reach conclusions about the effects of either program. Unfortunately, methodological errors of this sort characterize most of the research conducted by the California utilities. We have extensively critiqued the methodology of this work elsewhere. Beyond these methodological problems, however, there are basic difficulties with the marketing approach toward conservation.

To promote conservation successfully, fundamental changes in both the types of outcome measures and interventions utilized must be made. Since proper outcome measures are essential to all types of programs and interventions, we first discuss more promising outcome measures that can accurately indicate the energy saving effects of conservation programs. We then suggest more powerful interventions likely to be successful in promoting better conservation practices.

Outcomes: Assessing Program Effects

It is a popular misconception that there is a strong and consistent relationship between attitudes and behavior. In fact, the relationship between them is complex. Under some specifiable circumstances, an intervention that produces attitude change will also produce behavior consistent with the attitude; under other circumstances, it will not. We can illustrate this with a simple marketing example, where an attitude-behavior relationship may exist.

Suppose people were shown an advertisement for Crest toothpaste in which clear data are presented that it produces fewer cavities than other toothpastes. Suppose these viewers were then interviewed and asked how they feel about Crest's effectiveness. Social psychological research suggests most of the viewers would have increased their respect for Crest. Probably a substantial (but somewhat smaller) number would also claim to intend to use Crest. Only a small percentage of those who intend to use Crest, however, would subsequently buy it. Nonetheless, an ad campaign for Crest might be cost effective since the barriers to switching to Crest, habit and product loyalty, are minor. Toothpaste is something a person buys often and the prices are comparable among various name brands. So, while in the supermarket, the consumer might just as easily reach for Crest as for Pepsodent.

Energy conservation behaviors are different. It is much easier to try a new brand of toothpaste than it is to curtail a sharply pleasurable activity (such as keeping one's home comfortably warm in the winter). Considerably more expense is required to retrofit one's home or install solar water heating. Such behaviors require changes in lifestyle and behavior patterns, changes made with far greater difficulty.

Since there is little effort, expense, discomfort, or lifestyle change involved in switching toothpastes, it is tempting to conclude that, if we can only change attitudes, behavior change will follow. Decades of systematic research on the social psychology of persuasion have made it clear that this is an erroneous assumption. Thus, if the ultimate intent of an

intervention is to change behavior, it is not enough to measure a change in attitude, find such a change, and conclude that the intervention was successful. The California utility companies, however, often did exactly this; 85% of the 213 studies reviewed used attitude measures as the major dependent variable.

Cogent illustrations of the tenuous relationship between attitudes and behavior are found in the domain of energy conservation. This research consists of surveys of respondents' general attitudes about the seriousness of the energy crisis and their report about their own energy-conserving behavior. There is virtually no relationship in any of these studies. It should be emphasized that this is not a controversial generalization. In his painstaking review of the research in this area, Olsen could not find a single study which demonstrated a significant relationship between belief in the seriousness of the energy crisis and conservation behavior. This research consists of self reports of behavior. If anything, these findings might be biased in favor of a positive relationship because most people find it socially desirable to interpret their own behavior in a way consistent with their beliefs.

The utilities also used self-report behavioral measures extensively. Respondents were asked if they had taken a recommended conservation action, or if they intended to do so. These measures then were used to evaluate program effectiveness. But this procedure overestimates the effect of the program. There is a wealth of evidence attesting to the unreliability of this type of data. For example, Olsen and Cluett found no correlation between reported household conservation actions and the amount of actual energy saved in the households.

We found examples of this phenomenon in the utility research itself. One utility distributed a booklet describing what its customers might do to reduce consumption during peak load hours. The booklet invited customers to seek additional help and guidance from the utility. The study found that: "A total of 16% of the respondents indicated that they had requested or intended to request additional conservation help from [the utility]. However, at the end of six weeks, not one request had been received by [the utility] field personnel as a result of the booklet" (emphasis added).

In another utility study, roughly 30% of the people interviewed reported they had seen a specific advertisement about shutting off a pilot light before the ad had appeared. Another found that 82% of appliance dealers reported they were displaying conservation materials in their stores; but direct checks found only 56% were displaying the materials.

If these researchers had been satisfied with self-report data alone, they would have overestimated the success of these programs. While under limited circumstances attitudes, intentions, and self-reported behavior may be suggestive, they are not synonymous with behavior. If the goal of an intervention is merely to increase awareness of energy shortages as a problem, it makes sense to examine attitudes and awareness. But if the goal of the intervention is to alter consumer behavior, one cannot

safely assume that if awareness increases or if attitudes change, so too will behavior. Thus, it is unwarranted to conduct a study that measures only attitudes and to conclude that behavior will necessarily be influenced. Direct behavioral data are the best and most reliable index of the impact of an intervention. The bottom line for evaluating conservation research should be whether the program reduced actual energy consumption.

Measures of actual energy consumption are in many ways an ideal dependent variable. Units of energy are measured on a ratio scale, allowing the use of multivariate statistical procedures. They correspond exactly to the behavior of interest (i.e., energy use) and measure this behavior virtually without error. Further, these data are routinely and inexpensively available to utility companies, since meter readings are taken regularly for billing purposes. Yet actual energy consumption was used as a dependent variable in only 3% of the studies reviewed. To be sure, there are difficulties with using direct measures of energy use -- difficulties utility representatives claim made their use misleading in program evaluation. Their concerns center on the inherent "noise" in consumption data caused by confounding variables, and the so-called "rebound" effect. Neither of these problems, however, is so insurmountable as to preclude using measures of direct energy use in evaluating conservation programs.

Noise in consumption data. There are several extraneous factors that prevent energy use from being completely under the control of the user. For example, building characteristics such as its age and size, the presence of insulation, and air leaks partly determine energy efficiency. The weather is another important factor, as are the number of occupants in the building and the type of appliances owned. These variables make consumption data "noisy," that is, marked by a high degree of variability. This variable error makes interventions more difficult to evaluate, but fortunately, there are quasi-experimental designs that allow these factors to be controlled.

Time-series designs are especially promising. With these designs, changes in energy use patterns are evaluated for lengthy periods of time to determine a program's effectiveness. Such methods require a long baseline period, where energy use is monitored before a program is implemented. A large number of data points is necessary. No major changes should occur as a result of extraneous factors during this baseline period. For example, if an uncharacteristic heat wave occurred at this time, air conditioning use might rise, giving an inflated measure of energy consumption. Finally, the baseline period should include a range of control values of what may occur during the program intervention.

These requirements pose no problem to utility companies, who continually monitor all energy use. Utilities possess data on an impressive array of energy patterns -- where it is consumed, how much is consumed, changes in consumption, and individual and aggregate differences in its use. The range and depth of this body of information is, from a scientific point of view, enviable

and filled with potential. The large number of potentially confounding variables in energy use data thus presents no fundamental obstacle to utilities.

The rebound effect and energy efficiency. The rebound effect raises further issues in the use of consumption data. According to this argument, when a consumer installs energy saving devices, the cost of energy is subsequently reduced. Since energy is now cheaper, more of it will be used. For example, a family can heat their home for less money with insulation. Consequently, they will use more energy, such as by raising the thermostat, and thus cancel the energy saving effects of the insulation. Utility representatives argued that their programs could be effective in inducing conservation without producing an observable decrease in energy use due to this rebound effect. For this reason, they maintained that energy efficiency should be the criterion for evaluating conservation programs.

We find both the rebound effect and the efficiency criterion problematic. Specifically, we find four conceptual difficulties with the rebound effect. First, it implicitly assumes that consumers must be aware that energy is cheaper. They must be cognizant of the fact that the energy bill is less than it was before the conservation hardware was installed. If there is a savings in energy visible to consumers, it should also be visible to the utility - since both have the same billing data available to them. Thus, even if an individual who installed an energy saving device eventually opted for greater comfort over cost reduction, there should first be an measurable reduction immediately after the device installation.

Second, it is too simple to assume that if consumers save money on gas and electricity that they necessarily convert these savings into greater usage of that particular commodity rather than into the many competing uses for their savings. This assumption makes sense only if people are deprived. For example, if a family can only afford to heat one room in winter and then installs insulation, responding to a reduced bill by heating two rooms would not be surprising. But once a comfort threshold is met, there is no reason to expect families to open windows while the heat is blasting because they have insulation. More plausibly, the family would reinvest the saved income in whatever needs were more pressing.

A third problem results from the rising trend of energy prices. Due to this trend, consumers who install energy saving devices may well reduce their use of therms or KWH's and thereby achieve significant cost savings in the long run, while their monthly bill shows little change. As Kempton and Montgomery point out, however, consumers are more influenced by immediate dollar costs than by units of energy expended or even long-term cost savings. Hence the water heater insulation blanket generally is assumed to have a payback period of about one year for a $10-$12 investment. It is unlikely that the small savings reflected in the monthly bill would cause anyone to shower longer or wash more clothes. Yet the energy saved may be substantial and would be evident to the utility.

Finally, there is little empirical evidence that the rebound effect exists. There is, however, ample evidence to support the contention that with careful, well-controlled studies, conservation programs can be evaluated using actual energy use reduction as the dependent variable. Illustrations of this work are provided by Winett and by a host of studies reviewed by Yates and Aronson. One such investigation showed that consumers' public commitment to conservation goals resulted in substantial energy savings at the meter. Moreover, a follow-up study a year later continued to show the effects of this one intervention. The utilities' own research also failed to support the rebound effect. One utility conducted a before and after study of the effects of attic insulation on energy consumption. The actual energy consumed declined and no rebound effect was found.

Consequently, we question the argument that savings at the meter are unreliable. This is particularly the case when the argument provides no analysis about the conditions under which the alleged rebound effect is likely to occur. While the rebound effect enjoys a place in economic theory, it may not exist in this domain. The burden of proof is on those who believe in the effect. Meanwhile, this hypothetical argument cannot be used to argue against using consumption data as the dependent variable of choice.

Fundamental difficulties also result from using efficiency to evaluate conservation programs. At face value, energy efficiency appears useful as implying minimizing wasted energy. Yet, this is an area where definitions are crucial. The California utilities never clearly defined efficiency, nor did they explicitly articulate how they would measure it. Under some definitions, increased efficiency could be claimed even if actual energy consumption increases many times over. When we raised this issue with utility representatives, they agreed that simultaneous increases in energy consumption and efficiency were quite possible. This makes efficiency impossible to defend as a sufficient goal for conservation.

In addition, invoking notions of efficiency threatens to obscure program evaluation or even render it impossible. Efficiency can become a smokescreen used to describe any program as a success - including those followed by increases in energy use. By itself, efficiency is not directly observable, and increased efficiency can be alleged post hoc without evidence.

The success of conservation programs should depend ultimately on their ability to reduce energy consumption. Behavioral data are the best and most reliable index of an intervention. And to influence the behavior of energy consumers significantly, powerful interventions should be utilized. Unfortunately, the California utilities generally failed to implement the types of programs likely to have a meaningful impact on conservation behavior. We now turn to these interventions and offer alternative approaches that hold more promise for inducing conservation behaviors.

Interventions: Alternate Approaches

Many of the utility studies evaluated advertising programs. The goal of the advertisements was to interest people in and provide information about different conservation methods. This goal reflects the belief that these nonbehavioral changes are, in some way, prior to and necessary for behavior change. We have already shown this is a false assumption. Now we wish to emphasize that advertising itself, at least as currently implemented by the utilities, is an ineffective way to change conservation related attitudes and provide such information.

It is not surprising the utilities elected to use advertising extensively. This method is, after all, used to sell a wide range of products in our society. But, with some exceptions, energy conservation does not involve a product or commodity of the type advertising normally promotes. Most commercial advertising addresses purchases that will be made anyway. People will buy toothpaste in any event, and advertising seeks to influence the choice of brands. Energy conservation does not fit this model, since conservation behaviors concern non-habitual purchases and lifestyle changes.

No utility studies we reviewed examined the effect of advertising on actual behavior. Instead, recognition measures were taken to see if the ads were noticed and remembered, and several studies included self-report measures on whether people felt influenced by the ads. Given the softer, non-behavioral nature of these outcome measures, it should be easier to uncover positive findings than if one were to measure energy consumption directly. But even with these soft measures, weak effects were found. Recall rates for advertisements were as low as 7%, and the estimated incidence of self-reported behavior was low, commonly 5% - 10%.

The effectiveness of advertising on energy conservation remains an empirical question. It is conceivable that advertising can produce significant and sustainable effects on energy consumption. The reviewed utility studies, however, do not increase our knowledge in that they do not demonstrate strong advertising effects of any type. Because advertising is so costly, the burden of proof to demonstrate its effectiveness clearly rests on those who wish to use advertising to promote conservation. At the present time, there is little or no such evidence.

The Diffusion of Innovations

A more fruitful strategy for promoting conservation would be to employ those interventions already proven to be effective in changing behavior. The literature on the diffusion of innovations is now widely recognized as a promising approach toward promoting conservation. This research has shown that people are likely to adopt innovations (new technologies, inventions) when they learn the details of these innovations from friends and neighbors who have had successful experiences with them. In this situation, one's social network has proven far more influential than the mass media.

Some appear to regard energy devices as unrelated to other types of innovations. This is unwarranted, since the diffusion of innovation appears to follow consistent adoption patterns across a wide variety of technologies, including solar water heating and lowering the thermostat. People do not make energy decisions in isolation. Instead, they are moved to make such decisions in part because of social influence, e.g., a friend has a solar water heater and it works.

Utilities can apply diffusion principles as an alternative to advertising to inform consumers and motivate conservation actions. Thus, the utilities could conduct an experiment where (1) some individuals are presented with standard information about a "greenhouse window"; (2) other individuals are presented with information about the window plus relevant tax credits; and (3) still others are given the opportunity to observe the installation of a greenhouse window in some home in their community. The dependent variable in this design would be the proportion of individuals in the three conditions who have installed the window six months or a year later. In this study the utilities could directly compare the effect of diffusion methods with the simple providing of information. This same design could be used for solar water heaters. The diffusion condition in this case would involve the chance to observe a solar water heater in operation at a typical home in the community.

Another means to employ diffusion methods would be to enlist the aid of local community based, nonprofit groups. Such groups have established social networks through which information could be quickly and effectively disseminated. This educational method would be considerably less expensive than advertising. Utilities, for example, could work through the Grey Panthers, local energy groups, or high schools in distributing information and performing minor retrofitting. The utilities could train the volunteers and then provide the phone numbers of these groups to consumers. Information diffused in this manner is likely to have a powerful effect on behavior.

Education Programs

The California utilities relied extensively on other types of education programs (e.g., bill inserts, seminars). The effectiveness of these programs also can be improved by adoption of social psychological principles. A large literature exists in cognitive social psychology that investigates how people process complex information. The incorporation of this work into utility education programs would increase the impact of this material on consumers. Yates and Aronson discuss several applications of this research to such conservation programs as the Residential Conservation Service. Here we offer suggestions likely to enhance the impact of educational efforts.

The presentation of information. More personalized and vivid information is more likely to influence behavior. Consumers are far less influenced by statistical statements than they are by concrete, vivid, personal examples - such as how much

money their neighbors saved after retrofitting. A bill insert should not simply include a statistical summary of potential savings associated with various hardware. Instead, the insert might describe how consumers can calculate savings from their own bill from using the devices. Whenever possible, normative information about how much their neighbors have saved should be included.

Research by Kahneman and Tversky demonstrates that people are more sensitive to loss than to gain. The amount of happiness derived from winning $50 is less than the dismay suffered from losing the same amount of money. Accordingly, when presenting information about the monetary rewards of installing conservation equipment, showing people how much money they are losing every month by not investing in the devices is more effective than emphasizing how much they can save by using them. Unfortunately, most conservation programs stress the latter.

Kahneman and Tversky also show that people have difficulty integrating complex quantitative information, such as the type necessary to make some conservation decisions. In judging whether installing a solar water heater is cost effective, for example, one must consider tax credits, the rising cost of energy, interest rates, and the like. Kempton and Montgomery find that people systematically underestimate the savings potential of conservation actions. Thus, cost information given to consumers should incorporate the impact of economic factors as well as emphasize the amount of money lost by failing to perform the action. Yates documents that presentation of this information does indeed make solar water heating and an insulation blanket more attractive.

Yet another variable to consider in presenting information is specificity. This is particularly important when behavior change is costly, either in capital outlay or time, effort, or comfort, as with many conservation efforts. The more concrete and specific the recommendations and the more clearly marked is the path individuals must take to achieve their goals, the more likely attitudes and intentions will be reflected in behavior. A concrete recommendation about weather stripping and insulation needs of a specific home, plus recommendations of where to get the job done and what the costs and payback times are, is far more effective than a general recommendation to conserve energy. This general principle has been confirmed in a recent critical review of research aimed at encouraging energy conservation and other pro-environmental practices. In this review, an analysis of 41 representative experiments found that the simple procedure of providing people with information through advertising, prompts, and the like had little impact on behavior. But the impact was increased if specific actions were recommended.

Improving advertising. While we have argued that the advertising currently conducted by the utilities is ineffective in influencing conservation behaviors, a recent study suggests a new approach to presenting information that has implications for creating more powerful advertising. Winett and his colleagues have explored ways of using videotapes to promote conservation. Based on several behavioral-communication strategies, these

videos differ from traditional T.V. ads in important ways. They are carefully designed to use characters and locales which correspond to a specific target population; they show people who must learn to plan and readjust their lifestyles; the actions taken are clearly depicted and reinforced; and explicit care is taken to diffuse counter-beliefs and attitudes. These videos work because they depict what others are actually doing, how they are doing it, and the effects of such actions. In one study, homeowners who watched videos about efficient electricity use in the summer decreased the amount of electricity they used for cooling by 35% and the amount they used overall by 16%.

Hutton's review of the U.S. Department of Energy's conservation advertising offers similar insights into designing effective advertising. Hutton showed that conventional advertising that attempted to motivate conservation behavior by increasing awareness and changing attitudes was ineffective. However, advertising became effective when coupled with the free distribution of a low-flow showerhead and a booklet describing simple conservation actions for the home. Thus, advertising should be designed to target behavior directly and behavioral recommendations should be specific and easy to do.

A range of such behavioral advertising programs is possible. Direct mail advertisements could be sent to a sample of utility customers offering to install an inexpensive conservation device at no charge if an enclosed coupon is returned. Newspaper advertisements could be placed that offer a number to call for a free water heater blanket and booklet on other conservation actions for the home. Archer et al provide further suggestions for behaviorally targeted advertising. Cook and Berenberg discuss other helpful strategies for designing better education programs and advertisements.

"Hard" and "Soft" Interventions

Consider two scenarios on how to induce people to purchase and install a water heater blanket. The first is typical of current practice by California's utilities. A program of public information about the importance of installing the blanket is first devised. The criterion of success for this program would be the number of installations of the device. No fewer than seven links must take place to install the device: (1) a credible series of advertisements must be designed and produced; (2) time and space must be purchased in print and broadcasting media; (3) individuals must perceive, understand, and believe the advertised message; (4) individuals must remember the ad; (5) individuals must be sufficiently influenced by the ad to make a decision to purchase the blanket; (6) individuals must find time and money to make the purchase and locate a source from which the blanket could be purchased; and then (7) the individual must install or find someone to install the blanket.

All seven of these links must occur before the blanket is installed. The number of contingent links in this chain makes clear that the probabilities against success are formidable, at

least for this hypothetical intervention. If even one of these links is not forged, the blanket will not be installed and energy will not be saved.

The second scenario is considerably simpler: the utility installs blankets free of charge in its service area, or offers a rebate to consumers who purchase a blanket from local retailers. We term this latter method a "hard" intervention, and regard this type of program as far more promising than "soft" interventions like advertising. "Hard" interventions have a direct link to behavior and possess definite benefits. First, energy savings are automatic, unrelated to human attitudes and lifestyles. Second, energy savings will be enduring, invulnerable to human commitment and changes in occupancy. Third, energy savings can be estimated directly, independent of self-report and other dubious outcome measures. Hard interventions may have yet another benefit. Success with one form of conservation hardware may increase interest in conservation and motivate further purchases and behavior. Although utilities throughout the country have used hard interventions, and two such programs have been implemented by California's utilities (a zero interest loan program for purchasing conservation hardware and a water heater blanket program), many more are needed.

Such programs, of course, are costly. However, the advertising approach widely in use is itself extremely expensive. The California utilities spend many millions of dollars on advertising. Yet this advertising approach is of dubious value in terms of demonstrated energy conservation. On the other hand, no other program can rival hard interventions in terms of consistent, reliable, enduring, and guaranteed savings. They are clearly cost effective. For this reason, their cost becomes a question of program priorities. And the marked advantages of hard interventions argue that they be the method of first resort.

The cost of hard interventions may well turn out to be less than what is spent on many current "soft" programs. One utility's promotional and advertising costs for an insulation program for poor housing were greater in absolute terms than what it would have cost simply to install the insulation in the targeted housing. Nearly $200 million has been budgeted for conservation programs by the California utilities for 1983. If a portion of this were to be spent on providing low-flow shower heads and water heater blankets for every household in their service areas, the resulting energy savings might be greater than those realized from all the soft intervention programs of the past several years.

Summary and Conclusions

We have argued that both the outcomes used to evaluate the conservation programs of California's utilities and the types of interventions used to promote conservation are inadequate. We also advised against using efficiency as the definition of successful conservation, and uncovered no current evidence for the existence of a rebound effect. Accordingly, the marketing

research approach toward conservation should be abandoned and we recommend the following for future conservation efforts: (1) the use of actual energy consumption as the major outcome measure, with a pre-intervention baseline period to rule out confounding variables; (2) discontinuing conventional advertising as a conservation activity and instead relying on such alternate methods as social diffusion to disseminate information; (3) designing educational materials that present vivid and personal information, explicitly integrate complex information, recommend specific actions, and stress monetary loss from failing to conserve rather than savings; and (4) relying on "hard" interventions, such as providing conservation hardware directly to customers.

We conclude on a positive note. The California utilities showed they were capable of evaluating and promoting the type of conservation programs advocated here. One study evaluated two types of home energy audits. Three groups of respondents were chosen. One group was sent information inviting them to have a free home energy audit done by a representative of the utility; a second was invited to receive a packet for a do-it-yourself audit; and a third group served as a control and received no information about energy audits. The customers who had either of the audits done, along with the control group, were compared on demographics, attitudes, and conservation actions. Moreover, actual energy consumption was compared for the three groups before and after the audit.

This study incorporates three of the four guidelines given above. Energy consumption was the main outcome measure; advertising was not the major focus of the program; and the program utilized a hard intervention - assisting respondents in retrofitting their homes. Further, the evaluation of the study employed a control group.

Interventions of this nature were rare. It is clear, however, that utilities are in a position to contribute greatly to our understanding of the processes whereby people make energy decisions. They possess high quality data on energy consumption and have the resources to implement sweeping and powerful conservation programs. Yet this potential will not be realized without a fundamental change in methods along lines advocated here. Conservation programs will be effective in reducing our energy needs only when powerful interventions are employed and rigorous evaluations of those interventions conducted.

References

1. D. Archer, E. Aronson, T. F. Pettigrew, L. Condelli, B. Curbow, B. McLeod, and L. White, "An Evaluation of the Energy Conservation Research of California's Major Energy Utility Companies, 1977-1980," Energy Conservation Research Group, Stevenson College, University of California, Santa Cruz, CA 95064, Feb., 1983.

2. L. White, D. Archer, E. Aronson, L. Condelli, B. Curbow, B. McLeod, and T. F. Pettigrew, Evaluation Rev. 8, (in press, 1984).

3. P. Stern and E. Aronson, (Eds.). Energy Use: The Human Dimension. W. H. Freeman, San Francisco, CA (in press, 1983).

4. I. Ajzen and M. Fishbein, Psychol. Bulletin 84, 888 (1977).

5. W. McGuire, in G. Lindzey and E. Aronson (Eds.), Handbook of Social Psychology, (Vol. 2, second edition). Addison-Wesley, Reading, MA (1969).

6. R. Anderson and M. Lipsey, Publ. Opinion Q. 42, 17 (1978).

7. W. Cunningham and S. Lopreato, Energy use and Conservation Incentives. Praeger Publishers, New York, New York (1977).

8. R. Pearlman and R. Warren, Families in the Energy Crisis: Impact and Implications for Theory and Policy. Ballinger, Cambridge, MA (1977).

9. D. Sears, T. Tyler, J. Citin, and D. Kinder, Am. J. Political Sci. 22, 56 (1978).

10. M. Stearns, "The Social Impacts of the Energy Shortage: Behavioral and Attitude Shifts," National Technical Information Service, PB-246-818, Washington, D.C. (1975).

11. D. Leonard-Barton and E. Rogers, "Adoption of Energy Conservation Among California Homeowners," unpublished manuscript, Stanford University Institute for Communication Research, Palo Alto, CA (1979).

12. M. Olsen, J. Soc. Issues 37 (2), 108 (1981).

13. M. Olsen and C. Cluett, "Evaluation of the Seattle City Light Neighborhood Energy Conservation Program," Batelle Human Affairs Research Centers, Seattle, WA 1979.

14. S. Cook and D. Campbell, Quasi-experimentation. Rand-McNally, Chicago, IL. (1979).

15. L. McClelland and S. Cook, Evaluation Rev. 4, 119 (1980).

16. W. Kempton and L. Montgomery, Energy, 7, 817 (1982).

17. R. Winett, "Systems Perspective on Residential Energy Conservation," paper presented at the national meeting of the American Association for the Advancement of Science, Washington, D.C., January, 1982.

18. S. Yates and E. Aronson, Am. Psychologist 38, 435 (1983).

19. M. Pallak, D. Cook, and J. Sullivan, in L. Bickman (Ed.), Applied Social Psychology Annual (Vol. 1). Sage Publications, Beverly Hills, CA (1980).

20. E. Hirst, Evaluation Progm. Plann. 4, 219 (1981).

21. P. Stern and G. Gardner, Am. Psychologist 36, 329 (1981).

22. R. Hutton, J. Advertising 11, 27 (1982).

23. E. Rogers and F. Shoemaker, Communication of Innovations: A Cross Cultural Approach. The Free Press, New York, New York (1971).

24 J. Darley and J. Beninger, J. Soc. Issues 37 (2), 150 (1981).

25. A. Shama, Energy Policy, 11, 148 (1983).

26. D. Kahneman and A. Tversky, Econometrica 47, 263 (1979).

27. R. Nisbett, E. Borgida, R. Crandall, and H. Reed, Cognition Soc. Behav. 2, 227 (1976).

28. R. Nisbett and L. Ross, Human Inference: Strategies and Shortcomings of Social Judgment. Prentice-Hall, Englewood Cliffs, NJ (1980).

29. S. Yates, "Using Prospect Theory to Create Persuasive Communications About Solar Water Heaters and Insulation," doctoral dissertation, University of California, Santa Cruz 1982.

30. M. Fishbein and I. Ajzen, Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research. Addison-Wesley, Reading, MA (1975).

31. M. Tuso and E. Geller, J. Appl. Behav. Analysis 9, 526 (1976).

32. P. Ester and R. Winett, J. Envir. Systems 11, 201 (1982).

33. R. Winett, J. Hatcher, T. Fort, I. Leckliter, S. Love, A. Riley, and J. Fishback, "The Effects of Videotape Modeling and Daily Feedback on Residential Electricity Conservation, Home Temperature and Humidity, Perceived Comfort, and Clothing Worn: Winter and Summer," unpublished manuscript, Psychology Department, Virginia Polytechnic Institute and State University, Blacksburg, VA 1982.

34. S. Cook and J. Berenberg, J. Soc. Issues 37 (2), 73 (1981).

35. E. Hirst, L. Berry, and J. Soderstrom, Energy 6, 621 (1981).

36. San Jose Mercury, p. 6B, December 10, 1982.