THE EFFECTS OF INFORMATION, FEEDBACK, AND GOAL-SETTING ON ELECTRICITY CONSUMPTION IN THE HOME

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THE EFFECTS OF INFORMATION, FEEDBACK, AND GOAL-SETTING

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The author wishes to dedicate this thesis to his parents, Mr. and Mrs. Roger Keeley, whose understanding and love shall always be acknowledged with deep appreciation.

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SUMMARY

Much of the research on energy conservation in the residential sector to date has been directed toward technological or "hardware" approaches to the energy problem. Recognizing that residential energy conservation is a function of people's activities in the home, however, as well as technological innovation, psychologists have recently begun to investigate behavioral approaches to the energy shortage problem.

The present study has two basic objectives. The first is to evaluate, by means of a field experiment, the effectiveness of energy-related information and feedback in reducing residential electricity consumption. The second objective is to explore the applicability and similar effectiveness of another variable, goal-setting, which has not yet been studied in the context of residential energy conservation.

Study participants consisted of 62 households residing in total-electric condominium homes. These households were grouped according to level of electricity use during a two-week baseline period and assigned randomly to either a goal-setting condition (set specific conservation goals, receive daily feedback and energy-related information), a feedback condition (receive daily feedback and information), an information condition (receive information only), or a control condition (no contact). Weekly level of electricity consumption in kilowatt-hours during each of three experimental weeks and a two-week follow-up served as the dependent variable in this repeated measures study.

A multivariate covariance analysis revealed an overall significant difference between the groups in their level of electricity use during the study period. Examination of this difference through multiple comparison tests revealed that the goal-setting group used significantly less electricity than its control group, whereas the feedback and information groups did not. This finding suggests that goal-setting may be a promising motivational technique for the achievement of electricity conservation in the home.

CHAPTER I

INTRODUCTION

Concern has been growing in recent years over the long-term availability of energy resources in the United States, and indeed the world (Sporn, 1976). As such, the conservation of these resources is seen as the most promising short-term solution to the problem until alternative sources of energy can be developed (Rosenberg, 1975). Electrical energy conservation is of particular importance for two reasons. First, electrical energy consumption has tended to grow at least twice as rapidly as energy consumed in other forms; and second, the conversion of raw energy to electricity is only about 40 percent efficient (Darmstadter and Hirst, 1974). Research attention has consequently been stimulated by the exigent need to develop effective conservation strategies in this area.

Within the residential sector, which accounts for approximately 20 percent of the nation's electricity consumption, much of this research has been directed toward technological or "hardware" solutions to the energy problem, e.g., design improvements of heating and cooling equipment, appliances, etc. (Rubin, 1976). In contrast, relatively little emphasis has been placed on conservation strategies which directly involve the energy-use behaviors of the residential consumers themselves, yet it is recognized that the activities of people within the home are important determinants of energy usage (Rubin, 1976; Jones and Hendrix, 1975).

To meet this existing deficiency in research, psychologists have recently begun to investigate behavioral approaches to conservation in the home. In general, such an approach to energy conservation can be thought of as one which investigates the application of established behavioral science principles (e.g., learning, conditioning, motivation) through various techniques (e.g., feedback, reinforcement) in an attempt to encourage energy efficient behaviors in the home (Bittle, 1976; Winett, 1976). Specific techniques which have been investigated in these studies include daily feedback (e.g., Seligman and Darley, 1977), monetary rebates (e.g., Winett, Kagel, Battalio, and Winkler, 1978), daily prompts (Palmer, Lloyd, and Lloyd, 1977), public commitment (Pallack and Cummings, 1976), social commendation (Seaver and Patterson, 1976), and information (e.g., Winett and Neitzel, 1975).

The present study has two basic objectives. The first is to further evaluate, by means of a field experiment, the effectiveness of two of the above variables, information and feedback, in reducing residential electricity consumption. The second objective is to explore the applicability and effectiveness of another variable, goal-setting, which has not yet been applied to residential energy conservation. The usefulness of goal-setting has, however, been demonstrated in applied industrial settings (Latham and Yukl, 1975).

The remainder of this chapter will review and discuss the relevant literature concerning these variables, elaborate upon the study objectives, and conclude with the specific hypotheses to be tested.

Psychological Research on Energy Conservation: The Information and Feedback Variables

Introduction

In 1974, Darmstadter and Hirst pointed out that an important energy research need was to answer the following question, "How effective might educational programs be in attaining conservation goals?" (p. 431). This is an important question as educational campaigns have been the most prevalent technique used by power companies and the government in their attempt to promote energy conservation (Peterson, 1974). Since that time, several studies appearing in the psychological literature have examined the effects of energy conservation information on electricity consumption in the home (e.g., Heberlein, 1975; Winett and Nietzel, 1975; Hayes and Cone, 1977).

Recent studies have also examined the applicability of feedback to the area of residential electricity conservation. This is not surprising since feedback has long been found to have a facilitative effect upon performance (e.g., Ammons, 1954). Research attention in this area has included attempts to alter patterns of electricity use (Kohlenberg, Phillips, and Proctor, 1976) as well as to decrease the overall level of consumption (e.g., Seligman and Darley, 1977).

Studies of energy conservation which have involved the use of information and feedback are reviewed in the following section.

Review of Specific Research

The earliest study of energy conservation information found in the literature was reported by Heberlein (1975). In this study, 84 units of

an apartment complex were assigned to one of four treatment conditions, two of which were designed to decrease electricity use, one was designed to increase use, and the fourth was a control condition. Information contained in a letter sent to one "decrease" group and the "increase" group attempted to manipulate the following variables: "beliefs about the cost of electricity, beliefs about the consequences to others of the use of electricity, and the personal responsibility of the consumer for these consequences" (p. 107). The other "decrease" group received a pamphlet published by the local power company containing energy conservation tips. The control group received no information. Results of this study revealed no significant differences in KWH use between baseline data collected before the treatments were implemented and electricity use following the treatments.

The following year, Heberlein assessed the impact of the media campaign to save energy during the winter energy crisis of 1973-74. No significant differences were found when the electricity use of the apartment units during the two time periods was compared. The author concluded that the energy crisis, and its subsequent publicity, had no influence on electricity consumption in these apartment units.

While the experimental treatments and the energy crisis had no effect on electricity consumption, it may be misleading to conclude that the information had no effect on conservation. The studies took place during the winter months in a northern state (Wisconsin) where much of the total energy requirements during that time were for heating. It is possible that the apartments used in this study were heated by natural

gas rather than electricity (the article makes no reference to this). If this is the case, then the subjects may have lowered their thermostats to conserve energy in response to the information and media campaign; however, this would not have significantly altered their electricity use.

In another study, Winett and Nietzel (1975) compared the amount of energy use reduction in a group receiving both monetary incentives and an information manual detailing conservation techniques (incentive group) with a group receiving the information package only (information group). The incentive group averaged about 15 percent more electricity reduction than the information group, a significant difference. A two-month follow-up, however, revealed no significant differences between the groups although there was a trend for the incentive subjects to reduce more than the information subjects.

Although the incentive group was clearly superior to the information group in amount of conservation, it is not possible to accurately determine the effect of the information itself in this respect since a separate control group was not employed in the study. Although not discussed by the authors, a plot of the data showing energy use during baseline, the treatment period, and the follow-up period reveals that the information group did reduce its electricity use to some degree during the treatment and follow-up periods. In a separate publication it is revealed that the amount of this reduction was eight percent (Winett, 1976).

Caution should be taken in interpreting this finding, however, as the subjects in the information group were also given a form on which to record their weekly meter readings. This feedback confoundment does not allow one to unequivocally attribute the cause of the electricity reduc-

tion to the information, even though recent evidence indicates that weekly feedback is ineffective in reducing electricity consumption (Winett, Kagel, Battalio, and Winkler, 1978).

Kohlenberg, Phillips, and Proctor (1976) examined the effectiveness of information, feedback, and monetary incentives in decreasing the use of electricity during peak demand hours of the day. In this study three volunteer families were told about peaking, its effect on the local environment, and were given a list of the wattage ratings of home appliances. Results showed that this information condition had no significant effect on the energy-use behaviors of those families.

The feedback condition in this study consisted of a signal light which was activated if the electric current level in the household exceeded a criterion peak level established during a two-week baseline. Results showed this feedback to be moderately effective in reducing peaking behavior (actual figures were not given). An experimental condition involving monetary incentives and feedback was found to be the most useful in altering usage patterns. It should be noted, however, that the generality of these results is limited by the small sample size (N=3) and the volunteer status of the subjects.

Seaver and Patterson (1976) investigated the effectiveness of feedback and social commendation in reducing residential fuel oil consumption. Randomly selected subjects (N=180) were assigned randomly to one of three experimental conditions: (a) feedback; (b) feedback plus social commendation; and (c) a no treatment control. The feedback condition consisted of a slip attached to the subject's fuel oil delivery ticket comparing the

rate of oil usage of the current delivery period with a similar period during the previous winter. The slip also detailed the corresponding monetary savings or loss which would have been experienced had the subjects continued to use at the previous winter's rate. The social commendation treatment consisted of a small decal ("WE ARE SAVING OIL") and an explanatory note attached to the feedback slip of subjects who actually did reduce consumption compared to the previous winter. Seventy-five percent of the families assigned to this group did conserve and received the decal. The remaining 25 percent received feedback slips only. Results of this study showed that the rate of consumption for the feedback plus commendation group was significantly lower than the feedback only group and the control. The group receiving only feedback was found not to differ significantly from the control group. In discussing this finding, Seligman and Darley (1977) point out that since the feedback which was provided to the subjects pertained to their entire previous months' usage it was nearly impossible for them to relate this usage feedback to their actual behavior during that month, and hence be useful as feedback.

In their study, Seligman and Darley (1977) investigated the effectiveness of daily feedback to homeowners concerning their rate of electricity consumption. The electric meters of a control group (N=20) and an experimental group (N=19) were read five days a week for approximately one month. Feedback was given to the experimental group as a percentage of actual consumption over predicted consumption. A regression line was plotted to predict daily electric consumption from the daily average temperature. Results indicated that the feedback group used 10.5 percent less

electricity than the control group.

Using a combined multiple-baseline and withdrawal design, Hayes and Cone (1977) studied the effects of information, monetary payments, and feedback on the electricity usage in four units of an apartment complex. The information condition in this study consisted of a poster which described ways to reduce electricity consumption and which gave the energy requirements (both in KWH and dollars and cents) of common household appliances. Apart from a slight initial reduction in one of the units following the information distribution, this intervention produced no significant and lasting reduction in electricity use.

The feedback treatment in this study did produce moderate reductions in electricity use. This condition consisted of daily notices which contained information regarding the previous day's usage in monetary terms, how much electricity was consumed so far that week, and also the percent above or below baseline that a projected weekly total represented. As in the Kohlenberg et al. (1976) study, however, monetary payments were found to be the most effective in reducing electricity use.

Palmer, Lloyd, and Lloyd (1977) studied the electricity consumption of four residential families using the following experimental treatments: (1) Consumption Feedback--consisted of a card presented to the families indicating their daily electricity consumption compared to their mean daily consumption for the previous baseline period; (2) Cost Information Feedback--the average monthly bill projected from mean baseline consumption was recorded on the feedback card along with the projected bill if each day's consumption were maintained for 30 days. The difference between the two projections was also indicated; (3) Daily Prompt--families received daily

prompts (written conservation slogans); (4) Prompt plus Feedback--both the feedback and prompt conditions were in effect; (5) Government Prompt--consisted of a letter sent to the families from the Director of the Iowa Office of Energy requesting a 20 percent reduction in electricity consumption.

The researchers used a reversal design in which these various experimental conditions were interspersed between repeated baseline conditions. Each family received a different experimental sequence of treatments. In general, results showed that daily prompts and cost information feedback were effective to much the same degree in decreasing electricity use. The authors report that two families who received daily cost information feedback after the first baseline period decreased their consumption 16 percent and the other two families who received daily prompts following the initial baseline decreased consumption 23 percent.

In another study, Winett, Kaiser, and Haberkorn (1977) studied the effects of monetary rebates and daily feedback on electricity conservation in twelve units of an apartment complex (six experimental and six control subjects). Following a one-week baseline, all six experimental units were placed on a high monetary rebate system for one week. During the second week, three experimental units were placed on a reduced rebate system (50 percent of previous rebate) while the other three units received daily feedback indicating their usage relative to baseline. All experimental subjects received nothing but feedback during weeks three to six. Although formal statistical analyses were not conducted due to the small sample size and a large variability in the data, the authors found that the faily feedback resulted in an average reduction in electricity use of 10-15 percent. It will be recalled, however, that this feedback was preceded by a high rebate

system for all experimental units. Inspection of the data also revealed that the feedback was much less effective during very warm days in which air conditioning was used.

In the most recently reported study, Winett, Kagel, Battalio, and Winkler (1978) looked at the effects of monetary rebates, weekly feedback, and information on the electricity consumption of a sample of 129 Texas households. The information condition in this study consisted of the distribution of two energy related booklets. As in previous studies, these authors found that energy conservation information was ineffective in curtailing use. Interestingly, in fact, the group of families receiving information by itself (other groups received information in addition to rebates, feedback, etc.) actually increased their electricity use by about eight percent compared to the control group. The authors did not speculate upon the cause of this increase, but did note that the same information given to the control group later on in the experiment resulted in only a one percent increase in electricity consumption, an insignificant amount. Further results showed that while a high rebate condition was effective in reducing use, the weekly feedback did not have any effect on consumption. This feedback consisted of weekly meter readings and comparisons of each week's usage with the average usage of the previous summer.

The Information Variable: Summary and Discussion of the Problem

In summary, the general consensus of this research strongly suggests that information by itself is an ineffective means of reducing energy consumption in the home. Of those studies discussed, only one (Winett and

Nietzel, 1975) provided any supporting evidence for its effectiveness, and this was questionable due to a feedback confoundment and lack of a control group. The remaining studies found little or no effect, and one of these (Winett et al., 1978) actually found that electricity use increased in a group receiving information about energy conservation.

Although weaknesses exist in some of the studies reported earlier, it can generally be concluded that conservation information is not a sufficiently powerful treatment by itself to effect significant changes in energy related behavior. This is a discouraging finding considering the widespread use of information and educational campaigns to promote energy conservation. This suggests that further research should at least make an effort to determine how the effectiveness of information might be improved.

Winett, Kagel, Battalio, and Winkler (1978) suggest a promising method that may prove helpful in this respect. This method entails the systematic planning of conservation strategies by individual families based on the energy tips and suggestions usually found in energy conservation information. That is, in addition to simply reading conservation material, individuals should use the information to plan specific ways in which they can most effectively conserve energy in their home.

In their study, Winett et al. (1978) found that this systematic planning of conservation measures by subjects was related to a nine percent reduction in electricity consumption from the previous summer. The authors note that this finding was statistically significant and of practical importance.

Clearly, the effectiveness of conservation planning should be investigated in further studies of energy conservation. Therefore, the present study did include a conservation planning procedure as part of its information condition in an attempt to test the generality of the Winett et al. (1978) finding and to improve the effectiveness of the information treatment.

The Feedback Variable: Summary and Discussion of the Problem

The review of the literature indicates that daily feedback to consumers is at least moderately effective in curtailing electricity use (i.e., 10-15 percent reductions), whereas weekly feedback and monthly feedback are ineffective. Consistent with Ammons (1954), these results show that the proximity of feedback to actual behavior in the home is very important for conservation to occur. Individuals must be able to relate their specific energy behaviors in the home to actual KWH consumption, which can suggest ways to conserve and allow the individual to see the results of his/her conservation efforts. A monthly utility bill, however, does not allow the consumer to see this relationship and hence is ineffective as feedback.

The present study is an attempt to further evaluate the effectiveness of daily feedback in curtailing the use of electricity. The behavioral study of residential energy conservation, while growing rapidly, is still in its infancy. Therefore, it is important to demonstrate the generality of the findings reported thus far on different populations at different times (Winett et al., 1978). This is especially important since at least half of the reported studies base their findings on sample sizes

of only three or four subjects. Concerning feedback in particular, Winett et al. (1978) say that "the further study of feedback is important because while energy consumption may not be greatly reduced using feedback, low-cost (written) feedback procedures may be readily enacted and methods can be developed to increase the saliency and proximity of feedback. Such procedures may facilitate conservation efforts." (p.5).

The feedback system tested in the present study, while similar to those used in previous studies, differs from most in at least two respects. First, it does not provide the consumer with any cost information, e.g., monetary savings or losses. Rather, the feedback is given only in terms of KWH consumption, and compares the subject's cumulative usage during the week with his/her previous week's total. Palmer et al. (1977) included both "consumption feedback" and "cost information feedback" in their study, but while supporting evidence was found for the monetary feedback, design weaknesses did not allow any conclusions to be made concerning the consumption feedback. While the present study does not compare the two types of feedback, it will be able to determine if consumption feedback can be effective in decreasing electricity use. This is an important question when one considers the relative ease with which residents could provide their own consumption feedback, i.e. by reading their own meter.

The feedback treatment in the present study differs from the others in a second respect. In the present study the subjects were asked to record their daily KWH usage on a special form and also to record their major energy-using behaviors which accounted for that usage. This repre-

sents an attempt to enhance the "directive" effectiveness of the feedback (Payne and Hauty, 1955).

Psychological Research on Goal-setting

Introduction and Review

As mentioned earlier, one purpose of the present study is to examine the effectiveness of goal-setting as a means of reducing residential electricity consumption. The rationale for studying goal-setting within an energy conservation context is based primarily on its demonstrated effectiveness as a motivational technique as applied to performance in laboratory tasks (e.g., Locke, Bryan, and Kendall, 1968) and more recently to performance in actual applied settings (e.g., Kim and Hamner, 1976).

Locke (1968), in an important article, reviews and discusses the existing literature up to that time concerned with the relationship between conscious goals and performance. In general, such literature is conclusive in showing that the setting of specific and difficult, yet attainable goals, results in improved performances compared to conditions in which no goals are set. Although his conclusions are based primarily on laboratory studies, a review of goal-setting studies taking place in applied field settings generally confirms Locke's findings (Latham and Yukl, 1975).

Discussion of the Problem

The present study addresses the question of whether these encouraging findings of improved performance as a result of goal-setting in applied industrial settings are generalizable to applied non-industrial settings as well. Specifically, would setting a specific, difficult goal for re-

duced energy consumption in a residential home environment be motivationally effective in facilitating energy conservation behaviors?

There is some supporting evidence to suggest that goal-setting may be a promising variable for study in this context. Pallack and Cummings (1976) conducted a study which found that homeowners who publicly made a commitment to conserve energy did reduce their natural gas and electricity consumption more than privately committed individuals and those in a control group. These authors suggest that commitment causes greater concern and attention to one's personal energy usage which leads to reduced consumption.

Goal-setting is very strongly related to the concept of commitment. The process of setting and accepting a goal represents a commitment for an individual to work toward achieving that goal.

In the present study the goal-setting treatment consists of setting specific conservation goals and receiving feedback concerning the achievement of those goals. Feedback is included primarily because of Kim and Hamner's (1976) finding that feedback significantly enhances the effectiveness of goal-setting. Also, the potential effectiveness of feedback in an energy conservation context has already been demonstrated.

Study Objectives and Hypotheses

The major objectives of this study and the specific hypotheses to be tested are as follows.

The first objective is to determine the effectiveness of energy conservation information and the planning of a specific conservation strategy in reducing electricity consumption in the home. It is predicted

that families receiving information and who plan a conservation strategy will use less electricity than a no-treatment control group.

$$H_o : u_{information} = u_{control}$$

$$H_A : u_{information} < u_{control}$$

That is, the alternative hypothesis predicts that the mean kilowatt-hour usage of the information group will be less than the usage of the control group.

The second objective is to determine the effectiveness of daily consumption feedback in reducing electricity consumption. It is hypothesized that families receiving daily feedback and an information treatment will use less electricity than families receiving only the information treatment.

$$H_o : u_{feedback} = u_{information}$$

$$H_A : u_{feedback} < u_{information}$$

The third objective is to determine the effectiveness of a goal-setting procedure in reducing electricity use in the home. It is hypothesized that a group of families receiving goal-setting and information will use less electricity than a group receiving only information.

$$H_o : u_{goal\text{-}setting} = u_{information}$$

$$H_A : u_{goal\text{-}setting} < u_{information}$$

The group receiving only information is the most appropriate control group to test the effectiveness of the feedback and goal-setting treatments since these latter treatments also include an identical information component.

CHAPTER II

METHOD AND PROCEDURE

Setting of the Present Study

The present study was conducted in three residential condominium complexes in Atlanta, Georgia from September 12 to November 7, 1977. More than one complex was chosen in order to provide an adequate sample size for the study. Although the units in these complexes were not identical in structure or design, all were total electric two-story townhouses with central air conditioning and heating units and equipped with basically identical major appliances.

Total electric units were chosen primarily because the dependent measure in the present study was kilowatt-hour (KWH) electricity usage. Total electric homes therefore maximized the sensitivity of this dependent measure to all conservation attempts by the subjects, whereas some attempts to conserve in homes with natural gas, for example, would have gone entirely unrecorded.

Condominiums were selected for study for two reasons. First, these dwellings offered the convenience of close proximity to one another within a complex. This was important as the design of the study demanded the repeated hand delivery and retrieval of various study materials (e.g., questionnaires, feedback slips, etc.) throughout the study period. Condominiums were also selected because they offered a higher degree of structural homogeneity between units than would have been possible with

single-family detached homes. Condominiums were the "next best thing" to single-family homes, however, in that they were actually owned by the residents.

Recruitment of Participants

Initially, the general purpose and methodology of the study was explained to the president of the homeowner's association at each complex. Each of these individuals gave his permission to conduct the study in his complex and kindly offered to help in any way possible.[1]

Homeowner policy in each complex, however, strongly dictated against the disclosure of names, addresses, and telephone numbers of individuals living within each complex. As an alternative sample list, the addresses of the occupied two-story units in each complex were compiled and used as a basis for subject selection.

The initial contact with these potential subjects was by a formal letter inviting them to participate in the study (see Appendix A). It explained that the study was concerned with "energy conservation in the home" and informed the families[2] that the experimenter would contact them in the near future to describe the study further and to answer any questions. Following the distribution of this letter, the experimenter went to each home to discuss the study briefly with the residents and attempted

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[1]The author would like to thank Dave Rosenblatt, Jim Chambers, and Andy Anderson for their cooperation and support.

[2]In the present study, a family is defined as any number of individuals living in a separate condominium unit. Therefore, an individual living alone constitutes a family, just as couples, and couples with children are considered families.

to recruit them as participants. A standard dialogue was followed for each person contacted.

The primary requirement necessary for selection was that the residents have no major vacation or travel plans during the time of the study (short weekend trips, etc. were acceptable, however). If a willingness to participate in the study was indicated and the above requirement was met, then a brief interview was conducted by the experimenter to obtain demographic data on the subject, e.g., family composition, work schedules, appliance inventory, etc. At this time, permission was obtained to read the subject's meter and to gain access to their billing and consumption records from the local power company. The subjects were also promised a summary of the study findings.

After having contacted, or attempted to contact, most of the families who had received letters, the difficulty involved in recruiting families during the summer months became apparent. Many of those contacted were unable to participate because they were definitely planning to be away on vacation sometime during July or August. A fewer number simply refused to participate, and a substantial number could not be found at home, even after repeated attempts by the experimenter to locate them.

Since the study could not have been conducted without an adequate sample size, it was decided to postpone the starting date of the study until after the vacation season ended. By doing this, many of those families who were taking vacations in July or August would be able to participate in the study, and more time could be spent attempting to contact those families who were not at home on earlier attempts. Another letter

was then sent to those families who were already recruited explaining the reason for the postponement. By the first week in September the sample size increased to 76 and the study was finally launched on September 12.

Participant Demographics

Subject responses to the initial interview and to a questionnaire at the conclusion of the study provided certain demographic information concerning the participants. The adult males in each household, for example, ranged in age from 28 to 77 years (median, 46), while the ages of the adult females ranged from 22 to 70 years (median, 43).

Concerning household composition, almost half of the homes in the study (47%) consisted of married couples with no children while single adults living alone constituted 21 percent of the sample. Of the former, both partners worked outside the home in 69 percent of the households while 88 percent of the single adults were employed.

Eighteen percent of the households consisted of families with one child, 13 percent had two children, while three children were present in only one home (1.6%). The adult members in more than half (55%) of these households with children were also employed outside the home.

The questionnaire data also revealed that the majority of the sample was highly educated. Seventy-six percent of the male household members for which responses were available (89% of total sample) had earned a college degree, 29 percent of which were beyond the Bachelor level. An additional 17 percent of the male sample had at least some college. Of the female members for which responses were available (84% of total sample), 46 percent earned college degrees, of which 19 percent

were advanced degrees. Thirty-one percent of the females had at least some college, while 23 percent ended their formal education at the high school level.

Subject Assignment to Treatment Conditions

From a twelve-month history of electricity use for the subjects obtained from the local power company[3] it became evident that substantial variations in level of monthly KWH use existed among the subjects. It was decided, therefore, to use level of consumption as a blocking variable in the experimental design. The use of this blocking variable helped to control for differences among the homes in size, amount of insulation, family composition, and other factors having an influence on electricity use which would have been impossible to control for individually.

The subjects' combined two-week baseline use served as the criterion to determine the levels of the blocking variable. From a frequency distribution of this baseline use three different usage levels became apparent: (a) less than 350 KWH (low); (b) between 350 and 750 KWH (moderate); and (c) over 750 KWH (high). Twenty of the 76 subjects (26%) fell in the low category, while twenty-eight subjects (37%) were each included in the moderate and high levels, respectively.

Subjects within each usage level were then randomly assigned to one of the four experimental groups. Only addresses were used to eliminate any chance of experimenter bias in the assignment procedure. Each of these addresses was randomly assigned a number of one through four, and

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[3]The author would like to thank the Georgia Power Company for their assistance in providing this information.

then the four numbers were randomly matched with a specific experimental condition.

Experimental Conditions

The four treatment conditions in the study are described below.

1. Goal-setting Condition (N=15)

Participants in this group set a conservation goal for each of the three weeks which comprised the experimental period. The goal-setting procedure is operationalized as follows: At the beginning of each week the experimenter telephoned the subjects in this group to discuss the setting of a conservation goal for that week. This goal was expressed as a KWH amount representing a certain percent reduction from the subject's previous week's usage. The specific percentage was mutually agreed upon by the subject and the experimenter as being a somewhat difficult, yet attainable goal.

These subjects were given daily written feedback showing their daily electricity use and how close they were to achieving their weekly goal (see Appendix B). To facilitate the usefulness of the daily feedback, subjects were given a "Daily Energy-use" form on which to record their daily KWH use (taken from the feedback slip) and their major energy-using activities and behaviors in the home primarily responsible for that day's electricity consumption. This was to help subjects account for fluctuations observed in their daily electricity use and hence recognize where the most potential for conservation existed in their home.

In addition, subjects also received an information booklet on energy conservation, a form on which to plan a conservation strategy for

their home, and a short questionnaire concerning the information contained in the conservation booklet they received, the primary purpose being to encourage them to actually read the material.

2. Feedback Condition (N=14)

Subjects assigned to this condition received daily written feedback, the identical information booklet, questionnaire, and "Daily Energy-use" form as above, and were asked to plan a conservation strategy. In addition to showing the daily KWH usage, the feedback slips also compared the subject's cumulative use so far that week with their total consumption for the previous week. This was an attempt to enhance the motivational effectiveness of feedback by presenting it in a way to facilitate the setting of goals (Locke, Cartledge, and Koeppel, 1968).

3. Information Condition (N=15)

These participants received only the information booklet and questionnaire, and were asked to formulate a conservation plan for their home. No further contact was made with these subjects after the transition week in which the questionnaire and conservation plan were completed.

4. Control Condition (N=18)

Subjects assigned to this group received none of the previously described treatments. The only contact with these subjects during the study was an initial letter explaining their role in the study as representing a "normal use condition," and informing them they would be contacted again at the conclusion of the study.

Experimental Design

A split-plot repeated measures experimental design with two factors and five variables was used in the present study. This design is illustrated in Figure 1. One factor represents the four experimental conditions (Goal-setting, Feedback, Information, and Control), while the other factor represents the three levels of electricity use (low, moderate, high) which were used as blocking variables in the design.

A two-week baseline of electricity use was established for each home in the experiment, before the treatment conditions were implemented. The third week of the study represented a "transition" from the baseline to the experimental period. During this week a package of materials (unique to each treatment condition) was distributed to the subjects. This package generally consisted of the following: (a) a letter briefly explaining the subjects' role in the study and requesting them to refrain from discussing their participation in the study with others; (b) an instruction sheet detailing the activities which the participant was asked to perform; and (c) all necessary forms and other materials needed to complete these activities. With the exception of control group participants, each subject was contacted by telephone following receipt of the package so that any questions concerning the materials could be answered.

Weeks four, five, and six constituted the three-week experimental period during which the treatments were in effect, while weeks seven and eight served as a follow-up period. During this latter period all experimental treatments were withdrawn but weekly meter readings continued.

EXPERIMENTAL CONDITIONS	USAGE LEVELS	N	STUDY PERIODS							
			1	2	3	4	5	6	7	8
			Baseline		Transition	Experimental			Follow-up	
CONTROL	low									
	moderate									
	high									
INFORMATION	low									
	moderate									
	high									
FEEDBACK	low									
	moderate									
	high									
GOAL-SETTING	low									
	moderate									
	high									

Figure 1. Design of the Experiment

Dependent Measure

Weekly level of electricity consumption in kilowatt-hours during each of the three experimental weeks and the two-week follow-up served as the dependent variable in this study. It was necessary that all meter readings be conducted by the experimenter in this unfunded study, although it would have been desirable to hire trained meter readers with no knowledge of the experimental conditions. Reliability of this measure was determined by comparing specific meter readings taken by the experimenter with those of the local power company made on the same day. These readings showed very high agreement. The small discrepancies which were found (mean = 2.4, range 0 to 9) are to be expected considering that the two readings were taken at different times of the day.

CHAPTER III

RESULTS

Participant Attrition

Fourteen of the 76 subjects in the original sample were excluded from the data analyses for various reasons. Four participants requested to be dropped from the study because of serious health problems, one because of family problems, and one because of no interest. Another participant moved away during the course of the study, while three others were out of town during much of the experimental period. An additional three subjects were removed because they showed no signs of cooperation in carrying out the requested treatment procedures. Finally, no baseline data had been collected for one household due to an oversight and was necessarily excluded. Participants who were dropped from the study included one from the Control group, four from the Information group, five from the Feedback group, and four from the Goal-setting group.

Adjustment of the Data

Twenty of the 53 participants responding to a questionnaire at the conclusion of the study reported being out of town at some time during its eight-week duration. These subjects were away an average of 4.65 days total during the study period with two days being the mean length of any one absence.

Corrections were made in the weekly KWH usage of these subjects to

adjust for their absent days. That is, an estimate was made of the usage which would have occurred if the subjects had been at home, and then this was added to the weekly KWH total. In making adjustments of this kind it is necessary to take into account the electricity usage that will normally occur whether or not the occupants are at home, i.e., base level. This usage represents the continuing electrical draw of the refrigerator, water heater, and other devices (e.g., clocks) that are usually left in operation during short trips away from home.

The level of this base usage in the sample homes was estimated by examining the recorded usage of subjects in the Feedback and Goal-setting groups on days which they reported being absent. (Daily meter readings were not available for the other two groups.) The average electricity consumption in these households during the absent days was found to be approximately 12 KWH, or 84 KWH during an entire week.

Using this base figure, the data adjustments were calculated by the following formula:

$$K' = (7 - a)\,[(K - 84)/a] + K$$

where

K' = weekly KWH use adjusted for absence

a = number of days per week home was occupied

K = recorded weekly KWH use

The weekly base figure of 84 KWH was first subtracted from the recorded KWH usage for the week in which an absence was recorded (K). This figure was then divided by the number of days in which the home was occupied that

week (a), giving the average daily usage above the base level. This figure was then multiplied by the number of absent days during the week (7 - a) and added to the original KWH recording for the week.

Analysis of Electricity Use

Statistical control was utilized in the data analyses to adjust for pre-experimental intra-subject differences in electricity usage. An average of the two-week baseline data collected on each subject was selected as a covariate to achieve this control. A one-way analysis of variance reported in Table 1 revealed no significant differences between the four treatment groups on this baseline data.

Electricity use during the transition week was excluded from all data analyses as this week represented neither a true baseline nor experimental week. Usage during the three experimental weeks was kept as separate measures in the analyses while the two-week follow-up period was averaged into a single measure. Little change in each group's usage was observed during these final two weeks. In summary, five repeated measures of KWH consumption were used in the data analyses: the average baseline as a covariate, and the three experimental weeks and average follow-up as the criteria.

A multivariate analysis of covariance was performed to test for differences in electricity consumption between the four groups and also to determine if the groups differed in their pattern of usage over the repeated measures of the experiment, i.e., trend.

In conducting this test the raw data matrix was transformed to yield scores representing an overall group difference measure and a linear,

Table 1. Analysis of Variance Summary Table: Electricity Use During Baseline

Source	SS	df	MS	F	p less than
Within Cells	370908.4	50	7418.2		
Level (L)	1223179.6	2	611589.8	82.445	.001
Group (G)	26038.2	3	8679.4	1.170	.331
L x G	10824.3	6	1804.05	.243	.960

quadratic, and cubic (residual) component of trend. The former measure is the sum vector consisting of the linear combination of the raw scores over the repeated measures of the study, i.e., three experimental weeks and follow-up.

This multivariate analysis examined experimental group (G) and level of use (L) in the two-way factorial design. It was decided that if a significant multivariate effect was found on any of the factors or their interaction, then this significance would be further examined by performing individual univariate tests on the criteria (sum, linear, quadratic, and cubic components).

The results of the multivariate analyses are summarized in Table 2. These analyses revealed a significant within cells regression ($p < .001$), indicating that the statistical use of the covariate was meaningful, and a significant experimental group effect ($p < .015$). The multivariate test of level (L) and the group by level (G x L) interaction did not achieve significance.

Investigation of the significant experimental group effect through univariate tests of the individual components revealed significant effects on the sum vector ($p < .009$) and on the quadratic vector ($p < .027$). An effect approaching significance was found on the linear component ($p < .07$). This component might have achieved significance given a larger sample size. These tests are summarized in Table 3.

The significant effect on the sum vector reveals the existence of an overall difference in level of electricity consumption between the groups. This difference was investigated through the use of *a priori*

Table 2. Multivariate Analysis of Variance Summary Table: Sum, Linear, Quadratic, and Cubic Components (Adjusted for Covariate)*

Source	df	F	p less than
Within cells regression	4; 46	6.933	.001
Group (G)	12; 122	2.210	.015
Level (L)	8; 92	1.109	.364
G x L	24; 162	1.201	.248

*Test of significance using Wilks' lambda criterion.

Table 3. Univariate Tests of Group by Trend Components--Three Experimental Weeks and Follow-up (Adjusted for Covariate)

Source	df	F	p less than
Sum	3; 49	4.255	.009
Linear	3; 49	2.502	.070
Quadratic	3; 49	3.334	.027
Cubic	3; 49	1.104	.357

multiple comparisons of treatment means designed to test the specific hypotheses of the study. Specific tests were conducted between the Information and Control groups, Feedback and Information groups, and Goal-setting and Information groups.

The step-wise Bonferroni t statistic was used to conduct this set of planned comparisons. As shown in Table 4, the major finding from this analysis was that the Goal-setting group used significantly less electricity than the Information group ($p < .01$), thereby rejecting the null hypothesis of equality between these two groups. This difference in electricity use over the three experimental weeks and follow-up amounted to approximately 31 percent.

The other comparisons found no significant differences between the Information and Control groups, and between the Feedback and Information groups. The null hypotheses of equality between these groups must therefore be accepted. It is interesting to note that while the difference between the Feedback and Information groups was in the hypothesized direction, the difference between the Information and Control groups was not. It was predicted that the Information group would consume less electricity than the Control group, but in fact it used approximately 15 percent more electricity during the three experimental weeks and follow-up period.

The significant effect found on the univariate test of the quadratic component is also of interest. This finding indicates that an overall difference exists between the groups in the shape of their quadratic trend. Figure 2 indicates that the quadratic shape of the consumption data over the duration of the experiment is due primarily to the peak in electricity

Table 4. KWH Differences Among Group Means: Three Experimental Weeks and Follow-up*

Group	Mean KWH Use	X_{GS}	X_{FB}	X_C	X_I
Goal-setting	932.33	-	190.96	210.	418.39**
Feedback	1123.02		-	19.31	227.7
Control	1142.33			-	208.39
Information	1350.72				-

*While only the pairwise differences underlined were used in the comparisons, the others are presented for observational purposes.

** $p < .01$

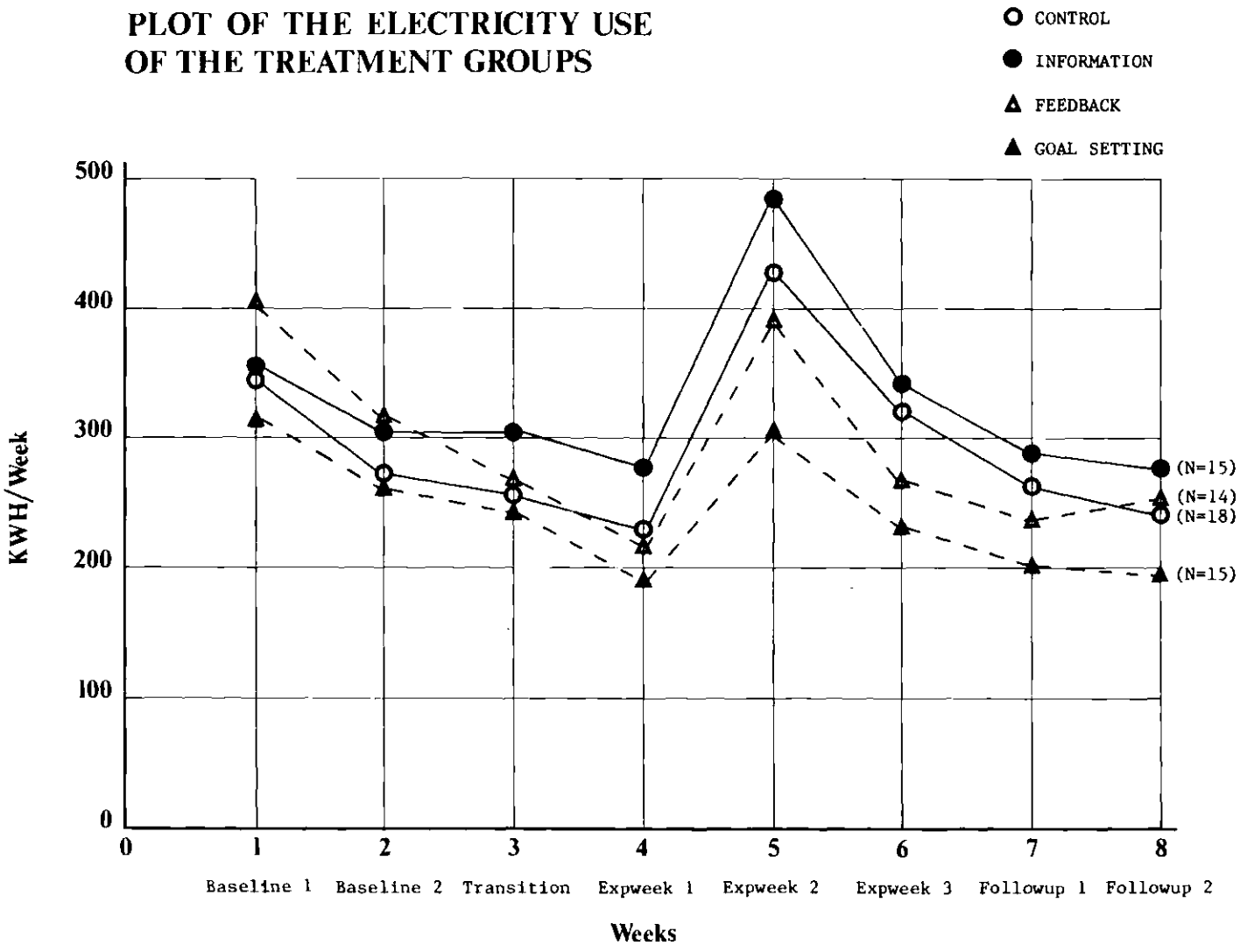

Figure 2. Plot of the Electricity Use of the Treatment Groups

consumption which occurred during the fifth week of the study. (Mean scores and standard deviations are presented in Table 5.) This peak can be attributed to the below average temperatures experienced during this week which prompted many study participants to use their electrical heating systems. A comparison of the groups during this week indicates that the Goal-setting group increased its usage to a lesser degree than the other three groups, accounting in large part for the significant group effect on this trend component.

Finally, a covariance analysis performed on the average follow-up usage revealed that the significant group effect remained for at least two weeks after the treatment interventions were withdrawn ($p < .036$). This analysis is summarized in Table 6. Inspection of the data suggests this effect again to be largely attributable to the reduced consumption of the Goal-setting group.

Analysis of Reported Conservation Behaviors

In addition to the electricity consumption data which were used in the previous data analysis, a variety of qualitative questionnaire data was also collected in an Energy-Use Survey distributed at the conclusion of the study (see Appendix C). Eighty-six percent of the study participants completed this questionnaire. Among other things, this survey attempted to determine the specific conservation behaviors implemented by the subjects both prior to and during the study period.

It was revealed, for example, that nearly all (92%) of the responding participants had already engaged in a variety of conservation behaviors prior to their recruitment in the study. The mean number of conser-

Table 5. Group Means and Standard Deviations of KWH Use During Each Experimental Period

		Control		Information		Feedback		Goal-setting	
Period	Week	X	SD	X	SD	X	SD	X	SD
Baseline	1	346.5	175.5	351.3	167.6	404.0	233.4	320.2	161.4
	2	280.5	137.5	301.7	137.2	303.9	192.9	278.9	141.9
Transition	3	253.2	119.8	300.9	133.2	257.5	168.3	251.2	118.2
Experimental	4	234.6	100.4	282.3	117.9	231.6	105.8	189.4	64.9
	5	428.4	190.0	487.7	181.2	392.9	145.3	308.1	139.2
	6	328.9	116.5	346.3	150.4	268.7	109.8	236.3	100.0
Follow-up	7	264.1	97.2	285.8	103.9	248.4	116.9	205.7	60.7
	8	246.4	91.6	283.5	118.9	253.5	118.4	204.1	59.2

Table 6. Analysis of Covariance Summary Table: Electricity Use During the Follow-up Period

Source	SS	df	MS	F	p less than
Within Cells	209161.611	49	4268.604		
Regression	101298.184	1	101289.184	23.729	.001
Level (L)	3494.722	2	1747.361	.409	.666
Group (G)	39543.794	3	13181.265	3.088	.036
L x G	7261.776	6	1210.296	.284	.942

vation behaviors per household was approximately 2.6. As there is a limit to how much any family can realistically conserve (i.e., ceiling effect), this finding indicates that the magnitude of the treatment effects may have been somewhat restricted in the present study, hence increasing the probability of Type II errors. There were no observable differences between the groups in the number of these prior conservation attempts.

It was also of interest to determine how many conservation behaviors were initiated by the subjects during the study period itself. These reports might serve as another index of the effectiveness of the experimental treatments. While 58 percent of the respondents reported implementing new conservation measures during the study, it was found that a large percentage (68%) of those who did not were from the Control and Information groups. When the number of conservation behaviors reported by group was divided by the number of that group's responding participants it was found that the Feedback and Goal-setting groups had a much higher number of conservation behaviors per household than the Control and Information groups. These rates are as follows: Control, .46; Information, .27; Feedback, 1.46; and Goal-setting, 2.07. A t-test comparing the combined rates of the Feedback and Goal-setting groups with those of the Control and Information groups revealed that this difference was statistically significant, t (51) = 5.2, $p < .001$.

Sixty-two percent of the participants indicated a further intention to engage in some conservation efforts beyond that which they had previously indicated. The majority of these reported plans concerned the installation of energy conservation materials, e.g., storm windows and doors,

insulation, etc. No major differences were observed between groups in the number of conservation measures planned.

CHAPTER IV

DISCUSSION

Review of Findings

This study demonstrated that while the information and feedback treatments did not have a significant effect upon electricity consumption, the goal-setting treatment was effective in curtailing electricity use in the home. This finding is important in two major respects. First, it extends the psychological literature by showing that goal-setting, studied primarily thus far in the laboratory and in industry, can effectively be applied to problems and situations other than those encountered in these settings. Second, and more specifically, it suggests the use of goal-setting as a promising, inexpensive technique to achieve electricity conservation in residential homes. Since the present study represents only an exploratory attempt to examine the usefulness of this variable, however, further research is needed to test the generality of the findings reported here.

Daily written feedback, without goal-setting, did not have as potent an effect on electricity consumption in these condominium homes as was predicted. While the Feedback group did use approximately 17 percent less electricity than the Information group, this difference was not significant. Also, the KWH usage of the former group during the three experimental weeks and the follow-up period in this study was almost identical to

that of the no-treatment Control group.

This finding strongly suggests that consumption feedback (electricity use given in KWH terms) is less effective than monetary or cost information feedback (electricity use given in terms of dollars and cents). It has been found, for example, that consumers do report cost as their primary motivation to conserve energy (Cunningham and Lopreato, 1977). The moderate (albeit non-significant) reductions of the Feedback group in comparison to the Information group should not be overlooked, however. Considering that consumption feedback is now (and has been) readily available to the vast majority of households in this country, moderate, or even small, reductions spread over this large number of homes could have considerable practical importance. Residents need only to learn the simple technique of reading their own electric meter. Studies are definitely needed, however, to test and compare the effectiveness of consumption and monetary feedback on similar household samples.

The present study is consistent with previous research in showing that information is an ineffective means of changing energy related behavior of residents. It was hoped that the planning of a conservation program by the subjects would be helpful, but in fact this added nothing to the information treatment. Because the conservation plan was completed only at the request of the experimenter, it is speculated that perhaps many of the subjects were not personally interested in planning an energy strategy or motivated to follow the plan once it was formulated. The media have periodically written on the apparent apathy of the American public toward energy matters.

The finding that the Information group actually used more electricity than the Control group in the present study is one similarly reported by Winett et al. (1978). This curious effect is deserving of further research attention. A good place to start might be to consider the source of the information itself. Cunningham and Lopreato (1977) cite an Opinion Research Corporation study which revealed that the main reason why a majority of households did not follow governmental recommendations on thermostat settings during the winter of 1974-75 was that "the federal government was not a good source of advice on energy-saving procedures" (p. 103). It is possible that individuals feel the same way about power companies, especially since they are in business to sell electricity. Yet power companies and the government are probably the primary sources of energy conservation information. This ironic situation suggests that research attention might be given to the credibility variable as reported in the social-psychological literature (e.g., Aronson, Turner, and Carlsmith, 1963).

Participant Reactions to Treatments

A primary purpose of the Energy-Use Survey distributed to the subjects at the study's conclusion was to learn their reactions to the various treatment interventions. Of particular importance were the goal-setting and feedback treatments. An attempt was made to learn which elements of these treatments were or were not effective, and why.

Nine of the fourteen goal-setting subjects (64%) responding to this survey felt that setting a conservation goal helped them to conserve more than they would have otherwise. Five of these nine participants

cited an increased awareness of electricity use as the reason why goal-setting was effective. Of the five subjects who said that goal-setting did not help, three said that an inability to conserve further was the reason. A typical response was, "No matter what the goal was I could not have conserved any more than I was." This illustrates the ceiling effect on conservation discussed in the previous chapter.

Several questions concerning the feedback intervention were asked of both the Feedback and Goal-setting subjects. All of these participants indicated that they were either "strongly interested" (70%) or at least "interested" (30%) in seeing how much electricity they used on a daily basis. Participants in these two groups were also asked what they learned from receiving the daily written feedback. Nearly 70 percent of those responding said that they learned how different appliances affected usage or that they learned to identify the major "users" of electricity in their home. Only two subjects said that they didn't learn anything from the daily feedback.

Seventy-two percent of the participants indicated that the daily feedback helped them to conserve electricity. The response most often given when asked how it helped was that it made the participants "more conscious" of their electricity use and of conserving. Five participants said that the daily feedback was of no help in conserving energy. Four of these five, however, said that it was not helpful because they had already done all they could to conserve. This again illustrates the ceiling effect discussed earlier.

In a personal communication, Winett (1977) pointed out that in

evaluating a feedback system it is important to determine specifically how the recipients were using the feedback. Although some indication of this was revealed in the previous responses, a specific question was asked to discover how often the feedback slips were discussed by household members. Responses to this item revealed that 35 percent of subjects in the Feedback and Goal-setting groups reported discussing the feedback slips "everyday" with other family members or friends. Fifteen percent said that the feedback slips were discussed "frequently," while 31 percent reported discussing them "sometimes."

In summary, a majority of the subjects said that the feedback and goal-setting treatments made them more aware or conscious of their electricity consumption. Pallack and Cummings (1976) state that, "Any variable that may induce increased attention to energy usage may effectively reduce energy use levels." (p. 29). The present study does not provide support for this statement. While subjects in both the Feedback and Goal-setting groups did report an increased awareness of electricity usage, only the latter group was able significantly to control its electricity consumption. This indicates that a motivationally effective commitment to save energy is also very important.

The KWH data in the present study indicate that the commitment which the goal-setting provided was particularly effective during the second experimental week of the study when the cold temperatures prompted many participants to use their electric heat. The trend analysis reported in the previous chapter revealed, however, that the Goal-setting subjects were less influenced by the cold temperatures than were subjects in the

Feedback, Information, and Control groups. This observation suggests that goal-setting can be an effective technique even in a relatively high demand situation. This finding is of importance considering that previous research has found that the effectiveness of particular experimental treatments (e.g., feedback, monetary incentives) in curtailing electricity consumption is substantially reduced when the major energy requirement of the sample households is for heating or cooling purposes (e.g., Winett and Nietzel, 1975).

Limitations of the Present Study

As in most field research there are a number of variables which are very difficult or impossible to control. One such "nuisance" variable in the present study was the weather. In particular, temperature variations during the course of the experiment had substantial influence on the electricity use in these total electric sample homes. Since each of the experimental groups in the study was presumably equally exposed to these weather changes, however, it can be assumed that the differences in electricity consumption found between the groups were due to variables other than the weather, i.e., experimental treatments.

The weather did have a particular effect on the goal-setting procedure, however. Since the subjects set specific goals based on their previous week's KWH consumption, the weather during each week ideally should have been identical in order for the goal-setting to be perfectly meaningful. Fluctuating temperatures, however, at times made the specific goals unrealistic. Given the positive effects of goal-setting which were found despite this problem, one can only speculate that goal-setting should

be an even more powerful treatment when such problems are eliminated. Further research should make attempts to improve the design of goal-setting interventions.

Another limitation of the present study concerns the possible effects which the experimenter may have had on the behavior of the subjects (Rosenthal, 1976). All of the participants had consented to be involved in the study and knew that their electricity use was being monitored. It is possible that at least some subjects were conserving to meet the expectations of the experimenter rather than as a direct result of the particular experimental treatment. Some insight into this problem is provided by Hayes and Cone (1976) who were able to examine the effect of monitoring electric use on the consumption patterns of their sample residents. Essentially, they found only an initial reaction of the subjects, and no long-term effects. While such a finding is encouraging, it would be desirable to replicate the present study with a different experimenter, expecially since the goal-setting procedure in the present study involved the direct participation of the experimenter. Until such a replication can be conducted, the results and conclusions drawn from this study should not be seen as definitive, but at most promising.

Study Implications

The present study has implications for the development and implementation of behavioral energy conservation strategies, and consequently for the energy problem in general. If future research affirms the effectiveness of goal-setting as a means to motivate residential electricity conservation, it is conceivable that this technique could be operationalized

and "packaged" in such a way that it could be implemented on a widespread basis. Procedures of this nature may prove to be more practical than costly monetary rebates to homeowners.

Careful study is needed, however, to determine how conservation goals can be most effectively applied on a large scale. Some insight into this problem can be gained by looking at the goal-setting procedure in the present study. In this situation, the experimenter made weekly contact with the goal-setting subjects to discuss their performance and to work with them in setting a goal for the coming week, much as a supervisor might do in an industrial goal-setting situation. A study by Ronan, Latham, and Kinne (1973) indicates that this "supervisory" role of the experimenter in the present goal-setting procedure was a very important one. Briefly, their study revealed that goal-setting in an industrial setting was effective only when it was accompanied by supervision. As these authors concluded, "It would appear that assigned goals do not affect performance unless a supervisor is present to encourage their acceptance." (p. 306).

It would seem, therefore, that the most effective way to disseminate a conservation goal-setting program would be through small, local groups in the community. Cunningham and Lapraeto (1977) cite supporting evidence indicating that "conservation strategies will be more successful the more they derive from the local setting" (p. 101). Recognized leaders in these local groups could conceivably establish themselves as the "supervisors" in this goal-setting effort.

Like feedback, goal-setting would probably be most effective when operationalized in monetary terms. Several authors, for example, have

already suggested the utility of an electric meter within the home which would simultaneously display on-going electricity consumption in kilowatt-hours and its cumulative monetary cost, much like that presently found on gasoline pumps (e.g., Kohlenberg et al., 1976; Hayes and Cone, 1977). Goals could be set, and timely feedback would be readily available to evaluate the progress in meeting these goals.

The present study also has implications for psychology. Specifically, these findings demonstrate the important role which psychology can and should play in resolving significant societal problems, such as the energy shortage. As discussed in the Introduction, this energy conservation problem, at the very least, has both a technological and a behavioral component. It is apparent that greater research attention should be given to psychological variables if we are to fully understand how to most effectively achieve energy conservation in the home.

APPENDIX A

THE RECRUITMENT LETTER

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF PSYCHOLOGY

Dear

I am a graduate student at Georgia Tech and am conducting a research project this summer on energy conservation in the home. This research will serve as my master's thesis, and will be supervised by Dr. C. M. York, Associate Professor of Psychology at Georgia Tech.

I would be very pleased if you would consider being a participant in this study. Energy conservation is rapidly becoming a major concern for homeowners and I am confident you would find the study interesting, and useful as well. You would also be making a significant contribution to an important research area if you decide to participate. In addition, you would be helping me to complete my degree requirements...which I would greatly appreciate.

I will contact you personally within the next several days to describe the study further and answer any questions you might have.

Sincerely,

Timothy Keeley

Timothy Keeley
Graduate Student

C M York

C. M. York
Associate Professor
School of Psychology

APPENDIX B

THE FEEDBACK SLIPS

Name _____ Date _____

Your electricity consumption for the 24 hour period _____ was _____ KWH.

Last week (_____ to _____) you used a total of _____ KWH.

So far this week you have used _____ KWH.

Please record your KWH usage for this date on your Daily Energy Use form.

(Feedback Group)

Name _____ Date _____

Your electricity consumption for the 24 hour period _____ was _____ KWH.

Your conservation goal for this week (_____ to _____) is _____ KWH.

So far this week you have used _____ KWH.

Please record your KWH usage for this date on your Daily Energy Use form.

(Goal-setting Group)

APPENDIX C

THE FINAL QUESTIONNAIRE

November 8, 1977

Dear Research Study Participant:

Tim Keeley's thesis research on "electricity consumption in the home" has been progressing effectively--thanks to your cooperative spirit and his diligent unfunded behavior.

In my role as faculty thesis advisor, permit me to express openly my observation that the "working relationship" you have established with a serious graduate student is commendable. I believe he will make a contribution to the research literature and the promised study findings to you will prove helpful and beneficial.

Tim's culminating activity in the field (i.e., interacting with you, the test and control subjects) involves a survey form which allows you to provide him necessary information relating to the study experience and your energy use. It is important that you respond carefully to each item.

Thank you.

Sincerely,

C. Michael York, Ph.D.

For Academic Research Purposes Only

Name _____

Date _____

ENERGY USE SURVEY

1. Please indicate as nearly as possible the specific days in which your home was vacant from Sept. 12 to Nov. 7, (e.g., days in which you were out of town, etc.)

2. Please explain any factors which in any way disrupted your "normal" pattern of electricity use from Sept. 12 to Nov. 7, (e.g., relatives visiting, sickness, etc.) If possible, please include the dates of these occurrences, even if approximate.

3. What steps had you taken to conserve energy in your home prior to Sept. 12?

4. What additional steps have you implemented to conserve energy in your home since this study began (Sept. 12)?

5. What plans do you have to conserve electricity in the future, (e.g., after Nov. 7)?

6. On the average, how often does your family typically use the following appliances? Your best estimate is acceptable.

   (a) dishwasher: _____loads per week
   (b) clothes washer: _____loads per week
   (c) clothes dryer: _____loads per week
   (d) television: _____hours per week

7. Is there anything else you would like to comment on or feel that I should be aware of?

(Control and Information Groups only)

3. What steps had you taken to conserve energy in your home prior to Sept. 12?

4. What additional steps have you implemented to conserve energy in your home since this study began (Sept. 12)?

5. What plans do you have to conserve electricity in the future, (e.g., after Nov. 7)?

6. On the average, how often does your family typically use the following appliances? Your best estimate is acceptable.

   (a) dishwasher: _____loads per week
   (b) clothes washer: _____loads per week
   (c) clothes dryer: _____loads per week
   (d) television: _____hours per week

7. To what extent were you interested in seeing how much electricity you used each day (i.e., from the daily KWH feedback slip)?

   _____ strongly interested
   _____ interested
   _____ neutral
   _____ disinterested
   _____ strongly disinterested

8. What did you learn about your electricity consumption from the daily KWH feedback slips?

(Feedback and Goal-setting Groups only)

9. Did the daily KWH feedback slips help you to conserve? If yes, how did they help? If no, why didn't they help?

10. Did you discuss the daily feedback slips with your husband/wife or other family members (or friends, for those individuals living alone)?

_____discussed every day
_____discussed frequently
_____discussed sometimes
_____discussed rarely
_____discussed never

Why or why not?

11. Is there anything else you would like to comment on or feel that I should be aware of?

(Feedback Group only)

9. Did the daily KWH feedback slips help you to conserve? If yes, how did they help? If no, why didn't they help?

10. Did you discuss the daily feedback slips with your husband/wife or other family members (or friends, for those individuals living alone)?

_____ discussed every day
_____ discussed frequently
_____ discussed sometimes
_____ discussed rarely
_____ discussed never

Why or why not?

11. What kinds of things did you try in order to achieve your weekly conservation goal?

12. Do you feel that setting a conservation goal helped you to conserve more than you would have otherwise?

_____ Yes _____ No

Please explain your answer briefly.

13. Is there anything else you would like to comment on or feel that I should be aware of?

(Goal-setting Group only)

Demographic information: For Statistical Purposes Only

Sex of respondent _____

Occupation _____ Partner occupation _____

Age _____ Age of partner _____

Education (indicate highest level completed):
_____ some high school
_____ high school graduate
_____ some college (specify years completed)_____
_____ college graduate
_____ advanced degree (specify)_____

Partner education (indicate highest level completed):
_____ some high school
_____ high school graduate
_____ some college (specify Years completed)_____
_____ college graduate
_____ advanced degree (specify)_____

Number and ages of children living at home_____

Please indicate the average number of hours you spend in your home each day during the week (Monday thru Friday) and also on weekends (Saturday and Sunday):

	Number of hours in morning (7-12 a.m.)		Number of hours in afternoon (12-5 p.m.)		Number of hours in evening (5-12 p.m.)	
	Mon-Fri	Sat-Sun	Mon-Fri	Sat-Sun	Mon-Fri	Sat-Sun
(a)	_____	_____	(b)_____	_____	(c)_____	_____

Now please do the same for the other household partner:

(a)	_____	_____	(b)_____	_____	(c)_____	_____

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