

## DEVELOPING STRATEGIES FOR INFLUENCING RESIDENTIAL CONSUMPTION OF ELECTRICITY

**C. SAMUEL CRAIG**

*Graduate School of Business Administration  
New York University*

**JOHN M. MC CANN**

*Graduate School of Business  
Duke University*

### ABSTRACT

The time bias in the propensity to consume electricity is an underlying cause of brownouts and less than desired load factors for many utilities. Over the years utilities have employed a variety of marketing techniques to change the pattern and extent of demand for electricity. This article applies the concepts of demarketing and syncromarketing to the problem of load management among residential consumers who are heavy users of electricity. Based on a survey of heavy users a profile of these individuals is developed. Significant differences were found between the target audience for demarketing and syncromarketing strategies versus the non target audience. This provides a basis for formulating strategies aimed at influencing these individuals.

### INTRODUCTION

It is clear that energy problems, whether in the form of brownouts or shortages of gasoline, heating oil, and natural gas, are going to be a continuing reality as there has been a fundamental shift from a seemingly limitless supply of cheap energy to a quite finite supply of increasingly expensive energy. On a long term basis technological solutions offer considerable promise, however, they do little to ameliorate more immediate problems. On a short term basis, considerable opportunity exists to influence consumers' behavior and reduce the amount of energy consumed. The price mechanism has an immediate and direct effect on the amount of energy consumed. In addition to price changes there are

opportunities to develop communications programs that influence energy consumption.

Marketers rely heavily on communications, primarily advertising, to persuade consumers to buy a particular product. One of the key elements of any communication program is identification of the target audience and development of appropriate strategies to influence them. This paper identifies the key target audience for demand modification efforts. Two subgroups are also examined, the heaviest users of electricity and those most likely to respond to time-of-day metering programs. The analysis suggests strategies for effectively reaching these groups. Further, the general approach taken here can be applied to other forms of energy consumption.

### **Demand Stimulation**

Activities aimed at influencing the demand for electricity over the years have taken different forms. Until recently most utilities were actively engaged in programs designed to stimulate demand for electricity. Utilities promoted additional uses of electricity and aggressively marketed "all electric homes." Some utilities sold major appliances to consumers to stimulate demand. Apart from active programs, utilities engaged in other activities that encouraged consumption. Since economies of scale and some inherent efficiencies were realized with the construction of new generation facilities, companies applied for rate reductions. In addition many had rate structures that encouraged greater consumption by charging less per kilowatt hour for higher consumption.

### **Demand Reduction**

With the onset of the energy crisis utilities began to try to reduce demand for electricity. A number of factors accounted for the severity of the crisis:

1. most economies of scale in the generation of electricity had been realized;
2. construction cost for new generation capacity increased considerably;
3. fuel costs increased markedly;
4. supplies of fuel became less certain;
5. mandated pollution standards placed limitations on the type of fuel that can be burned; and
6. pollution control devices increased the cost of generating each kilowatt.

Utilities responded by increasing the price of electricity and, in some cases, changing the rate structures to discourage increased consumption. It should be noted that pricing was not used as a conscious device to limit demand but rather as a necessary device to have revenues keep pace with costs. Bill enclosures which once suggested new uses of electricity now encouraged conservation. Media advertising shifted its emphasis. For example, Con Edison of New York embarked on a major advertising campaign built around the theme of Save-a-Watt.

The rationale behind this and other campaigns was to get people to reduce their consumption so that new generation facilities would not have to be built and that more expensive fuels would not have to be burned.

## **Demand Modification**

Recently utilities have become concerned with demand modification. This approach holds considerable promise due to the time bias in the consumption of electricity. Demand for electricity varies by the time of day. In terms of demand modification this presents the real opportunity. Figure 1 shows the demand pattern for selected summer and winter days for a large utility serving a highly urban area. While individual classes of consumers have different peaking characteristics the underlying pattern is similar; very high levels of demand at certain times of the day and lower levels of demand at other times. Utilities must strain to meet demand at certain times while at others there is considerable excess capacity.

The major demand modification efforts have been focused at shifting demand from peak periods to non-peak. To do this many utilities have either implemented or are experimenting with time-of-day rates. Time-of-day rates offer consumers an economic disincentive if they consume electricity at the time of peak demand and an economic incentive if they consume electricity at off-peak times. Definition of peak time depends on the particular demand pattern facing a utility and can vary considerably. Con Edison of New York has defined summer peak-time for residential users of electricity as weekdays 10 AM to 10 PM from May 16 to October 15 and winter peak-time has been defined as the same hours during the winter. Off-peak is from 10 PM to 10 AM and weekends. The rates can vary to either penalize or reward consumption at the different times. Summer peak rate is 20.4 cents per kilowatt hour (KWH), winter peak rate is 8.6 cents per KWH and the off-peak rate is 2.8 cents per KWH. These compare with Con Edison's present rate of approximately 10 cents per KWH. Time-of-day rates encourage consumers to shift consumption of electricity from peak to off-peak times.

## **Consumer Response**

Consumers have three basic strategies in response to demand modification efforts. They can:

1. forego consumption (demand denial);
2. postpone consumption (demand deferral); or
3. store energy.

The last strategy involves a capital investment in some device that stores electricity (such as batteries) or devices that will either store heat or cool produced during off-peak hours. While storage devices hold considerable

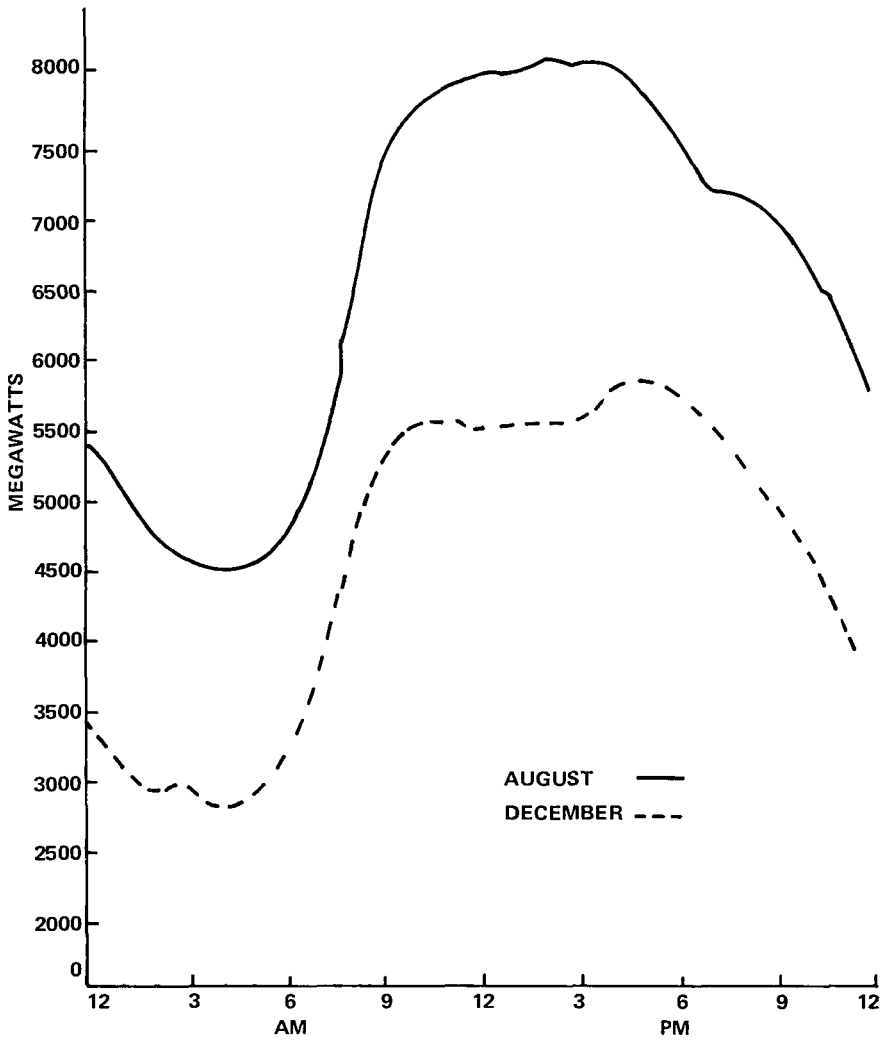


Figure 1. Total system distribution for an urban utility.

promise, the technology has not advanced to the point where mass marketing in the U.S. is feasible. For this reason we will focus on the first two strategies since it is feasible to implement them immediately.

*Demand denial*—One way consumers can respond to demand modification efforts is to deny themselves use or full use of particular appliances during peak periods. For example, rather than run an air conditioner all day on an 82°F day an individual may turn it off and be a little less comfortable. Consumers can be encouraged through mass media or bill enclosures to reduce the use of certain appliances or to run them only with a full load. Through widespread demand denial the maximum system load is reduced (see Figure 1). This also reduces the total system load.

*Demand deferral*—Consumers can also respond by deferring demand for electricity during peak time until off peak. Air conditioner usage no longer provides a convenient example as the hottest times of day tend to coincide with peak rate times. However, use of appliances such as dishwashers, clothes washers, dryers, and self-cleaning oven features can be deferred until weekends or evenings. Not all consumers will find it as easy to shift or, given equal ease, not all will find the incentive sufficient.

It should be noted that both denial and deferral are legitimate goals regardless of whether a utility offers time-of-day rates or not. In the absence of time-of-day rates there is no economic incentive for consumers to change their present demand patterns. However, appeals directed at persuading consumers to change for other reasons can be formulated. Without some tangible incentive, the latter approach is apt to be of limited value.

## Tasks of Marketing

The tasks of marketing are two fold:

1. demarketing and
2. syncromarketing [1].

The thrust of demarketing efforts is to get consumers to consume less electricity. The thrust of syncromarketing efforts is to more closely match supply and demand. In each case the problem is fundamentally the same—identifying and reaching the target audience.

*Demarketing*—The efficiency of any marketing program depends on whether it can selectively reach members of the target audience to the exclusion of others. In the case of demarketing (demand denial) the target audience is the “heavy half.” The target audience becomes more precisely defined in terms of heavy users of certain appliances which use considerable amounts of electricity. The

light user of electricity has very little discretion in what he uses. With a limited supply of appliances that are run either out of necessity (e.g., a refrigerator) or of convenience (e.g., a television) there is very little opportunity for demand denial. To be successful efforts must be focused at individuals who have some discretionary consumption.

*Syncromarketing*—The target audience is somewhat different for activities (syncromarketing) aimed at fostering demand deferral. Since the excess supply of electricity occurs during the evening and early morning hours, the target audience becomes individuals who not only own appliances that can be operated during those hours but also individuals who could do so easily. Many people own appliances the use of which is easily deferrable; however the likelihood of demand deferral strategies succeeding is much greater if the usage pattern advocated does not deviate radically from existing patterns. It is one thing to ask a housewife to defer doing her laundry until after 10 PM if she normally does it between the hours of 6-10 PM. It is clearly another thing to ask her to defer doing laundry if she normally does it from noon to 3 PM. In the first case the new behavior advocated is not drastically different from her present behavior. In the second case the new behavior is quite different.

The remainder of this paper attempts to provide an empirical basis for demarketing and syncromarketing strategies aimed at modifying the demand for electricity. First, characteristics of people who are frequent users of major appliances—dishwashers, clothes dryers, washing machines, and self-cleaning ovens are identified. This provides the target for demarketing. Then, characteristics of people who use these appliances during the early evening—between 6 and 10 PM, are identified. This provides the target for syncromarketing. The assumption is that if these people can be identified and understood, a strategy can be devised which would lead them to reduce consumption or to transfer at least some of their appliance use to the off-peak period, after 10 PM. It is assumed that these individuals can respond more readily than other groups.

## METHOD

### Sample Selection and Questionnaire

All respondents in the survey purchase their electricity from Con Edison of New York. As indicated earlier it is important to direct energy conservation efforts at those who have the potential to respond. There are many households which consume relatively modest amounts of electricity and therefore have little opportunity to reduce their consumption. Thus, the first criterion for respondent selection was that the household's annual electricity usage qualified it as belonging to the heavy half. The heavy half was arrived at as follows. Analysis of Con Edison records showed that 17 per cent of the individually

metered households consumed 39 per cent of the total energy consumed by that service classification.<sup>1</sup> Thus, of the approximately 2.4 million individually metered households in Con Edison's service territory (Manhattan, Bronx, Brooklyn, Staten Island, Queens, and most of Westchester County), 400,000 accounted for over one third of the electricity usage.

A random sample of 2,000 heavy users was drawn from Con Edison's computer files. A six page questionnaire was sent to the individual who normally received the electric bill. Questions dealt with the following: A-I-O's concerning energy and energy related issues, frequency of use of major appliances, time of use of major appliances, and demographic information.<sup>2</sup> In addition to the name and address, Con Edison provided data on actual electricity usage of the respondents.

Of the 2,000 questionnaires sent out, 375 usable ones were returned. An important step was to determine whether respondents were different from non-respondents with respect to electricity usage. Respondents had annual average consumption of 7,252 kilowatt hours while non-respondents had an annual consumption of 7,374 kilowatt hours. This difference was not significant ( $t = .28$ ,  $d.f. = 374$ ). Hence, there is some evidence to support the idea that the respondents are typical of the population of heavy users of electricity.

In addition to the questions indicated above all respondents completed Rotter's Internal-External Scale [2]. Rotter's scale has been used extensively and seems particularly appropriate for the present study. Simply stated Rotter's scale measures the extent to which an individual believes what happens in life is determined by events beyond his control. A person scoring high on the scale (external) tends to believe that luck or chance shape outcomes. On the other hand a person who scores low (internal) on the scale tends to believe that his own actions can make a difference. In persuading people to conserve energy it is imperative that they believe that their own actions can help ameliorate the energy crisis. Thus, if individuals tend to be internals there is a greater likelihood they will be more responsive to communication urging them to help conserve scarce resources.

## ANALYSIS AND RESULTS

### Factor Analysis of Energy AIO's

All heavy users were asked to complete a battery of seventy activity interest and opinion questions concerning energy topics and energy conservation. To

<sup>1</sup> Data taken from, Consolidated Edison of New York, Class Demand Study-Electric Department, Table 2, 1974.

<sup>2</sup> A-I-O's are questions designed to measure the respondent's activities, interests, and opinions concerning energy related issues.

reduce the number of items and determine the common elements, the seventy items were factor analyzed. The results of the factor analysis are shown in Table 1.<sup>3</sup>

There were ten factors that explained 71 per cent of the variance. Four factors (1, 4, 5 and 9) had to do with activities and opinions about energy conservation. One factor (2) reflected individuals' attitudes toward the utilities that provide electricity. Two factors reflected concern about the environment (3, 10). One factor dealt with communication of energy information (6). The remaining two factors (7, 8) dealt with beliefs about attaining energy independence and whether an energy problem still exists.

The factors themselves are of interest in that they provide an indication of how individuals feel about energy matters. In terms of developing strategies designed to influence consumption the factor profiles provide guidance for the development of relevant appeals. To assess whether the target markets for the marketing strategies differed, scores were developed for each respondent on the ten factors by summing the respondent's response to each question loading on a particular factor. These composite variables were then used to determine whether individuals in the target audience differed from non-target individuals.

### **Demarketing Target Audience**

In order to determine the appropriate target audience for demarketing efforts the sample of heavy users was looked at in terms of how frequently they used their major appliances. While it is important to reach all heavy users of electricity those who actively use their appliances are a better target. If nothing else they can be urged to stop practices that are known to be wasteful, or to use their appliances less frequently. To determine the prime group, the heavy half was divided into two groups, above and below the median, based on the frequency of appliance usage. These two groups were then compared in terms of demographic and psychological characteristics. These comparisons were performed by calculating mean values for each variable in the two groups and using a t-test (or chi-square when appropriate) to determine the statistical significance of the difference between the groups. The results are given in Table 2, which shows only those variables for which a significant difference was found.

Demarketing of electricity efforts are apt to be more successful if they are directed at individuals who live in houses rather than apartments and who own their dwelling rather than rent. Relatedly these individuals have larger homes (more rooms) and higher income. Households above the median in frequency of appliance usage also have higher electric bills. While not surprising this indicates

<sup>3</sup> The factor analysis was performed using an iterated principle component method with the communalities being updated on each iteration. Those factors with eigen values greater than 1.0 were subjected to varimax rotation. For a more complete discussion of factor analysis see [3].



Table 1. Factor Analysis: Profile of the Heavy User

Factors	Per cent responding				
	Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree <sup>b</sup>
Factor 1: Conservation Conscious (22) <sup>a</sup>					
.71 I believe we should all try to use less electricity.	32	51	8	7	2
.62 By conserving electricity in the home I feel I am a better citizen.	17	40	20	19	4
.60 I will be willing to cooperate in a program to save electricity.	31	49	15	4	1
.66 Conserving electricity is important to me.	26	56	9	8	1
.72 I think it is a good idea to start conserving electrical power in the home now.	26	55	11	6	2
Factor 2: Utility Attitude (10)					
.50 Utility companies try to help the consumer save energy.	9	39	19	21	12
.52 I am satisfied with the service provided by the electrical utility companies.	7	35	10	28	20
.70 The utility companies charge a fair rate for electricity.	3	8	24	32	33
Factor 3: Nuclear Power Attitude (7)					
.57 Nuclear Power will help save our scarce resources.	23	44	22	4	7
.76 Nuclear Power plants are a menace to our society	4	9	32	37	18
Factor 4: Use Conscious (6)					
-.46 I turn off lights when leaving a room.	36	48	2	12	2
.63 I leave the television on even though I am not in the room to watch it.	5	16	3	51	25
Factor 5: Further Conservation (6)					
.52 It would be very hard for me to cut down on the use of electricity in my home.	14	34	8	39	5
.41 There is not much the average citizen can do to save electricity.	3	15	11	50	21

Table 1. (Cont'd.)

Factors	Per cent responding				
	Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree <sup>b</sup>
Factor 6: Energy Communication (5)					
.59 I often follow the suggestions of my friends concerning energy conservation.	5	42	12	36	5
.81 I give advice to my friends on how to save energy.	9	40	16	29	6
.62 I give advice on cutting down on electrical bills.	5	34	14	39	8
Factor 7: Energy Independence (4)					
.63 The U.S. can achieve energy independence.	44	37	11	7	1
.47 We should be less dependent on foreign oil.	49	39	5	4	3
Factor 8: Energy Problem (4)					
.72 We still have an energy problem.	36	51	7	6	0
Factor 9: Constant Bill (4)					
.43 I use less electricity than my neighbors.	5	16	64	12	3
.53 My electricity bill would be about the same no matter what I did.	5	9	11	51	24
Factor 10: Environmental Attitude (3)					
-.56 Utility companies should be allowed to burn cheaper fuel even though this will cause more pollution.	8	19	17	34	22
.60 Preserving the environment is important to me.	37	51	7	4	1

<sup>a</sup> Number in parentheses indicates per cent of variance explained by each factor, total variance accounted for by all ten factors was 71 per cent.

<sup>b</sup> Sample size was 375.

Table 2. Characteristics of Target Markets for Demarketing and Syncromarketing Efforts

<i>Characteristics of demarketing target</i>	<i>Characteristics of syncromarketing target</i>
Live in houses <sup>a</sup>	Live in house <sup>a</sup>
Own dwelling <sup>a</sup>	Own dwelling <sup>a</sup>
Larger homes <sup>a</sup>	Larger homes <sup>a</sup>
Higher Income <sup>a</sup>	Higher Income <sup>a</sup>
Higher Electric Bill <sup>a</sup>	Higher Electric Bill <sup>a</sup>
More people in household <sup>a</sup>	—
Tend to be externals <sup>c,d</sup>	—
Older individuals <sup>e</sup>	—
Talks about energy conservation <sup>c</sup>	—
—	More Education <sup>e</sup>
—	Managerial <sup>f</sup>

<sup>a</sup> Difference between target and non-target groups significant,  $p < .01$  t-test.

<sup>b</sup> Difference between target and non-target groups significant,  $p < .05$  t-test.

<sup>c</sup> Difference between target and non-target groups significant,  $p < .1$ , t-test.

<sup>d</sup> As measured by Rotter's Internal-External Scale.

<sup>e</sup> Difference between target and non-target groups significant,  $p < .01$   $\chi^2$ .

<sup>f</sup> Difference between target and non-target groups significant,  $p < .05$   $\chi^2$ .

that they have a greater potential for reduction. It also confirms the adequacy of the self-report data on usage frequency. The target group also tends to be older and have more people in the household.

The data do not provide much guidance for formulation of demarketing appeals. There was only one significant difference between groups on the composite energy AIO's shown in Table 1. Individuals in the target market appear more likely to give advice and talk about energy conservation. This is very positive in that it indicates that promotional efforts aimed at them will be magnified by word of mouth. None of the other differences were significant.

All respondents filled out Rotter's internal-external scale. As indicated earlier internals tend to see themselves as masters of their own fate while extreme externals would view themselves as hapless pawns of fate. Frequent users of appliances show a slight tendency to be externals. This suggests it may be more difficult to convince them that their actions can make a difference.

### **Syncromarketing Target Audience**

A different criterion was used to define members of the target audience for syncromarketing efforts. Peoples' use of appliances is deeply intertwined with their life-styles. Strategies that advocate radical shifts in life-styles are unlikely to succeed. For this reason the target market comprised those households that used one or more of their major appliances between 6:00 PM and 10:00 PM. The

implicit assumption is that these households can postpone appliance usage more readily than any other group.

The syncromarketing target audience has a number of characteristics in common with the demarketing target. They too tend to live in larger houses that they own. They have higher electric bills and higher incomes that facilitate payment of their electric bills. In addition to the shared characteristics, these individuals tend to have more education and are more likely to be employed in managerial occupations.

## SUMMARY AND CONCLUSION

Marketing principles and practices hold considerable promise for dealing with energy consumption problems. There is a heavy half among electricity consumers and it is at this heavy half that energy conservation programs should be targeted.

The opportunities for conservation of electricity and relatedly the resources used to generate it, boil down to two basic marketing strategies: demarketing and syncromarketing. The target markets for these strategies have distinct characteristics. They both tend to live in larger homes that they own rather than rent. Their incomes are higher than non-target groups as are their electric bills. While these groups share some characteristics there are important differences.

The target market for demarketing activities tend to be older and have more people living in their households. They also tend to be externals which gives some guidance for formulation of appeals. Unfortunately, the fact that they are externals may make it more difficult to convince them that their actions can make a difference. In addition to the shared characteristics enumerated earlier, the target market for syncromarketing activities tend to have a higher level of education and are more likely to be employed in managerial occupations.

There were no differences between target and non-target groups on the composite activity-interest-opinion variables except the one noted for demarketing. This suggests that the opinions and activities reflected in Table 1 can be used to formulate appeals appropriate for all groups. These appeals, while relevant to the target groups, are not apt to have a differential effect. For the demarketing target group there will be an element of synergy as these individuals are more likely to talk about energy conservation to others.

Evidence continues to mount that energy problems will continue to plague the United States. While technology holds considerable promise for long term solutions there are numerous short run problems that will not be readily solved. Some of these problems can be ameliorated through the use of marketing principles and practices that have proven successful elsewhere.

This paper has focused on one aspect of the energy problem, electricity consumption. Consumption of electricity is almost universal in the U.S. Its use, like the consumption of all forms of energy, is closely linked to individuals' lifestyles. The data presented enable a definition of the target audience for both

demarketing and syncromarketing activities. While the data pertain only to consumers of electricity the same approach could be used with other forms of energy, such as natural gas.

### REFERENCES

1. P. Kotler, The Major Tasks of Marketing Management, *Journal of Marketing*, pp. 42-49, October, 1973.
2. J. B. Rotter, Generalized Expectancies for Internal versus External Control of Reinforcement, *Psychological Monograph*, 80, pp. 1-28, 1966.
3. H. H. Harman, *Modern Factor Analysis*, University of Chicago Press, Chicago, 2nd ed., 1960.

### ACKNOWLEDGEMENT

The authors wish to acknowledge the assistance of Jerry Spencer, Charles Stannard, and Wilson Chung during various phases of this research.

Direct reprint requests to:

C. Samuel Craig  
Graduate School of Business Administration  
New York University  
100 Trinity Place  
New York, New York 10006