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CONSUMERS' ATTITUDE TOWARD ENERGY
CONSERVATION IN A MIDDLE-SIZE CITY

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Abstract

This study explores the attitude of household consumers toward conservation in their electrical usage. It examines whether a time-of-day pricing structure will influence their response to shifting their electrical usage from peak to non-peak hours. It also attempts to measure their perceived elasticity of electricity consumption.

1. INTRODUCTION

The problem of energy crisis needs to be approached from the aspects of both supply and demand. Effective and efficient steps must be taken to encourage ecologically sound supply and discourage wasteful demand. This study conducted in the city of Springfield, Illinois, looks into the household attitude toward certain aspects of electrical energy conservation.

Electricity is currently man's most usable form of energy. As supply of oil and gas diminishes, coal and nuclear fuels can be expected to play an increasingly important role as primary energy sources. Electricity seems to be the main form of energy mediating between the "future" primary energy sources and its ultimate users. Hence, it can be expected that the economy will, slowly, tend to go all-electric. It is becoming increasingly important to explore into the dynamism of the electrical economy.

For efficient management of the household demand for electricity, two proposals must be emphasized--(1) the consumers should be educated and encouraged to reduce wasteful usage of electricity, and also (2) they should be encouraged as much as possible to shift their electrical usage from peak to non-peak hours of the day. This study brings together ideas regarding the above two proposals, prepares a questionnaire based on the assembled ideas, and through the use of the questionnaire, attempts to measure the household attitude toward electricity consumption and conservation.

2. METHODOLOGY

Data was gathered through a telephone survey. Instead of using the telephone directory for random selection of the sample, the first three

digits of the telephone number were systematically selected and the last four digits were generated by using a random number table. This technique increases the number of unusable telephone numbers, but eliminates the bias which would have been otherwise introduced because of unlisted phone numbers. Hence, the unlisted numbers did not influence the sample selection.

The sample size is 400. All the respondents live in the service areas of City Water Light and Power Company of Springfield, Illinois. The survey was conducted during the months of July and August of 1977. In the first part of the questionnaire, a descriptive probing was done to find out the household's electrical appliances and the use pattern of these appliances. The second part explores the household's attitude toward various aspects of electrical consumption and conservation.

3. SURVEY RESULTS

3.1 STATISTICAL PROFILE

Survey results are summarized in tabular form. A statistical profile of the households surveyed is presented in Table 1. Table 2 describes the appliance profile of the households. Both the profiles seem plausible and are similar to ones obtained in other studies (3). By looking at the two tables, one can notice that the survey covers a wide spectrum of the population. The differences found in the two income groups (lower income \leq \$15,000 per year, higher income $>$ \$15,000 per year), again, look plausible. Respondents in the higher income group more frequently own their home, live in a larger home, are more educated, have less unemployment, and own more of the desirable appliances. The two groups do not show any significant differences in their pattern of household activities.

Table 3 summarizes the household activities of the two groups by time of day.

Table 1
Statistical Profile of Households Surveyed
(In Percentages)

Household Income (N=400)		
Less than \$5,000	8.2	
\$5,001 - \$10,000	13.7	
\$10,001 - \$15,000	18.2	
\$15,001 - \$20,000	15.2	
\$20,001 - \$25,000	11.2	
\$25,001 - \$30,000	5.0	
\$30,001 - \$35,000	3.0	
Over \$35,000	3.7	
No Response (NR)	21.5	
Mean	\$16,200	

Type of Occupancy	Income ≤ \$15,000	Income > \$15,000
	N=161	N=153
Own	54.7	83.0
Rent	44.1	16.3
Other, NA	1.2	0.7

Type of Dwelling	Income ≤ \$15,000	Income > \$15,000
	N=161	N=153
Single family	64.6	79.7
Mobile home	3.7	4.6
Two family duplex	9.9	6.5
Apartment	18.6	7.8
Condominium	0.5	6.0
Other	2.5	1.3

Age of Dwelling	Income ≤ \$15,000	Income > \$15,000
	N=161	N=153
Less than 3 years	1.9	11.1
3 - 10 years	18.0	22.2
11 - 20 years	14.3	22.9
More than 20 years	59.6	43.1
Don't know	6.2	0.7

Number of Rooms	Income ≤ \$15,000	Income > \$15,000
	N=161	N=153
3 or less	12.4	0.7
4	32.3	9.2
5	28.0	20.9
6	14.9	24.8
7 or more	12.4	44.4
Mean	4.86	6.56

Age of the Head of Household	Income ≤ \$15,000	Income > \$15,000
	N=161	N=153
25 or less	21.7	9.8
26 - 35	16.8	24.2
36 - 50	23.0	40.5
51 - 65	22.4	22.2
66 or more	16.1	3.3
Mean	44.17	42.35

Education of the Head of Household	Income ≤ \$15,000	Income > \$15,000
	N=161	N=153
Less than high school	16.8	4.6
High school	37.9	22.2
Some college	25.5	26.1
Bachelor's degree	14.9	20.9
Graduate education	3.7	24.2
Other, NA	1.2	2.0

Activities of the Head of Household	Income ≤ \$15,000	Income > \$15,000
	N=161	N=153
Employed full time	65.2	90.8
Employed part time	7.5	1.3
Unemployed	6.8	0.7
Other	20.5	7.2

Table 2
Appliance Profile of Households
(Saturation in percentages)

Appliance	Income ≤ 15,000 N=161	Income > 15,000 N=153
Electric heat.	16.8	22.2
Electric water heater.	30.4	41.2
Electric stove	43.5	65.4
Microwave oven	2.5	12.4
Central air conditioning	37.9	63.4
Clothes washer	65.2	88.2
Electric dryer	34.2	63.4
Automatic dishwasher	22.4	56.9
Separate humidifier.	14.9	19.0
Separate dehumidifier.	6.8	18.3
Well and water pump.	3.7	4.6
Plug-in electric heater.	13.7	19.0
Window air conditioner	49.1	32.7
Separate food freezer.	32.3	45.1
Black and white TV	58.4	62.7
Color TV	70.8	82.4
Electric lawn mowers	2.9	8.5
Refrigerator	98.8	99.3

Table 3
Household Activities by Time of Day

Activities	Morning	Afternoon	Evening	All Time	Other, NA
Most cooking	8.1	27.3	58.4	3.1	3.1
	6.3	24.2	57.4	3.3	8.8
Laundry at home	33.5	5.6	14.9	8.7	37.3
	35.0	8.5	30.4	13.7	12.4
Bathing	25.9	3.1	59.8	9.3	1.9
	34.0	1.3	54.2	9.2	1.3
Dishwashing	10.2	5.6	58.7	21.7	3.8
	10.8	3.3	70.9	13.1	1.9
Ironing clothes	19.8	9.3	16.0	11.2	43.7
	13.6	11.8	24.2	7.8	42.6

In each response category, upper line represents households with income ≤ \$15,000, and lower line represents households with income > \$15,000. (Results are in percentages)

Table 4 shows the energy efficiency profile of the homes surveyed. The R-value tells how well an insulation resists summer heat gain and winter heat loss. The higher the number, the better the insulation. It can be seen that more than 80% of the households are not knowledgeable of "R-factor". In this table again, respondents in higher income group seem to have somewhat more energy efficient homes.

3.2 CONCERN FOR CONSERVATION

Respondents were asked how often they and the members of their family turned off lights and

appliances such as TV when not being used. The lower income group appears to be somewhat more concerned about conservation. When asked about the temperature at which they usually kept their heating thermostat, the response varied from 60° to 88°, the average being 68°. The two groups did not exhibit any significant difference in this regard.

3.3 TIME OF THE DAY PRICING

To our knowledge, relatively little publicity has been given to the complex topic of time-of-day pricing system for household electrical consumers.

Table 4
Energy Efficiency Profile of Homes
(In Percentages)

	<u>Good</u>	<u>Fair</u>	<u>Poor</u>	<u>Other, NA</u>
Wall insulation	42.9 66.0	28.6 21.6	19.9 6.5	8.7 5.9
Attic insulation	43.5 66.7	20.5 17.0	12.4 7.2	23.6 9.2
Floor insulation	44.1 64.1	22.4 10.5	10.6 5.2	23.0 20.3
Overall insulation	46.0 75.2	28.0 15.0	18.0 6.5	8.1 3.3
	<u>All</u>	<u>Some</u>	<u>None</u>	<u>Other, NA</u>
Insulated or storm windows	78.9 88.2	8.7 5.9	10.6 4.6	1.9 1.3
Weather stripping	46.0 69.3	26.7 20.9	24.2 7.2	3.1 2.6
		<u>Yes</u>	<u>No</u>	<u>NA</u>
Attic ventilation		49.7 68.6	15.5 9.2	34.8 22.2
Knowledge of "R-factor"		11.2 17.6	86.3 81.7	2.5 0.7

In each response category, upper line represents households with income \leq \$15,000, and lower line represents households with income $>$ \$15,000.

Therefore, ground was prepared before seeking answers to some hypothetical questions on their propensity to alter household routines. An attempt was made to find out how much the households could be induced to rearrange some of their activities by provision of a cheaper (30%) rate during non-peak night hours. Fifty-five percent of the respondents replied that they would change some of their household rou-

tines to take advantage of the cheaper rate. On further inquiry; laundry, dishwashing, and ironing were found to be relatively more flexible. On the other hand, as expected, cooking and bathing were found to be relatively inflexible. Gollin and Smith (3) have found similar characteristics in New Hampshire.

Table 5
Extent of Changing Timing of Selected Household Routines
(Number of Households)

Activities	Proportion Saying:				N
	Great Deal	Somewhat	Little	No change	
Cooking	4 4	3 3	1 0	107 97	115 104
Laundry	33 37	10 17	4 6	27 20	74 80
Bathing	5 6	2 2	4 6	105 94	116 108
Dishwashing	15 14	5 5	2 2	37 38	59 59
Ironing	15 9	2 1	2 2	42 48	61 60

In each response category, upper line represents households with income \leq \$15,000, and lower line represents households with income $>$ \$15,000.

The inducements offered by a time-of-day pricing system do seem, on this evidence, to have motivational significance in influencing people's willingness to alter established household routines.

3.4 PERCEIVED PRICE ELASTICITY

Considerable amount of work has been done analyzing the demand for electricity. Taylor (9) surveyed the work done in this field. Almost all the studies have focused on determining the price elasticity of electricity consumption by using the past data. These studies seem to assume that the past behavior would continue in the future also. This study, on the other hand, attempts to measure the price elasticity based on the intended behavior of the consumers. Intentions, as the time progresses, may change also. However, the notion of perceived price elasticity does seem

to provide an added dimension which can be advantageously incorporated in a policy-making environment.

Table 6 describes the responses of the households to two hypothetical price increases---10% and 20% respectively. Table 7 notes the computed elasticity figures for the two income groups. These elasticity estimates are somewhat in the lower range when compared with the ones estimated by using actual past behavior. One can notice that for the higher income group, as theoretically expected, the perceived electricity demand is somewhat more price inelastic. Overall, the perceived household demand for electricity, at least in the short run, seems relatively insensitive to small changes in electric rates.

Table 6
Percentage Decrease in Consumption When Electric Rate Increases
(Number of Respondents)

	No Decrease	1-5% Decrease	6-10% Decrease	More than 10% Decrease	Total Respondents
Rate Increases	96	8	10	8	122
10%	92	4	12	9	117
Rate Increases	75	2	12	26	115
20%	68	4	7	23	102

In each response category, upper line represents households with income \leq \$15,000, and lower line represents households with income $>$ \$15,000.

Table 7
Perceived Price Elasticity of Electricity Consumption
(Weighted Average Elasticity)

Respondents	Rate Increases 10%	Rate Increases 20%
Income \leq \$15,000	-0.30	-0.39
Income $>$ \$15,000	-0.29	-0.35

4. CONCLUSIONS

This study attempted to measure how much motivational value a time-of-day rate structure would have in influencing households' response to shifting their electrical usage from peak to non-peak hours of the day. It also attempted to determine their perceived price elasticity of electricity consumption. It is felt that such attitudinal studies provide additional dimensions which could and should be incorporated when formulating policies and strategies.

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6. BIOGRAPHIES

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