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A GROUP CONTINGENCY FOR ELECTRICITY CONSERVATION IN MASTER-METERED APARTMENTS

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Two studies evaluated the effects of a group contingency on electricity conservation. In Study 1, residents of 166 apartment units in three towers held meetings and received biweekly payments of the value of electricity saved compared to predicted use. The group contingencies were initiated in each tower in a multiple-baseline design. The program produced substantial savings in one tower (11.2% of temperature-adjusted baseline), moderate savings in another (4.0%), and minimal savings in a third (1.7%). Overall, the residents saved 6.2%. In Study 2, residents of 255 apartment units, also in three towers, received the same treatment, except only 50% of the value of their savings were paid, and they received a one-time bonus of $5 for using ≥ 10% less than baseline. Towers in Study 2 showed savings of 9.5%, 4.7%, and 8.3%, an average of 6.9%.

Over the past several years, there has been a burgeoning interest among social scientists in applying behavioral principles to reduce residential energy consumption. Several studies have demonstrated that regular feedback on energy use can reduce consumption (Becker, 1978; Hayes & Cone, 1977; Kohlenberg, Phillips, & Proctor, 1976; Palmer, Lloyd, & Lloyd, 1978; Seligman & Darley, 1977; Winett, Kaiser, & Haberkorn, 1977; Winett, Neale, & Grier, 1979). Monetary rebates based on decreases in energy consumption have also been shown to be effective means of reducing residential energy use (Winett, Kagel, Battalio, & Winkler, 1978; Winett & Nietzel, 1975).

Although these studies have demonstrated that energy consumption can be modified, their practical importance is somewhat questionable. Most of them involve homes or apartments with individual meters, where residents can reduce their bill by energy conservation. No one else is likely to administer such programs because only the individual benefits directly.

There is a category of residential units in which there is someone with a strong interest in getting residents to conserve energy. These are master-metered apartments, in which residents do not pay for their own energy use directly. Energy conservation benefits apartment owners by reducing their operation costs, and cost-effective incentive or feedback programs may be practical. Master-metered apartments use about 35% more electricity than similar individually metered buildings (Midwest Research Institute, 1975). Approximately one-third of all apartment units in the U.S. are master-metered and their total waste of electricity is estimated at 9.1 billion kilowatt hours per year.

This study evaluated the use of a group contingency for electricity conservation. Group con-

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tingencies, defined here as reward systems in which members of a group receive equal individual rewards based on the performance of the entire group, have been used effectively in education (see Litow and Pumroy, 1975), in industry (Lawler, 1971), and in other performance areas. In the area of energy conservation, two studies (McClelland and Cook, 1980; Newsom and Makranczy, 1977-1978) have successfully used group contingencies to reduce energy consumption in university housing. It is difficult, however, to generalize from university housing to privately owned apartment buildings.

Slavin and Wodarski (Note 1) have used a group contingency to reduce natural gas consumption in an apartment complex. Residents were mailed checks every 2 wk for their portion of 75% of the value of energy saved by their building. This contingency produced a reduction in gas use of only 3.3%, and even this savings did not maintain into a third month of implementation. The present paper reports the results of two studies that evaluated group contingencies designed to improve on the Slavin and Wodarski methods.

STUDY 1

METHOD

Participants and Setting

The participants were the residents of 166 all-electric apartment units in "Rice Hill," a condominium in Baltimore, Maryland. Residents were primarily elderly and middle to upper middle class. The apartments were organized into three towers, each with its own electric meter. Tower 2 had 40 units, Towers 1 and 3 each had 63 units. Occupancy was at 100% throughout the project. Apartments had individual air-conditioning thermostats.

Data Collection

Each meter was read three times each week at the same time of day. Reliability checks yielded inter-reader reliabilities of 100%. Average daily use was computed by dividing the kilowatt hours consumed by the number of days in the period (two or three).

Design

In Study 1, the group contingency was implemented in multiple-baseline fashion in a randomly determined order. Tower 1 received the treatment first (in June 1977), followed 3 wk later by Tower 2, and 3 wk after that by Tower 3. The group contingency was continued through the summer, for a total of 14 wk for Tower 1, 12 wk for Tower 2, and 8 wk for Tower 3.

Baseline

Beginning in late May, baseline meter readings were begun in all three towers. A total of 14 readings were taken before the contingencies went into effect at Tower 1. The 14 baseline observations were used to generate a linear regression equation relating temperature to electricity usage so as to establish an expected level of electricity use for each temperature.

Treatment

The treatment was as follows:

1. Resident meeting. Two weeks before treatment began, all tower residents were sent a letter inviting them to a meeting. A reminder was sent 6 days later. Five days before the contingencies were to go into effect the meeting was held. It took 60-90 min, and followed a structured sequence of activities, including an appeal for conservation, description of the rebate program, energy saving tips, solicitation of resident energy conservation suggestions, and extensive question-and-answer periods. Attendance at the meetings ranged between approximately one-fourth and one-half of the residents.
2. Letters to residents. On the morning after each meeting, a letter was sent to all tower residents reviewing suggestions brought out in the meeting, and describing the group contingency. It also contained a copy of the energy tips, a sticker saying "We Conserve

Energy" and a second sticker containing a reminder to turn off the air conditioner, turn out lights, and close drapes before leaving the apartment. The residents were asked to display these stickers in their apartments.

3. Implementation of group contingencies. Every 2 wk, the total amount of electricity used by the tower was compared to the amount predicted based on the daily temperature for that period and the prediction equation for the tower. If less than predicted, the kilowatt hours saved was multiplied by the electricity rates then in effect (an average of 2.8¢ per kilowatt hour). The total savings earned by the tower was divided by the number of apartments and a check for that amount was sent to each resident. Whether or not the tower earned a payment, residents received a feedback letter explaining how much electricity the tower was expected to use, how much was actually used, and how much money was earned (if any).

RESULTS

Figure 1 depicts the weekly electricity use per resident for each of the three towers, adjusted for temperature. The adjustment was carried out by computing a linear regression of degree-days on electricity use per resident over the entire study and then adjusting each weekly total to remove the effect of temperature.

The initiation of the group contingency in Tower 1 produced an immediate and sustained decrease from baseline in electricity use. Table 1 shows that the greatest savings were made immediately following initiation of the group contingency, with the savings decreasing as time went on. A similar pattern was observed by McClelland and Cook (1980). Overall, Tower 1 used 11.2% less electricity during treatment than during baseline. The experimental contingencies were not effective with Tower 2. Electricity use actually increased from baseline during the first 3 wk of the group contingency, and overall, Tower 2 used only 1.7% less during treatment. The results for Tower 3 are less clear than those for Tower 1, but they do show a decrease in use of 4.0% during treatment.

Table 1

Percent changes from baseline in electricity use during treatment, Study 1.

	Three-Week Periods					
	1	*2*	*3*	*4*	*5*	*Total*
Tower 1	−14.7	−11.1	−14.8	−9.0	−6.4	−11.2
Tower 2		+4.3	−5.5	−2.7	−1.6	−1.7
Tower 3			−5.8	−1.9	−4.3	−4.0

Taken together, the apartment complex used 6.2% less electricity during treatment than during baseline, a total value of $1,521.13. Payments to residents averaged $1.78 every 2 wk and totalled $1,452.70.

In summary, the group contingencies seemed effective in two towers, but not in a third. In the buildings in which the treatments were effective, the effects appeared to be strongest immediately following the initiation of treatment.

STUDY 2

METHOD

Participants and Setting

The participants in Study 2 were the residents of "Nevermoor," a 255-unit rental apartment complex in Baltimore. Like the residents of Rice Hill, those at Nevermoor were primarily elderly, but they were lower middle to middle class. The apartments had electric air conditioning (with individual thermostats) but gas ranges. The apartments were organized into three towers. Tower A had 82 units, Tower B had 88, and Tower C had 85. Occupancy was near 100% throughout the project.

Data Collection

Meters at Nevermoor were read in the same way and on the same schedule as those at Rice Hill.

Design

Study 2 used the same design as Study 1. The contingencies went into effect at Tower A 1 wk

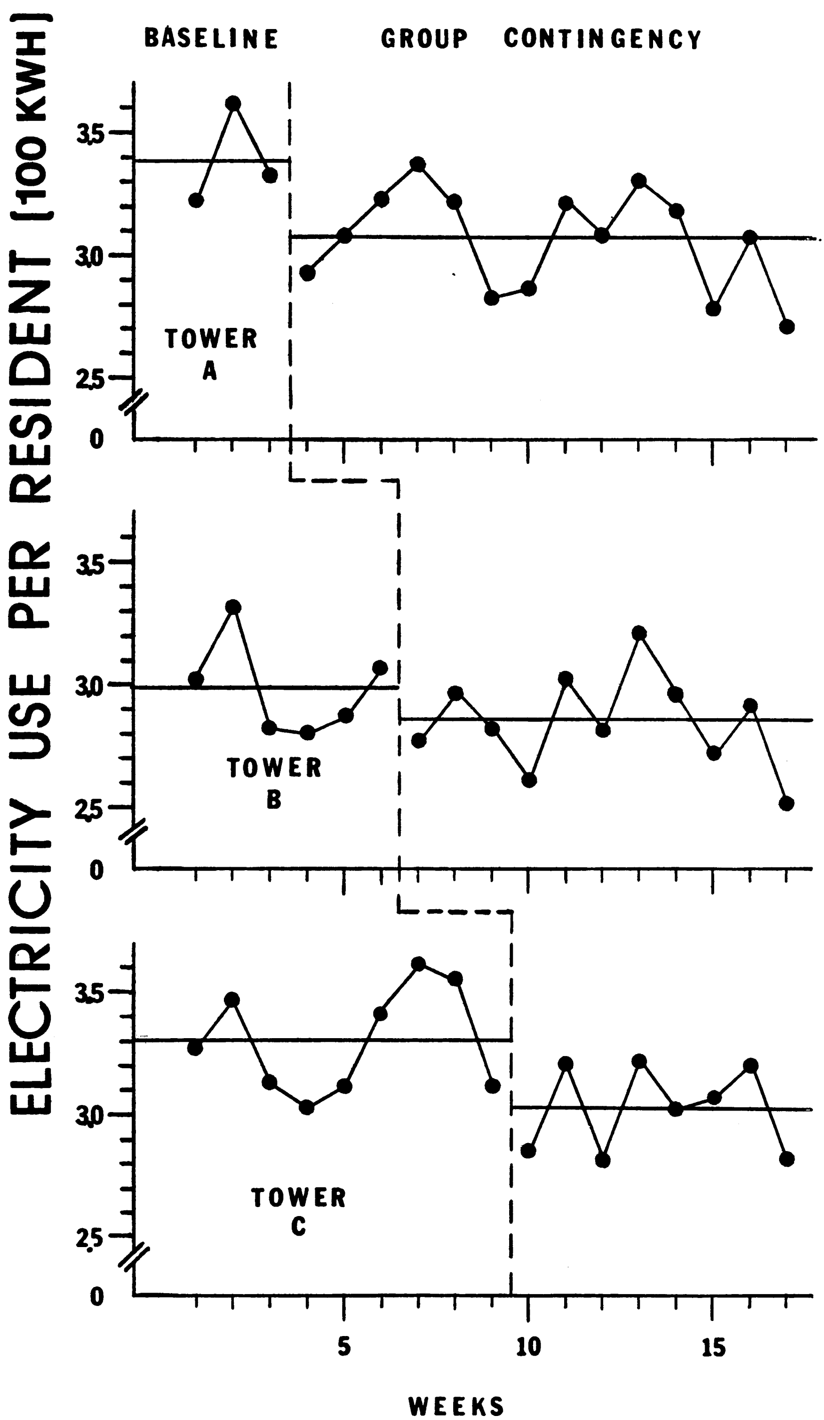

Fig. 1. Weekly electricity use per resident in 100 KWH units, adjusted for temperature, Study 1 (Rice Hill Apartments). The horizontal lines indicate mean use during baseline and treatment, respectively.

after treatment at the first tower at Rice Hill began. The group contingency was in effect for a total of 14 wk for Tower A, 11 wk for Tower B, and 8 wk for Tower C.

Baseline

Twelve readings were taken before the group contingency began at Tower A. These baseline observations were used to generate electricity-use prediction equations.

Treatment

The experimental treatment applied at Nevermoor was the same as that used at Rice Hill, with one important exception. At Rice Hill, the residents received 100% of the value of their entire savings as a group, and received their checks every 2 wk. At Nevermoor, residents received only 50% of the value of the energy they saved. Also, although they received feedback letters every 2 wk, beginning 2 wk after the contingencies went into effect, they received payment only every 4 wk. This schedule was used to increase the size of each payment, as 50% of actual energy savings was a small sum even if the residents saved a great deal. In addition, residents received a one-time bonus of $5 the first time their tower exceeded a 10% savings in a 2-wk period. This bonus was expected to increase the saliency of treatment and serve as an early, highly visible indication to residents that they could save energy if they tried.

RESULTS

Figure 2 depicts the weekly use per resident, adjusted for temperature, for each of the three towers in Study 2. A linear regression was used to remove the effect of temperature on electricity use, as in Study 1. The group contingency was effective in Towers A and C, and somewhat effective in Tower B. Table 2 shows that overall usage was 9.5% less than baseline at Tower A, 4.7% at Tower B, and 8.3% at Tower C. Unlike the findings at Rice Hill's Tower 1, the savings did not decrease over time at any of the Nevermoor towers. Over the treatment period, the entire complex used 6.9% less electricity during treatment than it did during baseline, a value of $1,925.15. Average monthly payments to resi-

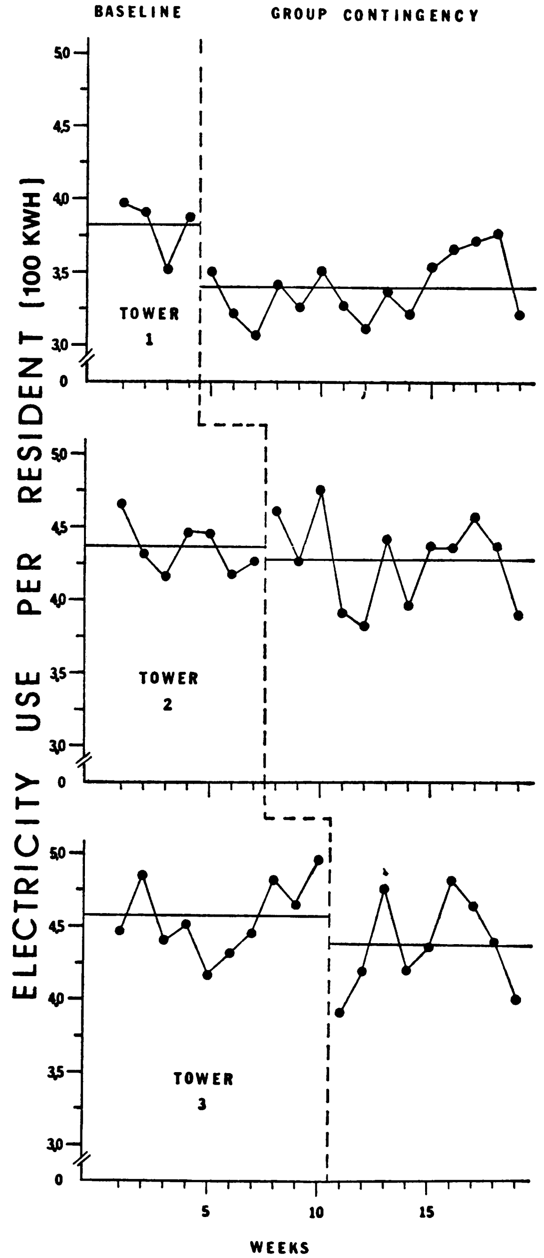

Fig. 2. Weekly electricity use per resident in 100 KWH units, adjusted for temperature, Study 2 (Nevermoor Apartments). The horizontal lines indicate mean use during baseline and treatment, respectively.

Table 2

Percent changes from baseline in electricity use during treatment, Study 2.

	Three-Week Periods					
	1	*2*	*3*	*4*	*5**	*Total*
Tower A	−8.8	−7.2	−9.6	−8.6	−14.9	−9.5
Tower B		−4.3	−5.7	−0.9	−9.3	−4.7
Tower C			−10.4	−5.9	−8.8	−8.3

*Two-week period.

dents, not including the $5 bonuses, were $1.44, and totalled $952.34. Towers A and C earned their $5 bonuses for exceeding a 10% savings in a 2-wk period. Including the bonuses, the residents received a total of $1,787.34.

Study 2 shows that group contingencies can reduce electricity consumption in master-metered apartment buildings. As in Study 1, one of the towers saved less than the others. However, unlike Study 1, Study 2 did not find any trend toward diminishing treatment effectiveness over time.

DISCUSSION

The studies reported here demonstrate moderate effectiveness of a group contingency package for saving energy in master-metered apartments. The program has real practical significance because these were normal, private apartment buildings and the size of the incentives given and procedures used are within the means of apartment managers.

The effectiveness of the very large group contingency demonstrated in these studies is interesting. Classical motivation theory would predict that because the effect of any one person's behavior on his or her own chances of being rewarded is small, motivation to change behavior will also be small. However, although individual behavior is poorly linked to individual rewards in a large group contingency, it may be very well linked to interpersonally applied contingencies among group members (Slavin, 1977). Because it is difficult for any individual to increase his or her own rewards acting alone, there is a strong motivation to socially reinforce others for behaviors that help the group attain its goal. In this study, neighbors presumably reminded one another of the group norm favoring conservation and reinforced actual conservation and reports of conserving behaviors. In a postexperimental questionnaire, 45% of the respondents at Rice Hill and 31% of those at Nevermoor reported that they had talked about saving electricity with residents of five other apartments or more; only 18% at Rice Hill and 20% at Nevermoor reported never having talked to their neighbors about saving energy. Also, only 5% of the respondents at Rice Hill and 3% at Nevermoor thought that "only a few" of their neighbors were trying to save energy, and no respondents thought no one was saving. On the other hand, 60% of the Rice Hill respondents and 62% at Nevermoor thought that most of their neighbors were saving electricity. In other words, the apartment residents both perceived a group effort toward the group goal and discussed the goal with their neighbors, which may account for the results seen.

This study adds to the evidence that although group contingencies can modify energy conserving behaviors, their effects are likely to be moderate. If the waste in master-metered apartments is 35% or more of the total electricity used, the 5-7% savings found by McClelland and Cook (1980), Newsom and Makranczy (1977-1978), and this study is only a small portion of what could be saved. These savings are still important, given the magnitude of the problem, but there is much more to be done.

REFERENCE NOTE

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