Promoting energy conservation with implied norms and explicit messages

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Abstract

The goal of this research was to test the role of contextually implied descriptive social norms in promoting energy conservation, and the norm-salience consequences of posted messages. In Experiment 1, the norm in a campus computer laboratory was manipulated (all unused computers/monitors turned on or off) as well as activation of the norm (small signs posted directing that machines/monitors be turned off before leaving, or no posted signs). Researchers observed and recorded the behavior of 308 participants. As hypothesized, results showed that students were significantly more likely to shut down their computers and monitors in the condition with all machines preset to be off and the small signs posted. A second experiment was conducted to provide a practical test of the norm-aligned condition. The results showed that computers and monitors were shut down significantly more often in the norm-aligned condition than in the control condition (no sign posted and all machines/monitors left on). The results are discussed in terms of the Focus Theory of Normative Conduct.

Keywords: Energy conservation; Behavior change; Social norms.

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Using energy efficiently has many local and global benefits including saving money, conserving resources, and reducing carbon dioxide and other greenhouse gas emissions. Given that inefficient energy use is often the result of human behavior, motivating conservation requires changing behavior (Brook, 2011; Dietz, Gardner, Gilligan, Stern, & Vandenbergh, 2009). Social psychologists have conducted numerous empirical tests designed to examine the most effective ways to promote a change in pro-environmental behavior (Schultz & Kaiser, 2012; Stern & Aronson, 1984). For example, Yates and Aronson (1983) reviewed persuasion tactics to influence energy conservation among homeowners. They demonstrated how the home energy audit could encourage investments in energy-efficient upgrades. A key component of their recommendations focused on “social diffusion theory and the modeling behavior of consumers”—issues related to the power of social norms (p. 439).

SOCIAL NORMS

Social psychological research has consistently documented the strength of modeling as a powerful influence on behavior (Bandura, 1977). Specifically, research has shown that individuals often change their behavior to follow the behavior of others, especially others whom they find similar (Abrams, Wetherell, Cochrane, Hogg, & Turner, 1990). One relevant example can be found in a study designed to prompt men showering in a locker room to turn the water off while soaping (Aronson & O’Leary, 1983). The researchers posted signs to encourage water conservation and planted confederates who modeled the desired behavior. They found that conservation rose from 6%, in the control condition (sign posted), to 49% when one confederate modeled the appropriate behavior. With two models, 67% of participants shut off the water mid-shower. The success of the conservation project was based on manipulation of the descriptive norm (information about what behaviors are prevalent in a situation). However, the researchers’ conclusion is somewhat weakened because they did not compare the impact of the model(s) both with and without the sign (the sign was posted in all conditions).

The impact of descriptive norms has also been examined in the context of littering (Cialdini, Reno, & Kallgren, 1990). Across three studies, the researchers consistently observed higher rates of littering in heavily littered settings whereby the context activated a pro-littering descriptive norm. That is, simply creating a littered setting (without signs) led participants to litter more than when the setting was litter free. Of primary relevance to the current paper was the condition that resulted in the least littering. Although one might assume that litter-free settings would produce the lowest littering rates, the authors reported that participants littered least when a single piece of litter was planted in an otherwise clean site. On the basis of these findings, Cialdini et

al. (1990) proposed a Focus Theory of Normative Conduct, which explained that a single piece of litter in an otherwise clean setting drew participants' attention to the litter-free condition of the environment. They used the single piece of litter to activate the descriptive norm. Without it (when the setting was litter free) participants were less likely to notice how littered or clean the setting was. The researchers concluded that when norms are activated, they can powerfully motivate behavior.

Although Cialdini et al. (1990) made the descriptive norm salient through an inconsistency (a single piece of litter in an otherwise clean setting), there are a variety of strategies that could activate a norm. Kallgren, Reno, and Cialdini (2000) conducted a series of follow-up studies to test different norm focus procedures. The first study used a physiological arousal task to activate norm focus. The researchers found that this arousal task effectively operated as a norm focus manipulation, with participants in the norm focus condition most influenced by an antilittering message. In the second experiment, the researchers staged a confederate who engaged in norm-relevant behavior to activate the norm. Once again, the outcomes were strongest among participants in the norm focus conditions. Although the first two studies tested situational norm focus strategies, the third study examined internal focus on participants' personal norms. In this case, the researchers found that participants in the norm focus condition were most likely to behave according to their personal norms regarding littering. Across these three experiments, the researchers found that greater norm focus produced greater levels of norm-consistent behavior.

APPLICATION OF NORMS TO SAVING ELECTRICITY

Several studies have applied the power of social norms to encourage energy conservation. Oceja and Berenguer (2009) tested contextual variables to encourage people to turn off the lights when they exited a restroom. The researchers examined having the lights on or off when participants (who were alone) entered the restroom, as well as the impact of four different messages. Oceja and Berenguer (2009) found that only their straightforward message ("Before leaving, turn the light off") was effective at changing behavior. Consistent with predictions from the Focus Theory of Normative Conduct, the highest turn off rate (70%) was found for participants who entered the restroom with the lights off and saw the simple message posted. These findings show that normative information can be particularly influential when a message is aligned with the prevailing descriptive norm. In this case, the salience manipulation occurred through the use of a simple sign (see also Keizer, Lindenberg, & Steg, 2008).

The goal of the current experiments was to extend the research on norm

activation by testing the alignment of a contextually implied descriptive norm that is activated via a posted message. Our behavior of interest was energy conservation, and messages were posted to encourage students to turn off their computers and monitors in a computer laboratory when they finished working.¹ On the basis of prior studies, we hypothesized that students would be more likely to turn off the computer and monitor when the descriptive norm implied that this was common *and* the posted sign made this norm salient. The current research is a systematic replication and extension of Ocejja and Berenguer's (2009) research. Like the original study, we are interested in the activation of the setting's norm with a sign. However, Ocejja and Berenguer (2009) limited their observations to participants who were alone. Although this eliminated the influence of others' behavior on the participants' behavior, it also reduced the generalizability of their norm-based investigation. In most field settings, people are going to have others nearby. Thus, it is important to demonstrate that a norm activation strategy can work, even (or especially) in the presence of others. We would also like to highlight the value of a systematic replication and extension, especially given the applied nature of our research. Aronson, Ellsworth, Carlsmith, and Gonzales (1990) reported that a successful replication provides increased assurance in the original finding's reliability and indicates that the manipulated variable can produce effects that are not peculiar to the original setting. Given that unobtrusive observations in a field setting provide less control than laboratory investigations, we assert that the test of a norm activation procedure in a computer laboratory provides valuable applied information to promote conservation. If we find strong effects for norm activation in this new setting—and modifying the manipulation of the norm—we can more confidently generalize across settings and to different types of behaviors. These results would also enable us to recommend this strategy to promote conservation in diverse settings.

EXPERIMENT 1

We used a descriptive norm manipulation, similar to the technique used by Ocejja and Berenguer (2009), combined with a simple message to motivate students in a university computer laboratory to turn off their computers and monitors before leaving. On the basis of the Focus Theory of Normative Conduct, we predicted that students would be most likely to turn off their computers and monitors if they arrived during a condition when unused machines were turned off and a small sign was posted directing that behavior.

¹ There is a popular misconception that the sleep mode on computers makes it unnecessary to turn off an unused machine. It is actually much more energy-efficient to turn off a desktop computer when it is not being used—even if it is only going to be off for a few minutes (Mercier & Moorefield, 2011)

The small sign was designed to serve as the norm activation manipulation. We expected that without it participants would be unlikely to notice whether unused computers were on or off. However, when the sign was posted and unused machines turned off, we expected that this message would activate the descriptive norm because participants would notice the prevalence of this behavior and turn off their machines.

Method

Participants. Participants were observed in a campus computer laboratory at a public university in Upstate New York, where 28 desktop computers were available. During the 4-day experimental observation period, 308 participants were observed.² Participants included 121 males, 181 females, and 6 participants of unknown sex.

Design. The experimental design was a 2 (all unused computers/monitors were turned off vs. on) X 2 (sign posted vs. no sign) factorial design. The posted sign was the size of a business card and contained the university's logo. To further personalize this prompt, the university name was printed and was followed by: "... Green Machine: Please turn off the computer & monitor when you are done." This sign was taped to the bottom left corner of each monitor. All unused machines were randomly assigned to one of the four conditions in 2-h blocks.

Procedure. Researchers worked in pairs from 10 am to 8 pm each day, wearing the computer staff uniform to enable unobtrusive observation. Each 10-h day was divided into five 2-h blocks. Each of those 2-h blocks was randomly assigned to one of four experimental conditions. As students entered the laboratory, researchers recorded participants' gender, login time, whether the participant was alone/with others, logoff time, as well as whether or not the participant turned the computer and/or monitor off at logoff. After each student left, the researchers reset the vacated machine to the status of the appropriate experimental condition (as needed). The researchers found that signs were left in place, indicating a lack of reactance and confidence in the integrity of the experimental conditions.

² It is possible that some participants were counted more than once, which introduces error. A review of our data revealed that occasionally repeat participants were noted and only initial data were included in the analyses. Given that data collection involved unobtrusive observation with gender being the only identifiable demographic that was recorded, there was no way to precisely eliminate all repeat participants.

Results

To determine the success of our randomization procedure, participants were compared on demographic characteristics by condition. To facilitate the Chi-square analyses, the four experimental conditions were analyzed as a single factor. There were no differences by condition on gender (male, female, unknown; $\chi^2(6, N = 308) = 2.3$, n.s.), minutes spent working ($F(3, 302) = .42$, n.s.), or whether the participant was alone ($\chi^2(3, N = 308) = 6.7$, n.s.). Thus, participants were equivalent on demographics by condition.

The primary outcome measures were frequencies of participants in each condition who turned their computers and/or monitors off upon logging off. The possible outcomes were (1) turned off both the computer and monitor ($N = 45$); (2) turned off either the computer or monitor ($N = 23$); or (3) left both the computer and monitor on ($N = 237$). Turn off rates did not differ by gender (male, female, and unknown; $\chi^2(4, N = 307) = 4.6$, n.s.), length of work time ($F(2, 302) = .54$, n.s.), or being alone/with others ($\chi^2(2, N = 306) = 1.5$, n.s.). The percent of participants who took each type of action by condition is presented in Figure 1. Results showed that the most effective manipulation was the condition in which unused machines were off and small signs were posted. Forty eight percent ($N = 48$) of participants in this condition took pro-environmental action (turning off the computer, monitor, or both), which is significantly higher than the overall 10% rate found across the other conditions ($N = 21$), $\chi^2(1) = 55.3$, $p < .001$.

Next, we ran Chi-square analyses to test our primary hypothesis that the sign would change participants' behavior depending on the implied norm. For these tests, we compared the two main outcome measures: participants who left both the computer and monitor on versus those who turned both the computer and monitor off. We ran two separate Chi-square analyses. The first analysis examined outcomes for participants who encountered the norm of having all unused computers left on. The second analysis examined outcomes for participants who encountered the norm of having all unused computers turned off. Among participants who arrived in the "on" norm status, we found no significant difference in participants' turn off rates between those who had the sign posted (2%) versus those who had no sign posted (3%); $\chi^2(1, N = 140) < 1$, n.s. However, among participants who entered the laboratory in the "off" norm status, there was a highly significant difference between the sign posted versus no sign posted conditions, $\chi^2(1, N = 143) = 12.5$, $p < .001$. Among participants who found all unused machines off, only 12% ($N = 7$) of those who had no sign posted turned off their computers and monitors. Whereas in this same "off" norm setting, 34% ($N = 34$) of the participants who had the sign posted turned off their computers and monitors.

Figure 1. Percent of participants in each condition who took each type of action (turned both the computer and monitor off, turned one off, or who left both on) in Experiment 1.

Discussion

The purpose of Experiment 1 was to apply a norm focus strategy to motivate college students to shut down their computers and monitors at logoff. Small signs directing this behavior were placed on monitors to activate the norm. We predicted that participants would be most likely to turn off their computers and monitors if they arrived to the laboratory and were prompted by the signs to notice that all unused computers and monitors were off. The results revealed that the norm activation procedure was effective. Students were much more likely to turn off their computers and monitors when all unused computers/monitors were turned off and the signs were posted. Without the signs, the laboratory machines' status had minimal effect on behavior. This finding is consistent with the Focus Theory of Normative Conduct which explains that norms are most likely to influence behavior when they are made salient.

Given the success of our norm activation condition, an important question remained: Could this manipulation be practically implemented? Experiment 1 required pairs of researchers to methodically observe and record participants' behaviors. This was an effortful process that entailed checking and recording the status of all recently vacated machines, and depending on how the computers and monitors were left, the researchers reset them to maintain the appropriate condition. As the researchers performed these tasks, they simultaneously watched for and recorded students' departures and/or new students' arrivals. Although it was encouraging to find that our target condition was effective, these results have less meaning if that manipulation cannot be easily implemented. Therefore, our next goal was to examine whether the norm activation condition could be practically applied. We conducted a second experiment to determine whether our strongest experimental condition would still be effective if it were periodically maintained by computer laboratory staff rather than by researchers who made continuous interventions. Given the applied nature of this research, it is important to demonstrate that the norm activation manipulation can be implemented in a sustainable manner.

EXPERIMENT 2

In order to assess the effectiveness of implementing the norm of having unused machines turned off without requiring the labor of researchers to constantly monitor and maintain the status of the machines, we developed a follow-up experiment. This test compared our strongest condition from Experiment 1 (unused computers/monitors turned off with the signs posted) with a baseline condition of having the computers/monitors left on with no signs posted. If the more practical application used in Experiment 2 was effective, it would mean that our norm/sign manipulation produces a change in powerful behavior, which can be realistically implemented with the potential to conserve electricity over the long term. We also conducted Experiment 2 at a different college to enhance the generalizability of our research.

Method

Participants. Five computer laboratories at a private college in Upstate New York were identified, and baseline and experimental conditions were implemented for 5 consecutive days. Across the observation period, a total of 4999 machine (computer/monitor) observations were made (2875 baseline observations and 2124 experimental observations). The five computer laboratories had 25, 28, 8, 27, and 9 computers, respectively.

Procedure. Each of the five computer laboratories had a different schedule whereby the baseline or experimental condition was assigned by day (e.g., Laboratory #1: day 1 baseline condition, days 2 – 5 experimental condition; Laboratory #2: days 1 and 2 baseline, days 3 – 5 experimental; Laboratory #3: days 1 – 3 baseline, days 4 and 5 experimental; etc.). These sequences were determined through random assignment. In the baseline condition, all computers and monitors were turned on when the laboratory opened. In the experimental condition, all computers and monitors were left off when the laboratory opened and the small sign (with the same wording as used in Experiment 1) was posted on each monitor. A staff member checked the status of each machine once per shift (approximately every 1.5 h) and recorded which machines were in use. For unused machines, the staff member recorded the status of the computer and monitor. Finally, the staff member reset any computer/monitor to maintain that day's condition.

Results

Given the clustered nature of the data-set, we began by calculating the intra-class correlation coefficient (ICC). In this study, multiple observations ($N = 4999$) were conducted for multiple machines ($N = 97$), and it is possible that certain outcomes are more common for some computers than others. For example, a computer near the entry might attract students who do quick email checks, and are less likely to turn off that machine. Such a computer would have a high number of cases in the data-set due to its frequent use, and would, therefore, have an overweighted effect on the results. The ICC was calculated using SPSS MIXED. As before, the outcome variable was dichotomized such that 0 indicates computer and monitor left on, and 1 indicates computer and/or monitor turned off. The results from a random effects ANOVA showed that both the level-1 variance ($\sigma = .22$, $Z = 35.48$, $p < .001$) and the level-2 variance were statistically significant ($\tau = .013$, $Z = 4.13$, $p < .001$). The ICC was .056. Because of the small ICC, we proceeded with our analyses using conventional statistics, ignoring the clustering effect.

In some instances, we did not know the status of the machine immediately prior to when the next student arrived, because it had been in use at the prior observation period and could not be reset to the defined experimental treatment. Therefore, we removed observations of any machine that was in use in the previous observation period because, in these cases, the status of the machine could not be reset to the appropriate experimental condition. This left machines in which the initial status was known (because it was available to be reset by the laboratory attendant). Among the 443 machines observed in the baseline condition, nearly all of them (95%, $N = 422$) were left by the students with both the computer and monitor on, see Figure 2. Only 3% ($N = 13$) of these machines had both the computer and monitor turned off. Again, very few users (2%, $N = 8$) left either the computer or monitor turned off. Among the 330 machines observed in the experimental condition, 60% ($N = 201$) were found to have both the computer and monitor left on. Impressively, 30% ($N = 100$) of those machines in the experimental condition had both the computer and monitor turned off, whereas 2% ($N = 8$) turned off either the computer or the monitor. The difference in turn off rates between the baseline and experimental conditions was highly significant, $\chi^2(3, N = 773) = 144$, $p < .001$. Although barely 3% of machines in the baseline condition had both the computer and monitor turned off, over 30% of machines in the experimental condition had both the computer and monitor turned off.

GENERAL DISCUSSION

The results of these two experiments provide strong evidence for the power of the norm activation manipulation. In Experiment 1, participants were much more likely to turn off their computers and monitors if the unused machines were turned off and a small sign directed this behavior. We believe that the salience manipulation (the posted sign) activated the norm to turn off machines. In our follow-up experiment, we demonstrated that this manipulation was effective even if it was only periodically maintained. In this case, a staff member reset the machines once per shift, as opposed to the continuous adjustments that were made in Experiment 1. The experimental condition still influenced the appropriate behavior, even when implemented in a more practical manner. The shutdown rate for the computers and monitors in the experimental condition was nearly 10 times as high as it was for the baseline condition.

This study extends the work of Kallgren et al. (2000) who tested different types of norm focus procedures. They found that norm focus techniques prompted the target behavior using a variety of procedures. This study used a small sign to focus participants on the normative behavior. We observed the highest shutdown rate when the unused computers and monitors in the laboratory were turned off, and the sign activated participants' attention to this status. These findings are also relevant to recent studies on the role of contextual variables in moderating posted messages. Although the classic literature on normative social influence has focused on interpersonal social influence, this study demonstrates that contextual cues about the behavior of others can exert a strong influence on behavior. These contextual cues are particularly strong when they are activated through a posted message. Similar results were reported by Keizer et al. (2008) and Keizer, Lindenberg, and Steg (2011). They found that posting an anti-littering sign in a clean environment significantly reduced littering rates compared with littering rates in a clean environment without the sign (47% compared with 39%). However, Keizer also showed that littering rates increased when an anti-littering sign was posted in a highly littered environment (from a baseline of 61–70% with the posted sign; see also Schultz & Tabanico, 2009).

Figure 2. Percent of participants in baseline condition versus experimental condition who took each type of action (turned both the computer and monitor off, turned one off, or who left both on) in Experiment 2.

Although the current findings are in line with previous research, it is worth noting that our results showed that the presence of the sign activated the norm of turning the machines off, but only when the setting depicted that it was common to do so. We did not produce a reduction in turning off machines when the sign was posted but the unused machines were on. In fact, our results showed a nonsignificant effect for the sign when the unused machines were on (2% turned off the computer and monitor). We attribute these results to a floor effect, and not a lack of evidence for the same-norm effects on behavior. In Experiment 2, only 3% of participants turned off the computer and monitor in the baseline condition when the unused computers were on.

The reported findings have practical implications. First, our results suggest that merely posting a sign encouraging a specific behavior is insufficient to induce action. Instead, the presence of a sign can prompt individuals to seek additional cues about the prevailing contextual norm. Behavior change is substantially more likely when the message is aligned with the prevailing norm. Second, our results underscore the potential for default settings to influence behavior. In the energy domain, manufacturers are encouraged to design electronics in which the default setting is efficient (e.g., washing machines default to cold water). The primary reason is that individuals are unlikely to exert effort to switch from the default setting. However, our results suggest that such default settings can help to convey a contextual norm that can potentially produce a more generalizable influence on current behaviors.

Although our results suggest that signs are unlikely to work in some contexts, we also provide strong evidence that signs can play a critical role in promoting specific behaviors. In Experiment 2, the presence of a sign that was aligned with the contextual norm dramatically increased conservation behavior (from 5% in the baseline condition to 30% in the experimental condition). In addition, Experiment 1 showed that just the default setting of “machines off” was sufficient to promote conservation behavior (from 3% in the machines on condition to 12% in the machines off condition). However, the presence of the sign paired with the “machines off” setting nearly tripled conservation—from 12% to 34%. This suggests that the signs are important, but they need to be aligned with the prevailing norm.

Finally, it is important to comment on the potential energy savings associated with this technique. Given the scale of the changes required to address pressing environmental issues, such as climate change or depletion of natural resources, what role can behavioral approaches play? Although a number of authors are skeptical of the potential behavioral contribution—emphasizing instead policy changes or developing more efficient technologies—it seems clear that a behavioral focus can produce realistically achievable results. Dietz et al. (2009) estimate that behavioral interventions could produce a 20% reduction in household direct emissions. Such changes could occur quickly, and without major lifestyle disruptions or financial

investments.

The approach tested in these two experiments involved a default “off” setting for laboratory computers and monitors, coupled with a posted sign to activate the “off” norm. Our results showed that with this combination, 34% of students turned off their computers and monitors. On the basis of a series of realistic assumptions, we estimate that the approach would save 240 kWh per workstation over a 1-year period.³ This is a 70% reduction compared with a no-treatment baseline condition in which only 3% of users turn off their computers and monitors.

In both Experiments 1 and 2, the descriptive norm was manipulated by having all unused machines turned off or on. In reality, people often encounter conflicting descriptive norms in a setting. We expect that as the descriptive norm breaks down, the power of that norm would weaken. Cialdini et al. (1990) conducted a follow-up study in which participants encountered 0, 1, 2, 4, 8, or 16 pieces of litter. Although the lowest rate of littering occurred when a single piece of litter was present, and the highest littering rate occurred when 16 pieces of litter were present, there were moderate levels of littering in the more ambiguous settings (when there were 4 or 8 pieces of litter). Thus, the settings that presented a less consistent norm produced weaker responses. We predict that a computer laboratory that depicted a mixed norm (some machines on while others are off) would lead to less effective behavior change. Thus, to promote conservation in computer laboratories, we recommend that attempts be made to keep unused machines off as a way to strengthen the descriptive norm. Fortunately, Experiment 2 demonstrated that the norm does not need to be perfectly maintained; strong effects can still occur with periodic maintenance of the descriptive norm across the majority of unused computers.

In addition to examining the influence of contextual norms, it would be interesting for future researchers to examine participants’ personal norms to determine whether personal norms guide behavior in settings with ambiguous descriptive norms.

³ Computations are available upon request. Savings estimated based on comparisons with a baseline condition in which all computers are on when the laboratory opens, and off at closing (based on the posted schedule for each laboratory), a 3% baseline shut-off rate, and an estimated “inactive” consumption rate per computer per hour (based on the technical specifications of the 144 computers included in this study; average consumption of 95 W/h). Reductions are based on a 40% laboratory occupancy rate, an average use of 1 h, and a protocol in which all unused computers are turned off by laboratory attendants in 2-h shifts. If left on during all open laboratory hours, the average campus workstation is on 3745 h/year, resulting in an annual consumption of 355 kWh.

Other researchers have found that because personal norms are linked to one's self-concept, personal norms are most likely to guide behavior when they are activated (see Kallgren et al., 2000). This activation requires an awareness of consequences and a feeling of responsibility (see Hopper & Nielson, 1991). It is difficult to speculate regarding the levels of those variables among our participants. We encourage future researchers to consider personal norms as well as past behavior to determine their respective impact in settings in which conflicting norms are present.

We also recommend that future researchers test whether the stimuli used to activate the norm [i.e., the small sign used in our studies, or the single piece of litter used in the Cialdini et al. (1990) research] are solely activating a descriptive norm. It seems possible that these stimuli may also activate an injunctive norm. For example, the single piece of litter in the clean setting (Cialdini et al., 1990) may have prompted participants to notice that the setting was otherwise clean—or perhaps participants realized that littering was not socially acceptable, and they refrained from littering as a result of the injunctive norm. In our research, it is possible that our signs led participants to turn off their computers because the messages prompted participants to consider social disapproval of disobeying the message. Cialdini et al. (1990) pointed out that it is difficult to conduct manipulation checks in field settings. But we see great value in future research that could determine whether the stimuli used to prompt the descriptive norm are only activating the descriptive norm, or whether an injunctive norm is prompted as well. In conclusion, the results from these two experiments demonstrate the norm-activating effect of a posted sign when the desired behavior is aligned with the prevailing descriptive norm. In the context of campus computer laboratories, students were substantially more likely to turn off their computer when the prevailing descriptive norm was that unused computers were off and a sign was posted that encouraged conservation. Given the importance of minimizing wasteful energy consumption, the technique outlined in this paper offers a promising tool for promoting a more efficient use of energy resources.

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