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Determinants and implications of employee electricity saving habit: An empirical study in China

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Working Paper 35
http://ceep.bit.edu.cn/english/publications/wp/index.htm

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May 2012

This paper can be cited as: *Zhang Y, Wang Z, Zhou G. 2012. Determinants and implications of employee electricity saving habit: An empirical study in China. CEEP-BIT Working Paper.*

This study is supported by Program for New Century Excellent Talents in University (Ref. No. NCET-10-0048), China Postdoctoral Science Foundation (Ref. No. 2012M510008), Humanities and Social Sciences Research Foundation of Ministry of Education of China (Ref. No. 12YJC630301), Fok Ying Tung Education Foundation (Ref. No. 121079), National Natural Science Foundation of China (Refs. No. 71203007, 71173017 and 71172106), Doctoral Fund of Ministry of Education of China (Ref. No. 20101101110034), State Key Development Program of Basic Research of China (Refs. No. 2012CB955703 and 2012CB955704), the Basic Research Fund of Beijing Institute of Technology (Ref. No. 20122142002), and Natural Science Foundation of Beijing (Ref. No. 9112013). The views expressed herein are those of the authors and do not necessarily reflect the views of the Center for Energy and Environmental Policy Research.

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Determinants and implications of employee electricity saving habit: An empirical study in China

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Abstract

Employees constitute a large target group for energy conservation. Companies that want to reduce their energy consumption should promote their employees' participation. For successful energy saving in companies, employees should save energy on a continued basis, and develop the habit of energy saving. Unfortunately, success in having employees continue to save energy in organization is difficult. Motivated by such concern, taking office workers as example, this study develops a model to explain employee electricity saving habit in organization. Determining factors are identified based on social exchange theory, norm activation model and literature on threat and harm. Data were collected through a survey of 211 office workers from 10 organizations in Northern China. Partial Least Square (PLS) path modeling was used to analyze the collected data. The results show that enjoyment, personal norm, image and perceived harm significantly influence employee energy saving habit in organization. While anticipated extrinsic benefit and perceived threat don't have significant impact. This paper contributes to the energy saving literature by studying employee energy saving habit in organization.

Keywords: energy saving habit; social exchange theory; personal norm; perceived threat; perceived harm

1. Introduction

China is one of the major energy-consuming countries. In 2001, total amount of energy consumption of China is 1504.06 million tons of standard coal equivalent. However, this number increases to 3249.39 in 2010, which is about 2.16 times of the 2001 level [1]. Along with the fast economic development, the energy demand is huge; as a result, the energy consumption in China is also likely to increase in the future. Energy consumption brings huge number of carbon dioxide emission, which is believed to be one of greenhouse gases. The consumption of energies also brings other exhaust gases, which can damage the environment and people's health and well-being. Furthermore, the increasing energy consumption damages energy safety [2], and intensifies energy crisis in China. For example, many cities in China

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experienced power shortage in summer and had to conduct electricity rationing in peak hours. Thus, China is adopting measures to promote energy saving and reduce energy consumption.

Under external pressure from the government and motivated by reducing energy cost, many companies realize the importance of energy saving and begin to adopt measures to save energy [3-5]. Employees' participation in energy saving is crucial for the success of company's energy saving. Companies that want to reduce their energy consumption should facilitate their employees' participation. In companies, employees' energy consumption is usually free of charge, and they don't need to pay for it. This may reduce their motivation to save energy. There is also energy wasting of employees in many companies. For successful energy saving in companies, employees should save energy on a continued basis. Unfortunately, success in having employees continue to save energy in organization is difficult. They may just save energy occasionally and stop their energy saving later. How to promote continued energy saving and prevent their discontinuance are essential questions for managers to consider. If we want to promote continued energy saving, we should understand what drives it.

Through literature review, we find that employee energy saving is largely ignored in the current literature. By contrast, many studies have been conducted on the macro level or technology level, and researched many issues, e.g., energy efficiency [6-8], eco-industrial park [9], energy conservation in buildings [10-12]. The most relevant literature is household energy saving which is also individual level research, and many research works have been done to study its determinants [13-17]. In addition, the current literature neglects to study what factors influence individual's energy saving habit. Habit is important, and once individuals form this habit, they will save energy naturally and continually. Further research needs to study determining factors of employees' energy saving habit. This helps enhance our theoretical understanding of employee energy saving. It also has important implication for managers to promote employee energy saving.

To fill the research gap and enhance our understanding, we build a model of employee energy saving habit in organizations. As earlier attempt to research this issue, we take office workers as example to build the research model. Office workers don't engage in material production, and electricity (e.g., lighting, computer, air conditioner) is the main form of energy they consumed in their organization. It is interesting to research whether they can form the habit of electricity saving, and explore what factors contribute to this habit. Thus, we will study factors influencing employee electricity saving habit in their organization.

In the following part, we will formulate the research model and develop research hypotheses. After that, empirical method used to test the research model will be described. The results will be presented, followed by discussion and implications of results.

2. Research model and hypotheses

Employee's habit of electricity saving is crucial. Once they form this habit, they will naturally engaged in electricity saving in organizations. Thus, it is important to know what factors contribute to employee electricity saving habit. In order to enhance our understanding, we build a research model, as shown in Figure 1.

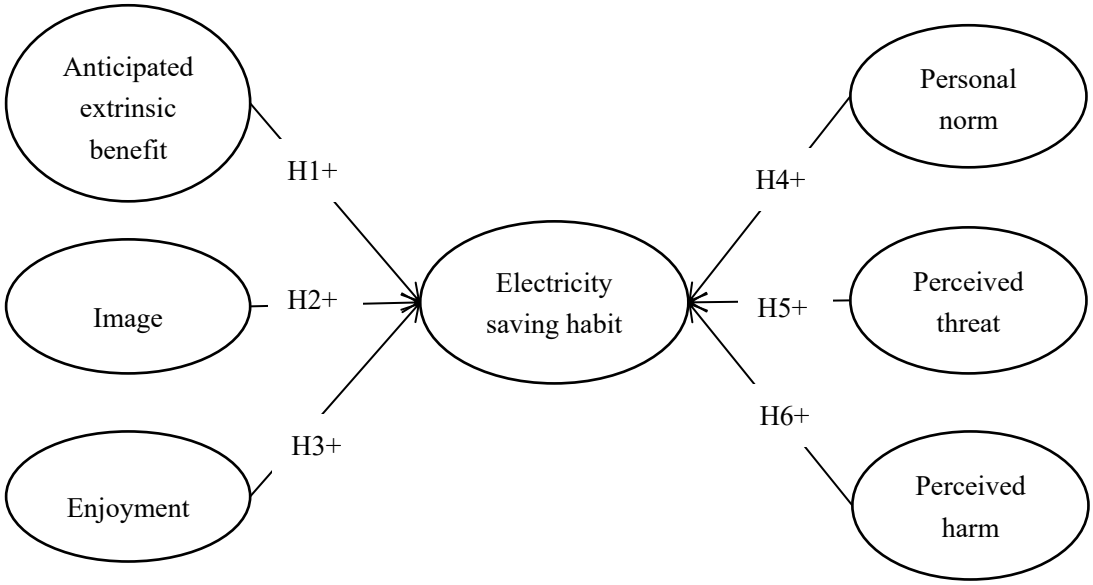


Fig. 1. Research model

2.1. Social exchange theory

Social exchange theory is an influential social psychological theory widely used in the literature. Based on social exchange theory, human interactions can be viewed as social exchanges in essence, and human relationships can be viewed as different kinds of social exchange relationships [18]. Through different social exchanges, individuals can fulfill their needs by exchanging different resources [19]. Resources involved in social exchange can be tangible material resources (e.g., money), or intangible social-psychological resources (e.g., support, reputation, respect) [20, 21]. When engaging in social exchange, people are guided by the "principle of reciprocity" [22, 23]: they expect gaining "rewards" or "benefits" for their pay out. "Benefits" refer to useful resources gained or behavior consequences beneficial for them, which server as motivating factor driving human behavior. The more benefits one gain through social exchange, the more likely that one will engage in such social exchange relationships.

Social exchange theory is also an important theory which is used for studying employee behaviors [24]. Employee-organization relationship can be viewed as social exchange relationship. Employee's behavior in organization is influenced by the gained benefits in such social exchanges, and the more one gain, the more one is willing to reward the organization. Such benefits can be tangible (e.g., salary), or social-psychological (e.g., support and respect). Previous researchers have used social exchange theory to study various issues, such as employee's organizational citizenship behavior [25-27], turnover intention [28], trust in organization [24], and knowledge sharing [21].

In this paper, we argue that employee energy saving in organizations can be viewed as social exchange: they pay by forming energy saving habit and actively saving energy, and in reward, they expect to gain "personal benefits". The more personal benefits they can gain, the more likely that they form the habit of energy saving. In this paper, we identified three kinds of personal benefits for employee's electricity saving in organizations: anticipated extrinsic benefit, image and enjoyment.

2.1.1. Anticipated extrinsic benefit

To encourage employee energy saving, organizations may provide some rewards, such as bonuses, better work assignment. Based on rational principle, this anticipated extrinsic benefit is likely to promote employee energy saving behavior and help them form energy saving habit. Thus, if employees believe that there is extrinsic benefit for energy saving, they are more likely to form energy saving habit, in order to get such rewards.

Hypothesis 1: Anticipated extrinsic benefit is positively related to employee electricity saving habit in organization.

2.1.2. Image

Employee's image in organization is very important for him/her in the organization. People want to build a better image in their organization through their behaviors. Energy saving may improve one's reputation and image in the organization. In this paper, image is defined as reputation increase due to electricity saving in organizations. Those who believe saving energy can improve one's image are more likely to form energy saving habit to gain such benefit.

Hypothesis 2: Image is positively related to employee electricity saving habit in organization.

2.1.3. Enjoyment

Enjoyment is powerful motivating factor for individual behavior. If one enjoys a behavior, they can gain inner satisfaction and fulfillment through the behavior. For example, researchers found that enjoyment positively influences employee's knowledge contributing behavior in organization [21]. Similar, we propose that employees who enjoy energy saving will engage more in such behaviors, and form the habit of energy saving in organization.

Hypothesis 3: Enjoyment is positively related to employee electricity saving habit in organization.

2.2. Personal norm

Employee's energy saving can be viewed as one kind of pro-social and pro-environmental behavior. First, energy saving benefits the organization as it can reduce energy consumption cost of an organization. Second, power generation usually brings huge carbon emission and cause air pollution (This is especially true because the major source of electricity in China is thermal power). Thus electricity saving can reduce emissions, thus benefiting the environment. Norm activation model (NAM) is a theory widely used to study pro-social and pro-environmental behaviors. Prior research works have demonstrated NAM's power in explaining different kinds of individual pro-environment behaviors, such as green phone purchasing [29], households' energy saving [30], recycled paper products purchasing [31], green travel [32, 33]. NAM provides a useful perspective to understand employee energy saving in organizations, thus is used in the paper.

Personal norm is the core factor in NAM. Person norm is defined as "moral obligation to perform or refrain from specific actions" [34, p 191]. According to NAM, individual's pro-environmental behavior is determined by their personal norm. High personal norm can facilitate individual's pro-environmental behavior, and low personal norm hinders the behavior. Considering the key role of personal norm in NAM, we include it in our model to

see how it can influence employee electricity saving habit.

With high personal norm, employees have moral obligation to save electricity in the organization and this moral obligation will guide one's behavior, promoting one to save electricity in the organization. Not saving electricity will violate one's moral obligation and bring one feeling of guilty. Previous researchers also found personal norm positively influences individual's pro-environmental behaviors. For example, Abrahamse and Steg [30] found that personal norm positively influences households' total energy saving. Harland et al. [35] found that individuals with high personal norm are more likely to choose public transportation for traffic. Similarly, employees with high personal norm may engage in electricity saving repeatedly, and form the habit of electricity saving. Thus, we have the following hypothesis:

Hypothesis 4: Personal norm is positively related to employee electricity saving habit in organization.

2.3. Perceived threat and perceived harm

In China, environmental problems are becoming more and more serious, and many people's personal well-being and health are threatened and even harmed by environmental pollution. According to cognitive stress theory, once people are threatened or harmed, they will take actions to cope with the problem, in order to reduce such threaten and harm [36]. Researchers also argued that personal treat and harm are important factors motivating various behaviors, including pro-environmental behavior [36, 37]. Similarity, if employees believe that their health and well-being is threatened or harmed by environmental pollution, they may take actions to avoid and reduce such damage. Energy saving is such a means to achieve this goal. Therefore, this perceived threat and perceived harm may promote their motivation for energy saving, thus they are more likely to form the habit of electricity saving. Therefore, we propose the following two hypotheses:

Hypothesis 5: Perceived threat is positively related to employee electricity saving habit in organization.
Hypothesis 6: Perceived harm is positively related to employee electricity saving habit in organization.

3. Research method

Survey method was used to collect data for model testing. It is best for obtaining personal beliefs and perceptions.

The main variables included in the model are latent variables. In order to get their data, we need to develop measures for them. Each latent variable is measured using several items (also named as indicators). Electricity saving habit was measures using items adapted from Limayem et al. [38]. Measures of anticipated extrinsic benefit were developed based on Kankanhalli et al. [21] and Bock et al. [39]. Image and enjoyment measures were adapted from Kankanhalli et al. [21]. Items measuring personal norm were developed based on Godin et al. [40]. When adopting measures from the literature, words of items were revised to fit the current context. Individual meetings with university colleagues and experts were held to

discuss the initially developed measures. We developed a revised questionnaire based on their suggestions. The respondents were asked to what extent that they agree/disagree with each item using seven-point Likert scale (1 represents strongly disagree, 4 represents natural, and 7 represents strongly agree). Table 1 shows constructs and their measurement items.

Table 1

Survey items

Construct	Item code	Item wording
Habit	HBT1	Saving electricity in my company has become automatic to me
	HBT2	Saving electricity in my company is natural to me
	HBT3	Saving electricity in my company has become a habit to me
Anticipated extrinsic Benefit	AEB1	I will receive additional points for promotion in return for my electricity saving
	AEB2	I will get a better work assignment in return for my electricity saving
	AEB3	I will get a higher salary in return for my electricity saving
	AEB4	I will get more job security in return for my electricity saving
Image	IMG1	People in the organization who save electricity have more prestige than those who do not
	IMG2	Saving electricity in my company improves others recognition of me
	IMG3	When I save electricity in my company, the people I work with respect me
Enjoyment	ENJ1	I enjoy saving electricity in my company
	ENJ2	It feels good to save electricity in my company
	ENJ3	Saving electricity in my company gives me pleasure
Personal norm	PNM1	It would be against my moral principles not to save electricity in my company
	PNM2	Not saving electricity in my company would go against my principles
	PNM3	I have a moral obligation to save electricity in my company
	PNM4	I would feel guilty about not saving electricity in my company
	PNM5	I feel obliged to save electricity in my company
Perceived threat	PTR1	I am worried about the health consequences of pollution
	PTR2	I feel that my health is threatened by pollution in everyday life
	PTR3	The thought of this pollution makes me uneasy
Perceived harm	PHM1	Pollution in everyday life has harmed me
	PHM2	My health has become worse by the pollution in everyday life

The final questionnaire was used to collect data from organizations in Northern China. We contacted 15 organizations, and 10 of them agreed to participate in this survey. With the help of our contact persons in the companies, we were able to distribute 300 questionnaires to office workers. In terms of ownership, 2 of the companies are state-owned, 5 of them are privately-owned, and 3 of them are foreign-controlled. In terms of company size, 2 of them have fewer than 100 employees, and 3 has employees between 100 and 300, another 3

companies have 300~1000 employees, and 2 companies have more than 1000 employees. These companies belong to 6 different industries, and industrial types and number of companies responded are as follows: internet information service (2), software development (2), information technology consulting (1), professional technical service (2), skills training and education (2) and market research (1).

In total, there are 211 usable responses, and the overall response rate was 70%. About half (51.2%) of the respondents are male. About one third (35.1%) of them aged between 26 and 30, and about a quarter (25.6%) of them aged between 31 and 35. Most of them are well-educated, and more than half of them had final education experience of undergraduate study. 37 % of the respondents have a monthly income of between 3000 and 6000 RMB, and 35.5% of them have a monthly income of between 6000 and 10000 RMB.

Partial Least Square (PLS) path modeling was used to analyze the collected data for model testing. PLS is a widely used method to estimate models with latent variables [41]. There are two models in a PLS path modeling analysis: measurement model and structural model. The former reflects relationships between latent variables and items used to measure them. The later reflects hypothesized relationship between latent variables. PLS path modeling is usually analyzed using two steps: firstly checking the measurement model's reliability and validity, then examining the path coefficient in structural model to conduct hypotheses testing [42]. Specifically, the software of SmartPLS was used to conduct PLS path modeling analysis [43].

4. Results

4.1. Measurement model

Reliability and validity of the measurement model is prerequisite for achieving valid results, thus we first examined reliability and validity. Reliability of latent variables can be checked using Cronbach's α, and the suggested threshold low value is 0.7, which means if the Cronbach' α of a variable is greater than 0.7, we can say this variable has good reliability [44, 45]. As shown in Table 2, all the Cronbach's α values rage from 0.81 to 0.93, both of which exceeds 0.7, thus supporting reliability of our measures.

Table 2

Results of measurement model analysis

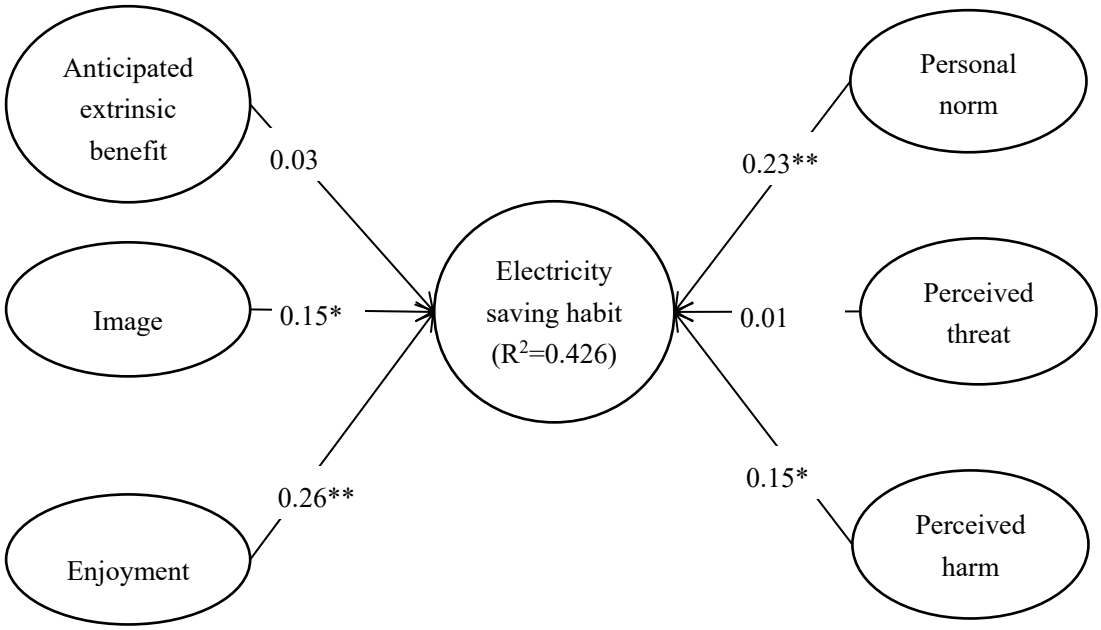
Construct	Cronbach's α	AVE	Item code	Item loading
Habit	0.92	0.86	HBT1	0.91
			HBT2	0.94
			HBT3	0.93
Anticipated extrinsic Benefit	0.93	0.82	AEB1	0.88
			AEB2	0.93
			AEB3	0.90
			AEB4	0.90
Image	0.92	0.86	IMG1	0.90
			IMG2	0.95
			IMG3	0.93
Enjoyment	0.90	0.83	ENJ1	0.89

			ENJ2	0.94
			ENJ3	0.91
Personal norm	0.87	0.66	PNM1	0.83
			PNM2	0.84
			PNM3	0.75
			PNM4	0.85
			PNM5	0.78
Perceived threat	0.81	0.72	PTR1	0.80
			PTR2	0.88
			PTR3	0.86
Perceived harm	0.90	0.91	PHM1	0.96
			PHM2	0.94

Validity can be reflected by average variance extracted (AVE) from a construct and item's loading on their corresponding construct. AVE measures the amount of variance that a construct captures from its measurement items relative to the amount due to measurement error [46]. The suggested threshold low value of AVE is 0.5 [46, 47]. As shown in Table 2, all the AVE values rage from 0.66 to 0.91, both of which exceed 0.5, providing support for validity. In addition, item's loading on their corresponding construct were also checked. Each item's loading on its construct is significant and is greater than the threshold low value of 0.7 [46, 48], providing further support for its validity.

4.2. Structural model

In order to test the proposed research hypotheses, structural model was analyzed, and Figure 2 shows the results. Overall, the model explained 42.6% of the variance in employee's electricity saving habit. In sum, four of the six hypotheses were supported by the data, and two hypotheses were not supported.



[a]*p≤0.05; **p≤0.01

Fig. 2. Results of PLS analysis

Table 3 summaries the results of hypothesis tests. Hypothesis 1 posits that anticipated extrinsic benefit influences electricity saving habit. From Table 3, it can be observed that the path coefficient is 0.03, and this path coefficient is not significant (P>0.05), thus rejecting Hypothesis 1. Results show a positive effect of image on electricity saving habit (β=0.15, P<0.05), thereby confirming Hypothesis 2. Hypothesis 3, which states that enjoyment affects electricity saving habit is also confirmed (β=0.26, P<0.01). The positive effect of personal norm on electricity saving habit is also observed (β=0.23, P<0.01), thus confirming Hypothesis 4. However, threat didn't influence electricity saving habit (β=0.01, P>0.05), thus rejecting Hypothesis 5. Furthermore, the results show the positive effect of harm on electricity saving habit, thereby confirming Hypothesis 6 (β=0.15, P<0.05). None of the control variables have significant effect.

Table 3

Results of hypothesis tests

	Standardized coefficient	Hypothesis test
Anticipated extrinsic benefit	0.03	H1 was not supported
Image	0.15*	H2 was supported
Enjoyment	0.26**	H3 was supported
Personal norm	0.23**	H4 was supported
Perceived threat	0.01	H5 was not supported
Perceived harm	0.15*	H6 was supported
R^2	0.426	

[a]*p<0.05; **p<0.01.

In order to assess the relative impact of social exchange factors and the other factors on electricity saving habit, we compared the change of squared multiple correlations (R^2) between the full model (Figure 1) and one which did not include (anticipated extrinsic benefit, image and enjoyment) by following procedures in prior research [49]. First, we excluded anticipated extrinsic benefit, image and enjoyment from the full model (Figure 1), and the R^2 was 0.337. Then we calculate the effect size f^2 using the following equation: $(R^2_{full}-R^2_{excluded})/(1-R^2_{full})$. Here, $R^2_{excluded}$ =0.337, and R^2_{full} = 0.426, thus the resulting effect size is 0.155. According to Cohen [33], this is a medium size effect (0.15 and 0.35 are defined as medium and large respectively). In conclusion, we found that social exchange factors (anticipated extrinsic benefit, image and enjoyment) had substantial impacts on employee electricity saving habit over and beyond the contribution of personal norm, perceived threat, perceived harm, and other control variables. These results provide further empirical support that social exchange theory can be used to explain employee electricity saving habit.

5. Discussion and implications

Employee is crucial for organizational energy saving, which ultimately helps reduce energy consumption and carbon emission in China. However, there is no guarantee that employees will automatically engage in energy saving, and many employees even waste energy in organizations as they don't need to pay for their energy consumption. Despite its importance, little research has been done to study factors influencing energy saving of employees in

organization. By contrast, previous individual level research mostly focused on household energy saving in their homes. In addition, the individual level research of energy saving also ignored to study what factors can influence individual energy saving habit. In this research, we built a model to investigate this important issue and fill the research gap. In summary, the results show that enjoyment and personal norm have a relatively larger impact, followed by perceived harm and image. Anticipated extrinsic benefit and perceived threat didn't have significant effect. Based on these findings, when employee can enjoy electricity saving, and when they have such personal norm, they are more likely to form the habit of electricity saving in the organization. When they believe electricity saving can improve their image, and when they have experienced harm of environment pollution, they are likely to form the habit of electricity saving. Demographic information (gender, age, education level, and income level) didn't have significant effect on employee electricity saving habit in this paper.

This research provides a new theoretical perspective to study employee electricity saving habit—social exchange theory. The derived factors (image and enjoyment) indeed can explain employee electricity saving habit, and their explanation power is as strong as factor in traditional theory (i.e., personal norm in norm activation theory). This provides further support for its usefulness in explaining employee energy saving habit. Enjoyment had a positive effect on employee energy saving habit, so managers can work to improve employee's experience of enjoyment for their energy saving. One possible way is to let them know how their energy saving can benefit the organization and others. The realization that others can benefit from their behavior can increase the feeling of altruism, and bring them enjoyment. Managers can raise the image of employees with better energy saving habit. The perception of such increased image can help them form energy saving habit in the organization.

However, we found that anticipated extrinsic benefit didn't influence electricity saving habit significantly, implying that extrinsic benefit does not help build employee's energy saving habit. This result is not consistent with our previous expectation. There are some possible reasons. First, we examined the average level of respondent's anticipated extrinsic benefit, and found that their average score is only 3.7. Score of 3 stands for one "slightly disagree", and 4 stands for natural. The average score of 3.7 implies that the anticipated extrinsic benefit is low on average. Many employees didn't think they can get extrinsic benefit for the electricity saving in organization. This low level of anticipated extrinsic benefit may explain why it cannot significantly influence employee's electricity saving habit. Second, the benefit they received may not meet their expectation (i.e., the form and volume of extrinsic benefit), which lead to dissatisfaction of their previous electricity saving. And this dissatisfaction will prevent them from continuing electricity saving, which hinds him/her from forming electricity saving habit. Third, extrinsic reward is effective in temporary compliance context, while employee's energy saving in organization is relative long term orientated. Usually, employee cannot receive extrinsic benefit at once after they save energy. This can weaken the link between extrinsic benefit and energy saving, which hinders its impact on employee energy saving.

Personal norm has a positive effect on employee electricity saving habit, so managers may raise employee's level of personal norm of energy saving. This may be done by showing the negative consequences of their energy consumption (e.g., increasing CO_2 emission, intensifying energy crisis, and causing greenhouse effect and local environmental pollution).

It is also important to let them realize their own responsibility in inducing such negative consequences. Once they realize such negative consequences, and their own responsibility in inducing these consequences, they are more likely to have high personal norm of energy saving [51, 52].

We found that perceived harm and perceived threat have different effects on employee electricity saving habit: the former has significant effect, while the later doesn't. This result implies that if one perceives threat of environmental pollution, it is not enough for one to form energy saving habit. However, if the threat comes true (i.e., they believe that their health and well-being is harmed by environmental pollution), they will act to save energy and form this habit, which may contributes to reduce such pollution. Previous researchers have argued threat and harm as important factors influencing individual pro-environmental behaviors. However, empirical study is relatively few. Our research thus contributes to energy saving literature by showing the different impacts of threat and harm on employee electricity saving habit. Measures can be taken to improve employee's perceived harm. Considering the fact that much pollution may harm people's well-being and health gradually and many people don't know such harm to themselves, information about how their health and well-being is damaged by pollution can be made available to them, which can let them be aware of this harm. This may improve their perception of environmental harm to themselves, which help them form energy saving habit.

Although our empirical findings are encouraging in supporting our conceptual model, caution must be taken when attempting to generalize the results to different samples in varied contexts. To provide external validity and accumulate more empirical evidence, future studies can replicate this study in other contexts. For example, future research can study energy saving habit of employees in public organizations or production workers in industrial enterprises. This research provides significant accumulation of knowledge in this area and offers an impetus for future research.

6. Conclusion

In this study, we developed and empirically tested a theoretical model that explains employee electricity saving habit in organizations based on social exchange theory, norm activation model, and research on threat and harm. Anticipated extrinsic benefit, image, enjoyment, personal norm, perceived threat and perceived harm were hypothesized to influence employee energy saving habit in organizations. We collected survey data from office workers in China. We found that image, enjoyment, personal norm, and perceived harm had significant impact, while anticipated extrinsic benefit and perceived threat did not. This research adds to our understanding of factors influencing employee energy saving habit in organizations.

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