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Assessment of Enhancing Employee Engagement in Energy-Saving Behavior at Workplace: An Empirical Study

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Abstract: This paper investigates the possible benefits and effects of energy-saving attitude, subjective norm, perceived behavioral control, and the behavioral intention of employees on habits in the workplace. The total sample size was 322 respondents. Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) were used for the statistical analysis. The analytical results indicate that energy-saving attitude and perceived behavioral control correlate positively with the employees' energy-saving habits. However, the subjective norm does not have a positive correlation with employees' energy-saving habits. In addition, an examination of the mediating effect reveals that employees' behavioral intentions are a significant mediator for energy-saving attitude, the subjective norm, and perceived behavioral control of the employees' energy-saving habit. Moreover, this study provides a framework for the management of energy-saving in the workplace, and closes with a discussion on the theoretical and practical implications of the research findings.

Keywords: energy saving; attitude; subjective norm; perceived behavioral control; habit

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1. Introduction

The rising consumer demand for the growing influence of environmental protection is making firms more concerned about reducing their environmental footprint [1,2]. More specifically, there is increased awareness of global warming and climate change phenomena, which pose a severe threat to the human living environment. On an individual level, driven by the awareness of environmental protection and quality of life, the main purpose of energy-saving behavior is to reduce negative environmental impacts [3]. In most contemporary firms, the energy-saving behavior of employees in a workplace demonstrates the behavior of a green office and environmental protection [4]. In practice, taking the Harvard Green Office program as an example, it aims to guide and enhance the process of greening Harvard's workplaces [5]. Green consumption refers to the possible ways in which individuals can aggressively support and reduce the negative impact of human activities and protect the natural environment [6]. More recently, based on environment behavioral intention studies, consumers are willing to pay a higher price to protect their environment [7].

In response to global warming and natural energy shortage crises, governments around the world are aggressively implementing energy-saving strategies. Most global governments prioritize energy saving as a major national policy and actively promote energy-saving education [8–10]. According to this view, zero-energy building consumption is mandatory and is listed as a high-priority policy. The United Nations Environment Programme (UNEP) reported that approximately 80 to 90% of energy in buildings is utilized during the operational phase of a building's lifecycle. The amount of carbon dioxide emissions from buildings accounts for more than 30% of all human activities [11], and about one-third of the world's energy is consumed by workplace buildings. Pérez-Lombard et al. [12] point out that workplace buildings account for a large proportion of energy consumption, compared to non-residential energy consumption, thus they have huge potential

for energy saving. The above analysis points specifically to the importance of energy-saving in corporate workplaces. Du et al. [13] claim that countries around the world should be committed to developing forward-looking energy technologies, in accordance with global agreements and policy measures. These efforts can effectively reduce greenhouse gas emissions to maintain energy security and environmental sustainability. Taking China's energy policy as an example, it is crucially important to remember that, due to its highest portion of energy, such as crude oil, it still needs to rely largely on imports, and a stable energy supply is of paramount importance [14]. Since the first global energy crisis broke out in 1978, global governments have implemented a series of energy-saving measures. The major measures include mandatory energy efficiency management, technology research and development, and the advocacy of education. One of the most significant achievements, the Energy Policy Act of 2005, was passed by the United States Congress on July 29, 2005, and signed into law by President George W. Bush. In light of the abovementioned promotion of energy-saving and the effective reduction in greenhouse gas emissions, effective energy-saving policies have become one of the important administrative objectives of global governments and enterprises.

The promotion of energy saving in the workplace requires the active participation and support of its employees. Enterprises can improve their energy-saving efforts by encouraging their employees to actively participate in energy saving and to comply with regulations. It is important that employees develop energy-saving habits to help decrease overall workplace energy use [15]. In general, habits are formed in a natural context by the repeated use of specific products or services [16]. When repetitive actions are carried out due to the demands of life, at work, or through the process of using a specific product, a spontaneous behavioral pattern is formed, which researchers call a habit [17]. While conducting research on customer loyalty and service contract content, Woisetschläger et al. [18] observe that habits are a precursor to economic activity and social transformation. When enterprises are committed to promoting energy-saving policies, employees will receive a good education and sufficient awareness, they will understand the importance of energy saving, and will be willing to actively cooperate and participate with these environmentally friendly policies. In addition, the key factors that affect the employees' values, attitudes, and beliefs concerning their energy-saving behavior in the workplace need to be properly analyzed nowadays, in order to provide feasible improvements. In conjunction with previous studies of Theory of Planned Behavior (TPB) regarding energy-saving behaviors [19,20], the assumption usually made is that repeated performance of a behavior results in the establishment of a habit [21]. Even though the above studies in the literature clearly indicate the relationship of attitude, subjective norm, and perceived behavioral control with behavioral intention and habit, eventually, the following limitations are observed. First, research on energy saving behavior has gradually attracted a high amount of attention in recent years, but current research is mainly focused on issues such as household energy saving, public recreation, and leisure places [22,23]. Second, although Ajzen [21,24] and Barr et al. [25] indicated the mediating effects of behavioral intention and suggested that the effect of behavioral intention on the habit should be taken into consideration, these studies did not specifically focus on workplace energy-saving.

This paper aims to explore and correlate employees' energy-saving attitude, subjective norm, perceived behavior control, and energy-saving behavioral intention with their energy-saving habits. The first three study objectives include an examination and correlation of employees' energy-saving attitude, subjective norm, and perceived behavior control of their energy-saving habits. The study will then seek to gain an insight into the mediating effect of the employees' energy-saving behavioral intention, and finally, the different effects of the personal traits of the employees on their energy-saving habits will be discussed.

2. Literature Review and Hypotheses Development

In general, a habit is a significant factor that affects behavior with regard to environmental concerns; it is not just a simple repetition of past behavior, but also a quantifiable psychological structure [26]. Many studies have investigated how habits affect energy-saving behavior, while some studies use the TPB for daily behavior analyses, which add habits as a research variable [27,28]. The results of an experiment by Aarts and Dijksterhuis [26] show that suppressing habitual responses is difficult, and it is often not successful under conditions of cognitive load. Habits cannot evaluate various possible perceptions, nor are they behaviors that take into account the opinions of other factors—they are spontaneous reactions that are influenced by the environment [29]. Habits are generated as a result of repetitive daily behavior [30]. Although the role of a habit in each working environment is different, when some specific behaviors are carried out repeatedly, fewer and fewer assessment processes are required, and these behaviors then become natural habits [31]. In line with this view, Ouellette and Wood [32] offer further insight into the effect that habits may also have on strong attempts and predictions for future responses. If the behavior is already in a fixed environment and becomes a natural proficiency, through frequent and familiar execution, this automatic behavior affects the future behavior, that is, it is influenced by the habit. Wood et al. [33] have found that there are usually three ways to successfully correct old habits and establish new ones, namely: old habits must be broken; incentives for new actions must be established; and a stable memory can be established in the new environment, with the repeated response process then naturally becoming a new habit. Stern [34] advocates effective energy-saving actions, simplifying procedures to increase the frequency of people's behavior, and letting people become accustomed to this situation, which naturally forms an energy-saving habit.

Personal norms refer to an employee's awareness of the moral responsibility to save energy in an enterprise. In many ways, some research indicates that individual subjective norms have a significant and positive impact on energy saving [35,36]. From the perspective of the Norm-activation Theory, behavior is a function of ethics and behavioral consequences [37]. As soon as people feel the moral responsibility of social behavior, when they do not perform this behavior, they may feel guilty. In order to be consistent with social ethics, ethical responsibility drives individuals to engage in social behavior. Personal norms have a significant predictive effect on their choice of consumer products, information searches, and recycling behavior, and they have a positive impact on their social support behavior. Nordlund and Garvill [38] explore the impact of reducing the willingness to use private cars. Their results confirm that individual subjective norms can affect the willingness to drive private cars and that personal norms have a significantly positive impact on their energy-saving behavior [39]. To maintain the social environment, enterprises should aggressively encourage their employees to dedicate themselves to energy saving, to pay attention to turning off lights, and to saving water [40]. In general, environmentally conscious employees will take the initiative to cooperate with the above measures, but employees without environmental awareness may feel that it is an inconvenience [41]. Based on the above analysis, this study adds the subjective norms of employees to explore their impact on the habit of energy conservation.

Bamberg and Möser [42] analyzed the impact of environmental behavior and found that behavioral intentions in the TPB can only explain an average of about 27% of behavioral variations. Kerr et al. [43] and Broek et al. [44] adopt the frequency of a certain vehicle being used by a respondent, asking what happened the "previous week" to represent the habitual behavior. They suggested that habit or implementation intention variables could be included in the research model to predict behavior. Ajzen [24] commented further that habits could be one of the important factors that influence specific behaviors. Nowadays, many engineers use energy-saving concepts to diagnose the trends in the industry in which they are engaged, and to optimize the perfect combination of all elements within the company to develop new energy-saving products. Based on the above analysis, this study

combines the TPB model to explore the impact of an employee's energy-saving habits in the workplace.

2.1. The Effects of an Employee's Energy-Saving Attitude on His/Her Habits

Extant studies have different perspectives on the definition of an attitude. Behaviors generally refer to actions that are appropriate or inappropriate in a particular environment [45]. Meanwhile, behavior is also a general term for all the actions that are represented in a series of simple actions [46]. Attitude can be defined as the values, feelings, and motivations in a particular situation. Modern psychologists believe that an attitude is an intrinsic psychological tendency that covers cognition, emotion, and behavior, and that it is consistent and persistent. Individuals will behave with explicit actions, in accordance with this attitude [47]. Attitude also refers to the evaluation and behavioral tendencies that an individual holds in a given environment, for example, towards a person, event, thing, group, institution, or object that represents a specific subject. Attitude represents the tendency to assess an entity, such as evaluating an object or idea in a positive or negative way [48]. Attitude is also a persistent psychological reaction that originates from individual learning, and human beings thus use specific attitudes to deal more efficiently with the environment around them.

An attitude is the subjective view of an individual; the persistence of subjective methods is the result of learning and experience. An individual's attitude toward a particular behavior is a positive or negative feeling about that behavior, namely it is the attitude formed by the individual's evaluation of this particular behavior after conceptualization [49]. Furthermore, Ajzen [50] defines attitude as the positive or negative evaluation of a person, event, thing, or behavior. Behavioral beliefs exist when individuals take certain actions that may lead to certain outcomes. The measurement of an attitude can be made through the evaluation of behavioral beliefs and results; a positive behavioral attitude can promote individual behavior, while a negative behavioral attitude can hinder individual behavior. A habit is the result of long-term behavior, which is an important component in the formation of a person's personality. Geller [51] argues that to develop a spontaneous energy-saving habit, four stages of training are required. In the first phase, people who are unaware of energy-saving habits and have no ability to practice them must be assisted by means of indicative training courses. When people learn about energy-saving, they enter the second stage of being conscious of it, but they are incapable of practicing it. In the third phase, people are willing to engage in energy-saving behavior. Furthermore, when people are willing to apply this energy-saving behavior freely, they enter the fourth stage. This study intends to use this phenomenon to explain whether the energy-saving attitudes of employees will generate voluntary sustainable energy-saving habits.

Extant studies clearly delineate that there is a significant positive correlation between environmental behavior attitudes and environmental behaviors [46,48]. TPB argues that behavior is influenced by attitudes. The more people identify with a behavior, the more they will increase their habit to engage in that behavior. In other words, attitude is a function of behavioral beliefs and outcome evaluation. The more positive an individual's attitude is towards a certain behavior, the stronger the energy-saving habit [52]. With regard to the environment and energy, an attitude can be interpreted as the willingness to protect the environment and to save energy. Knowledge can be interpreted as an understanding of ecological balance [53]. The attitude of energy-saving behavior presented in this study refers to an individual's behavioral attitude towards the presentation of energy-saving and carbon dioxide emission-reducing preferences, and an understanding of the consequences of global warming and climate change.

Although most enterprises give a higher priority to the positive support of workplace energy-saving, some employees still do not take practical action as they do not fully understand the contributions that a reduction in carbon dioxide emissions could make. As long as employees understand that their contribution of supporting an energy-saving attitude within an organization is meaningful and valuable, they will be motivated to

take energy-saving actions. Based on the above, we hypothesize that a stronger employee energy-saving attitude is associated with greater energy-saving habits in the workplace.

Hypothesis 1 (H1). *An employee's energy-saving attitude correlates positively with energy-saving habits in the workplace.*

2.2. The Effect of an Employee's Subjective Norm on His/Her Habits

Individual subjective norms have been discussed by many sources in the literature. Cialdini et al. [54] point out that norms can predict the social behavior of people, while individual subjective norms are the individual standards of self-required behavior. Norms refer to the individual's ethical responsibility and obligation to recognize and conduct or not an act [55]. Fishbein and Ajzen [56] argue that subjective norms are affected by social pressures when individuals are engaged in a particular social behavior. The pressure may be derived from him/herself, parents, siblings, friends, or colleagues, but it may also be affected by the social environment.

Early studies reveal that an individual's level of understanding of an event will affect his/her motivation to realize this event, and then gradually turn it into a habit. If the personal norm of an employee is of a high standard, this ethical responsibility will act as a driving force to encourage him/her to save energy. In other words, high-level personal norm groups tend to think that they should abide by natural laws and be careful to avoid harm to the ecological environment, while groups with low-level personal norms believe that as long as society and the economy continue to advance, human beings have the ability to solve ecological problems in the environment through technological changes [57]. Subjective norm is the social pressure that individuals feel when they take on a particular behavior. The stronger the positive subjective norms are, the easier it is to affect the habit of taking on that behavior. This study considers that the formation of subjective norms is susceptible to the external environment, but that it ultimately manifests itself in individual behavior.

In recent studies, Lo et al. [36] and Zhang et al. [58] have found that positive energy-saving attitudes have a significant positive impact on the willingness of employees to save energy. Nevertheless, some corporate employees have not fully understood that energy-saving behavior in the workplace is one of the important ways of avoiding global warming [59]. Many studies have examined whether subjective norms positively affect an employees' willingness to save energy [60]. Lo et al. [36] have found that subjective norms positively affect the energy-saving behavior of employees. When employees are positive about energy-saving in the workplace, the behavioral standards held by the employees themselves will enhance their behavioral habit of energy-saving. In academic circles, through the study of computer-aided teaching software technology, it has been found that when the subjective norm is stronger, the habit to use the technology will be higher. Therefore, there is a significant positive correlation between the subjective norms and the habit, and an employee's subjective norm is likely to exhibit a greater energy-saving habit [6,61]. Based on the above discussion, the following hypothesis has been developed:

Hypothesis 2 (H2). *An employee's subjective norm correlates positively with his/her energy-saving habits in the workplace.*

2.3. The Effect of an Employee's Perceived Behavioral Control of His/Her Habit

The theory of planned behavior is an extension of the theory of reasoned action [56,62], which was made necessary by the limitations of the original model in dealing with the behaviors over which people have incomplete volitional control. It is worth noting that the theory of reasoned action argued that when an individual takes on a particular behavior, it is entirely due to his/her own willingness, while ignoring other external factors that may also affect this willingness. Recently, the concept of personal moral norms and the concept of pro-environmental norms have been added into the scope of theory of planned

behavior research [20,63]. In practice, personal behavior does not occur entirely due to its own willingness. Therefore, Ajzen [21] revised the theory and then proposed a TPB. In addition to the influence of subjective attitudes, the TPB adds a new variable, called a Perceived Behavioral Control (PBC). PBC refers to the degree to which an individual perceives a particular behavior as easy or difficult; meanwhile, PBC also takes into account the individual's experience, the expected obstacles, and the personal ability to control the external environment.

Several studies have proposed various explanations about the TPB, which aim to predict behavior through an individual's habit [6,61,64]. Some empirical studies reveal the following phenomena: Setiawan et al. [64] observe that perceived behavioral control is an important factor that affects the habit and directly affects behavior. When an individual plans to take a specific action, his/her perceived behavioral control naturally activates the inner-ability to judge and then control the further behavior required for taking action during this process, namely the individual's perception of the degree of difficulty expected to perform a particular behavior, and the degree of confidence over that particular behavior [21,63]. Specifically, when an individual has the ability to perform a behavior, or has enough information about it, the degree of self-confidence for successfully performing that behavior is stronger [65,66].

In the workplace, some employees may complain about the ambiguous or vague Kanbans that are difficult to understand. The leader should provide precise work guidelines and avoid dilemmas that may result in a negative work performance. In a study on substantial energy saving that can be achieved by reducing energy use in office buildings, Lo et al. [36] have found that perceived behavioral control has a significant positive impact on an individual's energy-saving habit. When researching the online user community, Hau and Kang [65] also claim that the perceived behavioral control plays a significant role, which affects the sharing of knowledge innovation. Ma and Kay [67] have pointed out that having a perceived behavioral control is the most important driving force on the energy-saving issue.

Different working environments may have a different impact on energy-saving behavior. Zhang et al. [58] indicate that perceived behavioral control correlates positively with electricity saving, and their results also show that environmental benefits, organizational benefits, and perceived enjoyment have a positive impact on the employee's electricity saving. Nevertheless, the energy-saving behavior of employees is somehow quite different to household energy saving. If one compares the home and the workplace, employees need to pay for their own household electricity; however, those who go to work are exempt from paying the electricity bill. This will reduce the enthusiasm of an employee to save energy in the workplace. Based on the above discussion, the following hypothesis has been developed:

Hypothesis 3 (H3). *An employee's perceived behavioral control correlates positively with his/her energy-saving habits in the workplace.*

2.4. The Mediating Effect of Energy-Saving Behavioral Intention on Employee's Habits

The TPB argues that the behavioral attitude, subjective norms, and perceived behavioral control can determine a person's behavioral intentions [21]. The TPB can be used to evaluate their behavioral intentions and to explore whether an employee's social behavior, energy-saving perception, values, subjective norms, perceived behavioral control, and attitude in the workplace affect their energy-saving behavior. In addition, compared to the Rational Behavior Theory, the TPB has been used in more research applications. Extant research argues that the application of TPB is a very rigorous, consistent, highly universal, and sound theoretical framework [20]. Based on the abovementioned literature, this study adopts the TPB to explore the energy-saving habits of enterprise employees.

In theory, as well as in practice, the definition of behavioral intention has been widely discussed from different perspectives in academic circles and enterprises [68,69]. In practice,

Zhang and Prybutok [70] argue that the measurement of behavioral intentions of e-services may be observed from three perspectives, namely: I intend to use e-services; I plan to use e-services frequently; and I plan to use e-services whenever I need electronic services in the future. Several sources in the literature claim that a consumer's satisfaction and emotional reaction are positively correlated with their behavioral intention, which includes customer loyalty, recommendations to other potential customers, word-of-mouth, as well as a willingness to pay a higher price [71]. The more aggressive an individual's attitude is toward a behavior, the higher the behavioral intention. Nevertheless, when an individual's attitude toward a behavior is more negative, the behavioral intention is lower [56]. Prior research has found that consumers who already participate in a wide range of green activities relating to environmental concerns are more willing to engage in other green actions [72,73]. The intention of the behavior is composed of recommendation, sponsorship intention, and purchase probability [74]. The formation of behavioral intentions includes the following components: cognitive factors, emotional factors, behavioral factors, and loyalty [66]. Furthermore, a number of notable findings have been reported, including the empirical verification that service quality, service value, and satisfaction may all be directly related to behavioral intentions [75].

The scope of energy-saving includes the energy usage method, home-life energy consumption, home appliances, transportation, personal habits, and leisure activities, etc., of the employee. With regard to their energy-saving attitudes, through a sustainable education process and learning courses, individuals can practice proper energy-saving attitudes [76]. Energy-saving attitudes are affected by many complicated factors, such as education, religious beliefs, a family's social background, living habits, job majors, the environment, social traditions, and political tendencies, etc. [77]. Energy-saving attitudes are subject to individual behavioral tendencies; in parallel, changes in a person's behavior are also affected by his/her habits. However, the TPB argues that intention is a significant mediator for the influence of an attitude toward the behavior itself, the subjective norm, and the perceived behavioral control of behavior [21]. The study of the effect of energy-saving behavioral intentions on habits has been quite diverse in recent research [55]. For example, Abrahamse and Steg [35] claim that the subjective norm of a resident's energy efficiency is related positively to his/her household energy efficiency [78]; furthermore, they have found that energy-saving habits could help people to reduce the use of their private vehicles. In their research, they argue that the personal norms in workplaces have a significant and positive effect on the energy-saving habits of employees; that is, when the employees' personal norms are high, they are more likely to repeatedly save energy, thus forming energy-saving habits. In a study of the effects of a young person's behavior and their perceived behavioral control of the intention of activity participation, Hagger et al. [79] find that perceived behavioral control has a mediating effect on a person's habits and behavioral intentions. During the recent research process of the purchasing behavior of mobile communication consumers, Amoroso and Lim [80] adopt the mediating effect of customary purchase intention to analyze user behavior. Furthermore, the findings of Guerassimoff and Thomas [17] also point out that energy-saving behavioral intentions encourage individuals to develop positively perceived behaviors and habits.

The above literature clearly delineates the relationship between the energy-saving behavioral intention of energy-saving habits in various contexts, such as energy-saving attitude, the subjective norm, and perceived behavioral control. Based on the above discussion, the following three hypotheses are posited regarding the mediating effect of an employee's energy-saving behavioral intention on their energy-saving habit in the workplace.

Hypothesis 4 (H4). *An employee's energy-saving behavioral intention is a significant mediator of the influence of attitude on his/her energy-saving habits in the workplace.*

Hypothesis 5 (H5). *An employee's energy-saving behavioral intention is a significant mediator of the influence of subjective norms on his/her energy-saving habits in the workplace.*

Hypothesis 6 (H6). *An employee's energy-saving behavioral intention is a significant mediator of the influence of perceived behavioral control on energy-saving habits in the workplace.*

Figure 1 delineates all relevant constructs in this study, the hypothesized relationship, and the theoretical framework.

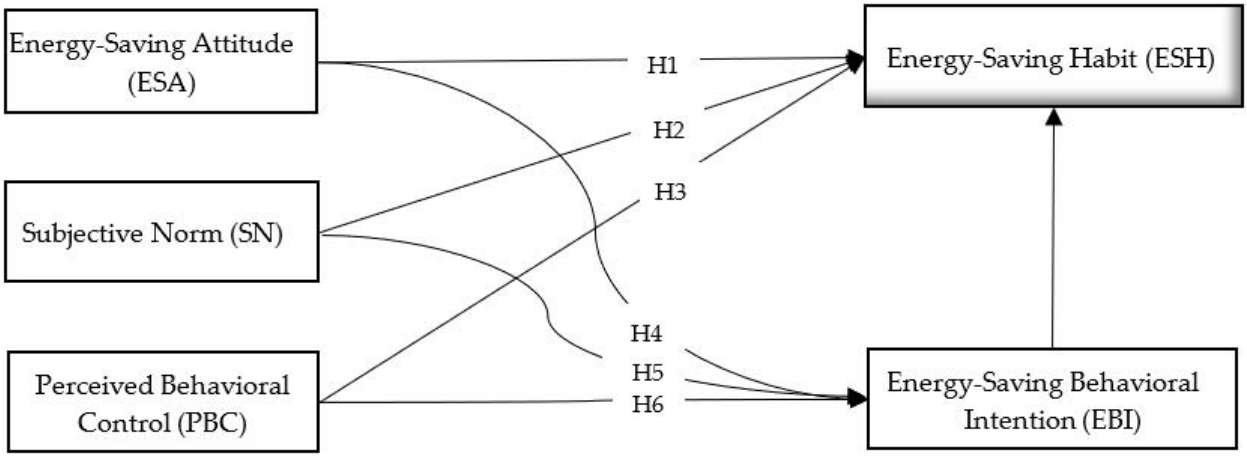

Figure 1. Research theoretical model.

3. Research Methods

3.1. General Information

This study investigates the possible benefits and effects of energy-saving attitude (ESA), subjective norm (SN), perceived behavioral control (PBC), and employee energy-saving behavioral intention (EBI) on energy-saving habits (ESH) in workplaces. Furthermore, we wanted to gain insights into the mediators of the effect of energy-saving behavioral intention (EBI) on energy-saving habits (ESH)—particularly in employee workplaces. To test the six hypotheses above, this study collected data between 2020/02 and 2020/06. The source of the sample includes corporate employees in Taiwan. Contact information for respondents was obtained from a leading commercial data information provider, D&B. Of the 600 questionnaires distributed, 356 were recovered—34 were invalid and 322 were valid.

3.2. Sample Characteristics and Data Collection

This study collected data from firms in Taiwan. The total sample size was 600 respondents. A questionnaire and an explanatory letter were e-mailed, mailed, or hand-delivered to corporate employee in workplaces. This study mainly focuses on employee energy-saving behavior in workplaces and does not contain any human subject research with human participants. Haggett and Mitchell [81] find that pre-notification by telephone significantly increased response rates over those achieved with pre-notification by letter or postcard. Assistance over the phone and e-mail was also provided to respondents to ensure completeness and correctness of the information. Significant effort was made to reach as many potential participants as possible. Research assistants were employed to approach potential employees by telephone. The questionnaire was first prepared in English and then translated into Chinese (traditional and simplified). The Chinese version was subsequently back-translated by a third party to ensure accuracy. The three translations indicated no substantial differences in the meanings of the scales.

Questionnaires were pretested to evaluate their reliability and validity. To test for possible non-response bias and the representativeness of participating employees, MANOVA analysis was carried out to compare early and late respondents in terms of all variables. The results revealed no significant difference between early and late respondents at $p < 0.05$ [82]. Respondent characteristics, such as position, experience, industry, and gender, are shown

in Table 1. The sample of companies that responded to the questionnaire was compared with the qualifying group who did not respond in terms of characteristics, including position, experience, industry, and gender, all of which were found to be almost identical between both groups. Hence, the sample of employees analyzed could be assumed to be representative of the target population.

Table 1. Respondent Characteristics.

Category	Description	Respondent	Percent	Category	Description	Respondent	Percent
Position	R&D	37	11.49%	Industry	Electronic	56	17.39%
	Marketing	63	19.57%		Opto-electronic	65	20.19%
	Manufacturing	86	26.71%		Communication	52	16.15%
	Financial	57	17.70%		Information	43	13.35%
	Management	41	12.73%		Green energy	68	21.12%
	Project Leader	38	11.80%		Others	38	11.80%
	Total	322	100.00%		Total	322	100.00%
Experience (Year)	Below 1	14	4.35%	Gender	Male	198	61.49%
	1~3	69	21.43%		Female	124	38.51%
	3~5	85	26.40%		Total	322	100.00%
	5~10	98	30.43%				
	Above 10	56	17.39%				
	Total	322	100.00%				

3.3. Measures and Methods

Evaluations were made on a Likert scale from 1 to 5, which were analyzed using SPSS 23 and LISREL 10.20. Confirmatory Factor Analysis (CFA) was utilized to test the measurement model and assess construct validity. The five latent variables were allowed to co-vary freely in the CFA model. The parameters in all models were estimated using the Maximum Likelihood (ML) method with the item covariance matrix as the input. The CFA revealed that the measurement model fitted the data with $\chi 2/df = 1.15$, Goodness of fit index (GFI) = 0.93, Normed fit index (NFI) = 0.95, Comparative fit index (CFI) = 0.98, and Standardized root mean square residual (SRMR) = 0.0401. The Root mean square error of approximation (RMSEA) was 0.022 for this model, with a 90% confidence interval between 0.00 and 0.05. All of the model-fitted indices exceeded their commonly accepted levels, which are provided elsewhere [83,84], demonstrating that the measurement model fitted the collected data fairly well.

Table 2 presents the measurements, items, response formats, composite reliabilities, and factor loadings of the measures. Composite reliability (CR) was utilized to evaluate the internal consistency of each construct in the model. All constructs in the model have values of composite reliability that exceed the recommended cut-off point of 0.70 [85]. All of the loadings of the constructs exceed 0.7, suggesting that the indicators that were used to measure each construct are indeed related to that construct.

Convergent validity is measured through factor loading, and the factor loading of all items should be above the cut-off value (lambda > 0.5) and their significance ($p < 0.05$) [86,87]. The results of convergent validity are presented in Table 2, and all factor loadings clearly exceeded 0.5, and have statistical significance ($p < 0.001$) with *t-values* ranging from 12.40 to 15.43. Hence, the constructs in the model clearly satisfy the criteria for convergent validity. Discriminant validity is the degree to which two similar but conceptually distinct measures differ. This can be tested by comparing the square root of the AVE of each construct with the corresponding interconstruct correlation coefficients.

Table 2. Analysis of measurement model.

Construct	Factor Loadings	*t-Value*	CR	AVE
Energy-saving attitude (ESA)				
ESA-1	0.838	14.12 ***	0.87	0.67
ESA-2	0.827	15.32 ***		
ESA-3	0.749	14.66 ***		
Subjective norm (SN)				
SN-1	0.779	13.36 ***	0.849	0.65
SN-2	0.785	12.40 ***		
SN-3	0.857	15.31 ***		
Perceived behavioral control (PBC)				
PBC-1	0.818	14.81 ***	0.847	0.64
PBC-2	0.792	15.30 ***		
PBC-3	0.788	15.43 ***		
Energy-saving behavioral intention (EBI)				
EBI-1	0.761	13.66 ***	0.871	0.58
EBI-2	0.734	13.21 ***		
EBI-3	0.727	12.84 ***		
EBI-4	0.724	12.72 ***		
EBI-5	0.84	15.17 ***		
Energy-saving habit (ESH)			0.882	0.60
ESH-1	0.799	13.80 ***		
ESH-2	0.804	14.23 ***		
ESH-3	0.816	14.51 ***		
ESH-4	0.697	12.90 ***		
ESH-5	0.758	13.11 ***		

Notes: *** $p < 0.001$.

Table 3 demonstrates that for each construct, the square root of the AVE exceeds the corresponding interconstruct correlation, indicating discriminant validity. Accordingly, the constructs in our model measure theoretically distinct concepts.

Table 3. Discriminated validity.

Construct	AVE	ESA	SN	PBC	ESH	EBI
Energy-saving attitude (ESA)	0.67	**0.82**				
Subjective norm (SN)	0.65	0.51	**0.81**			
Perceived behavioral control (PBC)	0.23	0.45	0.43	**0.80**		
Energy-saving behavioral intention (EBI)	0.58	0.51	0.37	0.41	**0.76**	
Energy-saving habit (ESH)	0.60	0.47	0.44	0.33	0.38	**0.77**

Notes: 1. Diagonal: square root of AVEs report along diagonal in bold. 2. Off-diagonals: correlation between latent variables.

3.4. Description of Variables

All variables were measured using a five-point Likert scale ranging from 1 = Never; 2 = Rarely; 3 = Occasionally; 4 = Often; 5 = Always. Energy-saving attitude (ESA) is determined based on the three-item scale [52,88]. Subjective norm (SN) was evaluated using a three-item scale that was adapted from previous empirical studies by Wang et al. [62] and Bock et al. [88]. Perceived behavior control (PBC) was evaluated using the established three-item scales of Hau and Kang [65] and Phipps et al. [66].

Energy-saving behavioral intention (EBI) was measured using a five-item scale that was adapted from Zhuang and Wu [89] and Wu et al. [90]. Meanwhile, Energy-saving habit (ESH) was measured using a five-item scale that was adapted from Zhang et al. [19] and Kerr et al. [43]. Details are shown in Table 4.

Table 4. Measurement items.

Factor	Descriptions	Author(s)
Energy-saving attitude (ESA)		
ESA-1	It is a great pleasure for me to discuss and participate in energy-saving activities with other colleagues in the workplace	Jareemit and Limmeechokchai [52]; Bock et al. [88]
ESA-2	It is a great pleasure for me to take the initiative to participate in energy-saving activities in the workplace	
ESA-3	It is a great pleasure for me to take the initiative to check and share energy-saving information with other colleagues in the workplace	
Subjective norm (SN)		
SN-1	The advertising and bulletin board at the workplaces will encourage me to follow energy-saving behavior	Wang et al. [62]; Bock et al. [88]
SN-2	I will follow the energy-saving behavior, due to the high electricity, water, and gas expenses	
SN-3	The atmosphere of environmental concern in the workplace will encourage me to follow the energy-saving behavior (e.g., e-mails, verbal advertising, bulletin boards, etc.)	
Perceived behavior control (PBC)		
PBC-1	In the workplaces, when I do not use the electrical equipment for a long time, I will take the initiative to turn the power off (e.g., the air conditioning equipment, the TV power adaptor, computer power adaptor, etc.)	Hau and Kang [65]; Phipps et al. [66]
PBC-2	When I use electrical equipment in the workplace, I will improve the efficiency of usage (e.g., use the air conditioning together, share the lighting source, etc.)	
PBC-3	I will re-use the resources in the workplace (e.g., blank surface waste paper, paper bags, plastic bags, etc.)	
Energy-saving behavioral intention (EBI)		
EBI-1	When I leave the workplace for a long time, I will turn off all unnecessary lighting and air conditioners	Zhuang and Wu [89]; Wu et al. [90]
EBI-2	I will take the initiative to turn off the lighting of the stairwell when the sunshine is sufficient during the daytime	
EBI-3	I will take the initiative to turn off the lighting of the stairwell when the sunshine is sufficient during the daytime	
EBI-4	When the indoor air conditioner is running, I will close the door spontaneously	
EBI-5	When I see that a colleague is wasting resources or electricity, I will remind and advise him/her to change such behavior	
Energy-saving habit (ESH)		
ESH-1	For the past year, I have been accustomed to using energy-labeling equipment in the workplace	Zhang et al. [19]; Kerr et al. [43]
ESH-2	Adopting energy-saving manufacturing equipment is a natural thing for me in the workplace	
ESH-3	Adopting energy-saving air-conditioning equipment is a routine behavior for me in the workplace	
ESH-4	Adopting an energy-saving attitude to electricity use in the workplace is a routine behavior for me	
ESH-5	Adopting an energy-saving attitude to water use in the workplace is a routine behavior for me	

4. Results

4.1. Structural Model Analysis

The maximum likelihood method and model path were utilized to elucidate the relationship between variables. The path coefficient was utilized to measure the direct influence of the latent independent variable on the latent dependent variable. The latent independent variable may have indirectly influenced the latent dependent variable through other variables. The causal structure of the hypothesized research model, which reflects the assumed linear, causal relationships among the constructs, was tested using a structural model. LISREL analysis was performed with the theoretical model, with three exogenous latent constructs of energy-saving attitude (ESA), subjective norm (SN), and perceived behavioral control (PBC) and two latent endogenous constructs, which were energy-saving behavioral intention (EBI) and energy-saving habits (ESH). All of the model-fitted indices of the structural model exceeded their respective common acceptance levels: the ratio of χ^2 to the number of degrees of freedom was 1.41 (χ^2/df = 1.41, GFI = 0.926, NFI = 0.931, CFI = 0.967, SRMR = 0.062), and the RMSEA index of this model was 0.041, with a 90% confidence interval of 0.0036 to 0.078, suggesting that the model fitted the data well.

4.2. Test of Structural Model

Table 5 present the results of the Structural Equation Modeling (SEM) analysis, and results are discussed as follows:

H1: An employee's energy-saving attitude correlates positively with energy-saving habits in the workplace. This analytical result supports hypothesis H1 (*t-value* = 4.38, β = 0.43, $p < 0.001$). Hence, this result is consistent with theoretical expectations.

H2: An employee's subjective norm correlates positively with his/her energy-saving habits in the workplace. However, greater subjective norm at the workplace does not correlate positively with energy-saving habits (*t-value* = 1.03, β = 0.07), so H2 was not supported.

H3: An employee's perceived behavioral control correlates positively with his/her energy-saving habits in the workplace. The statistical analysis revealed that an employee's perceived behavioral control correlates positively with energy-saving habits (*t-value* = 3.72, β = 0.35, $p < 0.001$), supporting hypothesis H3.

Table 5. Results of hypothesis testing.

Hypotheses	Coefficient	*t-Value*	Results
H1	0.43	4.38	Supported ***
H2	0.07	1.03	Not Supported
H3	0.35	3.72	Supported ***

Notes: *** $p < 0.001$.

4.3. Test of Mediating Effect

With respect to the mediating effect, the Sobel t test [91] with correction for abnormal formulation was applied to the indirect effect [92]. Sobel t tests of indirect effect beginning with Energy-saving attitude (ESA), Subjective norm (SN), and Perceived behavioral control (PBC) extent on energy-saving habits (ESH) were 5.56, 2.40, and 5.14, respectively (reported by LISREL). All *t-values* met the criterion for statistical significance (1.96). As Table 6 illustrates, the examination of mediating effect in terms of Sobel t tests revealed that energy-saving behavioral intention (EBI) was a significant mediator of the influence of Energy-saving attitude (ESA), Subjective norm (SN), and Perceived behavioral control (PBC) on energy-saving behavioral intention (EBI).

Table 6. Results of mediating effect *Sobel t test*.

Hypotheses	*t-Value*	Results
H4. Energy-saving attitude (ESA) → energy-saving behavioral intention (EBI) → energy-saving habit (ESH)	5.56.	Supported ***
H5. Subjective norm (SN) → energy-saving behavioral intention (EBI) → energy-saving habit (ESH)	2.40	Supported *
H6. Perceived behavioral control (PBC) → energy-saving behavioral intention (EBI) → energy-saving habit (ESH)	5.14.	Supported ***

Notes: *** $p < 0.001$, * $p < 0.05$.

H4. Energy-saving attitude (ESA) → energy-saving behavioral intention (EBI) → energy-saving habit (ESH), yielding a t-value of 5.56.
H5. Subjective norm (SN) → energy-saving behavioral intention (EBI) → energy-saving habit (ESH), yielding a t-value of 2.40.
H6. Perceived behavioral control (PBC) → energy-saving behavioral intention (EBI) → energy-saving habit (ESH), yielding a t-value of 5.14.

According to the LISREL output of direct and indirect effects (see Table 7), the proposed model (Figure 1), with the suggested direction of causality, explains the higher variance in the study's dependent variable, implying that the proposed causal directions statistically fit.

Table 7. Direct and indirect effects among variables.

Path	Direct Effect	Indirect Effect	Total Effect
ESA → ESH	0.43 ***	0.15 *	0.58 ***
SN → ESH	0.06	0.11 *	0.17 *
PBC → ESH	0.35 ***	0.18 *	0.52 ***

Notes: *** $p < 0.001$, * $p < 0.05$.

The Sobel *t* test for indirect effect begins with Energy-saving attitude (ESA), Subjective norm (SN), Perceived behavioral control (PBC) on energy-saving habit (ESH), as illustrated in Table 7 and which reveals that energy-saving intention (EBI) is a significant mediator for the influence of energy-saving habit (ESH). The *t-value* was statistically significant (1.96), so hypotheses H4, H5, and H6 were supported. Tables 6 and 7 present the *t-value*, path coefficients, and hypothesis test results.

5. Discussion and Managerial Implications

5.1. Energy-Saving Attitude and Energy-Saving Habits

The results demonstrate that an energy-saving attitude correlates with energy-saving habits, thus Hypothesis H1 is supported; the stronger the energy-saving attitude, the better the energy-saving habit. The uncertain speed of global warming and climate change is intensifying, and the measures used for low-energy consumption are a global trend. Energy-saving and developing a low-carbon economy have become a high-priority global policy for economic development. Enterprise workplaces are one of the main sources of energy consumption in the world. In order to effectively reduce the negative impacts and to protect the environment, enterprises should not only adopt energy-saving building materials, but they also need to educate employees to implement energy saving and to reduce greenhouse carbon dioxide emissions. Promoting energy-saving habits can effectively reduce energy consumption. These measures can enhance the energy-saving attitudes and awareness of employees, increase economic efficiency, and have a positive effect on their work goals, which will also positively affect employees and influence them to implement energy-saving habits.

5.2. Energy-Saving Subjective Norm and Energy-Saving Habits

The empirical data analyses do not support H2, which indicates that the extent of the energy-saving subjective norm is not positively correlated with energy-saving habits. Based on this statistical result, the following comments are provided: Subjective norms generally refer to employees' perceptions from other daily contact persons, such as relatives, friends, supervisors, and colleagues, which affect their judgement regarding the necessity for energy-saving habits in the workplace. This perception comes from social pressure and the employee's recognition of energy saving. In general, from the employee's point of view, the amount of workplace energy consumption is different from home energy consumption. From the employees' perspective, they themselves pay the household electricity bill. Nevertheless, the electricity consumption of the company has no direct or immediate impact on them, because they do not need to pay for electricity. Ironically, employees may care more about a comfortable working environment in the workplace; however, in practice, because of egoism, employees often behave with less motivation to save energy in the workplace. In addition, non-management or low-level employees may have little knowledge of energy-saving and may be less familiar with the negative effects of global warming, such as greenhouse gas effects and climate change. What is even worse, compared with the operation of traditional equipment, is that the design of the operational interface of new energy-saving equipment is very common, and there is no significant difference in the operation's interface. According to the abovementioned statistical analysis, the energy-saving subjective norm does not correlate positively with energy-saving habits.

5.3. Perceived Behavioral Control and Energy-Saving Habits

The results demonstrate that Perceived Behavioral Control correlates positively with energy-saving habits, thus, Hypothesis H3 is supported; the higher the employees' perceived behavioral control, the better their energy-saving habits. The result of this statistical analysis demonstrates the following phenomenon: It does not matter whether the employees have sufficient training in obtaining the relevant application technologies for energy-saving products and whether they understand the benefits of using energy-saving products. However, when they recognize the effectiveness of using energy-efficient products, they are more willing to adopt more perceived behavioral control and energy-saving behavior. The higher the awareness of the enterprise employees, the stronger their habit will be to decide whether to implement energy-saving habits or not.

The analysis results indicate that perceived behavioral control has a significant impact on behavioral intentions. Therefore, this study suggests that there should be a wide prompting of slogans or Kanbans in the workplace, such as posting a slogan to turn off the lights, or adopting a smart control system that enables multiple workforce members to share a lighting source near the copy machine that is set up with the re-use slogan, etc. In addition, improving the convenience of the workspace and optimizing the process of performing energy-saving behavior with the device/equipment significantly enhances the behavioral intentions of the employees.

5.4. The Mediating Effect of an Employee's Energy-Saving Behavioral Intention

In this study, an examination of the mediating effect, in terms of the *Sobel t test*, reveals that an employee's energy-saving behavioral intention is a significant mediator for the influence of an energy-saving attitude, a subjective norm, and perceived behavioral control on their energy-saving habits in the workplace, thus Hypotheses H4, H5, and H6 are supported.

The mediating effect analysis reveals the effects of energy-saving behavioral intention. It does not matter if implementing an energy-saving discipline is mandatory or voluntary, but the long-term behavior changes tend to naturally make an employee behave more spontaneously, and energy-saving behavior thus becomes a habit.

5.5. Limitations and Future Directions

Although this research yields several important contributions, some limitations of this study suggest directions for future research. First, we did not examine the order of causality between variables. Although collecting data at several points in time reduces common method variance, studies using multiple sources of data are warranted. Secondly, the unexpected number of returned questionnaires and our extensive review of prior research reveal significant differences between full-time employees and temporary employees. Although the number of returned questionnaire forms of temporary employees is not large enough to statistically support this finding, this issue is worthy of further investigation. Third, some workplaces have installed smart energy-saving systems; comparing traditional non-smart energy-saving system workplaces to smart energy-saving system workplaces is worthy of further investigation. Fourth, analyses of significance tests among formal employees, contingent employees, and temporary remote workers are also worthy of further study. Finally, time structures should be considered, as a panel analysis of success factors measured at different times may reveal the relationships between success variables.

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