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Study on the Influencing Factors of Electricity Saving Behavior

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Abstract: In order to explore the influencing factors of electricity-saving behavior, based on the survey data of residents' electricity consumption habits in some areas of Sichuan province, SPSS was used to analyze the differences of different electricity-saving behaviors. And then we establish factor analysis model, induce and extract the common factors that affect the electricity saving behavior. The results show that there are significant differences between psychological cost, behavioral cost, lack of relevant knowledge and electricity cost. They are three common factors that affect the implementation of electricity saving behavior, and the cumulative explainable rate is 52.302%.

Keywords: Behavior cost; Psychological cost; Factor analysis; Electricity saving behavior

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1 Introduction

As the development foundation of human civilization, energy can meet people's needs in daily life. People's daily production and living activities are all supported by energy consumption, and the continuous improvement of material conditions has greatly enhanced our dependence on energy[1]. Electricity is one of the most basic and important forms of energy in all sectors of industry, trade, family and productive life. The most basic way to save energy is to save electricity. Compared with other energy-saving measures and strategies, energy-saving has the advantages of low investment cost and quick effect. It has become the main energy-saving direction for many countries and regions, playing a leading role. Therefore, it is of great significance for resource protection and social development to explore the influencing factors of electricity saving behavior.

At present, most of the researches on electricity saving in China are focused on the level of energy saving consciousness, only a few of them are related to the electricity-saving behavior. He Yanan in <knowledge and practice of household energy conservation of urban residents - Taking Xiamen as an example>, collected data of 376 household residents through questionnaire survey in Xiamen. It is found that urban household residents pay little attention to the power consumption in their homes, and most of them lack all kinds of knowledge about energy conservation. Residents' understanding of electricity use and different types of energy conservation and related knowledge are affected by various factors. Most of these factors are closely related to residents' education level and family real estate. In addition, the data shows that the more people know about energy conservation, the more often they will take energy conservation measures. In the <Analysis of influencing factors of urban residents' energy-saving behavior and study of guiding policies>, Yueting screened out four categories of influencing factors of energy-saving behavior: social demographic factors, individual psychological characteristics factors, situational factors, behavioral outcome factors, and then constructed the influencing factor model of urban residents' energy-saving behavior[2]. The results show that demographic characteristics and family characteristics directly affect people's energy-saving

behavior, while individual psychological characteristics include eight variables: value concept, sensitivity to energy issues, energy-saving knowledge, subjective norms, self-efficacy, behavior control perception, environmental psychological control source and comfort preference. Through the mediation of energy-saving behavior intention, it indirectly affects energy-saving behavior; situational factors affect energy-saving behavior by adjusting the transition process from energy-saving intention to energy-saving behavior.

Energy conservation involves a wide range of concepts. This study focuses on the direction of electricity saving behavior, to explore the influencing factors of electricity-saving behavior. It is not enough to only rely on external constraints to save electricity. The most important thing is to start from the individual[3]. Only when individuals form a good habit of using electricity can the society really form a good new trend.

The above conclusions provide valuable information for our further research, and also find the shortcomings of the existing research. From the perspective of psychology and behavior theories, based on the survey data, this paper uses factor analysis to explore the factors that affect individual electricity-saving behavior.

2 Data sources and sample characteristics

2.1 Data source

The research team conducted field survey in some cities of Sichuan province from 2018 to 2019. The research group adopted random sampling method, combined with the residents' electricity-using habits and the "environmental protection electricity-using habits questionnaire" compiled by the guidance of the instructor. A total of 155 valid questionnaires were collected[4]. The content of the questionnaire mainly includes the basic information of the individual, the place of residence, the cost of electricity consumption, the electricity-using habits and so on. The common factors influencing the electricity-saving behavior are summarized through factor analysis.

2.2 Basic information of respondents

210 questionnaires were sent out in this survey, of which 155 were qualified and valid. According to the gender, there are 56 males, accounting for 36.13%; 99 females, accounting for 63.87%; according to education level, college students and university students are the most, accounting for 54.84%; master graduate students are the least, only accounting for 6.45%; according to occupation, the most are full-time students, accounting for 36.13%; next are students and freelancers, accounting for 34.84% and 20.65% respectively; according to family permanent population, there are four or more students accounting for 53.55% of them, 36.13% of them are three, 9.03% of them are two, and only 1.29% of them are one[5]. According to the age phase group, the age group of 20-30 years old is the most, accounting for 42.58%, followed by 41-50 years old and under 20 years old, accounting for 26.45% and 13.55% respectively.

3 Research results

The main content of this study includes the basic situation of individual electricity consumption, such as the daily household electricity cost, the implementation of electricity saving behavior, etc. The scale was used to measure the influencing factors of electricity saving behavior in daily life.

3.1 Reliability analysis

Table 1. Confidence level test

Alpha coefficient	Number
.912	21

According to the results of the above table, there are 21 items tested in total. The coefficient of clonbach α is 0.912, greater than 0.9, and the reliability is excellent.

3.2 Validity analysis

The higher validity indicates that the results of the questionnaire can show the real characteristics of the respondents very much. It can be seen from the excellent reliability above that the validity analysis can be carried out.

Firstly, KMO and Bartlett tests were performed on the questionnaire data.

Table 2. Validity test

KMO value		.861
Bartlett Test	Chi-square	1532.701
	Freedom degree	210
	Significance	.000

The validity of factor analysis was measured by spherical test and KMO statistical test. KMO statistical analysis value is 0.861 (greater than 0.8). The validity of the questionnaire is better, and the result of spherical test is significant. Two methods verify that the questionnaire is suitable for factor analysis.

3.3 Factor analysis

Table 3. Total Variance Explained

Composition	Initial Eigenvalues			Sum of squares of extracted loads			Sum of squares of rotating loads		
	Total	Variance Proportion	Accumulate%	Total	Variance Proportion	Accumulate%	Total	Variance Proportion	Accumulate%
1	8.16	35.478	35.478	8.160	35.478	35.478	4.783	20.796	20.796
2	2.538	11.037	46.515	2.538	11.037	46.515	4.005	17.411	38.207
3	1.331	5.787	52.302	1.331	5.787	52.302	3.242	14.095	52.302
4	1.159	5.039	57.341						
5	1.098	4.775	62.116						
6	0.909	3.95	66.066						
7	0.876	3.81	69.876						
8	0.81	3.522	73.398						
9	0.706	3.497	76.467						
10	0.631	2.742	79.21						
11	0.588	2.555	81.765						
12	0.573	2.491	84.256						
13	0.528	2.397	86.553						
14	0.471	2.146	88.599						
15	0.438	1.904	90.503						
16	0.402	1.848	92.251						
17	0.364	1.782	93.833						
18	0.322	1.662	95.233						
19	0.266	1.344	96.389						
20	0.233	1.245	97.403						
21	0.228	0.989	98.393						

Extraction method: analysis method for principal ingredient.

Table 3 shows the variance probability and cumulative probability of each factor. The variance contribution rates of 21 common factors are listed from top to bottom. The cumulative contribution rate of variance of the first three factors is 52.3%, indicating that the extracted factors can explain 52.3% of the original variables. It can basically reflect a lot of information of the original variable. According to the above judgment, these three factors are extracted to summarize the original 21 variables.

Table 4. Factor load table

	Composition		
	1	2	3
17. I will close the screen window to reduce the use time of mosquito repellent lamp or mosquito repellent liquid.	0.635		
4. I will close the useless mobile background program at any time.	0.687		
12. I'll turn off the router at bedtime.	0.702		
11. I would open the curtains at daylight and use natural light instead of light.	0.588		
3. I will try not to use the bathroom master in winter bath.	0.658		
8. I will set the air conditioner to the appropriate temperature (such as 25 ° to 27 ° in summer, 20 ° to 22 ° in winter)	0.679		
16. I will keep the power-saving mode of cell phone open for a long time.	0.655		
2. I will try to use natural wind instead of air conditioning and fans.	0.692		
19. I will unplug the phone in time after it is fully charged.			0.682
13. I will unplug the lamp after using it.			0.633
1. I will clean the dust in the dust-collecting box of the sweeper in time.			0.7011
14. I'll unplug the TV after I turn it off.			0.605
7. I defrost the refrigerator regularly.			0.679
18. I will adjust the temperature of the water heater according to the climate.			0.625
10. I will unplug the air conditioner in time after turning it off.		0.849	
6. I will dust the air conditioner regularly.		0.779	
5. I guarantee that the entrance and exit of the hair dryer are unobstructed.		0.608	
15. I'll set the TV volume and brightness to the right level.		0.804	
9. My fridge will leave a third of the space.		0.722	
20. I can cook with hot or warm water.		0.814	
21. I'll wait for the food to cool to room temperature before putting it in the refrigerator.		0.756	

Table 4 shows the topics of each of the three factors. The following three factors are named in turn: F1 factor explains 20.796% of the variation and F1 factor is named as psychological cost factor in this paper. F2 factor explained 17.411% variation and F2 factor was named behavioral cost factor in this paper. F3 factor accounted for 14.095% of the variation and F3 factor was named as the lack of relevant knowledge factor in this paper.

3.4 Correlation analysis

Table 5. Correlation

	Psychological cost	Behavioral cost	Lack of relevant knowledge	Electricity-using expenses
Psychological cost	1			
Behavioral cost	.799**	1		
Lack of relevant knowledge	.787**	.765**	1	
Electricity-using expenses	.195*	.137*	.127*	1

**. At level 0.01 (double tail), the correlation is significant.

*. At level 0.05 (double tail), the correlation is significant.

Finally, the correlation analysis between the three factors and electricity consumption cost shows that the correlation coefficients of psychological cost, behavioral cost, lack of relevant knowledge and electricity consumption cost are 0.195, 0.137 and 0.127 respectively; and they are significantly correlated at the level of 0.01; the bilateral correlation test values between the two factors are 0.015, 0.009 and 0.015 respectively. Therefore, psychological cost, behavioral cost, lack of relevant knowledge and electricity cost are significantly correlated, and the order of correlation is psychological cost > behavioral cost > lack of relevant knowledge[6]. The stronger the correlation is, the more difficult it is to change the power saving behavior included in the factor to some extent. Thus, the difficulty-changing sequencing order of the three influencing factors of electricity saving behavior is: psychological cost > behavioral cost > lack of relevant knowledge.

4 Research conclusions

According to the results of the survey data, there are three factors that affect the behavior of electricity saving: behavioral cost, psychological cost and lack of relevant knowledge[7]. Among them, the behavior cost refers to the conscious behavior effort consumed in order to achieve a certain purpose; psychological cost emphasizes the psychological resources sacrificed to achieve the purpose; lack of relevant knowledge refers to the lack of relevant knowledge about electricity saving and the blank of knowledge about this behavior before that can produce electricity saving effect. Through correlation analysis, we find that among the influencing factors of electricity saving behavior, psychological cost and electricity consumption cost have the greatest correlation, followed by behavioral cost, and finally lacking factor of related knowledge[8]. The correlation between each influencing factor and electricity consumption cost is different, so in the cultivation of electricity saving behavior, we should reasonably allocate the attention degree of the behavior under each influencing factor.

According to the theory of planned behavior, the behavior is influenced by attitude, subjective criterion and perceptual control[9]. This requires us to guide and develop a positive attitude towards electricity conservation in our daily life, and gradually form a resource-saving attitude towards electricity consumption through external incentive and other behavior strengthening mechanisms. In addition, the society needs to form a good atmosphere of saving electricity, and restrict the individual's electricity-using behavior through the overall social electricity-using codes of environmental protection, so as to promote the individual to form a good way of electricity use consistent with the social environment. Finally, aiming at perceptual control, it is necessary to cultivate the confidence of individuals to develop good habits of electricity saving[10]. From the consciousness level to the action level, we can improve our self-efficacy by forming some successful experiences, and finally keep the electricity-using habit of environmental protection.

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