ISSN : 0974 - 7435 Volume 10 Issue 18

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(18), 2014 [10788-10796]

Influence factors and variance analysis of residential solar photovoltaic power generation in China

Qing Guo[1], Huiling Song[1,2.]

[1]School of Economics and Management, China University of Geosciences, Wuhan, Hubei, 430074, (CHINA)

[2]School of Distance and Continuing Education, China University of Geosciences, Wuhan, Hubei, 430074, (CHINA)

ABSTRACT

As solar energy is inexhaustible, countries around the world strongly support the photovoltaic industry as the strategic industry of solving the energy and environmental problems which have become increasingly prominent, promoting the rapid development of the photovoltaic industry. Using the method of multiple linear regression, this paper analyzes the determining factors of residents choosing solar photovoltaic power generation. And the result shows that the propaganda education, citizen awareness and citizen preference significantly impact on China's residents' photovoltaic behavior. And then this paper uses the method of independent-samples T test to compare different types of residents' photovoltaic behaviors and variances of behavior determining factors on each dimension. And the result shows that there are some significant differences on the dimensions of citizen preference, citizen awareness and citizen behavior for the high-end residents (highly educated, high income and large housing area) and the low-end residents, and the former performance is superior to the latter; Male residents and female residents are significantly different on the dimensions of citizen awareness and citizen behavior, and the former performance precedes the latter; There exist significant differences on the dimension of propaganda education for the young residents and older residents, and the latter is better than the former. Based on the above analysis, this paper suggests to strengthen the propaganda education for solar photovoltaic power generation, improve citizen awareness to the solar photovoltaic power generation, and then guide the residents to prefer the solar photovoltaic power generation; According to different types of residents, make the different strategies to lead the residents' behavior for solar photovoltaic power generation.

KEYWORDS

Solar photovoltaic power generation; Multiple linear regression; Independent-samples t test; Influence factors; Variance analysis.

INTRODUCTION

Solar energy has been recognized to be one of the most competitive energy in the future, and it is abundant, unlimited and green. At present, the major countries in the world attach great importance to exploit and utilize the solar energy resources by developing the photovoltaic industry. By the end of 2011, the global photovoltaic power capacity has been up to 69 gigawatts (GW). The international energy agency (IEA) predicts that by 2050 the solar photovoltaic power generation will account for 20% ~ 25% of the world's electricity and become one of the basis of human energy. As one of direction of priority to the development of national new energy, the photovoltaic power capacity of our country at present is close to 3 gigawatts (GW), and it is expected that it will reach to 20 GW by 2015 and to 47 GW by 2020.

Compared with the technology and promotion of international solar energy power generation, there are some success for the development and utilization of the solar power and its spread in use in our country. In the solar power technology, the gap of the advanced level between China and the world gradually becomes narrow, and some technology is among the best in the world. By contrast, in terms of the solar power industry development, the task which shortens the gap with the world's advanced level is still very difficult. With the rapid development of economic globalization, the greenhouse effect caused by the excessive emissions of carbon dioxide becomes increasingly obvious, and it seriously influences the human environment. Implementing the strategy of renewable energy becomes the subject that must span to the economic development of all countries. Therefore, the development of renewable energy such as solar will become the most potential industry in the future. Solar energy is in a prominent position in the transfer of the world energy structure, and is the key development field of the new energy technology. As the technology of China's solar energy in development and utilization is gradually mature, the new upsurge of solar energy in development and utilization has come, and "solar energy economy" era is also coming. The author believes that China should take more active and effective measures that are valued in the concept and reflected in action, accelerating the pace of solar energy in development and utilization to greet the arrival of the "solar energy economy" era. The prospects for development of Chinese solar photovoltaic power generation is broad, and the experts call for China to intensify policy support as soon as possible, to expand the domestic market and let the photovoltaic power enter the ordinary people’s house at an early date. How to make the photovoltaics enter the ordinary Chinese families soon, and how to make the existing building become a "small factory" of solar photovoltaic power generation? How the majority of residents think of the photovoltaic, and whether it can rapidly realize one of the important bottleneck of household distributed photovoltaic application. Therefore, exploring on the influence factors and variances of residential solar photovoltaic power generation in China is of great theoretical and realistic significance.

LITERATURE REVIEW

Solar photovoltaic power generation, as a kind of new energy, has caused the wide attention of scholars both at home and abroad, and some literature research results show that the current solar photovoltaic power generation is still in its infancy and exists a series of problems, so the corresponding countermeasures should be taken (Yuzhi ZHU, etc., 2012; Xue CAO, 2009; Aqin HU and Qi MENG, 2011; Jie YANG and Yuncai LIU, 2010; Zulin SHI and Yixin DAI, 2000; Jingwen BAO, 2012; Lin JIANG, 2013). And the viewpoint of Yuzhi ZHU, etc. (2012) is more representative. Yuzhi ZHU thinks that the channel of photovoltaic power policy promotion is relatively single, and the residents know less about and invest less in photovoltaic power generation. The photovoltaic power policy in the future should consider how to reduce the upfront costs of residents, shorten the cost recovery period, and do a good job of supporting services. Foreign scholars tend to case analysis. Taking the Brazil for example, Gilberto and Conrado (2013) thinks that Brazil has a good chance to photovoltaic power generation, and the diversified energy use has the potential economic benefits and environmental benefits. Under the condition of the solar photovoltaic power generation and lack of additional support mechanism, the goal of long-term energy policy may be inefficient, and using this technology in the initial period exists the potential losses of interests. Ernest and Matthew a. (2009) make a feasibility study on solar photovoltaic power generation system in the several solar areas of the poultry industry in Tennessee. The result indicates that fiscal stimulus policies at present are different to use the solar photovoltaic power generation system, so the fiscal stimulus policies should be improved. The research from Firdaus and Roberto (2011) on solar photovoltaic residences in the UK and Malaysia shows that solar photovoltaic power generation can produce a good return on investment in Britain, but the return is lower than other investment tools; In Malaysia, most people do not know the government incentives for renewable energy, and are also reluctant to invest in solar photovoltaic power generation. The government needs to increase the publicity for solar photovoltaic power generation and make the support policies.

There are also some scholars who have carried on the empirical study and got some valuable conclusions. Ming ZENG (2012) utilizes double-factor learning curve model to make a forecast for the cost of solar photovoltaic power generation of our country in the next 10 years, getting that in different developments of cumulative production and cumulative amount of R&D, the cost of photovoltaic power generation decreases differently. Qingrong LIU (2009) measures the electricity generation and power consumption from solar grid-connected photovoltaic power generation system on two roofs, and evaluates that the photovoltaic power generation system is energy-saving, environmental and economical by the analysis on the buying and selling electricity between power generation and power grid and electricity consumption. Zhen PEI (2012) takes a 300kWp solar power in Hubei area as an example to simulate the cost, getting that the feed-in tariff is 1.499 yuan/kWh in Hubei province. And under the same conditions, simulating the situation of Ningxia, it is found that the feed-in tariff in Hubei province should be 60% higher than that in Ningxia. So it is concluded that it is unscientific to make a unified feed-in tariff in our country. Ramchandra and Ingo (2009) construct the data sets of 11 years from Japan's 47 prefectures, covering the panel data in the period of 1996-2006. The empirical results show that

the local government policy helps to promote the adoption of photovoltaic power generation system. It is also found that the installation cost has a negative impact on using the photovoltaic power generation system, and yet it has a positive role for housing investment and residents' environmental consciousness. Martin and Ricardo (2012) prove that the photovoltaic power generation has great potential in Brazil through the analysis of the net present value of income, and suggest that the pv grid-connected power generation can improve the competitiveness of the economy in developing countries under certain conditions. Ramchandra and Ingo (2009) analyze the household electricity consumption curve and the profile of cologne pv power, and find out the possibility of photovoltaic power enabling to meet the household electricity. This result is used to calculate the real grid parity, that is the wholesale price equal to the end user's price.

The review of the literature shows that: (1) The attitude of domestic and foreign scholars on the government for solar photovoltaic power generation is basically consistent, and all think that solar photovoltaic power generation should be vigorously developed; (2) Domestic and foreign scholars rarely research on the influence factors and variances for residential photovoltaic behavior. For this reason, this paper makes a large sample of sampling investigation and empirical studies on the residents of the new energy industry represented by the photovoltaic, and puts forward some reasonable policy advice for the development and promotion of photovoltaic power generation.

METHOD AND DATA

Environmental consciousness, propaganda education, citizen awareness and citizen preference may have a significant impact on the residential photovoltaic behavior. Therefore, this article first makes the analysis of multiple linear regression through taking the residential photovoltaic behavior as the independent variable and taking environmental consciousness, propaganda education, citizen awareness and citizen preference as the dependent variable, to determine exactly what factors may affect the residential photovoltaic behavior.

At the same time, different types of residents, such as of different incomes and education background, may exist differences in the photovoltaic behavior. As a result, this article makes the fractional analysis respectively to the residents of different education background, different monthly income, housing area, different gender and age, selecting independent-sample T test method to determine whether there exists a significant difference for different types of residential photovoltaic behavior dimensions and behaving each determinant dimension.

This paper has designed six identification problems and sixteen research questions to measure the variables of Chinese residential photovoltaic behavior and the determining factor. Furthermore, 6 identification problems are about residents' territory, gender, age, education background, monthly income and housing area; 13 research questions are respectively designed according to the elements of affecting the photovoltaic behavior, and in the form of questionnaire which respondents choose to fill out; Another three research questions are aimed at reflecting the actual behavior of residents, and in the form of situational experiment filled out by the observer. The questions are adapted with reference to the existing research results, to ensure the validity of scale problems. A total of 928 supermarket residents voluntarily participate in questionnaire and situational experiment, among which the results of 925 volunteers were valid.

Specifically analyze the distribution situation from the sample data for different types of residents. Regional dimension: The total distribution of six cities involved in sample survey is of general equilibrium, and the frequency distributes in between 16% (wuhan) -22% (shenzhen); Gender dimension: The female sample frequency (56.30%) is higher than men's (43.70%). Age dimension: The sample subject is the young and middle-aged who gradually become the main force of solar photovoltaic power generation, and the cumulative frequency of samples aged 20 to 49 is up to 85.60%. Academic dimension: Samples are mainly distributed in higher vocational college (28.70%) and undergraduate (35.40%), and it accords with the current degree structure characteristics of China. That is to say, the education background of the youth is mainly undergraduate degree, and that of the middle-aged is mainly higher vocational degree. Income dimension: The cumulative frequency of samples of monthly income below RMB5000 is 82.30%, and it is generally consistent with the current statistical data of China's urban residents per capita disposable income;Resident housing area: The frequency of consumer groups with 100 m^2 housing area is 36.50%, and the distribution conforms to the relevant statistical description about the present situation of Chinese residents. All in all, the samples of this article are distributed in different types of residents, enable to represent the different characteristics of the current residential solar photovoltaic power generation in China, and have relatively good representative.

RESULTS AND DISCUSSIONS

The analysis of determining factors of solar photovoltaic power generation

This paper uses the method of multiple linear regression to explore the determining factors of Chinese residents' photovoltaic behavior. Specifically speaking, this article will take the data obtained by the situational experiment observation as the independent variable, and the environmental consciousness, propaganda education, citizen awareness and citizen preference acquired through the questionnaire survey as the dependent variable, making the analysis of multiple linear regression with SPSS 20.0 software (It is as shown in formula 1).

$$Y = \alpha + \beta_1 PE + \beta_2 EC + \beta_3 CA + \beta_4 CP \quad \textbf{(1)}$$

Y represents for actual behavior, PE for propaganda education, EC for environmental consciousness, CA for citizen awareness, CP for citizen preference, α for regression constant, and β_i for regression coefficient.

Analysis results show (see TABLE 1) that "propaganda education" is significant at the level of 5%, and the regression coefficient is positive. That means in the case of other conditions unchanged, the efforts of the government and enterprises to propaganda education of solar photovoltaic power generation are greater, and the performance of actual behavior of solar photovoltaic power generation is better; "Citizen awareness" is remarkable at the level of 5%, and the regression coefficient is positive. That means in the case of other conditions unchanged, the citizen awareness to solar photovoltaic power generation is higher, and the performance of actual behavior of photovoltaic power is better; "Citizen preference" is outstanding at the level of 5%, and the regression coefficient is positive. That means in the case of other conditions unchanged, the citizen preference to solar photovoltaic power generation is higher, and the performance of actual behavior of photovoltaic power is better. In addition," environmental consciousness" does not have a significant impact for photovoltaic behavior.

TABLE 1 : Estimation results of multiple regression model

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	-.265	.121		-2.308	0.015
Citizen Awareness	.148	.034	.127	4.026	0.000
Citizen Preference	.532	.032	.526	24.378	0.000
Environmental Consciousness	-.003	.028	-.002	-.102	0.721
Propaganda Education	.063	.032	.034	2.376	0.030

Data source: The author has sorted out according to the operation results of the SPSS software.

TABLE 2 : Results of independent-sample t test: analysis based on education background

Indicator Variables	College Degree or Below			Bachelor Degree and Above			t	Sig. 2-tailed
	Mean	Std. Deviation	Std. Error Mean	Mean	Std. Deviation	Std. Error Mean		
Precedence of Photovoltaic Power Generation in Residents' Decision Making	2.37	1.176	0.048	2.86	1.165	0.057	-4.136	0.000
Willingness on Using Photovoltaic Power Generation	2.68	0.758	0.028	3.14	0.812	0.038	-6.642	0.000
Preference for the Price of Photovoltaic Power Generation	1.56	0.786	0.026	1.86	0.932	0.041	-3.836	0.000
Awareness to Photovoltaic Power Generation	1.83	0.817	0.035	2.28	0.956	0.037	-5.565	0.000
Awareness on differences of Photovoltaic Power Generation and Thermal power generation	2.24	0.786	0.032	2.52	0.841	0.036	-5.876	0.000
Awareness to the Photovoltaic Technology	2.18	0.812	0.035	2.59	0.957	0.042	-8.832	0.000
Utility Evaluation of Propaganda Education on Photovoltaic Power Generation	3.48	0.907	0.038	3.76	0.748	0.029	-3.228	0.002
Wililingness to participate in Propaganda Education Activities on Photovoltaic Power Generation	3.36	0.869	0.036	3.62	0.769	0.028	-4.309	0.000
Wililingness to actively promote the Photovoltaic Power Generation	3.58	0.858	0.032	3.75	0.736	0.024	-3.416	0.002
The Amount Willing to Pay for Photovoltaic Power Generation	1.58	0.649	0.027	2.18	0.879	0.038	-8.713	0.000
The Proportion of Additional Payment for Photovoltaic Power Generation	1.69	0.673	0.029	2.24	0.838	0.039	-8.776	0.000
Willingness to install the Photovoltaic Power Generation	1.63	0.652	0.028	2.18	0.879	0.042	-8.601	0.000

Data source: The author has sorted out according to the operation results of the SPSS software.

Based on this, this paper carries out the analysis of independent-sample T test on different types of residents' photovoltaic behavior and the determining factors respectively from the five dimensions of the education background, monthly income, housing area, gender and age, to explore the similarities and differences between different types of residents' behavior, and then put forward the corresponding policy recommendations.

The comparative analysis to residents with different education background

Independent-sample T test is conducted to different education backgrounds, and the results are shown in TABLE 2. The residents with college degree or below and those with bachelor degree or above generally show significant differences on 15 manifest variables.

On the four dimensions of "citizen preference", "citizen awareness", "propaganda education", and "residents' behavior", residents with bachelor degree and above behave better than those with college degree or below.

The comparative analysis to residents with different monthly income

Independent-sample T test is conducted to different monthly incomes, and the results are shown in TABLE 3. The residents with monthly income below RMB 3000, and those with monthly income of RMB 3000 or above do not have significant differences on the two manifest variables of the dimension of "propaganda education". The two variables are the "willingness to participate in propaganda education activities on photovoltaic power generation" and the "willingness to actively promote the photovoltaic power generation". And both residents with different incomes generally show significant differences on latent variables of the three dimensions of "citizen preferences", "citizen awareness" and "citizen behavior", and the latter (high income residents) is better than the former (low income residents).

TABLE 3 : Results of independent-sample t test: analysis based on monthly income

Indicator Variables	Monthly Income Below RMB 3000			Monthly Income of RMB 3000 or Above			t	Sig. 2-tailed
	Mean	Std. Deviation	Std. Error Mean	Mean	Std. Deviation	Std. Error Mean		
Precedence of Photovoltaic Power Generation in Residents' Decision Making	2.58	1.163	0.048	2.86	1.187	0.057	-4.136	0.000
Willingness on Using Photovoltaic Power Generation	2.79	0.736	0.029	3.21	0.842	0.043	-7.518	0.000
Preference for the Price of Photovoltaic Power Generation	1.65	0.742	0.030	2.06	0.936	0.052	-6.558	0.000
Awareness to Photovoltaic Power Generation	1.87	0.778	0.031	2.27	1.026	0.056	-6.746	0.000
Awareness on differences of Photovoltaic Power Generation and Thermal power generation	2.28	0.738	0.028	2.56	0.928	0.048	-5.668	0.000
Awareness to the Photovoltaic Technology	2.18	0.807	0.031	2.58	1.037	0.056	-6.273	0.000
Utility Evaluation of Propaganda Education on Photovoltaic Power Generation	3.62	0.868	0.035	3.72	0.785	0.043	-2.712	0.006
Wililingness to participate in Propaganda Education Activities on Photovoltaic Power Generation	3.48	0.853	0.034	3.53	0.814	0.045	-1.656	0.087
Wililingness to actively promote the Photovoltaic Power Generation	3.59	0.828	0.033	3.68	0.773	0.042	-1.218	0.218
The Amount Willing to Pay for Photovoltaic Power Generation	1.56	0.625	0.024	2.26	0.919	0.051	-10.109	0.000
The Proportion of Additional Payment for Photovoltaic Power Generation	1.67	0.668	0.026	2.28	0.857	0.046	-10.242	0.000
Willingness to install the Photovoltaic Power Generation	1.59	0.642	0.025	2.29	0.918	0.052	-10.106	0.000

Data source: The author has sorted out according to the operation results of the SPSS software.

The comparative analysis to residents with different housing area

Independent-sample T test is conducted to different housing areas, and the results are shown in TABLE 4. The residents with housing areas below $100m^2$, and those with housing areas of $100m^2$ or above do not have significant differences on the two manifest variables of the dimension of "propaganda education". The two variables are the "willingness to participate in propaganda education activities on photovoltaic power generation" and the "willingness to actively promote the photovoltaic power generation". And both residents with different housing areas generally show significant differences on latent variables of the three dimensions of "citizen preference", "citizen awareness" and "citizen behavior", and the latter (residents with large housing areas) is better than the former (residents with small housing areas).

TABLE 4 : Results of independent-sample t test: analysis based on housing area

Indicator Variables	Housing Areas Below $100m^2$			Housing Areas of $100m^2$ or Above			t	Sig. 2-tailed
	Mean	Std. Deviation	Std. Error Mean	Mean	Std. Deviation	Std. Error Mean		
Precedence of Photovoltaic Power Generation in Residents' Decision Making	2.59	1.189	0.053	2.79	1.187	0.048	-2.519	0.010
Willingness on Using Photovoltaic Power Generation	2.78	0.742	0.033	3.10	0.828	0.036	-5.808	0.000
Preference for the Price of Photovoltaic Power Generation	1.65	0.763	0.032	1.89	0.904	0.040	-4.910	0.000
Awareness to Photovoltaic Power Generation	1.89	0.780	0.035	2.23	0.989	0.045	-4.962	0.000
Awareness on differences of Photovoltaic Power Generation and Thermal power generation	2.28	0.767	0.036	2.56	0.878	0.039	-4.474	0.000
Awareness to the Photovoltaic Technology	2.21	0.796	0.037	2.48	1.012	0.046	-4.425	0.000
Utility Evaluation of Propaganda Education on Photovoltaic Power Generation	3.65	0.912	0.042	3.72	0.783	0.035	-2.176	0.020
Wililingness to participate in Propaganda Education Activities on Photovoltaic Power Generation	3.52	0.881	0.040	3.48	0.808	0.036	-0.779	0.433
Wililingness to actively promote the Photovoltaic Power Generation	3.67	0.856	0.041	3.68	0.768	0.035	-0.359	0.714
The Amount Willing to Pay for Photovoltaic Power Generation	1.68	0.624	0.028	2.04	0.912	0.042	-6.119	0.000
The Proportion of Additional Payment for Photovoltaic Power Generation	1.79	0.676	0.030	2.08	0.868	0.038	-5.652	0.000
Willingness to install the Photovoltaic Power Generation	1.73	0.625	0.028	2.06	0.914	0.045	-6.203	0.000

Data source: The author has sorted out according to the operation results of the SPSS software.

The comparative analysis to residents with different gender

Independent-sample T test is conducted to different genders, and the results are shown in TABLE 5. The male and female residents do not have significant differences on the two manifest variables of the dimension of "consumption preferences". And the two variables are the "precedence of photovoltaic power generation in residents' decision making" and the "preference for the price of photovoltaic power generation";The male and female residents do

not have significant differences on the two manifest variables of the dimension of "propaganda education". And the two variables are the "utility evaluation of propaganda education on photovoltaic power generation" and the "wililingness to participate in propaganda education activities on photovoltaic power generation"; It also has no significant differences on the manifest variable of the dimension of "citizen behavior". The manifest variable is the "proportion of additional payment for photovoltaic power generation".

The male and female residents exist remarkable differences on the dimension of "citizen awareness", the former (male) performs better than the latter (female). Meanwhile, the male residents have a higher photovoltaic behavior than the female. In addition, in the "citizen behavior", compared to the female residents, the male residents are relatively willing to pay more for the solar photovoltaic power generation.

TABLE 5 : Results of independent-sample t test –analysis based on gender

Indicator Variables	Male			Female			t	Sig. 2-tailed
	Mean	Std. Deviation	Std. Error Mean	Mean	Std. Deviation	Std. Error Mean		
Precedence of Photovoltaic Power Generation in Residents' Decision Making	2.78	1.183	0.059	2.65	1.168	0.048	1.624	0.102
Willingness on Using Photovoltaic Power Generation	3.02	0.838	0.044	2.89	0.775	0.032	2.158	0.028
Preference for the Price of Photovoltaic Power Generation	1.78	0.908	0.048	1.76	0.793	0.033	1.676	0.090
Awareness to Photovoltaic Power Generation	2.18	0.929	0.049	2.03	0.874	0.036	2.312	0.019
Awareness on differences of Photovoltaic Power Generation and Thermal power generation	2.48	0.886	0.047	2.35	0.782	0.034	2.686	0.006
Awareness to the Photovoltaic Technology	2.42	0.938	0.049	2.28	0.903	0.037	2.102	0.028
Utility Evaluation of Propaganda Education on Photovoltaic Power Generation	3.68	0.852	0.045	3.62	0.848	0.036	-0.115	0.903
Wililingness to participate in Propaganda Education Activities on Photovoltaic Power Generation	3.49	0.859	0.045	3.58	0.827	0.035	-1.300	0.188
Wililingness to actively promote the Photovoltaic Power Generation	3.56	0.849	0.044	3.65	0.778	0.032	-3.683	0.000
The Amount Willing to Pay for Photovoltaic Power Generation	2.03	0.863	0.045	1.76	0.742	0.030	2.619	0.008
The Proportion of Additional Payment for Photovoltaic Power Generation	2.06	0.820	0.043	1.88	0.768	0.032	1.817	0.065
Willingness to install the Photovoltaic Power Generation	2.00	0.852	0.045	1.82	0.752	0.033	2.356	0.017

Data source: The author has sorted out according to the operation results of the SPSS software.

The comparative analysis to residents with different age

Independent-sample T test is conducted to different ages, and the results are shown in TABLE 6. The residents with ages of 29 or below, and those with ages of 30 or above do not have significant differences on the three dimensions of "consumption preference","citizen awareness and "citizen behavior". And on the three manifest variables of "propaganda education", both residents exist significant differences, and the latter (the elder) is better than the former (the young).

TABLE 6 : Results of independent-sample t test: analysis based on age

Indicator Variables	Ages of 29 or below			Ages of 30 or above			t	Sig. 2-tailed
	Mean	Std. Deviation	Std. Error Mean	Mean	Std. Deviation	Std. Error Mean		
Precedence of Photovoltaic Power Generation in Residents' Decision Making	2.75	1.179	0.058	2.68	1.188	0.049	0.792	0.425
Willingness on Using Photovoltaic Power Generation	2.89	0.718	0.035	2.97	0.863	0.036	-0.736	0.458
Preference for the Price of Photovoltaic Power Generation	1.73	0.779	0.039	1.85	0.886	0.038	-1.778	0.072
Awareness to Photovoltaic Power Generation	2.08	0.808	0.040	2.12	0.968	0.042	-0.843	0.395
Awareness on differences of Photovoltaic Power Generation and Thermal power generation	2.42	0.728	0.035	2.43	0.906	0.037	-0.278	0.776
Awareness to the Photovoltaic Technology	2.35	0.828	0.041	2.36	0.979	0.042	-0.076	0.935
Utility Evaluation of Propaganda Education on Photovoltaic Power Generation	3.62	0.779	0.038	3.78	0.887	0.038	-2.808	0.003
Wililingness to participate in Propaganda Education Activities on Photovoltaic Power Generation	3.48	0.786	0.039	3.60	0.878	0.035	-2.305	0.018
Wililingness to actively promote the Photovoltaic Power Generation	3.58	0.802	0.042	3.75	0.815	0.035	-2.761	0.004
The Amount Willing to Pay for Photovoltaic Power Generation	1.92	0.706	0.037	1.87	0.853	0.038	0.786	0.427
The Proportion of Additional Payment for Photovoltaic Power Generation	2.01	0.719	0.038	1.92	0.842	0.036	1.329	0.179
Willingness to install the Photovoltaic Power Generation	1.88	0.705	0.037	1.87	0.858	0.035	0.701	0.482

Data source: The author has sorted out according to the operation results of the SPSS software.

CONCLUSIONS AND SUGGESTIONS

Conclusions

Based on the above analysis, this paper gets the following conclusions:

(1) The propaganda education, citizen awareness and citizen preference significantly impact on residential photovoltaic behavior. The analysis of multiple linear regression shows that the three dimensions of "propaganda education", "citizen awareness" and "citizen preference" are significant on the level of 5%, and the regression coefficient is positive. That means the efforts of the government and enterprises to propaganda education of solar photovoltaic power generation are greater, and then the citizen performance on solar photovoltaic power generation is better; Citizen awareness to solar photovoltaic power generation is higher, and then the behavior performance in solar photovoltaic power generation is better; The higher preference of residents to solar photovoltaic power generation, the better performance on the photovoltaic behavior.

(2) There exist some variances on the photovoltaic behavior and each factor of affecting the behavior for different types of residents. The analysis of independent-sample T test shows that compared to the residents with low education, low monthly income and small housing area,the residents with high education, high monthly income and large housing area, show significant differences on the manifest variables of the three dimensions of "citizen preference", "citizen awareness" and "citizen behavior". And the former is superior to the latter; The male and female residents exist outstanding differences on the three manifest variables of "citizen awareness" and on the two manifest variables of "citizen behavior", and the male residents perform better than the female residents; The young residents and the middle-aged and elderly residents exist significant differences on the manifest variables of the dimension of "propaganda education", and the middle-aged and elderly residents behave better than the young residents.

Policy Suggestions

Based on the above conclusions, this article suggests that:

(1) Strengthen the propaganda education to solar photovoltaic power generation, improve residents' cognition to the solar photovoltaic power generation, and then guide residents to prefer for the solar photovoltaic power generation. It can propagandize the beneficial contribution of the photovoltaic to the residents and the natural environment through the mass media and community activities,etc. And it can also attract people to focus on the solar photovoltaic power generation through the promotion of the solar photovoltaic power equipment, so as to promote residents' cognition on the solar photovoltaic power generation, and ultimately form a preference for solar photovoltaic power generation.

(2) According to different types of residents, make different strategies to guide their behavior. For the high-end residents, because they have a certain recognition and preference to the solar photovoltaic power generation, the high-end residents can be set to the primary target customer groups for promoting the solar photovoltaic power generation; Influenced by Chinese traditional culture, female residents are the main body of purchase decisions and purchasing behavior for the photovoltaic, but their current cognition and preference to the solar photovoltaic power generation have to be improved; Middle-aged and old residents dominate in the buying decision for the photovoltaic. At the same time, this kind of residents show some interest to the propaganda education of solar photovoltaic power generation. Therefore, for the propaganda education activities on solar photovoltaic power generation, the middle-aged and old residents can be taken as the main target group.

ACKNOWLEDGEMENT

This research is supported by the project of Natural Science Foundation of China (No. 71473231).

REFERENCES

[1] Yuzhi Zhu, Haibin Sun, Jing Yang; Study and investigation on policy cognition and demand of household photovoltaic power generation[J], Economic Review, **(05)**, 72-75 **(2012)**.

[2] Xue Cao; Study on status, Problems and countermeasures of photovoltaic industry in China[J], China High Technology Enterprises, **(23)**, 76-78 **(2009)**.

[3] Aqin Hu, Qi Meng; Study on Development of Solar Photovoltaic Industry in China[J], Hubei Social Sciences, **(04)**, 92-95 **(2011)**.

[4] Jie Yang, Yuncai Liu; Study on policy support of new energy industry in China- based on analysis of development of solar photovoltaic, Wind power, New energy vehicles industry[J], Price Theory and Practice, **(05)**, 72-73 **(2012)**.

[5] Zulin Shi, Yixin Dai; The development direction and recommendations for chinese photovoltaic industry [J], China Population, Resources and Environment, **(02)**, 87-90 **(2000)**.

[6] Jingwen Bao; The overall interests of photovoltaic supporting policies should be considered[J], Solar Energy, **(09)**, 20-21 **(2012)**.

[7] Lin Jiang; Research on domestic and overseas grid integration policies of distributed photovoltaic power generation[J], Jiangsu Electrical Engineering, **(05)**, 66-68 **(2013)**.

[8] Gilberto, Conrado; Grid-connected Photovoltaic in Brazil: policies and potential impacts for 2030 [J], Energy for Sustainable Development, **17(1)**, 40-46 **(2013)**.

[9] F.Ernest, A.Matthew; Feasibility of solar technology (photovoltaic) adoption: A case study on tennessee's poultry industry [J], Renewable Energy, **4(3)**, 62-71 **(2008)**.

[10] Firdaus, Roberto; Photovoltaic in malaysia: The way forward [J], Renewable and Sustainable Energy Reviews, **16(7)**, 5232-5244 **(2012)**.

[11] Ming Zeng, Wei Lu, Jinhui Duan, Na LI; Study on the cost of solar photovoltaic power generation using double-factors learning curve model[J], Modern Electric Power, 72-76 **(2012)**.

[12] Qingrong Liu, Qunyin Gu, Yingjun Raun; Policy investigation and field study of grid-connected photovoltaic systems in japan[J], East China Electric Power, **(02)**, 280-283 **(2009)**.

[13] Zhen Pei; Operation analysis of photovoltaic power station and study on the policy of photovoltaic power generation in hubei province[D], Wuhan Textile University, **(2012)**.

[14] Ramchandra, Ingo., Grid parity analysis of solar photovoltaic systems in germany using experience curves [J], Solar Energy, **83(9)**, 1634-1644 **(2009)**.

[15] Martin, Ricardo; Economic performance and policies for grid-connected residential solar photovoltaic systems in Brazil [J], Energy Policy, **49(7),** 688-694 **(2012)**.

[16] Ramchandra, Ingo., Autonomous electricity supply to german households from solar photovoltaic systems [J], International Energy Journal, **10(3)**, 37-48 **(2009)**.