

PAPER • OPEN ACCESS

Demand Analysis of Advanced Energy-saving Consulting Service Based on SPSS Questionnaire Survey

To cite this article: Junxia Meng *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **252** 032037

View the [article online](#) for updates and enhancements.

Demand Analysis of Advanced Energy-saving Consulting Service Based on SPSS Questionnaire Survey

Junxia Meng^{1, a}, Limin Jiang^{1, b} and Xiaoxia Wu^{2, *}

¹China Electric Power Research Institute Co. LTD, China

²School of North China Electric Power University, Beijing, China

*Corresponding author e-mail: 391170921@qq.com, ^ajxmeng@epri.sgcc.com.cn, ^bjianglm@epri.sgcc.com.cn

Abstract. This study introduces the design and implementation of questionnaire based on the questionnaire of advanced energy-saving consulting service in typical industry, and expounds the operation process of statistical test of scientific questionnaire by using SPSS statistical software. Through the repeated adjustment of the questionnaire, the reliability and validity of the test, this study obtains a high-efficiency survey questionnaire. Based on the test results, the countermeasures and suggestions to strengthen the advanced energy-saving consulting service are put forward.

1. Introduction

All the work of energy-saving consulting service is to serve the users, and user demand analysis is critical to the development of advanced energy-saving consulting services. The demand of user data directly reflects the quality of energy-saving service, and it is the yardstick to test the quality of energy-saving consulting service. If there are some errors in user demand, energy-saving consulting service quality and scientific research function will not play a good role. So that it affects the user experience in the advanced energy-saving consulting service System. In order to ensure the efficient conduct of consulting services, it is necessary to make the various indicators of user demand as perfect as possible. At present, the scientificity of this articles, on the demand analysis of energy-saving consulting services, lack statistical testing of the questionnaire design. This study takes the user demand of advanced energy-saving consulting services as an example, scientifically and rationally designs questionnaires, and uses SPSS statistical software to conduct scientific tests on questionnaires to provide suggestions for strengthening advanced energy-saving consulting services.

2. Status of advanced energy-saving consulting services

2.1. Status of advanced energy-saving consulting services

In 2017, the national energy consumption per CNY ten thousands of GDP was about 0.65 tons of standard coal. The energy consumption per unit of GDP in developed countries such as the United States was 0.281 tons of standard coal per CNY ten thousands. The energy consumption per unit of GDP in China was about 2.3 times that of the United States. With the global resource prices continue to increase the catalytic, China's social and economic development needs to realize the basic



transformation of economic growth pattern from extensive to intensive type, to reduce energy consumption and improve the quality of economic growth [1].

Energy-saving services are primarily based on energy efficiency consulting, energy audits and energy-saving planning, and service areas are mainly distributed in the fields of architecture, industry and transportation [2]. With the increasing strength of energy-saving service institutions, energy-saving services are gradually extended to the third-party capacity to compile energy-saving audit reports, as well as provide energy-saving diagnosis, design, financing, transformation, operation, management and so on, meanwhile industry, transportation, civil construction, , agriculture and rural areas are also included in the focus areas of energy conservation services.

The figure below is China's 2008-2017 year energy-saving service value chart.

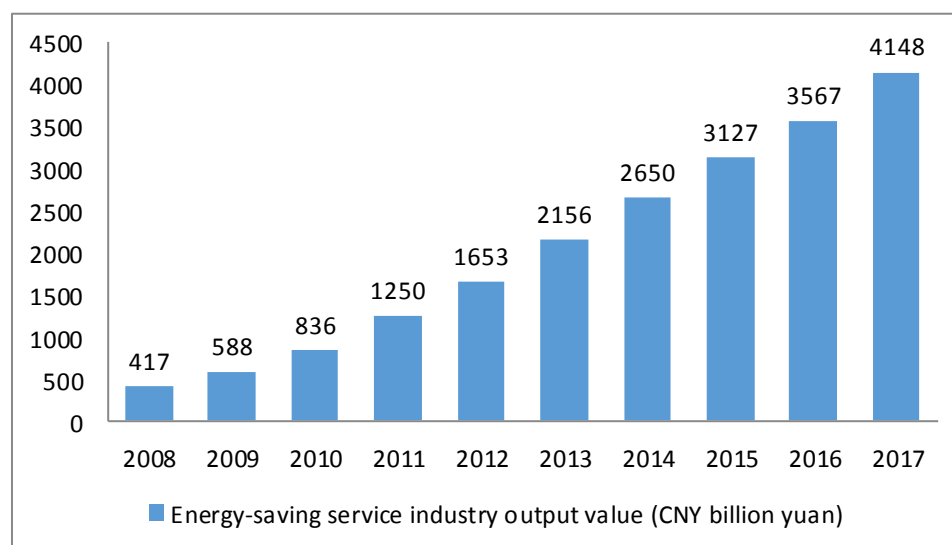


Figure 1. 2008-2017 Energy efficiency service value

Source: Energy Efficiency Service Industry Committee of China Energy Conservation Association

2.2. Advanced Energy-saving consulting service Content

Energy-saving service company and willing to carry out energy-saving transformation of the user signed energy-saving service contract, for the user's energy-saving projects for free competition or financing, to provide users with energy efficiency audits, energy-saving project design, raw materials and equipment procurement, construction, monitoring, training, operation and management services, and by sharing the project with users to generate energy-saving benefits to profit and rolling development.

Its services include: energy-saving Transformation program, energy-saving diagnosis, energy efficiency management, power audit, efficiency bench-marking, laws and regulations and policy advice, energy-saving training, energy-saving work exchange, Government Energy Conservation Award Project Declaration, bidding work and so on.

3. Analysis of the demand of advanced energy-saving consulting service by SPSS questionnaire

We conduct a questionnaire survey of the above user demands indicators.

3.1. Questionnaire design, sample and data collection

This questionnaire includes two parts: survey of respondents' basic situation and data demand of energy-saving consulting users. For the determination of sample size, it is recommended that sample sizes be at least 80, preferably 150 [3].

The respondents surveyed in this study mainly surveyed power grid companies. In September 2018, respondents from educational and scientific research institutions, power supply companies, and energy-saving companies were randomly surveyed by issuing electronic questionnaires. The survey users accounted for 25.4% of education and scientific research institutions, power supply companies accounted for 23.8%, energy service companies accounted for 14.3%, and other users in non-above industries accounted for 34.9%. 98.4% of the respondents were undergraduate and above, and 60.3% of the respondents were in the energy sector for more than 4 years. A total of 102 questionnaires, of which 86 were valid questionnaires, the effective rate of the questionnaire was 84.31%.

3.2. Indicator Reliability Test

Reliability refers to the reliability and stability of the questionnaire. Common indicators for measuring reliability are: the Kendal coefficient, the Cronbach's α coefficient, etc. This study uses the α coefficient method created by L.J.Cronbach. The α coefficient can be derived from Reliability Analysis in the SPSS software. It is generally believed that the α coefficient of 0.8 or more indicates that the effect of the index setting is very good, and about 0.7 is acceptable [4, 6]. The reliability test results in this paper are shown in Table 1.

Table 1. Reliability Test Results Summary Table

Variable	Correction item total relevance	Item deleted α coefficient	Cronbach α coefficient
Energy-saving renovation plan	0.982	0.996	0.996
Energy saving diagnosis	0.985	0.996	
Energy efficiency management	0.985	0.996	
Energy audit	0.974	0.996	
Energy efficiency benchmark	0.970	0.996	
Legal regulations and policy advice	0.983	0.996	
Energy saving training	0.981	0.996	
Energy saving work exchange	0.978	0.996	
Government Energy Conservation Awards	0.989	0.996	
Bidding work	0.972	0.996	

From the above table 1, the reliability coefficient value is 0.996, greater than 0.9, which indicates that the quality of the research data reliability is very high. For the " α coefficient of the item removed", the value of the reliability coefficient after the deletion of the item has not been significantly improved, so the description of the item should be retained, further indicating that the research data reliability level is high. For the "CITC value", the CITC value of the analysis item is all higher than 0.9, which indicates that there is a good correlation between the analysis items, and also indicates that the reliability level is good. In summary, the reliability coefficient value of the study data is higher than 0.9, the value of the reliability coefficient after deleting the item is not obviously improved, and the data reliability is high, which can be used for further analysis.

3.3. Indicator Validity test

Validity includes content validity, accuracy validity, and structure validity. Most of the research examines the architectural validity, which is mainly used to test whether the scale can really measure the measured results. Exploratory factor analysis is often used to test the structure validity of questionnaires. The validity test index of KMO is obtained by SPSS software, and the KMO value of this study is 0.923. When the KMO value of the general equivalent table is greater than 0.6, the validity of the questionnaire is acceptable.

According to the questionnaire results of the user demand survey of advanced energy-saving consulting service, 10 variables were analyzed using SPSS software, and the eigenvalues and variance contribution rate of correlation matrix were obtained. The results are shown in table 2.

Table 2. Characteristic Values and Contribution Rates

Validity analysis result		
	Factor load factor	Commonality
Energy-saving renovation plan	0.985	0.971
Energy saving diagnosis	0.988	0.975
Energy efficiency management	0.988	0.976
Energy audit	0.979	0.959
Energy efficiency benchmark	0.976	0.952
Legal regulations and policy advice	0.986	0.973
Energy saving training	0.985	0.97
Energy saving work exchange	0.982	0.964
Government Energy Conservation Awards	0.991	0.983
Bidding work	0.977	0.954
Characteristic root value (before rotation)	9.678	-
Variance interpretation rate (before rotation)	96.784%	-
Cumulative variance interpretation rate (before rotation)	96.784%	-
Characteristic root value (after rotation)	9.678	-
Variance interpretation rate (after rotation)	96.784%	-
Cumulative variance interpretation rate (after rotation)	96.784%	-
KMO value	0.923	-
Bart spherical value	2270.185	-
Df	45	-
p value	0	-

The validity study is used to analyze whether the research item is reasonable and meaningful, and the validity analysis is studied by using factor analysis method, which is synthetically analyzed by KMO value, common degree, variance interpretation rate value, factor load coefficient value and so on to verify the validity level of the data. The KMO value is used to judge whether the validity is valid, the common value is used to exclude the unreasonable research item, the variance interpretation rate value is used to describe the information extraction level, and the factor loading coefficient is used to measure the factor (dimension) and the item correspondence. From the above table 2, it can be seen that the common value corresponding to all the research items is higher than 0.4, indicating that the research item information can be effectively extracted. The KMO value is 0.923, which is greater than 0.6, which means the data is valid. In addition, the variance interpretation rate values were 96.784%, and the cumulative variance interpretation rate after rotation was 96.784%, which is greater than 50%. This means that the amount of information in the research item can be extracted efficiently.

4. Recommendations for strengthening senior energy efficiency advisory services

From the above analysis, the cumulative variance interpretation rate after rotation is 96.784%, so the user demand indicators of the ten advanced energy-saving consulting services are valid. Reasonable improvement measures can be proposed according to the importance degree of ten user demand indicators, and provide reasonable decision-making basis for advanced energy-saving consulting services.

5. Conclusion

The key of advanced energy-saving consulting service is to perfect the information of user data demand. Only the accurate analysis of the data demand index of the energy-saving consulting service can be put forward reasonable countermeasures accordingly. Using the SPSS questionnaire analysis method to analyze the influencing factors of user demand index of advanced energy-saving consulting service, the final empirical results are more objective, and reasonable improvement measures can be proposed according to the importance degree of each influencing factor.

Acknowledgment

This paper is supported by Power Efficiency Database Management System Design and Test Service Project (No. YD83-18-005).

References

- [1] Wang Guangjun, Cai Wenjing, Cangang. Discussion on the development prospect of energy-saving consulting service industry in China [J]. China Engineering Consulting, 2008 (5): 28-29.
- [2] Beijing Engineering consulting company. Taking energy conservation and emission reduction consulting service as the gripper, promoting the capital economic growth and structure adjustment [J]. China Engineering Consulting, 2010 (3): 70-71.
- [3] Kowei. Statistical analysis method in research and investigation [M]. Beijing Broadcasting Academy Press, 1992.
- [4] Zhang Wentong, Dong Wei. Advanced tutorial on statistical analysis of SPSS. 2nd edition [M]. Higher Education Press, 2013.
- [5] Chen Maochi, su for China. The technique of decomposition of multiple-choice questions in questionnaires using SPSS [J]. Statistical Science and Practice, 1997 (11): 31-32.
- [6] Shenhongli. Analysis of influential factors of readers ' satisfaction degree in university Library based on SPSS questionnaire [J]. Library work and Research, 2012 (1): 58-62.