Research on Customer Value Evaluation Index System in the Form of Proxy Purchase Electricity

Xinnan Zhou[1(✉)], Jing Xiang[2], Shuochen Han[1], and Ying Li[1]

[1] State Grid Jibei Electric Power Co., Ltd., Beijing 100054, China
hexinyu0214@163.com
[2] Economic and Technical Research Institute of State Grid Jibei Electric Power Co., Ltd., Beijing 100089, China

Abstract. The national development and reform in 2021 issued a notice (the development and reform office price 809), the establishment of the power grid enterprise agent purchasing mechanism, which marks the overall acceleration of the process of electricity market, power grid companies in the market positioning and face the market environment and power supply relationship has undergone major changes. As a new function entrusted to the power grid company by this reform, agent power purchase has had a profound impact on the company's service standards, service mechanisms and service processes. This paper aims to study the value evaluation system of power customers in the new situation, and provide support for the establishment of an efficient power purchase customer service system and the construction of an optimized development strategy for customer service.

Keywords: agent purchasing · customer value · evaluation index · data mining

1 Introduction

In 2021, the notice of the General Office of the National Development and Reform Commission on matters related to the organization and development of power grid enterprises' agency power purchase work made it clear that the establishment of a power grid enterprise agency power purchase mechanism and the smooth operation of the guarantee mechanism are clear requirements for further deepening the market-oriented reform of coal-fired power generation feed-in tariffs. It is of great significance for the orderly and smooth realization of all industrial and commercial users to enter the power market and promote the accelerated construction and development of the power market. This indicates that the process of power marketization is accelerating in an all-round way. The role of the power grid company in the market and the market environment and the relationship between power supply and power supply have undergone major changes. As a new function entrusted to the power grid company by this reform, agent power purchase has had a profound impact on the company's service standards, service mechanisms

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and service processes. The company's business boundaries, management priorities, and business processes need to be improved.

In the research at home and abroad, there are four principles for the establishment of the index system. The first is the principle of sufficiency. The evaluation method system should be mainly based on the customer's deep value understanding of the power customer value factors. The established value index system should also mainly include the core indicators that can reflect the representative factors. The relevant evaluation index system under each core dimension index should also be fully and comprehensively set up. The main principle is also one of them. The setting of index weight should generally follow the principle of its importance. There must be no omission in the measurement index of importance. For those important indicators that are difficult to quantify and relatively unimportant, they should be appropriately and completely eliminated; the measurement indicators that are difficult to quantify but are indeed important should generally be properly retained, and sometimes the best measurement of the weight of the important indicator can be directly determined by expert confirmation. Incentive and binding principles and dynamic principles are also very important principles, which indicate that some incentive indicators can also be set in the framework of resource value evaluation index system for power customers; at the same time, there are some benchmark (standard) evaluation constraint indicators that can be set up according to the requirements of relevant laws and regulations, policies, technical standards and other aspects, such as the compliance indicators of a series of environmental protection laws and regulations proposed by the environment; in the design and construction process of resource value evaluation index system for power customers, it is necessary to appropriately set various static index parameters, and at the same time, it should also be possible to appropriately set relevant dynamic indicators between the various index dimensions of the system. Through the static comparison and evaluation of the equivalent period values of these various dynamic indicators of the system or the base period values of the system, the future changes and trends of the system can be quickly found and analyzed.

The purpose of this paper is to study the value evaluation system of power customers under the situation again, and to provide support for the establishment of efficient power purchasing customer service system and the construction of customer service optimization development strategy. First consider the process of customer value evaluation; secondly, carry out research on the construction of value indicators and data mining; finally, the empowerment of indicators is studied.

2 Customer Resource Value Assessment Methods and Processes

2.1 Customer Value Evaluation Model Process

Based on the evaluation index system of power customer resource value, combined with the comprehensive evaluation model, the value of power customer resources is reasonably evaluated. When constructing the overall architecture of the model, the structure of the evaluation model is mainly designed according to the process shown in Fig. 1.

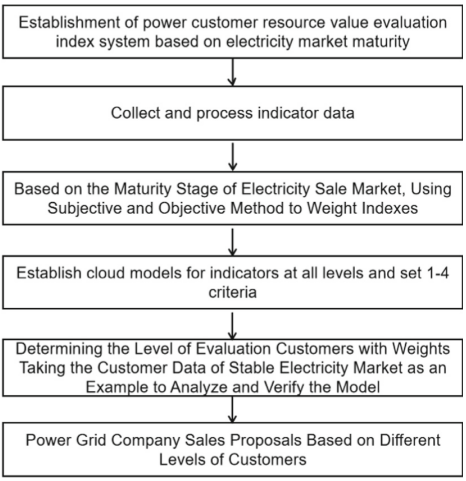

Fig. 1. Power customer resource value assessment flow chart.

2.2 Value Index Construction

Based on the research results of customer transaction value and transaction orientation, aiming at the existing customers, using the analytic hierarchy process, fuzzy comprehensive evaluation and other research methods, the customer criticality evaluation index system in the electricity market is constructed, which takes the key degree as the first-level index and the economic benefit, development trend, service risk and so on as the second-level index. Among them, economic benefits include the basic economic benefits generated by power products such as unit average electricity price and electricity consumption, as well as the demand and demand elasticity of high value-added services such as energy efficiency services, market transaction decision-making, agent operation and maintenance, and demand response; the development trend includes not only the development trend of electricity consumption of individual customers, but also the development trend of the industry and the development trend of high correlation industry. Service risks include electricity recovery risk, customer participation in market transactions risk and deviation assessment risk.

Based on the analysis of the index system, the data acquisition path is designed for each index, and the index assignment method and data processing method are studied. At the same time, the index system for weight setting, combined with analytic hierarchy process to measure the weight of the index system. At the same time, the key degree index is quantitatively studied, the key degree comment set is formulated, and the intuitive qualitative comment set is corresponding to the quantitative value range to form the key degree evaluation standard. Finally, guided by the applicability, the index system is calculated, and the index system is optimized according to the calculation results.

2.3 Data Mining and Model Research

Data mining methods include neural network [1], support vector machine [2], hierarchical clustering [3] and principal component analysis [4]. The traditional method is too

rigid in dealing with the problem of power customer value. The data model is the summary and soul of the data, which is of great significance to the deep knowledge discovery of the data. Therefore, the generation mechanism and characteristics of energy data are analyzed from the perspective of the business links and data classification characteristics of energy data. Combined with the classification of energy data and the link and theme planning of energy data, the generation mechanism and characteristics of various data are summarized by using attribute correlation analysis, data fitting modeling and other technologies, and the model standards and element concept levels of various data are formulated.

Aiming at the complex problem of data association evolution model in key customer energy big data fusion, the construction of energy big data association graph is considered to realize energy data fusion based on association graph. Association graph structure can be designed based on knowledge graph structure. Knowledge graph is an effective method to describe object elements and relationships between objects.

Key customer energy big data association map basic design idea is as follows: extract the energy data model, elements, traceability information and correlation between each other, in the form of map, and the application of the platform to support the theme in the map associated with the data label, realize the 'data', 'data connotation', 'data extension' three association, so as to provide the fusion of energy big data model, model association and theme application level support, energy big data association map diagram, in which various types of number.

2.4 Quantitative Indicator Processing

In the stock market and electricity market competition environment, the important problem after identifying and labeling key customers and combining marketing strategies to form products is how to realize customized product recommendation for key customers in different fields and types. By extracting and labeling the elements of the products in the product library, and modeling the constraints of the external environment data, combined with the key customer's demand model, the product features of various types of products in the product library are labeled, and the target customer product recommendation list is generated and prioritized.

Indicators in the index system include both quantitative and qualitative indicators. Data collection and standardization for quantitative indicators follow the following rules:

First, for positive indicators, the larger the index value, the better, such as profit, clean energy power generation ratio. Firstly, a lower limit x^{min} is determined according to the historical actual data of each index. Then, for the foreseeable period in the future, a maximum expected value is determined as the upper limit x^{max}.

The index standardization formula is:

$$y = \frac{x - x^{min}}{x^{max} - x^{min}} \tag{1}$$

Second, for reverse indicators, the smaller the better, such as cost, accident rate. Firstly, an upper limit x^{max} is determined according to the historical actual data of each index. Then, for the foreseeable period in the future, a minimum expected value is determined as the lower limit x^{min}.

The index standardization formula is:

$$y = \frac{x^{max} - x}{x^{max} - x^{min}} \tag{2}$$

Third, for the moderate index, the closer the index is to a certain critical value, the better, such as the electricity price level. Firstly, the upper/lower limits x^{max} and x^{min} are determined according to the historical actual data of each index, and then a moderate value expected to be achieved is determined for a foreseeable period of time in the future. For moderate indicators, first of all, according to the formula:

$$x' = \left| x - x^{mid} \right| \tag{3}$$

Convert indicators into reverse indicators, and then follow the reverse indicators. For qualitative indicators, according to the actual situation of the evaluation object, the indicators are quantified, and the quantitative results are divided into several levels, so as to quantify the qualitative indicators, and then follow the quantitative indicators standardization rules.

3 Research on Indicator Empowerment

After standardizing the data to obtain standardized data, you need to calculate the weight of each index, combined with standardized data can be evaluated value of customer resources. Traditional evaluation methods include Delphi method [5], analytic hierarchy process [6] and entropy method [7].When there are too many indicators, the weight is difficult to determine, the quantitative data is less, and the persuasion is low. Considering that the index systems at different maturity stages of the electricity sales market are different, it is necessary to design differentiated weights for the stages.

3.1 Basic Weight Calculation

The calculation of basic weights adopts a combination of subjective and objective methods. Subjective weighting adopts the analytic hierarchy process, while objective weighting adopts the fuzzy comprehensive evaluation method.

In the actual analysis of the power customer value, the variable factors considered by the analytic hierarchy process increase the factors that need to be considered after the new electricity reform. Joining these factors is mainly because after the new electricity reform, whether it is the main body of power generation, the main body of electricity sales or the customer base has undergone great changes. Each role not only has a single function, but also the main body exchange between various roles and the increase of the right to choose makes the credit status and potential value of the customer base owned by a power grid company extremely important.

However, only a single analytic hierarchy process will make the value evaluation of power customers more subjective. Therefore, an improved fuzzy comprehensive evaluation is introduced to objectively empower the indicators, which is called fuzzy analytic

hierarchy process (FAHP) in this paper. Mainly from the improvement of expert judgment matrix, the formation of consistency judgment matrix; and line normalization method and feature vector method combined to achieve a comprehensive evaluation of customer value; two steps to a more comprehensive application of customer information to quantify the data base, so that customer value analysis results more in line with the actual situation of customers.

3.2 Differential Weight Calculation

Based on the analysis of the maturity stage of the electricity sales market at different stages, based on the index system, the one-to-one correspondence between different stages and the focus of the index is analyzed, so as to construct the weight design of the corresponding index system at different stages of electricity sales maturity.

4 Conclusion

Based on the research results of customer transaction value and transaction orientation, this paper studies the method and process of customer resource value evaluation from the perspective of combing the construction principle of research index system. Based on the research results of customer transaction value and transaction orientation, this paper constructs the value index system by using analytic hierarchy process, fuzzy comprehensive evaluation and other research methods for existing customers. The fuzzy analytic hierarchy process considered in this paper can comprehensively apply the data base of customer information quantification, so that the customer value analysis results are more consistent with the actual situation of customers. Based on the research of this paper, we can further analyze the marketing environment and demand situation under the new situation of agent power purchase. According to the difference of customer demand or the characteristics of each target market determined by market segmentation, we can study different service strategies with market competitiveness and formulate differentiated service measures.

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References

1. Zhou Lin, Li Qiuhua, Liu Huayong, et al. Evaluating Power Quality Using Fuzzy Neural Network Models [J]. High Voltage Technology, 2007, 33 (9): 66-69.
2. Yang Bo. Power system short-term load forecasting based on support vector machine [D]. Jinzhou: Liaoning University of Technology, 2015.
3. Hu Xiaoxue, Zhao Songzheng, Wu Nan. Power customer segmentation based on SOM-DB-PAM hybrid clustering algorithm [J]. Computer Engineering, 2015, 41 (10): 295–301.
4. Xing Guojing. Application of principal component analysis in customer value evaluation of telecom enterprises [J].Cooperative Economy and Technology, 2010 (7): 34–35.

5. Zhang Jidong, Cao Liansheng, Yan Zhenzhou et al., comprehensive benefit analysis of Hohhot urban distribution network planning based on analytic hierarchy process and Delphi method [J]. Inner Mongolia Electric Power Technology, 2009, 27 (4): 10-12.
6. Liu Xincai, Zeng Ming, Huang Yan. Credit Risk Assessment of Power Customers Based on Analytic Hierarchy Process [J]. Power Demand Side Management, 2005, 7 (6): 19-21.
7. Zhuo Yuanzhi, Liu Jiajun, Wang Mingjun and so on. Research on electricity consumption forecasting method of combined model based on entropy method [J]. Power grid and clean energy, 2011, 27 (5): 47–50.