Big Data Analysis of Demand for Power Supply Service in Urbanization Development of Tourism Industry in Shaanxi Province

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Abstract. Shaanxi is a long-established tourism-oriented province. The warming of the tourism market has made it a national economic growth point in Shaanxi Province. With the gradual extension of the tourism market to cities and towns, how to improve the quality of power supply in the urban tourism industry has become a problem for power companies to consider. Now power supply companies are beginning to target the urban market to seize opportunities to develop tourism, fully grasp the use of big data, carry out resource sharing, and rely on scale effects to improve power supply services. To this end, how to seize the opportunities of tourism development, build an electric service system in the context of big data, and strive to improve market management capabilities and service capabilities are issues that power supply companies need to think about.

1. Introduction
In recent years, many power supplies companies have been able to quickly seize the opportunity of property rights reform, privatization reform, industrial restructuring, and diversified operations to vigorously develop non-electrical industries. One of the hot spots is tourism development. Shaanxi Province is a major tourist province. The imprint of the dynasties of the dynasties left Shaanxi Province to accept tens of millions of tourist traffic a year. To this end, power supply companies need to be based in the bureau, seize all opportunities and tourism opportunities, aim at the market to develop power supply companies with extensive links, information-based advantages, and actively expand channels to promote the development of power tourism.

In the context of smart grid development, big data has become a hot spot in the power industry research [1]. With the improvement of information collection technology, data such as electricity data, economic indicator data, industry data and user information generated by power production and marketing business have grown rapidly, and the degree of integration is relatively high, which has the prerequisites for the development of big data. In recent years, power control integrated systems, monitoring and control systems, geographic information systems (GIS), radio frequency technology, smart energy meters, etc. have been gradually popularized and applied, and the development of power informatization has achieved remarkable results. However, some power supply companies still have relatively weak application capabilities in information technology, and power marketing methods are relatively backward, and data management and control capabilities are low, which is not conducive to the development of power marketing systems. With the further advancement of power reform, power
supply companies are facing transformational pressures, especially the upgrading and transformation of power marketing services. Therefore, in the rapid development of tourism industry, how to build a new Shaanxi electric power marketing service system in the context of big data era, and strive to improve the market's management ability, predictive ability and service ability, is a problem that power supply companies need to think about [2].

2. Design of Big Data Analysis System for Power Supply Service Management and Control in Shaanxi Province

2.1. Analysis of ideas

(1) Establish a marketing service main system with complete links with the marketing system, basic data sources and relying on marketing system data, classify different functional modules, set objective quantitative indicators, and join the horse racing game competition scoring function, objectively and truly reflecting the performance of power supply service of each level of power supply unit is realized through the online management and control system of marketing service.

(2) Build a power supply service application system, real-time implementation of the first-end and end, vertical and horizontal, hierarchical management and control of all-round control and application, development of mobile client APP download to each employee's mobile phone, to achieve power supply services all-weather, the whole process online operation.

(3) Mainly realized functions: power supply service regulations and policies, information disclosure and release, work order acceptance and circulation, service indicator system, competition points system, work dynamics and experience promotion, comprehensive evaluation and rewards and punishments.

(4) In the design of power supply service management and control system, the emphasis is on system engineering management thinking, striving for standardization, standardization and operation, and establishing an information security mechanism corresponding to humanized management, which will promote the improvement of power supply service.

Fig. 1 Power supply control system

2.2. Open electricity information service platform

(1) Relying on the Internet and computer software technology, establish a GIS geography and power supply equipment integration system to realize real-time linking of fuzzy queries.
(2) Using the Internet + mode, the 95598-customer service system and the marketing service system are embedded, and the data is analyzed and analyzed to establish an open-ended client instant use and exchange interface.

(3) Building a diversified and intelligent service based on the expansion of computer communication systems, through the multimedia system, handheld APP, WeChat and other client systems, real-time communication with other information systems such as finance, meteorology, transportation and other communication exchange functions.

(4) Real-time release of all-weather blackout information, equipment fault inquiry, customer repair by means of power system dispatching D5000 system, production PMS system, marketing MIS system, power information collection system, etc. Service system integration function.

3. Power supply service demand big data analysis system interface design

3.1. Big Data Systematic Analysis

(1) Applying mathematical statistics principle and analytical method to carry out big data analysis, screening and research operation of power supply service. Through data analysis conclusion, reveal the inherent regularity of business management, operation process and management phenomenon through systematic management concept and scientific management method. The problem is to expand the measures in the field of power supply services and to increase the space for improvement.

(2) The categorization statistics and analysis of power supply service management can achieve a clear process, and the closed-loop relationship between the overall and local-to-personal discrete elements and the associated links can facilitate the discovery of problems, thus improving the statistical method of power supply service management. And analysis ideas [3].

(3) In the management of power supply services, the factors affecting the changes in power supply service indicators and the degree of influence of many factors can be quantified and screened, effectively solving the blindness and disorder of the analysis of complaints, and enhancing the complaints. The pertinence, purpose and regularity of the event analysis and management process have improved the level of refined management and work efficiency.

(4) In the process of marketing service activities, there are many discrete factors and physical phenomena with regularity and relevance, as well as procedural practice control processes, establish logical links of data analysis, carry out classification induction and operation analysis, and show different control the application interface, process control, and personality requirements required by the object.

3.2. Customer Information Service Platform

(1) Based on the Internet + mode and the computer network communication protocol, the GIS geographic system is the basic kernel, the navigation link is performed in real time, and the multimedia function interface is used to load and run on the computer terminal and the mobile terminal.

(2) Establish a model of different data structures, design several program modules and interfaces, implement built-in curing and tracking embedding methods, real-time data link related function modules, and flexible interaction in different support interfaces.

(3) In view of the information security control requirements, in the case of ensuring that the physical isolation and logical isolation of the power grid meet the safe operation, a unique authentication and electronic key, conditional open scheduling, production and marketing system data interface are provided at the design entry point to prevent Data corruption and virus damage have occurred.
4. System features and cost performance

4.1. Implementation function

1. The system realizes cross-professional mass information resource sharing, system public management and professional personality management, realizes professional integration, interaction and coordination, and can meet the management needs of personnel at all levels of power supply companies and different management levels.

2. The system can realize real-time online judgment, command and analysis, realize real-time online tracking and control of power supply services at all levels, and improve the timeliness, pertinence and authenticity of work.

3. Open-type electricity information service breaks through the bottleneck of traditional service technology, establishes a free, convenient and fast service channel for customers and power supply companies, and realizes instant response in time and space for customer appeal and business processing.

4. The development and use of the system can realize the vertical and horizontal coordination and expansion of various system resources of the power supply company, realize the effective application of internal resources, maximize the management efficiency and economic benefits of each system, and improve the efficient operation of enterprise assets through efficient use of resources.

5. The application of the system can improve work efficiency, reduce and reduce the heavy and repeated workload of personnel, and liberate the labor resources of the frontline personnel.

4.2. Cost-effective analysis

4.2.1. Software and hardware investment. The development cost of the one-time investment system is relatively low, basically it is used for the interface technology processing of various types of systems, and realizes the linkage between many systems and platforms. The system software operation and maintenance cost are low, except for the existing ones. In addition to the operation and maintenance costs of various systems, the system only needs to solve the interface cost. The main system needs to be equipped with new equipment of higher standard. The workstations at all levels are now equipped with computers and switches according to the unified standard, which can be used. It is recommended
that power supply service command centers at all levels build large-screen surveillance studios of different specifications.

4.2.2. Application Benefit Analysis. (1) After the development of the system, the integrated and efficient use of the technical service resources of the province's power supply system was realized, and the process and link of the control process were refined. The evaluation was objective and true, and the management benefits of the company were very significant.

(2) Client development and application and loading, new payment channels, customer self-service and other functions to expand and apply, greatly facilitate customers, greatly reduce customer complaints, corporate image, social satisfaction and social benefits significantly improved [4].

(3) The system innovation realizes the Internet + marketing service operation mode, which broadens the development path for power supply companies in the future, and can further extend the connotation of Internet + marketing services to power supply companies, such as: Internet + power platform, Internet + e-commerce, Internet + New energy applications and other services.

![Open electricity information service platform](image)

**Fig. 3** Open electricity information service platform

5. Power demand big data processing method

5.1. Two-part customer electricity fee structure

The two-part customer electricity fee structure consists of basic electricity, electricity and electricity, and power factor adjustment. The structure of the customer's electricity bill is complicated, and the system can only display some raw data or rigid data settlement results to the customer. The electricity customers generally do not understand the settlement method and process, and cannot adjust the actual power consumption according to their own characteristics, and reduce the average electricity price. The power supply enterprise department must also pass a complicated settlement process, and after long-term data statistics, it can give customers reasonable power supply advice.

5.2. Modeling process

5.2.1. Power inquiry. Provides a graphical display of two-part customer electricity usage, visually showing the daily, monthly, and annual electricity usage of two-part customers, including daily,
monthly, quarterly, annual basic electricity tariffs, electricity tariffs, power factor adjustment tariffs, and ratios. The situation can be compared and analyzed by two-part customers, which is convenient for electricity customers to understand their own electricity habits.

5.2.2. Power Type Clustering. Statistical analysis of the ranking of electricity consumption of enterprises in the same industry, to help users understand their own level of electricity consumption. Correlation analysis: Correlation analysis based on historical time series of two-part customers. Since the two-part customer can collect more information, the correlation coefficient can be analyzed from multiple dimensions such as power load, average capacity, reported capacity, and instantaneous maximum and minimum load. The complex correlation coefficient is an index reflecting the degree of correlation between one dependent variable and multiple independent variables (two or more), and describes the correlation between a dependent variable and a linear combination of multiple independent variables. The greater the correlation coefficient, the closer the linear correlation between the dependent variable and the independent variable [5].

To determine the complex correlation coefficient between a variable y and several other variables \( x_1, x_2, ..., x_k \), consider constructing a linear combination of \( x_1, x_2, ..., x_k \) by calculating the simple correlation coefficient between the linear combination and y as a complex between the variables y and \( x_1, x_2, ..., x_k \). Correlation coefficient. The specific calculation process is as follows:

The first step is to use y to return \( \hat{y} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_k x_k \) (1)

In the second step, a simple correlation coefficient between y and \( \hat{y} \) is calculated. This simple correlation coefficient is the complex correlation coefficient between y and \( x_1, x_2, ..., x_k \). The formula for calculating the complex correlation coefficient is

\[
R = \frac{\sum (y - \bar{y})(\hat{y} - \bar{\hat{y}})}{\sqrt{\sum (y - \bar{y})^2 \sum (\hat{y} - \bar{\hat{y}})^2}}
\]

Clustering: Clustering using the means algorithm based on complex correlation coefficients. Initially, some records are selected (or artificially designated) as a cohesive point, and then the loop process is started: the remaining records are agglutinated to the cohesive point according to the principle of proximity; the center position (mean) of each initial classification is calculated; the calculated center position is calculated Re-clustering; this cycle is repeated until the location of the cohesion point converges.

Regression fitting: For each type of aggregated two-part customer, you can regression the standard curve of the customer fitting this type, and get the standard deviation of the power curve of each two-part customer, which can estimate two The power consumption interval of the departmental customer on the next day (month) provides a certain amount of electricity guidance for the electricity customers.

5.3. Tourism customer power housekeeping service model

5.3.1. Tourism customer electricity fee structure. The composition of the travel customer is relatively simple, but there is a ladder electricity price. The ladder price is a three-step progressive price increase based on annual electricity consumption. Among them, the first gear is the annual electricity consumption of 2,760 kWh and below, the electricity price is not adjusted; the second gear is the annual electricity consumption 2,761-4,800 kWh, the electricity price is increased by 0.05 yuan based on the first electricity price. The third gear is more than 4,800 kWh, and the price increases by 0.3 yuan based on the first price.
5.3.2. **Modeling process.** (1) Power inquiry. Provides a graphical display of the travel customer's electricity usage, visually showing the customer's daily, monthly, and annual power usage, including daily, monthly, and annual power consumption peaks, valleys, and totals. It can be used for customer comparison and analysis to facilitate customers to understand their own electricity habits. Different from the two-part customer, the module directly displays the difference between the electricity cost of the travel customer using a single electricity price or the peak-to-valley time-of-use electricity price, and realizes that the customer directly changes the category according to the demand, directly saving the time cost and the monetary cost of the customer.

(2) Analysis and warning of the use of the ladder. According to the historical power consumption of each customer, do regression analysis, predict its power consumption next month, and give certain suggestions. The specific method is as follows. The average prediction method (including simple moving average method, weighted moving average method, and trend moving average method) is used to predict the user's power consumption next month. The specific operation is as follows. The paper briefly introduces the moving average method [6].

The simple moving average method is only suitable for short-term predictions, and it is a situation in which the development trend of the forecasting target does not change much. If there are other changes in the development trend of the target, the simple moving average method will produce a large prediction bias and lag.

If the \( \{y_1, y_2, \ldots, y_n\} \) customer power time series is known, the formula B can be used to predict the value of the \( y_{n+1} \) period when the basic trend of the predicted target is to fluctuate above and below a certain level.

\[
y_{n+1} = \frac{y_n + y_{n-1} + \ldots + y_1}{n}
\]  

Its prediction standard error is

\[
S = \sqrt{\frac{\sum_{i=N+1}^{T} (y_i - y)^2}{T - N}}
\]

5.4. **Customer Experience**

5.4.1. **For non-peak and valley electricity customers.** Through the model to calculate the annual total electricity tariff and the implementation of the peak price of the peak and valley electricity price comparison, the annual savings in electricity tariffs, and the system provides electricity price to change the process interface, so that users intuitive and convenient one-button change, saving electricity costs.

5.4.2. **For Peak Valley customers.** Provide peak-to-valley ratio chart and set low-altitude ratio warning (11% as the demarcation point), prompting customers to reduce electricity consumption by lowering the average electricity price and ensuring the safe operation of the grid economy.

5.4.3. **Step power usage.** The triangle chart shows the current power consumption level of the customer, as well as the ladder price increase situation, so that the customer can understand the concept of the ladder electricity fee more intuitively, and achieve the purpose of prompting the customer to save electricity.

6. **Conclusion**

Big data analysis of the demand for power supply services in tourist areas can help to better predict the demand for electricity in order to prepare for electricity and improve power services. The system and
the electricity big data analysis system can provide a handheld power platform, provide power customer butler service, integrate and analyze the fragmented power data, and obtain a visually simple view and calculation result, and give a reasonable power supply recommendation value. Service to improve user experience satisfaction.

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