Research on Rural Comprehensive Energy Service Operation Based on Data-driven of Electric Power Internet of Things

Yuxuan Qian[1]，Jia Yang[2]，Limin Liu[1]，Yichuan Xu[1]，Mu Qiao*[3]

[1]Department of Market，State Grid Changzhou Electric Power Supply Company ，China,213000
[2]Department of Operation, State Grid Changzhou Electric Power Supply Company, China,213000
[3]School of Health Economics and Management，Hanlin College of Nanjing University of Chinese Medicine,China,225300

Abstract—In order to promote the revolution of energy production and consumption, and build a clean, low-carbon, safe and efficient energy system, the research on rural comprehensive energy service operation based on the data drive of electric power Internet of Things was put forward. In this paper, the innovation of big data technology application concept drives the integrated energy service operation management mode, and improves the service quality and operation management efficiency. Focusing on the collaborative optimization of production and consumption, the construction and management of rural comprehensive energy services will make use of technological advantages to accurately locate customers' needs, improve service efficiency, and benefit the concept of energy green ecological construction in rural comprehensive energy development planning to build a smart energy ecosystem.

1. Introduction

At present, integrated energy services have achieved certain results in urban development. With the continuous implementation and promotion of rural revitalization strategy, integrated energy services have gradually penetrated into rural energy development [1]. Today, with the increasingly severe competition in the comprehensive energy service industry, the rural comprehensive energy business market still has great potential. Rural areas have different energy consumption characteristics and geographical environment from urban areas. The development of rural comprehensive energy services should be optimized and innovated based on big data technology and the experience of urban comprehensive energy development combined with the actual situation in rural areas. At present, the comprehensive energy service market has great potential and many participants. Platform development can promote the efficient connection of all participants, promote the organic combination of energy industry chain and digital economy, and rely on technical means to promote the high-quality development of rural comprehensive energy services [2-3]. The existing community energy system scheme of the Internet of Things can realize the intelligent management of the community power system to a certain extent, but there are still the following shortcomings in technology: it can not realize the local management of the photovoltaic system in the community, resulting in the transmission loss of photovoltaic power in the community; The fault detection of the power system in the residential area depends on the feedback of the users, and cannot be prevented in advance. In order to solve the above problems existing in the current technology, this paper designs a comprehensive energy service and subsequent implementation and operation and maintenance plan in line with the actual situation of rural areas, which can meet the comprehensive energy service needs of rural users to the greatest extent, achieve the goal of building a green smart village, achieve energy self-sufficiency, energy conservation and emission reduction, reduce unnecessary links in the implementation process, and reduce the operation and management costs of the grid company Improve service quality and operation management efficiency.

2. Rural comprehensive energy service projects to achieve deep empowerment driving force

2.1. Improve the energy industry chain and strengthen the ability of resource integration

The comprehensive energy service market is characterized by a long industrial chain. From construction planning to investment and construction, as well as the supply of corresponding equipment and resources, and the management of the whole industrial chain, it is very difficult to realize vertical and integrated management [4]. Most service providers, including energy and power companies, Internet companies and equipment manufacturers, focus on single or several links in the industrial chain. Specifically, the financing cost of energy and power enterprises is relatively low,

*373626972@qq.com

and they are good at investing and operating heavy assets; The Internet company has advanced information technology, and uses digital management system to collect, analyze and process all kinds of data. Equipment manufacturers focus on equipment R&D, manufacturing and operation and maintenance services. It can be seen from this that it is very difficult to exert one-stop service efficiency in order to complete the through development of the energy industry chain with its own resources in energy service. On this basis, comprehensive energy services are needed to realize the integration and optimization of resources in all links of the industrial chain through platform development, improve the accurate and efficient matching, and complete the docking and empowerment of energy services. For example, Table 1 shows the integrated energy local management system.

Table. 1 Integrated Energy Local Management System

source	lotus	Storage	net	Intelligent green
Photovoltaic power generation	Charging facilities	User side energy storage	Intelligent distribution network	Hui building
Triple power supply and generation	intelligent street lamp	Grid side energy storage	Volume management network	green building
External power grid	/	Water cold storage	Intelligent office network	/

2.2. Common needs and personalized needs are driven together, giving full play to service value in both directions.

To realize the common drive of the two, it is necessary to pool resources through the platform, give play to the value of functionality and service, and meet the common needs of energy service providers and customers [5-6]. The comprehensive rural energy service can meet the common needs of customers from the following aspects: the balance between supply and demand. Service providers need to provide diagnostic services and push services to tap the real needs of customers; Credit information service. Faced with a large number of enterprise energy-saving services, it is difficult for customers to distinguish their brand value and service efficiency. Through credit information service, we can deeply understand the actual payment ability of customers, and provide customized services for customers in combination with their consumption level. Financial services. There are only a few service providers with super financing ability in the field of comprehensive energy services. From the analysis of most situations, energy service providers need financial services such as financial leasing and low-cost credit to improve their delivery ability for heavy asset operation services. Third-party authentication service. The contract management business model needs the requirements of both the supplier and the buyer for the determination of energy saving, and the service provider directly gives the energy saving data in combination with the measured data. However, this method lacks credibility and persuasiveness for the customers, and requires the third-party certification body to determine the energy saving with professional standards and scientific measurement capabilities. The above needs to implement common needs, so as to lay a personalized service foundation. The value of platform development of integrated energy services is to integrate resources on the basis of fully tapping the demand of the generality of market players, and to meet the individual needs of users through the combination of financing resources and equipment resources of service providers with actual scenarios.

3. Construction ideas and optimization paths of helping rural comprehensive energy services with the concept of big data

3.1. Focus on users' needs and provide high-quality services by using energy data.

Effective rural comprehensive energy service operation and management strategy is based on customer-centered, with the development goal of reducing costs and increasing economic benefits through field investigation and field data investigation. Combined with all kinds of existing resource data of enterprises, with the help of cloud computing, big data, ubiquitous power Internet of Things, blockchain and other technologies, a set of databases around rural energy development and highlighting the characteristics and advantages of rural industries is built [7]. Through the integration and analysis of database resources, the development trend of the future energy market can be scientifically predicted, so as to establish the business development direction of the next stage of the enterprise. On this basis, enterprises need to combine and clarify the actual needs of customers, and analyze them according to the industrial structure and data. Through data collection, screening, analysis, induction, etc., and credit information service, diagnostic service, push service and other service methods, we can fully understand and master customers' ability to pay for services and their real demand for energy services. Therefore, service providers can customize personalized and professional comprehensive energy services according to the needs of different customers, which can not only improve service quality and efficiency, but also reduce costs and continuously empower the energy industry. Villages need to gather local resources, integrate with various energy businesses,

and fundamentally change the operation and management mode and backward management ideas of rural comprehensive energy services.

Specifically, first of all, to rationally allocate personnel and reduce unnecessary waste of resources, we can use the service concept of "one post system" to build a service team that wholeheartedly provides customers with high-quality services, shorten the business processing cycle and simplify the processing process, reduce operating costs and improve the working efficiency of personnel; Secondly, use digital equipment and power grid equipment to realize functional interconnection and mutual cooperation, improve the utilization efficiency of intelligent electronic equipment, and reduce risks in operation; Finally, increase communication with customers, lay a foundation for customer service, and do a good job in word-of-mouth marketing. Based on this, from the perspective of long-term development, we need to respond to market changes, which can be implemented one by one from four aspects: providing personalized services, risk prevention, emergency equipment and troubleshooting, and increasing customer stickiness. The premise of making personalized service is to use cloud platform and big data technology to integrate the data in the system, understand the basic information and purchase demand of customers, and analyze and establish comprehensive energy service plan by using energy database and technical means; Risk prediction and prevention of failure and offline of energy equipment with the help of energy facilities in cloud platform; According to the cloud platform data and risk prevention related information and data analysis, make emergency equipment, speed up the treatment of faults, and ensure the stable operation of electric power; Through data analysis, we can mine the potential service points of customers, update customer information and data in time, maintain customer relationships from different dimensions and attributes, and increase the stickiness with customers.

3.2. Make the industrial chain of energy production and consumption collaborative optimization, and improve the energy utilization rate.

The basic mode of operation and management of integrated rural energy services needs to be based on the collaborative optimization of the whole chain of energy production and consumption. Mobilize and allocate social resources under the application of energy Internet, and realize the exchange of energy flow, information flow and value flow through energy transmission network, cyber-physical systems, integrated energy management platform and information and value-added services, and practice the national green ecological construction goal [8-9]. According to the current national strategic planning and implementation of rural comprehensive energy operation and management, it is necessary to find an implementation path suitable for rural development in combination with China's national conditions, and to realize differentiated and customized comprehensive energy services with the help of the advantages of medium and large energy enterprises and service providers. Therefore, in order to promote the upgrading of rural comprehensive energy services, system upgrading and optimization, and industrial innovation, the State Council, various ministries and energy administrations have formulated a large number of policies in combination with clean energy production and consumption. It covers distributed power generation, internet plus smart energy, multi-energy complementary, micro-grid, cogeneration and other diverse contents. With the help of the advantages of information technology such as Internet, cloud platform and big data, it will improve the coverage of comprehensive energy services in the energy production and consumption chain. There are many subjects to carry out comprehensive energy services, including power grid companies, power generation enterprises, service companies and technology companies.

Based on the above viewpoints, if we want to coordinate the synchronous development of energy production and consumption chain, improve energy utilization efficiency and do a good job in rural comprehensive energy services, we can think from the following points: Mobilize industry resources, increase policy support and promote the formation of energy commercial ecosystem system. At the same time, guided by comprehensive energy optimization and industrial chain operation and management, we will develop the "1+N" energy service mode based on electricity, and cooperate with the government, service providers, energy enterprises and customers to strengthen mutual cooperation, realize the optimization of various energy sources with diversified service modes and management modes, build an ecological circle of energy interests, promote the development of comprehensive energy services, and continuously promote the transformation of energy production and consumption; Make use of new energy technologies to promote the optimization and upgrading of energy industry structure and realize a cross-platform industry technical standard system. Comprehensive energy service is a technology-intensive industry. Facing the fierce market competition environment and the energy science and technology innovation brought by operation and management, it is necessary to strengthen the research on the standardization and unification of comprehensive energy production and energy supply, establish a technical standard system and a statistical monitoring system, tackle key key core technologies of the industry, and promote the sustainable development of the industry. Therefore, integrated energy services need to be integrated into the development of big data applications, focusing on the three customer portals of integrated energy services, namely transaction portal, service portal and asset portal, so as to improve the quality of supply services and meet the service demand. The contents of three specific customer portals are shown in Figure 1. For example, Table 2 is the only way for comprehensive energy industry [10-11].

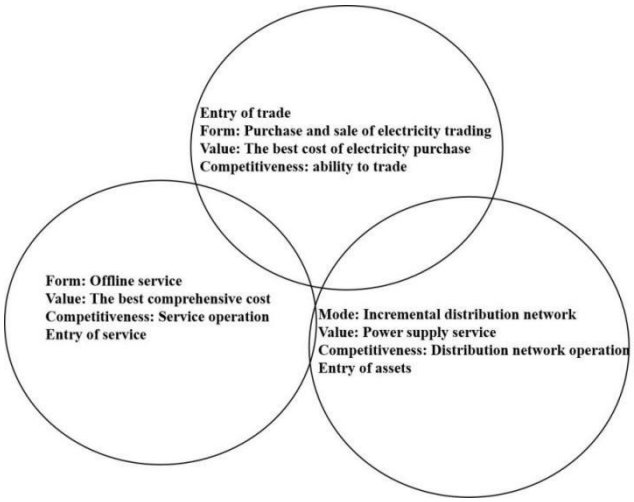

Figure. 1 Three customer entrances of integrated energy

Table. 2 The only way for comprehensive energy industry

Investment construction	Intelligent microgrid	Electric power transaction	customer service	Intelligent operation and maintenance	Energy trusteeship
New energy power generation construction	Construction and operation	Direct power supply for large users	Planning consultation	Operation and maintenance repair	Electricity charge trusteeship
Distributed new energy construction	Respond to demand	Wholesale electric power	Information construction	Equipment patrol inspection	Equipment custody
Energy-saving renovation project	Virtual power generation	Group purchase of electric power	Solution customization	Energy saving consultation	Tuoying
Investment and construction of distribution network	energy efficiency power plant	Customization of energy	/	Energy efficiency analysis	/
Construction and operation of charging station	/	Mutual benefit transaction	/	personalized/individual service	/

4. Conclusion

Combined with the instructions in the report of the 19th National Congress of the Communist Party of China, we should take "promoting green development" as the primary task of social development, comprehensively promote the revolution of energy production and consumption, and build a clean, low-carbon, safe and efficient energy system. Combined with the energy development strategy, this paper explores the driving force of rural comprehensive energy service development around the energy industry, accelerates the energy use efficiency of the comprehensive energy service industry, collects data around the construction of rural comprehensive energy service with the concept of big data, and builds a green and smart village.

References

1. Liu, T. , Wu, D. , Xu, F. , Song, P. , & Bai, X. . (2021). Research on operation of electrothermal integrated energy system including heat pump and thermal storage units based on capacity planning. Energy Engineering, 118(3), 535-548.
2. Zhu, Y. , Wang, Y. , & Liang, W. . (2021). Research on fog resource scheduling based on cloud-fog collaboration technology in the electric internet of things. Recent Advances in Electrical & Electronic Engineering （Formerly Recent Patents on Electrical & Electronic Engineering）, 14(3), 347-359.

3. Zhang, J. , Peiling, M. A. , & Jiang, Q. . (2022). Path of promoting industrial transformation and upgrading based on rural revitalization:a case study of green plum industry in luhe county of shanwei city. Asian Agricultural Research, 14(8), 4.
4. Zhang, J. , Zhu, W. , Wu, X. , & Ma, T. . (2021). Traffic state detection based on multidimensional data fusion system of internet of things. Wireless Communications and Mobile Computing, 2021(1), 1-12.
5. Luo, Y. , Wang, Q. , Li, X. , Yuan, Y. , & Fu, Z. . (2021). Research on supply and demand forecast of regional integrated energy system based on computer internet of things technology. Journal of Physics: Conference Series, 1915(2), 022035-.
6. Luo, Y. , Zhan, C. , Liu, Y. L. , Yu, H. , & Li, R. . (2021). Application research of customer side integrated energy service system based on machine learning. IOP Conference Series Earth and Environmental Science, 692(2), 022011.
7. Ning, S. , Ge, Z. , & Huang, X. . (2021). Research on the construction of urban and rural planning land classification system and land type identification based on multi-source data of internet of things. Journal of Physics: Conference Series, 1915(2), 022088 (5pp).
8. Li, L. , & Li, H. . (2021). Analysis of financing risk and innovation motivation mechanism of financial service industry based on internet of things. Complexity, 2021(3), 1-9.
9. Zhang, X. . (2021). Characteristics of mountain climate change and optimization of agricultural tourism management based on satellite internet of things. Arabian Journal of Geosciences, 14(16), 1-14.
10. Wang, L. L. , Jia, L. Q. , Chu, F. Q. , & Li, M. X. . (2021). Design of home care system for rural elderly based on artificial intelligence. Journal of Physics: Conference Series, 1757(1), 012057 (7pp).
11. Pan, L. , Zhang, Y. , Zhao, D. , Wang, J. , Deng, L. , & Sun, L. . (2021). Research and application of a new encryption transmission technology of internet of things based on plc power line carrier communication. IOP Conference Series: Earth and Environmental Science, 791(1), 012087 (5pp).