Analysis of the application trend of big data in power industry

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Abstract. With the permeate of new forms of digital economy into various fields of social development, the application of big data has become a driving force for innovation, transformation and upgrading in all walks of life. Internet enterprises and traditional power grid enterprises are actively exploring the innovation of big data application scenarios, which relevant data analysis ideas and methods are worth to learn.

1. Introduction
In today's world, the digital revolution is changing with each passing day, leading to major changes in the way of production and life. The world has stepped into the era of digital economy. In the report to the 19th national congress of the communist party of China, General Secretary Xi Jinping emphasize that to promote the deeply integration of big data and the real economy, accelerating the innovation of science and technology, constructing digital China. And in December 8, 2017 in the collective learning of the political bureau of the central committee, General secretary Xi Jinping has made a more specific deployment about this strategy, issued a mobilization order for the whole country to learn how to make good use of big data and take the initiative to seize the commanding heights of the digital development of the economy.

With the endowment of being able to copy, share and grow infinitely, data has been constantly integrated into various links of industrial innovation and upgrading, providing a foundation for the sustainable development of digital economy and becoming a key factor of production and important resource increasingly valued by major countries and multinational enterprises in the world in the era of digital economy. As the largest Public utility enterprise in the world, the power industry's ability to take the lead in the development of the world's digital economy depends on its own efforts in the development of strategic data resources.

2. Internet enterprises' innovation in the application of power big data
Internet enterprises are committed to becoming experts in the solutions of big data, which gather the power of big data from different industries and by virtue of its own data resources and experience and technical advantages to enable the transformation and upgrading of government and enterprises and facilitates the construction of smart cities. Internet enterprises mainly apply power data to fire control, transportation, energy, credit investigation and other fields.
2.1. Intelligent fire
Fire safety is related to people's livelihood and property safety, which is an indispensable part of public security in the construction of smart city. Tencent made the ‘Tencent Hui Ju’ big data platform applied to fire management in Jiangsu province. Build electrical fire grid monitoring system with community as the unit, which collects and analyses the real-time electricity consumption data of the networked unit, basic data of electricity consumption equipment, surrounding environment of buildings, and real-time meteorological information, etc., so as to realize all-weather real-time monitoring of electric appliance fire hazards. According to the grade assessment of leakage, overcurrent, over temperature and other faults, the detection system will automatically generate and push the grading warning information in advance, could effectively preventing fire accidents of electrical appliances. In addition, based on the big data analysis of consumption of electricity, water and gas, the group rental situation in the community was predicted with an accuracy of more than 90%, so as to realize the rapid detection and accurate prevention and control of fire hazards in the group rental.

2.2. Intelligent transportation
Transportation is the basic function of urban system, and the key elements of building a smart city must include intelligent and efficient transportation system. America Hickory Street Company and Carnegie Mellon University through the big data analysis of Austin's household electricity consumption, predicted the start time of highway traffic jam in the morning. They classify the households based on the time and quantity of their use electricity, such as electric vehicle charging time, household life work and rest habits, and analyse the relations between each category and the traffic congestion. According to the research they found that early peak traffic time was significantly related with specific types of electricity mode. They also found when household electricity mode change, the next day the start time of traffic congestion will be changed. The result of research shows that the electricity data is more advanced and effective than the real-time traffic data in predicting the morning traffic congestion. In recent years, the number of electric vehicles in China has increased rapidly, and the application potential of power big data in intelligent transportation is huge.

2.3. Intelligent energy
Energy provides basic guarantee for the normal operation and function of urban organisms, and intelligent energy is the foundation and standard of smart city construction. Lang De Hua Yun Energy Technology co. LTD through the construction of the Internet of things energy management and control system to collected a large number of scattered energy use data such as electricity, water, gas, heat and oil etc., as well as relevant operating parameters and environmental parameters of each energy consumption node. Then, it can be sorted, optimized, controlled and rationally allocated to provide an overall solution for the overall control, optimization, service and redistribution of urban building community or regional distributed energy. Q Cloud can build ‘smart energy management centre’ for commercial real estate and industrial parks. It also provides a series of services such as visual monitoring, power quality management, equipment energy use evaluation, equipment energy saving control, energy use plan management, power distribution equipment predictive analysis centre, so as to improve the operation efficiency of energy resources, reduce the comprehensive energy use cost and improve the regional environment.

2.4. Credit life
As the main body of modern economic activities, credit's solemn commitment to its own behaviour and the comprehensive evaluation of its commitment from all walks of life will be the passport for smart city to engage in social and economic activities in the future. Ali through access to electricity, water, gas payment data, financial data, and the government to open up the industry and commerce, taxation, education and other data, solves the problems of Internet companies although data accumulated rich but with less personal credit correlation. A complete and accurate sesame credit system is constructed, and with the increase of the application scenarios of credit life, the government and enterprises are
empowered to provide various credit rights and interests. At present, there are many platforms in China that have accumulated rich business data resources, such as e-treasure, state grid mall, e-commerce, Internet of vehicles, photovoltaic cloud network, and Internet finance etc., which have a good foundation for building a big data credit system.

3. Innovative application of big data on traditional electric power business

Big data of traditional electric power business mainly comes from various links of power generation, transmission, transformation, distribution and use, and has formed advantageous data resources in power grid operation, equipment operation and inspection, as well as power marketing. This paper focuses on digging to activate the potential value of power big data, so as to further optimize or innovate the operation and management of traditional electric power business and improve efficiency and benefit.

![Innovative application of big data on traditional electric power business](image)

**Fig.1** Innovative application of big data on traditional electric power business

3.1. Power grid operation

The operating conditions of the power grid are undergoing profound changes. It is necessary to strengthen the monitoring and data analysis of the power grid to support the stability of the power grid and optimize the regulation of the unpredictable renewable energy and external environment. Huawei has launched an Intelligent business solution covering all aspects of the power business, which integrates the traditional power system with the technology of BCIMI(big data, cloud computing, internet of Things, mobile internet and IntelliSense: BCIMI), to realize the comprehensive perception, interconnection and business intelligence of various kinds of electric power terminals, so as to promote the transformation of power grid operation to intelligence. Intel introduces advanced power grid management solution, with real-time monitoring and control infrastructure and smart edge devices based on Internet of things technology, make it easier to collect and analyze data from the entire grid, including distributed energy. It also helps to perform key functions such as the circuit voltage monitoring and optimization, sag and surge source identification, load balance improvement, the determination of technical and non-technical loss source, isolate the fault location to reduce the outage investigation time etc., so as to improve power grid operation efficiency and increase reliability and security.

3.2. Equipment management

Through visual monitoring and intelligent operation and inspection based on equipment data, remote and real-time sensing and management of power grid equipment can be realized efficiently and cheaply, and the potential of equipment can be fully released. The Predix platform of GE Company can simultaneously capture, analyze and manage massive data about the operation of various equipment such as aircraft engines and turbines, and build digital models for the equipment using digital twin technology. Through big data analysis of debugging and testing in a virtual environment, it can monitor and predict the status of the equipment and optimize the equipment operation, maintenance and overhaul plan. Tencent launched the "energy and matter-linked platform" with four advantages of massive heterogeneous energy equipment access, contactless continuous power installation and debugging, quick one-click code scanning deployment, and construction of virtual equipment library, which greatly
reduced the time and cost of device interconnection and the cloud on the Internet. Tencent realizes the functions of visual management of equipment, monitoring, operation and maintenance through two-way communication between data collection and command issuance between the equipment and the platform.

3.3. Electric power marketing
With the deepening of the electrical power reform, it is necessary to accurately understand and quickly respond to customer needs with the help of big data analysis, so as to optimize customer experience and improve customer stickiness. Peng Mai Energy Technology Co. LTD builds energy efficiency data sharing and application platform, and through data sharing and incentive mechanism, promote electricity users or energy efficiency service providers to use energy data to connect with the platform. The platform will evaluate the quality of the data, calculate and upload user contribution, which can be exchanged for the use of energy efficiency applications, and then build an energy big data ecosystem. Focusing on data value, build "three clouds of electricity sales" from the three steps of "electricity sales, electricity consumption and electricity purchase". "Selling electricity cloud" provides intelligent selling electricity management solutions for selling electricity companies, "Energy efficiency cloud" provides energy efficiency services of the whole life cycle for electricity enterprises, "Transaction cloud" provides trading strategy and decision support for power transaction, thus forming a one-stop, intelligent power marketing scheme. Tokyo Electric Power Co., LTD unites industry service providers such as network, housing, communication, automobile, electric appliances, scoreboard and insurance to build an enterprise alliance. Strengthening the cooperation of data exchange and provide decision-making support for the launch of personalized electricity price packages, energy conservation consulting, mixed points rebate, business alliance marketing and other services. And based on the analysis of electricity use information big data, to carry out the family security, care for the elderly, as well as family 24 hours door-to-door repair etc. service optimization experience.

4. Conclusion
The effective application of power big data can provide a large number of high value-added content value-added services for the industry and beyond. GTM research institution predicts that the global power big data management system market will reach $3.8 billion in 2020. Since electricity data can reflect the economic activity trajectory of residents, enterprises and even the society in real time and reliably, it has always been regarded as an important data resource for enterprises to build their own big data platform, such as the platforms of "Tencent Hui Ju" and "Ali Yun" etc. integrate data information from multiple industries (including electricity-related data obtained through various forms) by virtue of their data resources and technological advantages, thus enabling the transformation and upgrading of government and enterprises.

The application of big data in power grid enterprises is still in the primary stage of development, and its data resources have many compound values that need to be discovered and mined both internally and externally. Power grid enterprises should pay close attention to the dynamic of power big data applied by Internet enterprises, and strengthen cooperation and learning with Internet enterprises. Internet companies are stepping into the power sector to speed up the open sharing of power data. Power grid enterprises should closely track the relevant dynamics of Internet enterprises, strengthen the learning and reference of big data application, and explore the cooperation mode and sharing mechanism with Internet enterprises, governments and other external forces.

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