Research on The Application of Identifier Resolution and Blockchain Technology in The New Energy Field*

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Abstract. With the development of new energy power generation technology, distributed generation technology and small personal power generation have become an important development direction for new energy power generation. However, distributed generation technology may have the information island phenomenon due to its construction, grid connection, transaction and other links with data scattered in various departments, enterprises. Besides, differences in products, equipment and data type and lower degree of data sharing in links aggravate this phenomenon. In order to get through and integrate the data information of each new energy system, realize the sharing and centralized management of platform data resources, and remove the business barriers between various departments and enterprises, this paper proposes to use the electric power Internet of things identifier resolution system to standardize the data of all links in the new energy system, and each link in the system uses open data to create more value. In addition, this paper also uses a combination of blockchain technology and the Identifier resolution system to optimize new energy power transactions, and proposes a method for sharing private data in a small range of users. Inject new impetus into the development of new energy distributed generation.

Keywords: New energy power generation, distributed generation, identifier resolution, blockchain technology.

1. Introduction

With the development of society and economy, the massive utilization of traditional fossil energy has brought resource depletion and climate change, which seriously threaten the sustainable development of human society. The development and utilization of clean and sustainable new energy has become an inevitable transformation. Solar energy, wind energy and other new energy sources are gradually replacing traditional fossil energy sources with their renewable, clean and pollution-free characteristics, and their applications in the process of electric energy production are increasing year by year. In recent years, in the open electricity market environment, distributed energy has developed rapidly. The
installed capacity of large-scale centralized photovoltaic power plants and wind power plants has decreased significantly, and the capacity of distributed generation methods has been improved to a certain extent. Due to the low cost of power generation on the distribution side, the economic benefits for individual users or small power generators continue to increase. The distribution side also has a strong ability to absorb distributed generation. To a certain extent, the distribution efficiency of the distribution network is also improved. Besides, the degree of access to distributed generation equipment is still in the initial stage of development. It has a broad utilization prospect. Therefore, the distributed generation method of new energy is still the current key development direction [1, 2].

However, in the process of promoting distributed new energy, not only many small and medium-sized power stations exist, but also exist many personal power generations with different sizes and types. Faced with different aspects of its planning, pre-stage, supporting power grid construction, grid connection, operation, trading, subsidies, etc., the data information contained is scattered in different professional departments, and the types of products, devices, equipment, and data involved are different and the same information has different manifestations in different departments. The data utilization cannot be interconnected. This causes the problems such as untimely information transmission, inadequate information and low information conversion rate when the entire chain is centralized controlled [3]. In order to solve the problems of current non-sharing of data and non-cooperation of new energy management. This paper uses the electrical power IoT identifier resolution system to standardize equipment and data, break the data islands existing in various departments and enterprises, to improve the value of data utilization. Realize multiple functions in the new energy system. Then use blockchain technology to record all kinds of electricity sales business on the chain, disclose part of the transaction information and prevent tampering. Realize the sharing of private data transactions through the combination of the identifier resolution system and the blockchain technology, which can establish a more convenient and effective cooperation, to improve work efficiency, to improve service quality, and promote the rapid and stable development of distributed generation of new energy.

2. Research Status of Identification Resolution System and Blockchain

2.1. Development Status of Identification Resolution System

The related technologies, applications and industries of the IOT have maintained rapid development worldwide. IoT identifier resolution related technologies and services as the basis for the development of the Internet of Things industry, which is the core support for the rapid and large-scale development of the IoT industry. The identifier resolution system not only provides a DNS (Domain Name System) function similar to the Internet, but also standardizes and manages the information of the IoT. More importantly, it is very fast, effective, and safe for the interconnection of information and solving the problem of information islands.

In recent years, in the field of IoT identifier resolution management, technical standards led by foreign companies such as EPC and uID. These technical standards are accelerating penetration into the world. The ONS (Object Name Service) proposed by EPCglobal, the world's largest RFID standardization organization, is an IoT identifier resolution service using the existing DNS protocol on the Internet. The service only supports the item identification of a single coding standard, that is, its EPC code (Electronic Product Code). This service cannot parse the item identification of other coding standards, and the analysis power is completely controlled by EPCglobal. Japan uID Center (ubiquitous ID Center) proposed a proprietary address resolution protocol ucodeRP (ucode Resolution Protocol), which also uses the DNS protocol similar to the Internet to provide distributed light volume directory resolution service. But this parsing service cannot provide resolution support for item identification of other coding standards besides ucode [4].

The current IoT identification technology in China is also being continuously researched and applied. The Ministry of Commerce has organized the establishment of commodity coding standards in the commercial field, and it has been widely used in the meat and vegetable traceability system.
promoted nationwide; the tobacco industry promotes the use of RFID related to this industry Standard; Although the drug electronic supervision code previously used by the state has been abolished, its nationwide drug electronic supervision network is currently a relatively complete traceability system. In addition, Article Numbering Center of China has released the Ecode IoT identifier resolution standard [5]; The institute of Electronic Standardization of China has also promoted the IOT identifier resolution solution with OID as the core. In 1994, the handle system was proposed, then the non-profit organization DONA was established in 2014, dedicated to maintaining and operating the handle system, and accelerating the development of the handle identification system. The Handle system has 10 root servers in the United States, China, Germany, and the United Kingdom, which is safer and more practical than previous monopoly-type identification systems [6]. The State Council of China also regards the construction of the identifier resolution system as an important goal. The global root node and secondary root node of handle system have preliminarily completed domestic layout. The top national nodes and industry nodes have been launched. The identifier resolution system used in this paper takes the handle identifier resolution as the main body to achieve compatibility and interoperability of mainstream identification systems such as Ecode, ucode, OID, EPC, etc. Complete node access authorization and node trusted authentication in the field of new energy, and solve the problem of data communication in the field of new energy.

2.2. Research Status of Blockchain Technology
The Blockchain is a public database realized through consensus mechanism and "decentralization". Each system node on the chain has equal rights and responsibilities. There is no central node. Many nodes achieve data consistency on the chain through a consensus mechanism. Only data agreed by most nodes can be recorded in the blockchain. The information recorded in the blockchain is public, and all nodes can query the existing data and transaction records. The data and transactions recorded cannot be tampered with, which also ensures the security and traceability of the data.

The application of blockchain started from Bitcoin, developed to Ethereum and smart contracts, and then gradually emerged private chain and alliance chain, has been the focus of research in various industries. The Scanergy project of the European Union proposes to issue NRG coins as energy transaction tokens for energy transactions in the micro-grid [7]. The Trans Active Grid project launched by LO3 Energy of the United States applies blockchain technology to a microgrid scenario with a limited number of energy nodes [8]. Scholars have also studied the application of blockchain technology to distributed transactions in smart grids, vehicle networks, smart homes, and industrial IOT. Currently, academia has conducted a lot of research on blockchain [9-10]. This paper combines blockchain technology and identifier resolution system to study optimized transaction and data sharing methods in the field of distributed new energy power generation.

3. Application of Identification Resolution System in Distributed New
In order to solve the problem of unified management of heterogeneous data of new energy distributed generation equipment in different departments, identifier resolution system is used to identify equipment, data, etc. Realize the creation and analysis of the identifier resolution through the registration system and analysis system, use the identification data to complete the data interoperability, forecast and adjust the distribution of new energy power generation. And build a full life cycle chain of electrical equipment, realize real-time monitoring of equipment, product traceability, quality analysis and other functions.

3.1. Registration System and Resolution System of Identification Resolution System
The heterogeneous identifier resolution registration system will provide a unified logo registration protocol to realize registration services. Regardless of the size, each power generation user must register with the organization code, organization digital certificate, terminal equipment code, business system code, business system equipment code, business system digital certificate, etc. Then the Data resource
registration association will verify these identity registration request and check the registration authority. The IOT identifier resolution registration system will verify the validity of its organization code, certificate, and terminal code to ensure that the organization is valid, it is a request issued by this organization, the terminal used is within the scope of the license, and ensure that the business system is an authorized system. Those who meet the permission will be accept the request and returned to the registration system. In addition, the identity registration system also allows users who do not provide data resources but have data application rights to register. Such users are assigned a set of keys after verifying their identity, that is, they have application rights for identity data. The registration process is shown in Figure 1. On the other hand, the identifier resolution system can also provide the newly registered personal power generation with the associated business process, such as station construction and power planning in the early construction. Simplify the process of personal power generation grid connection.

![Fig. 1 The registration process](image)

After unified registration, the user can return to the corresponding access address of the target by applying to resolve the target's identification code. The system also needs to verify the applicant’s identity. After the identity verification is passed, a resolving request can be sent to the resolution system. The request contains the code needs to be queried. After receiving the requested identification, the resolution system identifies the service content corresponding to the identification code. The user can select the required service type, locate the service entry corresponding to the application service, and transfer the request to the corresponding service. For example, by resolving the device identification code corresponding to a power generation device, users can get the entrance of multiple functional services including the traceability function of the production, the maintenance and warranty function of the product, the power generation information statistics function of the device, etc. The target function can be quickly achieved. It avoids the situation that the same device with different identification codes in different functions has to be queried repeatedly, which wastes manpower and computing power. The resolution process is shown in Figure 2.
3.2. Application of Identification Resolution System to Equipment Data

The identifier resolution system can not only code the equipment, but also code the working status data of the equipment. The weather, temperature and other environmental data of the equipment can also be encoded. A large amount of data is constructed into a huge and comprehensive Database. During the resolution process, the device-related data can be extracted at once according to the function service, which simplifies the extraction process of related data. The identifier resolution system can realize the interconnection and data sharing between the equipment operation site and personal power generation, and it can also associate working data of devices in different regions, which solve the problem of data non circulation caused by the difference of data expression between different regions and provinces.

In addition, on the basis of the identifier resolution system, a new energy service cloud is constructed. After unified identification and standardized management of new energy terminal devices, device information and its status information can be accessed and synchronized in real time to monitor all new energy power stations in the platform. Through data monitoring of electrical parameters, environmental parameters, fault parameters, historical parameters, etc., the safe and reliable operation of the power station is ensured. At the same time, through the joint control with the energy storage power station to realized “source-network-charge-storage” coordinated interaction.

The new energy service cloud uses the correlation information between the identification to resolve the meteorological information such as the wind and light of the equipment in each area, and uses these relevant data to perform physical simulation calculations and scientific statistical methods to predict the wind power, wind speed, and radiation of the wind farm/photovoltaic power plant. Make short-term forecasts based on light and temperature, and predict the power of wind farms/photovoltaic power plants, which can also realize the requirements of power dispatching departments for new energy dispatching; reduce unnecessary waste of electrical energy.

3.3. Application of Identification Resolution System in New Energy Electrical Equipment

The quality of electrical equipment often has a greater impact on power generation efficiency, and distributed new energy power generation equipment needs more stricter quality assurance. The current source tracing method of power generation equipment is limited to the step-by-step retrieval of design, production, sales, and maintenance by manual means. The integration of each part of the system is low, and the fault tracking situation usually occurs. In addition, in terms of value maintenance, personal power generation often do not have professionals to regularly overhaul the equipment, resulting in reduced efficiency of power generation equipment due to damage. In order to enhance the usability of electrical equipment and improve the quality assurance of equipment, this method uses identifier resolution system to manage the entire life cycle of electrical equipment and efficiently complete the traceability, evaluation, warranty and other services of products.
In the product traceability stage, the identifier resolution system is used to build a product life cycle chain, the operations and data contained in the five stages. Including material component supply, power equipment production, logistics transportation, equipment sales and equipment operation are separately the constructed life cycle chain is shown in Figure 3.

These five stages are identified to open up barriers between different links. Comprehensively record and query the production and operation records of products and important parts, transportation and sales records of electrical equipment, share manufacturing and operation data of equipment. When quality problems occur in the operation of new energy service cloud monitoring equipment, rapid and efficient quality traceability is achieved to facilitate manufacturers’ remote operation and maintenance of equipment. Promote the effective sharing of information between enterprises, enterprises and users, which effectively short the downtime of electrical equipment due to failure problems.

The identifier resolution system can not only realize the traceability of equipment through the entire life cycle construction, but also construct the entire industrial chain and the entire electrical equipment value chain to achieve convenient information interconnection between enterprise organizations, including R&D and design, material procurement, manufacturing, and delivery, supply, acceptance inspection, warehousing and distribution, installation and operation, dismantling and scrapping. These can all be widely interconnected. After identification of data that can be shared by all links, the quality evaluation of electrical equipment can use the data of all links in the entire value chain to mine and refine key process data, study the impact of these data on product performance, and the inherent relationship with product quality relationship, which forms a typical data model for quality evaluation of electrical equipment based on identification management.

The operation monitoring function of new energy power generation equipment is the basis for equipment manufacturers to provide high-quality and intelligent product services. After the manufacturer and the user equipment are registered, the manufacturer obtains the operation data of the user equipment through the identifier resolution system sharing, so as to monitor the real-time status of the online operation equipment. Combines the equipment historical operation monitoring records to establish a comprehensive equipment evaluation model. The model can carry out a comprehensive inspection, analysis and identification of the equipment and grasp its operation status. So that evaluate the safe operation ability and comprehensive ability of the equipment in advance, and provides proactive services to customers. In addition, using technologies such as the IoT, big data, artificial intelligence, etc., through the extraction, classification and induction of fault types, a device fault model library is established. Through the multidimensional analysis and state comparison of the power station, a precise fault diagnosis, early warning and recovery system is established to provide a precise
and efficient equipment health diagnosis service for users, operation and maintenance personnel and power grid. Not only reduce the loss caused by accidents for customers, but also provide support for equipment manufacturers to provide high-quality product after-sales service.

4. Application of Combination Identification Resolution System and Blockchain Technology

4.1. Optimized Electric Energy Transaction Combining Blockchain and Identification Resolution System

The distributed generation of new energy has increased a large number of electricity transactions. Moreover, distributed access with a high proportion on the distribution side will have an impact on the safety and stability of the distribution system. It is necessary to safely dissipate electrical energy as soon as possible [11]. Electricity transaction system based on blockchain technology will be used to publish electricity sales information. Make purchasers purchase electricity with lower bidding price, which not only accelerates the speed of energy consumption, but also reduces the intermediary cost of electricity sales. Moreover, the essence of the blockchain is a distributed ledger built on a peer-to-peer network, which can guarantee the originality, authenticity and integrity of the certificate storage data. In the event of a dispute, the authority can directly obtain evidence from the node and verify it. It is more conducive to judicial landing.

At present, when using blockchain for electric energy trading, the system needs to review the information of electrical equipment for many times. Including the electricity retail matching data compare with the smart contract index embedded in terminal, if the distribution requirements are met, the physical verification of power distribution can be carried out. Otherwise the content of the transaction needs to be adjusted and the distribution verification need to be carried out again. Besides, it is also necessary to verify whether the parameters such as distribution voltage and power supply meet the standards; Different power generation equipment also need to call different verification procedures, the extensive verification process makes the transaction more complicated [12, 13].

In order to simplify the verification process of power transactions, the contract and equipment status are coded by identifier resolution system, so that new energy generating equipment such as light energy and wind energy have similar identification codes in format. In the process of electric power transaction, the users only need to provide the identification code of the equipment. Then the associated data can be resolved out by resolution system and related services can be invoked. After the identification resolution system extracts the associated services, the smart contract can choose the corresponding service function to complete the contract certification; parameters such as voltage and electricity can also be verified by the corresponding service function, which greatly simplifies the process of extracting data and verifying data for many times. After verification, the personal power generation record the equipment identification number, transaction price and other information on the block chain, waiting for the users to purchase.

In addition, establishment of new energy service cloud based on identifier resolution system. Cloud services can also be used to sell electricity automatically with the permission of users. Through the identification system, the device-related information is shared, the parsed smart contract and other data are verified on the new energy service cloud, and the sharing electrical energy data is used to calculate data such as the net load of the personal power generation and the power generation plan. The data required by the electricity party is automatically matched on the cloud platform for electricity retail. And record the transaction information on the blockchain for future inquiry when needed.

4.2. Private Data Sharing by Combining Blockchain with Identifier Resolution System

New energy generation uses identifier resolution system to break through the business barriers between different departments and different enterprises, and realize the sharing and centralized management of platform data resources. However, there must be private data between departments and enterprises that cannot be widely disclosed. In order to make these data more valuable, this paper uses a combination of
identifier resolution system and blockchain technology to achieve the purpose of sharing data on a small scale.

The identifier resolution system can not only mark a single object, but also use a code to mark multiple sets of data. In order to ensure a certain degree of privacy, companies or departments do not disclose the identification code of private data in the identifier resolution system, so that most users cannot get these data. When sharing data in a small area, only need to share the identification code between authorized users. Due to the open and transparent, decentralized and non-tamperable characteristics of blockchain technology, this paper chooses this technology as the sharing method of identification codes. Before sharing, Users who send the data sets a set of keys first, encrypts the identification code with the key, and then distributes the decryption key to the users who want to share. The encrypted identification code is uploaded to the blockchain for sharing. The user with the key can download the encrypted identification code on the chain, after decrypting the identification code locally, enter the resolution system to resolve the identification code to get private data shared by other users in a small scale. The sharing method is shown in Figure 4.

![Fig. 4 The sharing method in a small scale](image)

Using the identification code to compress the data and then sharing on the blockchain is more convenient to implement than the sharing method using blockchain directly. Because when using data for a certain research application, the amount of data is usually relatively large, and the capacity of each block in the blockchain is small, the amount of data recorded is small. When large amount of data is shared, multiple blocks are required to record, resulting longer waiting times. A large amount of data encryption and decryption operations will increase the workload of the task. Therefore, the data transaction using the identification code is more concise and faster.

5. Conclusions
The distributed generation method of new energy is developing rapidly in recent years. However, due to the problem of data islands, the function of new energy power generation is relatively single. There is no appropriate or convenient solution in many aspects. This paper uses identifier resolution system to unify the equipment and data of each link of new energy power generation, so that each link can use all data in the system to realize the full life cycle management of power equipment; remote monitoring and maintenance of equipment, power generation scheduling and other functions. This paper also combines the identifier resolution system and blockchain technology to optimize new energy transactions, and proposes a method for small-scale sharing of private data. The integration of identifier resolution system and blockchain method breaks the data gap between all links and departments of new energy generation. It provides strong support for the development of new energy distributed generation.

Acknowledgments
This work is supported by the State Grid Science and Technology Project “Research and application of key technology of intelligent IOT management system identification analysis” Funding, Project No.: 2400/2020-72002B
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