

# Design and implementation of remote meter reading system in smart grid

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**Abstract:** Every progress of science and technology will drive the reform of other undertakings, with the continuous improvement of computer network technology, power grid operation has also appeared technical reform, the outstanding performance is the operation and use of remote meter reading system. Through the analysis and contrast of the relevant data, the paper specifically discusses the design and implementation of the remote meter reading system in the smart grid, hoping that through the introduction of this paper can effectively drive the reform of the operation of the grid, improve the stability, security and reliability of the operation of China's power grid.

**Key words:** remote meter reading; System; Data analysis; Smart grid

## 1. Foreword

Power automation management system is related to the sustainable and healthy development of national economy and the growth of enterprise demand for electricity, and the contradiction between increasing demand for power in many aspects and insufficient supply has gradually become prominent. Nowadays, with the development of science and the progress of The Times, more advanced computer technology and network communication technology appear in people's vision, power automation management system has established a set of efficient, objective and stable power automation management platform. Including power metering, pre-paid control, automatic meter reading, distribution monitoring, load monitoring, power detection, line loss calculation, these can provide reliable decision-making basis for the operation and production management of power supply enterprises. Power automation system, while meeting the requirements of production management and operation management, saves a lot of power resources in power consumption, has extremely high social and economic benefits, and has broad market prospects.

## 2. The problems and defects of meter reading work in the power management system

### 1. Long inspection time

The inspection time is related to the scale of the inspection site. Now the community is getting larger and larger, the factory area is getting wider and wider, and the number of power distribution equipment within the inspection scope is also increasing. Therefore, the data of manual meter reading and meter reading time are also increasing.

### 2. There are errors in manual data

Manual meter reading is the most traditional way of data statistics, and at present, it is also a less efficient way. Manual meter reading has a high probability of reading errors, and it is impossible to read all the data of the energy meter at the same time and calculate the electricity quickly and accurately. Manual meter reading may be affected by human factors, such as meter reader's error, negligence, fatigue, etc., resulting in the inaccuracy of meter reading data.

### 3. Electricity assessment lags behind

Due to the use of manual meter reading, the real-time performance of meter reading data is poor, the data information of meter reading is lagging, and the real-time performance is poor. Finally, the results are obtained and evaluated, and the data does not reflect the current state, which also causes certain negative problems for energy management. The electricity assessment of all departments of the enterprise lags behind, which brings negative problems to energy management.

### 4. The burden of each management department is heavy

Manual meter reading efficiency is low, the cycle is long, the statistical speed is slow and so on seriously affect the economic benefits.

### 5. Overheads are too high

Manual meter reading requires a large number of staff, the more equipment, the more meter readers and administrators, so it directly affects the cost of the enterprise and about the development of production. At the same time, manual meter reading data is difficult to carry out real-time monitoring and audit, once there is a problem, it is difficult to find and solve in time.

### 6. The time cost is high

Manual meter reading requires a lot of time and human resources, especially for large-scale electricity users, it takes a lot of manpower and time to read meters.

### 7. Data entry delays and possible errors

The meter reading data needs to be manually entered into the system, and there may be data entry errors, resulting in the accuracy of the final data being affected; Manual meter reading data needs to be transmitted to the power management system through multiple links, and there may be a transmission delay, resulting in a decline in the timeliness of the data.

### 3. Solutions

To sum up, based on these reasons, for the construction of smart grid and power grid management system based on the above reasons, to adapt to the urgent requirements of the construction of smart grid and existing power grid management information system, automatic meter reading system has inherent advantages, and is undoubtedly an important part of power management information. However, there is a certain gap between the ideal and reality, at present, the automatic meter reading system is mainly based on wired meter reading, the success rate of wired meter reading is more than 92%, this success rate is not of great significance for the reality, many enterprise power management departments will be regarded as “heart disease”, so the meter reading personnel also need to manually read the meter that failed to obtain the meter reading data. In addition, the wire meter reading system investment cost is high, the hardware facilities are complete, small and medium-sized factories need more than 100,000 yuan, the construction cycle is long, and the need to coordinate with municipal, tap water, gas, telecommunications and other departments, the laying cycle needs at least 1 to 2 months. Because the cable is buried underground, if there is a fault, the cable repair is a difficult problem, resulting in economic and engineering accidents. There are other options for automatic meter reading, but they have not been well promoted due to cost, technical and implementation issues. Many business power management departments require meter reading to not only copy the code, but also pay attention to the site of the energy meter. For example, whether there is electricity theft, meter burning, power meter damage, etc.

With the development of industry and information technology, the remote acquisition system has been able to easily collect the flow state data such as pressure, temperature and flow rate. Based on the data collected by the acquisition system, the actual state and other information of the pipeline can be effectively obtained. After analyzing the data, the pipeline leakage can be qualitatively and positioned. At present, the commonly used methods include: model-based method, steady-state model method, transient model method; Based on dynamic pressure wave method, pressure point analysis method, pressure gradient method, negative pressure wave method, etc.

In view of the difficulties encountered by the above wireless meter reading, the development of wireless communication technology has gradually emerged a lot of wireless meter reading methods. Based on GPRS, GSM long-distance charge frequency band, based on Bluetooth, infrared, ZigBee and other short distance of the free frequency band two categories. The charge frequency band has better stability, but the price of charging according to the traffic is also high, and the practicality is poor; For example, the free frequency band based on ZigBee mode of data transmission, the cost is low, and the real-time is good, but the transmission distance is close.

### 4. System structure

The design and implementation of remote meter reading is crucial in smart grid. In smart grid, remote meter reading system is developed and used, with the help of the system, meter reading not only saves human resources, but also reduces the cost of power supply, and finally the efficiency of the whole system is improved, and the power enterprises have reached a new level, and the reliability and availability of the entire power grid are improved.

The basis of the remote meter reading system mainly refers to the integrated, high-speed two-way communication network, and the full application of advanced equipment technology, advanced control methods, advanced decision support system technology. Remote meter reading system includes: data acquisition, data transmission, data management processing analysis statistics, Web server, client and other modules.

#### 1. Data collection

The smart grid requires the distribution transformer as a platform unit to install the meter, and the concentrator installation of the data acquisition module should not exceed 500 meters from the end user's meter. And at the same time in the data acquisition module to collect 32 section meter signals, so as to promote the high-precision collection of multiple users of the energy meter can be successfully completed. At the same time, it can show the density safe and reliable storage power data with time index. If the superior device has a data request, the required power data can be processed by the data management center computer at this time. In the management center, the data acquisition terminal is used as a contact point and is connected to the collector under its jurisdiction by using RS-485 bus, and a maximum of 50 collectors are connected to each data terminal. Although the type of data collector is a variety of, but at this stage is used by the PLC carrier way of the bus table collector.

#### 2. Data transmission

Data transmission is mainly through the data line or meter reading device or wireless way to transfer the collected data to the centralized unit, and to connect it through the RS-485 bus, and finally can provide conditions for the computer to directly read the information in the data management system.

#### 3. Data management and Web server

Data management mainly refers to the implementation of the control function of the single chip microcomputer, mainly through assembly language to carry out, and to unified query and management of meter reading data, and the analysis of the comprehensive data of the day, month and year, and finally can get intuitive charts. At the same time, but also to carry out automatic meter reading, query data, query faults and management charges and other related operations. Through the Web server, the database server and the client can be connected, and the server mainly through the remote way to monitor and control the remote meter reading system, at the same time to provide Web services to the client in html format. On the client side, the staff only need to carry out simple operations according to the preset instructions, and the data can be transmitted to the corresponding user through the browser, which is convenient, timely and accurate.

## 5. The specific functions of remote meter reading system

Automatic meter reading, query fault and query data function. The remote meter reading system can not only realize the fast and accurate meter data collection, but also carry out a wider range of data collection on this basis, such as using the system can analyze the average electricity consumption in a certain period of time, the average annual electricity consumption in a certain area and so on. In addition, the system can also be used to monitor and manage the situation of the meter, such as the maintenance time and maintenance times of the meter, the specific model and operation of the meter, once the data is abnormal, the system will issue a warning instruction. The function of analyzing the data. Through the remote meter reading system can automatically calculate the electricity consumption, and can analyze, statistical database, and to the daily, monthly figures and the trend of electricity reasonable calculation, so as to provide scientific graphs and reports, and finally can provide a reasonable reference for the production plan.

## 6. The specific role of remote meter reading

It is convenient for the power system to grasp the information of electricity consumption and adjust the management mode in time. For example, the data of the remote meter reading system use computer network technology to draw an analysis chart, according to the change law of the chart can be summarized the peak hours and peak areas of electricity consumption, in order to ensure the stability of power supply, on the one hand, the majority of users are called to avoid the peak hours of electricity consumption, on the one hand, the gradient price can be used to restrict the power consumption. At the same time, the user is reasonable according to the budget to make a reasonable adjustment in accordance with the different time periods of electricity charges, and to reasonably calculate which time to use functional facilities. For example, from the results of electricity consumption, if the user intends to control his own electricity consumption, he can achieve this by turning off some non-use electrical power supplies in time. For example, when users are not at home, they can turn off the power supply of water fountains, TV set-top boxes, etc.

Remote meter reading system with the smart grid system operation, each user has its own independent account on the Internet, the user by entering a unique account name and password can realize the electricity consumption and other related power data query, easy for users to timely understand their own electricity situation. At the same time, any information update of the power system can also be directly reflected to the user through this platform.

## 7. Summary

To sum up, the use of remote meter reading system can not only realize the cost and manpower savings of the power sector, but also facilitate users to query the power consumption. The system is not only an operating equipment, but also an interactive platform between the user and the power system. At the same time, the power system can also analyze the power consumption of each area according to these automated data, and draw a chart to analyze the power consumption trend for a period of time in the future. In short, the remote meter reading system is an indispensable technology in the power system, and its functions need to be further developed and studied.

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