Research on Intelligent Management Platform for Energy Enterprises Based on Big Data Technology

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Abstract. This paper combines a large domestic energy company, takes energy informatics as the theoretical framework, combines the energy consumption status and structural characteristics of the enterprise, analyses the current situation of energy management in the enterprise and the problems in energy management, and uses data from the energy management information system. The exchange and information coupling mechanism connect the various information systems of the enterprise, and optimizes the design of the convection network, sensor body and sensor network to build an enterprise energy informatics model. With the big data idea as the core and the service-oriented technology architecture, the company's real-time energy is established Data warehouse to integrate energy information of the enterprise, further reduce energy consumption and improve energy efficiency, thereby ensuring that the enterprise minimizes waste in the process of energy use, while reducing operating costs, thereby achieving the goals of energy conservation, emission reduction and environmental protection.

1. Introduction
With the rise of China's economy and the continuous development of the equipment manufacturing industry, China has entered a highly industrialized country and has gradually become one of the world's processing and manufacturing bases. This development trend has made China's requirements for energy use more and more High, the contradiction between energy use and environmental pollution in basic industries is becoming increasingly prominent [1]. As China's manufacturing enterprises occupy an important position in the international community, but in a low-end position in the international division of labour, an international trade structure has been formed that imports mainly high value-added products and services and exports mainly general products. The energy consumption per unit value of imports and exports is different, which has caused international energy demand to shift. And industrial energy conservation is one of the issues that need to be prioritized. In terms of China's current level of technological development, the proportion of unit energy consumption is still far from that of developed countries. As an important industry, manufacturers face three challenges in the context of energy conservation and emission reduction: tight supply of resources accompanied by rising prices; the challenge of constraining environmental capacity as environmental standards continue to increase; manufacturing companies seeking Green circular economy strategy. Therefore, under such a severe
situation, we urgently need to adopt advanced technology and management methods to achieve the goals of reducing energy consumption and developing manufacturing.

Under the guidance of energy informatics and big data ideas, analyse the energy consumption status and characteristics of the enterprise's process flow. Based on this, build an enterprise's energy management model; use data exchange and information integration mechanisms to integrate the internal The various information systems are linked; taking the information system as the centre, optimizing the construction of the enterprise flow network, sensor body and sensor network, integrating the energy information of each system, thereby reducing energy consumption and improving energy efficiency, hoping to be a relevant theoretical researcher Provide a theoretical reference, and hope to help the company's sustainable development strategy [2].

2. Enterprise Energy Management Information System Model

2.1. Demand analysis

2.1.1 Achieve a balanced supply of energy for enterprises. The core function of energy information management is to balance energy supply and corporate security. The generation process of an enterprise is always accompanied by a dynamic process of energy generation, consumption and transformation. Therefore, the energy management information system must monitor all energy input and output states to ensure that the energy supply and demand are optimized and balanced during the production process.

2.1.2 Achieve energy management at the enterprise level. In order to achieve scientific and efficient energy management, the energy management information system must be able to collect, monitor, and automatically archive and process energy media data in accordance with the characteristics and conversion relationships of various energy consumptions of enterprises, and monitor and deploy energy and media usage in real time. On this basis, enterprises can predict and analyse the consumption trends of energy and media, realize the three-in-one combination of "energy flow, material flow, and information flow", and implement a systematic management of energy at a strategic level.

2.1.3 Achieve economic operation of corporate energy. Enterprises have many by-products of energy, and there is a process of mutual transformation and accompanying energy efficiency conversion. Therefore, the energy management information system needs to obtain enterprise production and manufacturing, equipment maintenance and other plans, optimize manufacturing processes, balance energy supply and demand, and use scientific enterprises. Energy use schemes promote the efficiency and economic maximization of energy cascade utilization.

2.2. Energy Informatics Model of Enterprise Energy Management Information System

Utilizing real-time information and fully coordinating the balance between demand and supply systems are the core ideas of energy informatics. The sensor network monitors the sensor body and the flow network in real time, returns the collected real-time information to the data centre, and conducts data analysis and parameter setting activities by the management information system, and then optimizes the control flow network through the sensor network. At the same time, the state quantities of the sensor network and the sensor body are transferred to the information system again, and the highly integrated intelligent energy management information system generated in this way supports the information interaction between suppliers and consumers and reduces energy consumption. Based on the analysis above, this paper proposes an enterprise energy management model, as shown in Figure 1 [3].
3. Analysis of Enterprise Energy Management Information System

3.1. Goal analysis

3.1.1 Improve energy information collection. Improving energy information includes improving energy information collection, storage, and management. This purpose is mainly achieved by adopting an energy information collection system to obtain the data of the current production process, to understand the operation of the system in a timely manner, and to timely correct the occurrence of adverse conditions, so that the system can improve energy information in the best state. Thereby reducing the probability of accidents. Decentralize control and centralize management to achieve optimal use of the system. Because the energy process system also has the characteristics of decentralized control and centralized management, the system can meet the needs of the enterprise and adapt to the strategic development of the enterprise.

3.1.2 Real-time monitoring and automatic measurement. It can realize real-time monitoring of the overall energy power system, timely and accurately grasp the system's operating conditions and equipment status, and can automatically, accurately, real-time and comprehensively obtain energy information data, and statistics and analysis of the data according to requirements. Real-time monitoring and automatic metering allow managers to understand the energy consumption of equipment companies in a timely and comprehensive manner [4].

3.2. Functional Design
Integrate the corporate organizational structure at all levels, re-design the enterprise energy management information system based on the existing energy management system and analyse the energy informatics
framework, and combine information technology with big data. Functional side-effect evaluation, scheduling management and measurement the system and other environmental factors, technically focus on diagnostic analysis, improvement management, on-site reconstruction and other management events. The system is divided into five main functional modules: system management, production monitoring management, data information management [5], accident emergency management, and energy basic management. The structure diagram is shown in Figure 2.

Figure 2. Basic Function Diagram of Energy Management Information System

3.3. Data Management System
Use service-oriented technology architecture (SOA) to classify, clean, exchange, and share data, and abstract it into flexible and loose service components. Based on data flow and business rules, business applications are decomposed into independent unit components. Secondary packaging into standard data components. In order to provide a highly flexible, configurable and easily expandable energy data management framework. The technical idea is shown in Figure 3 [6].

Figure 3. Schematic diagram of the overall SOA technology
4. Big data processing methods

4.1. Data access
The reason why the entire architecture introduces a data access queue system: In order to alleviate the processing pressure of the background server, a queue system is needed to buffer the messages sent by the client for subsequent programs to process. In order to support the real-time processing and persistent storage of messages at the same time, a queue system is needed to distribute the messages. Most queue systems such as ActiveMQ, open, and RabbitMQ are designed for integration between enterprise applications. The requirements for the queue system are good flexibility and high customizability. The requirements of big data platforms are good scalability and support for large-scale data streams.

4.2. Data processing
For data formatting, the data format for communication between the storage system and the data source system is defined based on the Thrift language-independent data format description language to ensure the correctness and scalability of data access. For the data calculations involved in the business, the HBase client and Spark calculation framework are combined to process the data in HBase accordingly. Multi-threaded processing and efficient parallelization tasks have significantly improved business calculation efficiency. All data must be checked for completeness and rationality before being stored in the database, and missing and abnormal data must be corrected.

5. System test
The system tests for abnormal data identification, processing, and business computing capabilities. The test environment uses 4 servers named h1, h2, h3, and h4. Each server runs 4 producer threads, 2 consumer threads, and Topic has 10 partitions. Device ID: 1 ~ 1000000. The sampling time starts from "2015-01-01 00: 00", the time granularity is 5min, the sampling type is 20, and the number of areas is 3000. For example, run 20,000 times and take out 10 times. The time it takes for the Producer to generate data (each server produces 250,000 records for a total of 1 million) is shown in Table 1.

| Time / MS | h1     | h2     | h3     | h4     | average   |
|----------|--------|--------|--------|--------|----------|
| 1        | 86.989 | 81.702 | 80.886 | 70.603 | 80.045   |
| 2        | 84.101 | 77.037 | 76.777 | 71.890 | 77.45125 |
| 3        | 90.205 | 81.773 | 85.688 | 77.567 | 83.80825 |
| 4        | 93.023 | 84.666 | 88.617 | 81.521 | 86.95675 |
| 5        | 96.644 | 90.038 | 93.193 | 90.685 | 92.640   |
| 6        | 68.728 | 61.193 | 63.766 | 60.380 | 63.51675 |
| 7        | 95.672 | 89.860 | 89.489 | 86.517 | 90.3845  |
| 8        | 102.458| 98.540 | 97.399 | 89.441 | 96.9595  |
| 9        | 89.190 | 77.171 | 82.138 | 67.304 | 78.95075 |
| 10       | 81.050 | 71.979 | 76.121 | 72.583 | 75.43325 |

The number of abnormal data on the consumer side (the average number of abnormal data processed by each thread, a total of 8 threads) is shown in Table 2. The time taken by the consumer device to sample the information into the database (each server stores 250,000 records each time, a total 1000000).
Table 2. Tab for the time taken by the consumer-side device to sample the information into the database

| Time/MS | h1       | h2       | h3       | h4       | average  |
|---------|----------|----------|----------|----------|----------|
| 1       | 113.578  | 114.080  | 111.110  | 114.735  | 113.3758 |
| 2       | 109.800  | 99.357   | 100.940  | 100.729  | 102.7065 |
| 3       | 114.479  | 111.088  | 114.045  | 108.851  | 112.1158 |
| 4       | 114.686  | 123.166  | 122.055  | 124.746  | 121.1633 |
| 5       | 116.187  | 126.935  | 116.993  | 127.419  | 121.8835 |
| 6       | 154.913  | 161.112  | 158.372  | 163.068  | 159.3663 |
| 7       | 117.487  | 125.549  | 110.514  | 112.311  | 116.4653 |
| 8       | 132.997  | 126.922  | 126.821  | 126.448  | 128.297  |
| 9       | 120.231  | 105.360  | 120.097  | 119.796  | 116.371  |
| 10      | 95.886   | 108.349  | 108.032  | 107.696  | 104.9908 |

The time for the consumer to update the area (excluding network overhead, each area updates 300 areas, for a total of 3000 areas) is shown in Table 3. From the test data, it can be seen that the big data platform is superior and stable in data processing and storage performance in the case of clusters; due to the use of parallel computing and other mechanisms, the data processing and storage performance are improved compared to relational databases under the same server configuration. More than 10 times, can meet the business processing performance requirements of large energy management systems.

Table 3. Number of abnormal data on the consumer side

| Number of times | h1     | h2     | h3     | h4     | average |
|-----------------|--------|--------|--------|--------|---------|
| 1               | 25.074 | 25.010 | 25.074 | 25.001 | 25.03975|
| 2               | 25.170 | 25.225 | 25.086 | 25.159 | 25.160  |
| 3               | 24.867 | 24.997 | 25.083 | 25.251 | 25.0495 |
| 4               | 25.149 | 24.928 | 25.077 | 25.017 | 25.04275|
| 5               | 25.227 | 25.091 | 24.985 | 24.980 | 25.07075|
| 6               | 24.956 | 24.965 | 25.109 | 25.077 | 25.02675|
| 7               | 25.096 | 25.050 | 25.309 | 25.077 | 25.133  |
| 8               | 25.104 | 24.999 | 25.136 | 25.184 | 25.10575|
| 9               | 25.212 | 25.238 | 25.082 | 25.112 | 25.161  |
| 10              | 25.093 | 24.949 | 25.048 | 25.115 | 25.05125|

6. Conclusion
By building a new energy big data system platform, it can effectively promote the in-depth development of the local clean energy industry from the informatization level, realize the transformation of the traditional management mode to the information digital online analysis and management mode, maximize the value of corporate data, and make the big data platform as a Bearing the important foundation for the development of industry enterprises.

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