Research on Smart Energy System Technology Based on Cloud Computing Platform

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Abstract. Based on the social and economic development, environmental protection needs, industrial policies and other smart energy systems have brought a new round of great changes compared with the traditional energy structure. Now the development of information technology provides a strong technical support for the transformation and upgrading of traditional energy to smart energy. This paper combines cloud computing, big data, artificial intelligence, blockchain and other emerging technologies to enable the traditional energy system, a smart energy system architecture based on cloud computing platform is proposed, which connects the bottom layer to the top layer of the energy system, and realizes the comprehensive integration of physical energy flow, information flow and value flow of smart energy.

1. Introduction
Integrated energy system emphasizes that information network should be positioned as the supporting decision-making network of energy Internet. On the basis of existing power energy management system, communication broadband and information collection, analysis and decision-making are added, so as to know the operation and scheduling of energy network. While smart energy emphasizes the deep integration of Internet technology and energy network, the transformation of current economic development mode urgently needs to upgrade of source development mode. The core of the latter is to treat energy supply, storage and transportation and consumption as a two-way communication system, and smart energy is the core means to promote the optimization and evolution of energy system.

This paper analyzes the information and communication technology of the existing energy system from the development demands of smart energy system (information communications technology, ICT) architecture features[1], combined with cloud computing, big data, Internet of things (IOT), mobile Internet, smart grid, blockchain and other emerging technologies to build a framework model of smart energy supply system, and according to the evolution path of new technologies, the smart energy system architecture based on cloud computing platform is proposed. The architecture adapts to the demands of current business development and has flexibility[2].

2. The status of smart energy system
The smart energy system will drive the structural upgrading of the whole energy and related industrial chain with the guidance of innovative scenario demand and the deep support of cross-border scientific
and technological forces\cite{3}. That is, the technology serves the scene, and the scenario comes from the
demand. In terms of current technical means, power is still the core of the entire energy system and the
central link of the entire energy industry chain. However, with the continuous evolution of society,
economy, environment and technology, the function of energy network has changed. Different from
the previous physical reliable and safe bearing function of power transmission and distribution, the
requirement of smart energy is to optimize the resource allocation of multiple energy sources In
addition, the efficient and economic operation of the whole energy system and various commercial
applications built on the grid, such as more flexible and effective energy market operation under
multiple economic entities, etc.

3. Development of artificial intelligence technology
With the explosive development of modern science and technology such as artificial intelligence, big
data, cloud computing and Internet of things, energy will develop in two dimensions of technology
and mode in the future. The technical level pays more attention to traditional energy and modern ICT
In the cross-border integration of technology, the mode level pays more attention to the in-depth
cooperation of resources within the system and private capital, and derives new business requirements
and application scenarios, which catalyzes the formation of new energy industrial structure. The
development of smart energy benefits from the breakthrough of various basic and cross-border
technologies, such as solid-state transformers, energy routers, microgrid, energy storage and other
basic technologies Background application technologies such as distributed energy management,
flexible energy coordination and control, and cross-border technologies such as cloud computing, big
data and Internet of things. The key technical bottleneck of the whole smart energy system lies in
Three levels: the bottom layer is the real integration of primary and secondary equipment; the middle
layer is the "value development" of power communication network; the top layer is the diversification,
value-added and Realization of background applications, and the intelligent energy solutions derived
from block chain, information physical system, cloud computing, big data and other technologies have
similar application scenarios\cite{4-7}, but the focus and problem-solving methods are poor It can be
implemented according to the maturity of technology. Single new technology is not a sufficient and
necessary condition for the realization of smart energy, but it represents the development direction of
current technology and is also the key support for the implementation of such projects.

4. The architecture design

4.1. Design goal
The ICT framework of smart energy system is designed to meet the integrated operation and
maintenance management of the entire energy supply area. It needs to integrate the Internet plus
traditional energy technology to get through the bottom to top level of the comprehensive energy
service system, so as to achieve the full integration of energy flow, information flow and value stream
in the smart energy system. Architecture serves 9 System construction of four capabilities: flexible
adaptation capability for different physical networks; panoramic perception capability for complex
multi-functional networks; plug and play capability for distributed energy production and marketing;
coordinated control capability for source, network, load and storage architecture; rapid and flexible
deployment capability for new scenario services; and capability for computing power and storage The
"flexible expansion" capability of the source; the "low-cost consensus" capability for multi-party
participation; the "cross regional transaction settlement" capability under the complex energy market
environment; and the "security protection" capability for the highly information architecture. The
model framework of smart energy system is shown in Fig 1:
4.2. Technical architecture

Smart energy system has a double-layer framework of energy network and Internet. The former provides basic energy supply support services, while the latter relies on modern ICT technology to re-explore the service value. The overall technical framework of smart energy is composed of four parts: physical architecture layer, network information layer, service application layer and value benefit layer. The technical bridge between physical architecture layer and network information layer is ICT technology and IOT technology. The technical bridge between network information layer and service application layer is a new technology such as modern control automation technology and blockchain. The whole architecture completes the linkage of energy, data and value from the bottom[8-10]. The technology framework is shown in Fig 2.

4.2.1 Physical frame layer

The physical framework layer is composed of power supply, heat source point, power transformation and distribution facilities, transmission line, heat pipe network, natural gas pipe network, etc. The planning and design of physical layer energy transmission network is particularly important. It is necessary to make reasonable planning according to the actual situation, load density, path conditions and policy processing factors of the existing grid structure, and fully consider the fault isolation and load transfer requirements in case of accidents, and support flexible operation mode switching.
4.2.2 Network information layer
The construction of network information layer includes the construction of basic network and information support system. For the basic network, combined with the physical conditions of the energy supply area, it is necessary to flexibly adopt the hybrid topology structure of star, tree and mesh, and select various construction modes such as dedicated line, operator leasing and public wireless network according to the actual data transmission demand of each network node to complete the network equipment selection.

For the information support system, the key point is the construction of intelligent terminals of physical nodes. Taking the power network as an example, the construction content not only includes the traditional secondary equipment to maintain the grid operation, such as data transmission device, distribution switch monitoring terminal and protection and control device, but also includes all kinds of measurement and control devices, status sensors and accurate metering devices on the user side arranged on the feeder and terminal distribution transformer.

4.2.3 Service application layer
The construction of service application layer includes two meanings: "service" is to achieve the goal, and "application" is the supporting means. The construction of energy market service level is to further explore the financial attributes and financial value of the user terminal side, provide more abundant and even customized services, improve the investment return rate of multiple financial entities and participants, and provide more diversified project financing schemes.

4.2.4 Value benefit layer
The ultimate goal of building smart energy is to serve the smart city, park industry and the supporting system derived from it. It includes smart government, smart transportation, smart healthcare, smart security, smart environmental protection and other infrastructure.

5. Conclusions
Based on information technology, this paper proposes a smart energy system architecture based on cloud computing platform for the transformation and upgrading of traditional energy to smart energy. The overall technical idea follows the core principle that technology serves the scene and scenario comes from demand. The overall architecture of the system starts from the whole energy system, analyzes the characteristics and pain points of the existing energy system, and combines with the current Internet technology. The development maturity of smart energy system can dig out the evolution direction, technical route and implementation method of smart energy system, and provide technical ideas and implementation scheme for the development of smart energy.

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