Application of heterogeneous integrated energy system in urban innovation park

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Abstract: Heterogeneous energy system includes different energy forms such as cold, hot and electricity, among which there is a large coupling relationship. This paper discusses the main features of heterogeneous energy system, introduces the characteristics and advantages of the application of heterogeneous energy system in the park. The methods of load interaction and comprehensive configuration used in the deployment of heterogeneous energy systems are described. Taking the energy system of Guangzhou university town as an example, the composition of heterogeneous energy and its application in the park are analyzed.

1. Introduction
Global climate change is a major challenge facing all mankind. To cope with this severe challenge, major developed countries have put forward the vision of integrated energy system and smart grid construction in the early 2000s, in order to achieve the goals of adjusting energy consumption structure, ensuring national energy security, and reducing carbon emission standards[1]-[3].

In this paper, heterogeneous integrate energy system is introduced. A planning method for heterogeneous integrate energy system is described. This method is based on the power and energy dynamic balance, decoupling algorithm. Deployment of energy supply system will be considered. The application of the method provides a clean energy supply and improves the energy efficiency and establishes a way of coupling adjustment between various energy subsystems.

This paper illustrates the main methods and processes of integrated energy power supply in industrial parks. Heterogeneous integrated energy configuration and application in Guangzhou university town is described in this document.

2. Heterogeneous energy system
The Under the background of energy structure adjustment, it provides favorable conditions for the construction of a new energy production and consumption model with multiple coupling and source network interaction. The integrated energy system covers electricity, heat, cold and gas. There are differences in physical form. Information, device state also presents unstructured characteristics[4]-[6].

Construction of heterogeneous energy system is shown as follows:
The analysis of user side energy consumption behavior is the basis of improving user side management. Therefore, strengthening the analysis of multi energy and supply user side is the key to rational configuration of heterogeneous energy system.

Integrated energy system user data itself has a large number of real-time characteristics. Big data and control platform are the key technologies to realize heterogeneous energy system.

3. Deployment method

There are many energy subsystems such as cold, hot and electric power in traditional industrial parks. Due to the lack of coordination and targeted optimization, problems such as large gap between peak and valley power, low energy utilization efficiency among users, and power shortage still exist.

According to the characteristics of the heterogeneous energy system, the multi-energy resources such as cold, heat and electricity in the park are isolated from each other, so they cannot coordinate with each other. Therefore, it is necessary to develop an integrated energy control system of cold, heat and electricity in the park.

The deployment method flow of the park includes analyzing the possible energy supply mode (natural gas distributed energy station, distributed photovoltaic, wind power, etc.) according to the resource conditions, so as to improve the self-power supply proportion and economic benefits of the park as much as possible.

On the basis of different energy supply modes, various optimization schemes shall be reasonably adopted to improve energy utilization efficiency and renewable energy utilization ratio, realize multi energy coordination and build heterogeneous comprehensive energy system in the park.

For the heterogeneous system, in addition to meeting the needs of users, the energy system adopts block coupling mode, and the scheduling and control system adopts centralized - hierarchical control system architecture mode. According to information gathering, the integrated energy management of the block demonstration park consists of two levels: the stratum and the park layer.

At the same time, at these two levels, It is necessary to realize multi-objective stochastic optimization and decision-making of large-scale heterogeneous energy system operation and management, considering the indicators of policy, rules and regulations, operation preference.
The existing platforms are usually designed and constructed independently for specific energy links, so the infrastructure resources cannot be shared efficiently, and the system architecture and functions are lack of generality, which makes it difficult to meet the needs of efficient collaborative operation and management between different energy sources.

Integrating these algorithms, an integrated management platform based on intelligent terminal monitoring is constructed, and demonstration applications in energy and other fields are realized[7]-[8].

The platform needs to integrate artificial intelligence, edge computing, cloud platform, Internet of things and other latest technologies. The structure of the platform is as follows:

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**Fig 2** Structure of platform of heterogeneous energy system

**Fig 3** Structure of platform of heterogeneous energy system

4. Case study

Guangzhou University city is located in Panyu district of Guangzhou, with a total planning area of about 43 square kilometers and a planned total population of about 350,000 and an existing population of 200,000.

Guangzhou University City has been carrying out comprehensive energy, new energy utilization of beneficial exploration. Some useful explorations have been made on source-network-load-storage. In the source (supply) university city distributed energy station, supercomputing distributed energy center
respectively put into operation. On the net, in addition to the distribution network construction, also formed a relatively complete cold network in the region. There are 3 refrigeration stations (4 were originally located).

The energy system structure of the pilot park is shown as below:

![Energy system of Guangzhou University city](image)

The next step, research and development in data collection, platform deployment, effect evaluation and other aspects of the heterogeneous integrated energy system will be launched to increase the coordination and control ability of the system.

Combined with the Internet of things and other advanced technologies, intelligent terminal and communication deployment scheme in the park is determined. [10]-[13]

Through the configuration of the platform and sensors, the operation and management strategy of the energy system is optimized on the large-scale cooling, heating and power coupling system, taking into account the technical conditions and the benefits of all parties, so as to improve energy efficiency and economic benefits. The application of the platform in the typical area of demonstration project can effectively reduce the energy supply cost.

5. Conclusion
In this paper, the characteristics of typical heterogeneous comprehensive energy system are presented, and the corresponding planning and deployment methods are designed according to the characteristic root of the energy system, which can effectively meet the energy requirement of users in the park[9][14]. Big data platform, Internet and multi energy collaboration are the key technologies for heterogeneous energy systems.

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Acknowledgements
This paper was supported by Key-Area Research and Development Program of Guangdong Province under Grant 2020B010166004.

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