Research on the Development of Beijing Multi-Energy Complementary Energy System

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Abstract: Under the new situation, China's energy security supply is not the focus and main contradiction of energy development. Energy Internet and energy storage technologies are developing continuously. New energy micro-grids and electric vehicles are on the rise. The structural reform of energy supply side continues to deepen. , creating conditions for the efficient use of energy intelligence. This paper starts with the investigation of the status quo of Beijing multi-energy complementary projects, starting from the problems in project approval procedures, implementation and operation, and analyzing the existing national and local multi-energy complementary policies, combined with Beijing multi-energy complementary projects. The actual situation of the development and the problems that have arisen, and put forward relevant policy recommendations suitable for the development of Beijing's multi-energy complementary system.

1. Introduction

Multi-energy complementarity refers to the energy use method that adopts multiple energy sources to supplement each other according to different resource conditions and energy-using objects, so as to alleviate the contradiction between energy supply and demand, reasonably protect and utilize natural resources, and obtain better environmental benefits [1-2]. There are two main modes of multi-energy complementary energy system engineering: one is to meet the energy needs of end users such as electricity, heat, cold and gas, and to co-ordinate development and complementary use of traditional energy and new energy, through the supply of natural gas, cold and heat, Distributed renewable energy and energy intelligent micro-grid to achieve multi-energy collaborative supply and energy integrated cascade utilization; Second, the use of large-scale integrated energy base wind energy, solar energy, water, coal, natural gas and other resources to combine advantages to promote landscape water and fire storage Multi-energy complementary system construction and operation [3].

According to the “13th Five-Year Plan for Energy Development” promulgated by the state, promote the integration of energy production and supply, build a smart energy system with complementary energy supply and supply and demand coordination, and list “implementing multi-energy complementary integration optimization project” as “Thirteen The main task of the five-energy development. In order to accelerate the construction of multi-energy complementary integration optimization demonstration projects, improve energy system efficiency, and increase effective supply, for the Beijing Municipality, the “13th Five-Year Plan” period is to fully implement the strategic positioning of the capital city and implement the Beijing-Tianjin-Hebei coordinated development strategy. During the critical period, the capital's energy development entered a new stage. Strengthening natural gas, power security, and increasing the proportion of renewable energy have become the key direction of Beijing's energy structure transformation [4-5].

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2. Status Quo at Home and Abroad

2.1. Foreign Development

Traditional energy services were created in the United States in the mid-1970s, followed by energy services based on distributed energy to promote renewable energy such as cogeneration, photovoltaics, heat pumps, and biomass. Countries around the world have developed comprehensive energy development strategies suitable for their own development according to their own needs. Europe was the first to propose the concept of an integrated energy system and implemented it at the earliest, with the fastest development [6-7]. The UK focuses on the integration of energy flows between energy systems. The UK government has long been committed to building a safe and sustainable energy system. In addition to integrated power gas systems at the national level, the research and application of distributed integrated energy systems at the community level is also supported in the UK. The United States has achieved good coordination between various energy systems, and the United States' integrated energy suppliers have been well developed. For example, the US Pacific Gas Power Company and Edison Power Company are typical integrated energy suppliers. In the demand side management technology, many regions in the United States, including California and New York, have clearly defined demand side management and power system flexibility as an important direction in the new round of power reform [8].

2.2. Domestic Development

In order to meet the needs of the new supply and demand situation, the development of the terminal integrated integrated energy supply system and the multi-energy complementary system of scenery, water and fire storage under the multi-energy complementary concept has become an important choice. Multi-energy complementation can provide a flexible solution for the construction of the park. Internal flexibility can help the company to make profits, and external flexibility can improve the security and stability of the national energy supply [9]. The wide-ranging development of multi-energy complementarity has certain advantages for gas utilization, and it also supplements the power grid peak-modulation and frequency-modulation capability under the background of large-scale consumption of new energy. On January 25, 2017, the National Energy Administration announced the first batch of 23 multi-energy complementary integrated optimization demonstration projects, and most of them are terminal integrated integrated energy supply systems [10]. The relevant planning and design plan has been completed, but due to various reasons such as project complexity, most of the projects are still in the unworked state, and the specific effects have yet to be evaluated [11].

3. Beijing's Development and Existing Problems

3.1. Development Status

"Beijing's "13th Five-Year Plan" Energy Development Plan" puts forward "the favorable opportunity to seize the world's new energy technology breakthroughs, give full play to the advantages of the capital science and technology innovation center, and promote the multi-energy integration development with smart micro-grid as the link. To build a modern energy system represented by green low-carbon and renewable energy, and continuously improve the level of energy intelligence and high efficiency utilization." Faced with the new characteristics and new trends of Beijing's energy development, the government actively guides the direction of energy utilization and strives to achieve energy development [12]. A new breakthrough in the transformation of the way and the improvement of the quality of energy development. At present, due to the high NOx emission of gas distributed in the multi-energy complementary system, and Beijing is also the region with high pressure of smog control in the country, it is limited by the difficulty of gas distribution project promotion, Beijing versatile Complementary projects landed less. By the end of 2018, the first batch of multi-energy complementary demonstration projects announced by the National Energy Administration had been selected, and only the multi-energy complementary demonstration project of Lize Business District in Beijing was selected [13]. The first batch of smart energy demonstration projects announced by the National Energy Administration were selected, namely Yanqing Internet Comprehensive Demonstration Zone, Economic Development Zone “Internet +” Smart Energy Project, Economic Development Zone (Lunan District) Energy Internet Comprehensive Pilot Demonstration and Haibei New District. Energy Internet Demonstration Zone.

At present, Beijing's multi-energy complementary and energy Internet demonstration projects are relatively slow. From the perspective of the project's energy utilization form, all projects include the construction content of gas distribution, and also consider the use of gas boilers as peaking standby [14].

3.2. There is a Problem

(1) Beijing's environmental protection task is arduous

As a key city for air pollution control, Beijing has strict environmental protection standards. Although the current NOx emission limit for gas-fired internal combustion engines set in Beijing is 75 mg/m3, it is higher than the latest gas-fired boiler emission limit (30 mg/m3), and the development of cold-heat-electric triple supply in Beijing, where environmental protection is extremely demanding. Projects must first address environmental emissions issues.

(2) Power market transactions are difficult to achieve

In 2002, the State Council issued the "Power System Reform Plan", proposing the "electricity reform policy of separation of plant and network, separation of main and auxiliary, separation of distribution and distribution, and bidding on the Internet." China's current power trading is not fully marketized, and electricity, transmission, and The sale of electricity is in a monopoly state. In the multi-energy complementary project, not only gas distributed generation, but also renewable energy generation is coupled, and distributed generation transactions are difficult to achieve marketization [15].

(3) Renewable energy application tariff preferential policy has not yet been implemented

The price of heat supply for ground source heat pump in Beijing still maintains a high level, and the operating cost of heat pump remains high, which objectively weakens the advantages of multi-energy complementary renewable energy applications and reduces project competitiveness. At the same time, because the cost advantage of large-scale application has not yet been formed, the investment cost of multi-energy complementary project construction is relatively higher than that of traditional energy sources.

(4) Multi-energy complementary projects are complicated

The multi-energy complementary project includes various energy supply modes such as gas distribution, photovoltaic power generation, heat pump, etc. From the research situation, the contents of each sub-item included in the project cannot be packaged and packaged separately, and each individual item must be separate, and there is also a separate power supply [16]. The procedures for grid connection make the project establishment process very cumbersome. Since the country has not yet issued a clear multi-complementary and comprehensive project, local governments cannot implement the specific implementation.

4. Policy Recommendations

According to the problems existing in Beijing's current multi-energy complementary and energy Internet demonstration projects, and in view of the lack of relevant policies, this study proposes the following policy recommendations:

4.1. Strict gas Distributed Emission Limits

Joint environmental protection and other relevant departments jointly promoted the revision of the "Standard Combustion Engine Air Pollutant Emission Standard" and reduced the emission limit from 75mg/m3 to 30mg/m3. Natural gas internal combustion engine equipment is required to be equipped with a flue gas denitration system to reduce nitrogen oxides (NOx) emissions. The priority preparation for new projects with alternative pollution reduction sources requires that the overall emissions of the project be less than the conventional natural gas boiler heating + electric refrigeration emission levels to control the total amount of nitrogen oxides (NOx) emissions in Beijing.

4.2. Increase Power System reform and Establish a Distributed Power Generation Market Trading Platform

First, continue to promote the reform of the power system, especially to ensure the orderly advancement of incremental power distribution reform. The second is to formulate unified national and industry standards for distribution network planning, construction, operation and maintenance, and related process operations, and improve various supervision mechanisms such as commissioning and construction. The third is to determine the incremental distribution network revenue accounting method, establish a voltage-level transmission and distribution price mechanism, and clarify the price standard for household supply and electricity sales services. The fourth is to clarify the conditions for entry and exit, improve the enthusiasm of the distribution of electricity business, encourage the mastery of high technology, and thus develop the incremental distribution business.

4.3. Improve the Price System Mechanism and form a Market-Determined Energy Supply Price Mechanism

It is recommended that the government study the introduction of preferential tariff policies and trading mechanisms for renewable energy applications, reduce the cost of renewable energy applications, and implement residential electricity prices for multi-energy complementary projects and peak and valley electricity prices on this basis. At the same time, we will formulate an external green power management system, clarify the sources of green power, pipelines, land prices and usage methods, and establish green power distribution, use and trading mechanisms.

Before the formation of the energy price marketization mechanism, implement the scientific price system such as peak and valley prices, seasonal prices, interruptible prices, high reliability prices, and two-part prices, and promote the implementation of price mechanisms such as gas and electricity price linkages to guide electricity and natural gas. Users actively participate in demand side management. Research and develop preferential electricity price policies for renewable energy, reduce the cost of renewable energy electric heating, and improve the economic and adjustment capabilities of multi-energy complementary projects.

4.4. Simplify Project Approval and Clear Project Conditions

Demonstration and pilot projects that meet the definition of multi-energy complementary projects can be tested on the overall record. The project needs to meet a certain proportion of renewable energy utilization (installation scale should not be less than 25%), and the scale should not be too large (single generator capacity does not exceed 10MW) The single-channel grid-connected voltage is not higher than 10kV. The construction period is less than 3 years. At the same time, under the condition of full-load operation, the annual comprehensive energy utilization efficiency can reach more than 75%. Wind power and solar power in the demonstration project will give priority to the use of this year's total indicators to ensure that the total scale does not exceed the national energy planning quota for the total amount of thermal power and new energy generation capacity in Beijing, and prevent enterprises from increasing the name of multi-energy complementary systems. The contradiction of oversupply of electricity.

4.5. Release Support Policy

Strengthen the construction and transformation of supporting power grids for multi-energy complementary projects, and support project enterprises and power grid enterprises to jointly construct and coordinate the operation of distribution network facilities to ensure that the supporting power grids and multi-energy complementary projects are simultaneously built and synchronized. Simplify the grid access mode and management procedures of multi-energy complementary projects. The grid enterprises shall specify the grid-connected service processes, the content of the application materials and the processing time limit, and establish a convenient and efficient grid-connected service system. Relying on the municipal trading center, a distributed power generation trading platform sub-module is set up in each district power grid area. The distributed power generation project that meets the access conditions is filed with the local energy authority. After the technical review by the power trading institution, the power transaction contract is signed with the nearest power user on a monthly or annual basis. Improve the measurement and statistics of power generation and on-grid power of multi-energy complementary projects, establish a two-way electricity meter measurement information management system, and exempt system spare capacity fees and related service fees.

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