Current Situation and Challenge of Distributed Renewable Energy Generation in China

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Abstract

China is still in the process of industrialization and urbanization, with huge energy demand and great pressure on environmental governance. The development of distributed renewable energy generation is conducive to easing the dual pressure of energy and the environment. This paper introduces the advantages and types of distributed renewable energy generation and analyzes the process, scale and development level of distributed renewable energy generation by taking distributed photovoltaic generation and distributed wind generation, which are widely used at present, as examples, and also discusses the current challenges of distributed renewable energy generation.

Keywords

Renewable energy; Distributed photovoltaic generation; Distributed wind generation; Current situation.

1. Advantages and types of distributed renewable energy generation

With the transformation of China's economy from high-speed development to high-quality development and continuous innovation in the energy field, distributed renewable energy generation has attracted extensive attention in recent years. The proportion and importance of distributed renewable energy in the energy supply system are increasing rapidly. Especially since 2017, Distributed photovoltaic generation and distributed wind power have shown a rapid development momentum, which is of great significance for optimizing the energy distribution and realizing sustainable development in China.

1.1 Advantages of distributed renewable energy generation

Distributed renewable energy generation is different from the traditional centralized power generation. It is an energy service system that installs small generating units close to users and uses clean energy as the main fuel to provide electricity to nearby users. Distributed renewable energy generation has the following advantages: (1) Save investment in power transmission and transformation. The power generation unit is directly located near the user with a short transmission distance. (2) Meet the needs for special occasions. It can meet the needs of areas that cannot be connected to the power grid due to constraints, such as remote rural areas, or users with high requirements for the safety and stability of power supply, such as hospitals. (3) Environmentally friendly. The adoption of renewable energy has greatly reduced pollutant emissions and contributed to environmental protection [1].

1.2 Types of distributed renewable energy generation

Distributed photovoltaic generation. Distributed photovoltaic generation refers to the photovoltaic power generation facilities built near the user site, which are self-used on the user side, connected to the Internet with excess power, and balanced and adjusted by the distribution system [2]. Distributed photovoltaic generation follows the principles of adapting measures to local conditions, clean and efficient, decentralized distribution, and nearby utilization, making full use of local solar energy resources to replace and reduce fossil energy consumption.

Distributed wind generation. Distributed wind generation refers to the distributed generation system that uses wind-driven generators as power sources to convert wind energy into electric energy. The amount of power it generates generally ranges from a few kilowatts to tens of megawatts. Distributed wind generation is not only environmentally friendly, but also has the advantages of less space demand, low wind power required for start-up, and low wind speed requirements for the environment [3].

Distributed biomass generation. The distribution of biomass resources determines that distributed generation is the main way of biomass energy development. Biomass generation includes agricultural and forestry waste gasification generation, garbage incineration generation, landfill gas generation, biogas generation [4]. This not only provides energy but also solves the problem of waste disposal, which is popular in rural China.

Small hydropower. Small hydropower stations generally refer to those with a capacity of fewer than 50,000 kilowatts. It is widely distributed in China, especially in remote areas. It can be developed and utilized according to local conditions, which can not only solve the problem of local people's electricity difficulty but also bring considerable benefits to investors [5]. However, due to the relatively mature development and utilization of small hydropower and the constraints of the ecological environment, its future development space is not big.

Among all kinds of distributed renewable energy, distributed photovoltaic generation, and distributed wind generation account for the largest share and develop the fastest, but at the same time, they also face great challenges.

Therefore, this paper will take distributed photovoltaic generation and distributed wind generation as examples to analyze the development status and major problems of distributed renewable energy generation in China.

2. Current situation of distributed renewable energy power generation

2.1 Development process and scale

2.1.1 Distributed photovoltaic generation

The large-scale photovoltaic station concession bidding policy that was implemented in 2008 and the photovoltaic station feed-in tariff policy in 2011 established the dominant position of large-scale photovoltaic station in the photovoltaic market. From 2009 to 2012, China's investment subsidy policy for distributed photovoltaic generation started the distributed photovoltaic market. In 2013, the National Energy Administration adjusted the photovoltaic development strategy, focused on the development of distributed photovoltaic, improved the photovoltaic power generation price policy, changed the mode of investment subsidy to electricity price subsidy, and set the target of 100 gigawatts of distributed photovoltaic installations by 2020, accounting for 56% of the total[6]. From 2016 to the beginning of 2018, China's distributed photovoltaic generation industry developed rapidly, while many problems were exposed. In 2018, the country reduced the number of subsidies, demanding that the pace of development be controlled. In 2019, the National Development and Reform Commission (NDRC) issued a circular, making clear the goal of getting rid of dependence on subsidies and pursuing high-quality and affordable development [7]. By March 2020, China's total installed capacity of distributed photovoltaic generation is 64.35 million kW, accounting for 44.7 percent of the total installed capacity of photovoltaic generation.

2.1.2 Distributed wind generation.

The development of distributed wind power generation in China has gone through the initial and exploratory stages and has entered a rapid development stage. In 2011, the National Energy Administration issued a notice to clarify the requirements of distributed wind power project management, marking the official launch of distributed wind power projects. In 2012, the first 18 distributed wind power projects were approved. In 2013, the National Development and Reform Commission issued a circular, proposing policies such as strengthening planning and management and encouraging local consumption. In 2017, the National Energy Administration issued a document

to encourage the acceleration of the development of distributed wind power, and local policies and plans were successively issued[8]. In 2018, a lot of distributed wind power was integrated into the grid. In 2019, a total of 203 distributed wind power projects were launched nationwide, 127 of which have been completed and generated electricity with a total installed capacity of nearly 5 million kilowatts.

2.2 Development level

China ranks first in terms of photovoltaic manufacturing scale in the world, with 85% of manufacturing equipment and raw materials domestically produced. However, some high-end manufacturing equipment and basic materials still need to be imported. China has basically mastered all kinds of grid-connected photovoltaic equipment. The efficiency of distributed photovoltaic system has reached about 80%. The grid-connected photovoltaic system has begun to be commercialized and popularized [9]. China has also achieved breakthroughs in key aspects such as the low-speed wind-driven generator and flexible tower technology required for distributed wind power generation, and the low-frequency noise and light pollution problems of wind generation have also been improved to a certain extent.

However, the management level of distributed photovoltaic generation and distributed wind generation is still relatively backward, and the industry standards and rules are not perfect enough. Because the output power of distributed renewable energy generation has strong fluctuation, the safe operation of the power grid is sometimes affected.

3. Challenges

3.1 High costs and reliance on subsidies

In recent years, with the continuous improvement of science and technology, the cost of photovoltaic generation and onshore wind generation has been decreasing, but compared with traditional fossil energy, coupled with the instability of renewable energy, the cost of these power generation methods is still high. The high cost has always been one of the major constraints on the continued development of distributed renewable energy generation. China has implemented a policy of giving grid connection subsidy to electricity generated by renewable energy sources, but with the rapid development of the domestic renewable energy industry, the proportion of electricity generated is increasing, and the subsidy fund is also increasing. By the end of 2017, the gap in subsidies for renewable energy generation had reached 112.7 billion yuan. Besides, the long-standing subsidies for renewable energy generation do not help enterprises to further promote technological innovation to control costs and promote the healthy development of the industry [10]. Although various policies released in China since the end of 2016 have set the goal of further reducing the cost of renewable energy generation, reducing reliance on subsidies and connecting to the grid at the same price, in reality, there are still many difficulties in achieving these goals.

3.2 Policy mechanism and market mechanism are not perfect

Although China has introduced various measures to encourage and restrain distributed renewable energy generation, the formulation of local implementation rules and development planning are always lagging behind. In this way, the utilization and management of energy will be loose or lacking, which may lead to blind development and waste of capital and manpower.

Distributed renewable energy, especially distributed wind generation, is not attractive for large capital due to its small scale and limited revenue. Moreover, due to the high threshold for construction, operation, and maintenance, there are few successful precedes, so it is difficult to popularize it in rural areas.

4. Conclusion

In recent years, distributed renewable energy, especially distributed photovoltaic generation and distributed wind generation, has been developing rapidly. This is not only responsible for China's commitment made at the Climate Conference, but also a requirement for sustainable development

and coordinated development of energy, economy, and environment. At present, more people are concerned about how to continue to strengthen industrial construction, increase investment in product research and development, establish a fair certification system, and enhance market competitiveness with new technologies and products. How to further refine the local management system, improve the policy mechanism, fully tap the development potential of renewable energy power generation; How to promote cost and subsidy reduction, and promote the marketization process of distributed renewable energy. The National Energy Administration has released its 14th five-year Plan for renewable energy development. China's progress on distributed renewable energy generation will soon be revealed.

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