

Current situation and problems of photovoltaic distributed generation investment in China

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Abstract: China has been developing distributed generation projects, which have economy, environmental protection, using energy diversity, peak shaving function, safety and reliability characters. Under the dual pressure of the air pollution control and climate change negotiation, clean energy alternative is constantly speeding up. Under the policy support and financial capital favor, China's photovoltaic distributed generation development is entering the fast lane. This paper, mainly discusses investment status of photovoltaic distributed generation from development statuses, investment advantages and barriers. And for investment barriers, put forward investment proposals, to better promote China's distributed photovoltaic distributed generation development.

Keywords: distributed generation, photovoltaic power, investment, policy

INTRODUCTION

Energy is material basis for human activities. For a long time, China relies on coal as its major energy resource, and a single energy consumption model have brought serious environmental pollution, at the same time, greenhouse gases emissions have also brought a heavy pressure to the environment. Use clean energy, in response to the requirements of the "13th Five Year Plan" to reduce the use of fossil fuels, meanwhile reducing the emission of pollutants. Distributed generation (DG) was published in 1978 by the United States in the public policy law then officially promoted, which is different from the traditional centralized power generation model, but to meet the needs of specific users and distribution network operation, decentralized near the user with pattern of distribution, small modular power generation system generating power from tens of millions watts to tens of megawatts. After years of developing distributed generation, American distributed generation resources, such as roof photovoltaic and energy efficiency technology and energy storage technology, have become an important part of power system[1-2]. In 2013, the California Legislative Council passed the AB327 Act, which requires utilities to formulate special plans to develop distributed generation and make it an important part of the energy system [3]. Distributed generation is also conducive to climate protection [4, 5]. The amount of investment in the UK distributed generation market, including wind power, photovoltaic power generation and cogeneration, there will be a sharp decline from 2016 to 2019[6-8]. Photovoltaic generation has been contemplated in Brazilian government policies only to supply electricity with off-grid systems in remote locations [9]. China's solar photovoltaic power

generation industry develops very quickly. Photovoltaic grid-connected power generation system has been used in provinces, safety and steady [10, 11]. At the same time, it is expected that distributed storage (DS) systems will interconnected with traditional electrical power distribution systems in the near future [12]. The paper, introduced investment status of China's photovoltaic distributed generation from development status, investment advantages, investment barriers, and puts forward some investment suggestions according to the current barriers, in order to promote the development of photovoltaic distributed generation in China.

Photovoltaic distributed generation Development status

In recent years, China's photovoltaic industry has developed rapidly and become one of the fastest developing countries in the world. Promoting the application of photovoltaic power generation vigorously makes great significance for optimizing the energy structure, ensuring energy security, and improving the ecological environment. Photovoltaic distributed generation in China started from 2002, since then, has established a number of photovoltaic demonstration projects; the main investor is Chinese government with large amount of investment. For example, in 2002 the Chinese government invested 47 billion yuan, to enforce "send electricity to the countryside" project, in two years had completed 268 small hydropower stations, 721 photovoltaic power plants, wind and solar energy mutual-complementing power stations. Solved using power questions of 7 provinces in West China's 1.3 million populations, which is the biggest project using photovoltaic and scenery complementary power

generation system to solve the residents of areas without electricity power in the world. Over the past two years, China has issued a series of policy

documents to support the development of photovoltaic distributed generation. As shown in table 1.

Table-1: China related policies about photovoltaic distributed generation

Time	Policy	Time Policies Contents
Format: flush	A draft about solar energy utilization of Thirteen-Five development plan	Comprehensively promote the photovoltaic distributed generation. Focus on developing rooftop photovoltaic distributed generation system in large industrial park, economic development zone, public facilities, residential buildings, make full use of the conditions of agricultural facilities, idle venues to enlarge the scale of use and promote photovoltaic building integrated engineering gradually. By 2020, the cumulative distributed photovoltaic installed size arrives to 70 million kilowatts.
2014.11	Notice on the National Energy Administration promoting the construction of photovoltaic distributed generation application demonstration zone	Announced list of 30 photovoltaic distributed generation application demonstration districts. Encourage demonstration district government, banks and other financial institutions to carry out financial services innovation pilot, through establish public guarantee funds, public funds pool, risk compensation fund, etc, to solve finance problems in application of the photovoltaic distributed generation.
2014.09	Notice on the National Energy Administration further implementing the policy of photovoltaic distributed generation	From 15 aspects proposed suggestions. Encourage to develop various forms of photovoltaic distributed generation applications. Improve photovoltaic distributed generation tariff settlement and subsidies appropriation. Innovative photovoltaic distributed generation finance services.
2013.11	Notice on exempting government funds for own production own use of photovoltaic distributed generation	Since October 31, 2013 to December 1, 2015, taxpayers selling self-produced by solar power, implement policy of levy refund 50% value-added tax.
2013.10	Opinions on the national grid about grid service of photovoltaic distributed generation (Interim)	Photovoltaic distributed generation projects are free from the system reserve capacity fees.
2013.08	Opinions on the National Energy Administration and China Development Bank Corp on supporting the finance services of photovoltaic distributed generation	China Development Bank Corp provides long-term loans first, short-term loans and liquidity loans second, diversified credit products to photovoltaic distributed generation projects. The maximum loan period up to 15 years. The investment projects for key customers and national planning, implement differentiated pricing.
2013.08	Notice on price leverage playing a role in promoting the development of photovoltaic industry healthily	For photovoltaic distributed generation price, in accordance with whole electricity subsidies, price subsidy standard is 0.42 yuan per kilowatt hour (including tax). The grid-tied surplus, purchased by power grid in accordance with benchmark price of local coal-fired units. The imposed various funds and addition of own power is free of charge, as well as system reserve capacity fees and other related grid-tied service fees.
2013.07	Some suggestions on healthy development of photovoltaic industry	Further improve the grid connection, subsidies, finance and other policy support. Support to construct distributed PV on its own roof, with loan 50 thousand -500 thousand.
2013.03	China State Grid Corp on doing a good job of distributed power grid-tied service	Full support for distributed solar power grid work, and implement "free access, full acquisition" policy. Photovoltaic distributed generation projects are exempted from the system reserve capacity fees, the same as power grid enterprises in the whole process of grid-tied application.

In policy and interest driven, many investors are developing photovoltaic distributed generation. In 2015, the distributed photovoltaic roof power station in Beijing Haidian Zhongguancun environmental protection science and technology demonstration garden connected to grid formally by one of the five major power groups, China Huadian Corporation. It is the largest distributed photovoltaic roof power plant put into operation officially in Haidian District until now. 2014 China Huaneng Group's first photovoltaic distributed generation project Changxin 5.14MW announced to connect to the grid. China Power International in Xinjiang, Gansu, Inner Mongolia, Yunnan, Hainan, the better solar energy resource areas, to create five solar power bases with one hundred thousand kilowatt class.

Investment advantages

1) Electricity generation

Photovoltaic distributed generation output highest in the daytime, coinciding in people demand for electricity most during the time, which can alleviate the local electricity tense situation to a certain extent. According to Renewable Energy Law, grid enterprises secure purchase electricity from solar photovoltaic power generation projects. Interim Measures on supervising photovoltaic power generation operations emphasizes the responsibility of power grid enterprise, buy all photovoltaic distributed generation electricity and if cannot be acquired, shall file on record from the department of the State Council. Generation demand is guaranteed.

2) Policy subsidy

According to Notice on price leverage playing a role in promoting the development of photovoltaic industry healthily, photovoltaic distributed generation price subsidy is 0.42 yuan per kilowatt hour, in principle, for 20 years. And Notice on implementing subsidy of photovoltaic distributed generation in accordance with electricity proposed photovoltaic plant subsidy funds by the provincial finance department, instead of directly allocating to the power grid enterprises, which simplify settlement procedure, more convenient. Interim Measures on management of photovoltaic distributed generation projects, provides the photovoltaic distributed generation projects which enjoy electricity subsidy policy by grid transfer pay national subsidy funds monthly, and settle excess grid-tied fees monthly.

Some local government, such as the Beijing introduced Photovoltaic distributed generation fund

awards management approach, for grid-tied photovoltaic distributed generation projects from January 1, 2015 to December 31, 2019, reward according to the actual power generation, standard as 0.3 yuan (including tax) per kilowatt hour (KWH), for 5 years. In addition to state subsidies, local government incentives to promote the development of photovoltaic distributed generation.

3) Energy saving and emission reduction

At present, economy in the China eastern region is relatively developed, but environmental pollution is relatively serious. Beijing-Tianjin-Hebei Region, Yangtze River Delta, Pearl River Delta and other regions, the individual city has fog and haze days more than 200 each year. The eastern region accounted for 8% China's territory, consumes the country nearly 50% coal, petroleum, iron and steel, cement and other resources, then forming large amounts of carbon dioxide, nitrogen oxides and soot and other pollutants. Promoting distributed solar power in sunlight areas such as eastern part, which will effectively ease the dependence on coal and other fossil energy, reach to energy saving and emission reduction effect.

4) Make up for the lack of centralized PV power station

China's centralized photovoltaic power plants are mainly concentrated in the western region. Because the projects are too concentrated, the power grid can't disposal easily, and transportation is difficult, abandoned light phenomenon is serious, local region abandoned light rate even reached 20% to 30%. Photovoltaic distributed generation "own production own use, more electricity access to grid" pattern, most power generation consumed by the users themselves, and impact on the grid less, to make up for the lack of centralized PV power station.

Investment barriers and suggestions

In current energy investment environment, because of weak China's photovoltaic industry foundation, the development bottleneck is more obvious. Photovoltaic generation development investment opportunities and risks coexist, but from the point of the technical level and market size, there is a certain gap from developed countries, photovoltaic distributed generation investment projects exist many problems. Table 2 summarizes the barriers of photovoltaic distributed generation, and put forward investment development suggestions.

Table 2: Advantages and barriers of photovoltaic distributed generation

Investment barriers	Suggestions
<p>Cost matter: Due to the expensive cost of photovoltaic power generation equipment, immature technology, the high initial investment from investors in the photovoltaic power generation project, lead to high cost of photovoltaic power generation. However, grid-tied price has no competitive advantage. Therefore, the current biggest problem that photovoltaic power generation projects investment is cost.</p>	<p>Lucrative investment: Photovoltaic distributed generation is generally about 10 years to recover the cost, with photovoltaic power generation system design life of 25 years, plus state subsidies for 20 years, it is worth the investment for long-term investment income perspective. Investors should pay more attention to the local subsidy policy, do a good job in the pre survey, and the use good equipment and materials, reduce the cost of accident maintenance.</p>
<p>Policy matter: Although China has promulgated a number of policies to support photovoltaic distributed generation, the implementing regulations and supporting policies are not perfect. lack of clear policy guidance, so the actual operations have problems. For example, most of the current distributed power plants are built on the roof of the owners of the power generation facilities which are fixed or semi fixed. Most electricity must be supplied to the roof of the owners, the developers can't control the power use of the owners. Some owners default electricity charge, or reduce the contract price. In addition to photovoltaic distributed generation subsidies, there is the existence of default subsidies, which is not conducive to investment incentives.</p>	<p>Perfect relevant laws and regulation: In the aspect of the law making, therefore, it is suggested that our country should learn from experience of developed countries. As soon as possibly clear renewable energy power generation project management and price management system, further clarify the administration measures for renewable energy power generation enterprise connected to grid and full acquisition and corresponding supervision mechanism. Development of photovoltaic distributed generation should be given more consideration to the profit mode and electricity price subsidies, and different areas have different distributed power generation cost, so subsidies should be adapted to local conditions. In order to solve the problem of the default electricity charge, by the local power company to collect electricity payment, reduce conflicts.</p>

CONCLUSION

China's photovoltaic industry is gradually mature and photovoltaic distributed generation projects develop fast. This paper, mostly from both side, policies and investment projects, analyzing photovoltaic distributed generation development status, knows about that policy subsidy, energy saving and emission reduction and make up for the lack of centralized PV power station these advantages promote the photovoltaic distributed generation investment. In the face of cost matter and policy matter, put forward reducing the cost of accident maintenance and perfecting relevant laws and regulation these suggestions, to promote the investment of photovoltaic distributed generation in China.

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