

Analysis on the Factors Restricting the Development of Solar-thermal Power Generation Industry in China

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Abstract—As the air quality and environmental pollution and other problems become increasingly serious brought by the traditional energy, the solar-thermal power generation is an important source for the new energy, and it becomes an investment hotspot in the renewable energy field in the world. Based on the research on the development status of the solar-thermal power generation industry in China, the paper also studies the factors restricting the industrial development.

Keywords—solar energy; solar-thermal power generation; industry; Restraining factor;

I. INTRODUCTION

1.1 Solar thermal power

The sun can provide us with energy in three main ways. Solar thermal power is one of these. Solar thermal energy is a form of energy and a technology for harnessing solar energy to generate thermal energy or electrical energy for use in industry, and in the residential and commercial sectors.

The first installation of solar thermal energy equipment occurred in the Sahara Desert approximately in 1910 when a steam engine was run on steam produced by sunlight. Because liquid fuel engines were developed and found more convenient, the Sahara project was abandoned, only to be revisited several decades later. Solar thermal energy systems – known as Concentrating Solar Thermal are versatile, reliable and flexible. Solar thermal delivers power to meet peak electricity demand, it can include thermal energy storage to deliver power day or night, it can be coupled with other fuels such as gas and biomass for fully dispatchable electricity supply. And solar thermal can also reduce coal consumption in coal-fired electricity plants, by delivering solar generated steam to augment existing steam systems.

1.2 Solar thermal power in China

Electricity from solar thermal power is generated in a very similar way to the way fossil fuel plants generate electricity. The main difference is that in a fossil fuel plant steam is created by burning fossil fuels, whereas in a solar thermal power plant the steam is produced by focusing sunlight.

After over 30 years' development, China has grasped a number of key technologies for solar-thermal power generation, the design of solar condensation, the high-temperature light-heat conversion and dish concentrator

system, the design and integration of megawatt tower power plant system and other aspects have realized the technological breakthroughs, the ability to produce the upstream and downstream elements in the solar-thermal industry chain grows quickly, and it has equipped with the production capability in the whole industrial chain basically.

Concerning the annual power generation capacity, the potential annual solar-thermal power generation potential in our country is 42000TW•h/year. This means that even in the future after all fossil energy is depleted, we still have the rich and stable solar-thermal power generation resources surpassing the self-sufficiency in our country, and China's solar-thermal power generation industry is a field with huge development potential.

This research project is done with the aim to provide information service for the development of solar-thermal power generation industry in China. In this study, the factors restricting the development of solar-thermal power generation industry in China discussed:

II. FACTORS RESTRICTING THE DEVELOPMENT OF CHINA'S SOLAR-THERMAL POWER GENERATION INDUSTRIAL CHAIN

Under the guidance of the government policy in our country and the investment led by five major power groups, the whole industrial chain has taken shape preliminarily. The enterprise in our country has entered into the upstream and downstream links in the solar-thermal power generation industrial chain. At present, the country has been equipped with all the key and main equipments to produce the solar-thermal power generation basically, some parts have been equipped with the commercial production condition, the solar-thermal power generation industrial chain is formed gradually, and independently establishing the large-scale solar-thermal power generation station becomes possible. However, the solar-thermal power generation industry in our country is still in the infancy until now, and there are many factors restricting the development of the industry.

From the analysis of solar-thermal power generation industrial chain, we can know that it is confronted with the challenges at different degrees on the technical links, which mainly includes:

2.1 The integration technology of thermal power generation station is lacked

The solar-thermal power generation plant involves the solar heat collection, conventional electricity, traditional thermal storage and other multiple system integration concerning the optical, thermal, material and mechanical and other technological fields. It is different from the traditional power generation and pure solar energy application. It needs the interdisciplinary and cross-disciplinary system integration technology, especially needs the systematic integration experience. At present, it has not completed the commercial demonstration plant at present, and there are only a few research trials stations running, there is no experience on the whole system design and system integration in the power station in the country, the solar-thermal power generation station system modeling and simulation technology have just started, and it lacks the whole construction, operational experience and ability in the power station.

2.2 The key technology is to be broken through

The solar-thermal power generation in our country is still in the initial stage of industrialization, and the core technology in thermoelectricity industrial chain is blank in our country; However, the sophisticated control technology for tower heating system heliostat, the high-performance concentrating collector design and manufacturing and other related process and the reliability processing technology of dish Stirling engine are monopolized by the foreign large enterprises; The manufacturing technology for groove vacuum heat collection pipe is mainly from German Schott company and Israeli Solel company, the produced vacuum heat collection pipe is sealing straight-through metal- glass vacuum heat collection pipe, and it implements the technical block, which means that it is hard to exchange the technology with the market share. The research and manufacture of key technology and equipment are directly related with the industrialization process of the solar thermal in our country. At present, the key technology and equipment are still in the research and trial stages in our country, and they are important restricting factors of the scale development of solar thermal power generation.

2.3 The direct solar radiation resource data is insufficient

Our country has a vast land, complex terrain and abundant solar energy resource, while there is a significant regional difference. However, the distribution of the meteorological station is intensive in the eastern and scarce in the western. There are 98 stations of radiation observation in the observation system in State Meteorological Administration, only less than 20 station observation projects include the direct solar radiation, this is out of proportion with the geographical distribution, and it can hardly satisfy the growing demand on the solar energy resource development and utilization. Therefore, it needs to establish the direct solar radiation resource investigation system urgently, and the direct solar radiation resource data collection system.

2.4 Lack of industrial service system

The solar-thermal power generation in our country is still in the technical research and demonstration phase, the product in the related industrial chain is in the trial and industrialization early stages, therefore, the domestic technical standard and specification on the solar-thermal power generation are just started, there is no experience on the whole system design and system integration in the power station in the country, the solar-thermal power generation station system modeling and simulation technology have just started, and it lacks the whole construction, operational experience and ability in the power station. The related detection system and standard system are still blank. The detection ability on the key equipments is in the early stage of the construction, therefore, the detection means and ability are lacked for the product newly tried in our country, the performance and reliability for the product produced in our country can not be verified, and further the construction development of domestic power station is slow due to the lack of the support of domestic industry. In turn, the slow construction of power station influences the research and development of industrial product, and it forms a vicious cycle.

III. DEVELOPMENT SUGGESTION

The lack of integration technology of thermal power generation station, the key technology to be broken through, the insufficient direct solar radiation resource data and the lack of industrial service system are main factors restricting the development of the solar-thermal power generation industry in our country. Breaking through the restraints needs to adopt the effective measures. Only in this way can we positively develop the solar-thermal power generation industry.

3.1 Increase the policy support

For the increasingly serious air quality and environmental pollution brought by the traditional energy, it is expected that the government will increase the force to formulate and implement the photo-thermal policy, and it will be more positive.

3.2 Establish the exemplary solar-thermal power station

The promotion of future commercial market mainly depends on the electrovalency policy of solar-thermal power generation at present, while the issuance of the electrovalency policy needs to base on the domestic industrialization situation and the cost to realize the project. Therefore, promoting a demonstrative solar-thermal power generation based on the localized product and technology, the cost and operational status of the power station, and formulating a industrial policy complying with the optical-thermal industry status in our country are the shortcuts to promote the industrial development.

3.3 Improve the technical accuracy

The professional construction of optical-thermal power station will become the work with the highest technical content for the construction of new energy in our country and the largest challenge for the existing construction means.

Improving the accuracy of light resource measurement, establishing the strict power station construction program and power station operation mode can meet the market demand.

ACKNOWLEDGMENT

This work was financially supported by the Beijing municipal financial research projects with Grant No. PXM2014-178214-000009.

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