

Development characteristics of the solar energy industry and related policies in China

As a clean energy source with rich resources, solar energy has great prospects and is the focus of the development of renewable energy all over the world. The two most important utilizations of solar energy are: (1) solar power, which converts solar radiation into electrical energy using semiconductors that exhibit photovoltaic effects (solar photovoltaic power generation – or PV for short); and (2) solar thermal, which converts solar radiation into heat. If this thermal energy is then used to generate electricity, it is called solar thermal power generation. In recent years, both China's PV industry and its solar thermal industry have expanded rapidly, but their paths of development have differed significantly. Renewable energy policies have played an important role in the development of China's solar energy industry.

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The development characteristics of China's solar energy industry

China is now ranked first in the world in both the photovoltaic industry and solar thermal industry, but the two industries demonstrate quite different characteristics.

(1) Start time and growth

The main solar thermal products manufactured in China are solar heat collectors (water heaters). China's solar thermal industry has become relatively large-scale and in the 1990s it entered a stable phase of development, with an annual growth rate of around 20 percent. The development of China's PV industry started at the beginning of the twenty-first century and has entered an explosive growth phase since 2003, with an annual growth rate of more than 100 percent. At the same time, the different parts of the PV industry chain, from downstream to upstream, have been exhibiting wave-like patterns of growth. The rapid growth of the PV industry in China began with the downstream parts of PV module packaging and PV cell manufacturing, while the upstream parts of silicon material took its first steps even later. Until 2005, the production of China's polysilicon – an essential and primary raw material in the production of solar cells – was only 80 tons. Two years later, however, polysilicon production experienced an explosive growth.

(2) Industrial scale

Although the production volume of China's PV cells and solar water heaters both rank first in the world, there are significant

differences between the two in terms of international status and international competitiveness. China's solar thermal industry can be described as thriving, accounting for more than half of the world's output, and the development of all aspects of the industry chain are fairly well balanced. China's output of PV cells does not have an absolute advantage in the world and, in particular, the upstream of China's PV industry chain lags behind that of other countries. This is illustrated by China's need to import large volumes of polysilicon to meet its PV cell production requirements. There is still a big gap between China's technical level and environmental governance, compared to other countries, although China's upstream polysilicon capacity has been expanding fast.

(3) Market distribution

The raw materials for China's solar thermal industry depend primarily on domestic supply. Likewise, 81.2 percent of the products between 1998 and 2007 were manufactured to meet domestic demand. China's total installations accounted for 57.6 percent of total global installations in 2008. It is safe to say that, even though international demand has been growing rapidly in recent years, the development of the solar thermal utilization industry is generally driven by the domestic market and demonstrates features typical of endogenous growth. By contrast, the features of China's PV industry demonstrate a dependence on the demand and supply of international markets. Specifically, on the one hand, it imports a large amount of vital polysilicon material; on the other hand, 98 percent of China's PV cells were primarily destined to meet international demand in 2008. In November 2003, Germany issued new provisions for on-grid power tariffs; in August 2004, it amended its Renewable Energy Law; and in 2006, Spain launched its Royal Decree on Solar Energy and began to adopt fixed grid electricity prices. All of these policies and regulations in developed countries greatly contributed to the growth of the world's PV market, as well as China's.

The role of energy policies in the development of China's solar energy industry

The Chinese government has always put more emphasis on the development and utilization of solar energy. According to the targets of various policies, regulations and specific policy measures relating to renewable energy, China's solar energy policy can be divided into two phases, since the promulgation of the Renewable Energy Law in 2005.

(1) The macro guidance phase 2005-2008.

The development of both China's PV and solar thermal industry benefited from the support of government. First of all, government policies indicate the direction of the development of new renewable energy, which enables enterprises to form expectations about the future and attracts them to invest in the field. Secondly, technology innovation in both industries has benefited from the government's support, especially in the early development stage. Thirdly, government purchase contributed to more than 60 percent of the domestic PV market and was essential for the promotion of technology, from the laboratory to the market. On the other hand, the Chinese government plays a limited role compared to other governments in developed countries. Although China introduced, among various policies, its Renewable Energy Law in 2005, its goals for solar energy development appear to be low, its supporting efforts are small, and its substantive promotion policies inadequate. Take China's PV industrial policy for example, the cumulative installation goals for solar PV power generation in the 'Medium- and Long-term Development Plan for Renewable Energy' are 300,000 kW and 1,800,000 kW, in 2010 and 2020 respectively, accounting for about 0.227 percent of the total national power capacity. The government has not adopted specific, practical measures to establish a long-term solar energy strategy.

(2) The vigorous promoting phase (since 2009).

Since 2009, the Chinese government has strengthened its efforts to support renewable energy use, including solar energy, and promulgated a number of policies with substantive content. The policy improves the development goals, takes comprehensive measures in terms of financial assistance, supports technology, and provides market incentives to accelerate the industrialization of domestic PV power generation and its large-scale development. For example, it sets out plans to provide financial support for no less than 500 MW PV power generation demonstration projects in the coming two to three years. In respect of grid-connected PV power generation projects, the government provides subsidies amounting to 50 percent of the total investment of the PV power generation system and its supporting transmission and distribution projects; independent PV power generation systems in remote areas without electricity are subsidized by up to 70 percent of the total investment. For a long time, policies have not paid enough attention to the use of solar thermal energy. However, in 2009, China's policies promoting the use of solar thermal appear to have made great progress. Firstly, enterprises involved in solar thermal utilization were finally accepted as members of China's Consumer Electronics Association. Secondly, and for the first time, solar water heaters came into the scope of subsidy policies of "the project to provide household electrical appliances to the countryside", and the subsidies were equivalent to 13 percent of product sale prices for farmers purchasing household appliance products.

Policy suggestions for promoting China's solar industries

(1) The significance of the solar industry for China

The development of the solar energy industry in China is of great significance. First, the Chinese government has promised that carbon dioxide emissions per unit of GDP will be reduced by 40-45 percent by 2020, compared to 2005. Bearing in mind the projected development of renewable energy, by 2020 China's non-fossil energy will account for about 15 percent of the country's primary energy consumption. Second, the solar energy industry is an emerging industry, and solar energy utilization technology, especially PV technology, is immature. This period of flux is allowing developing countries to catch up with developed ones in terms of technology. Via the development of the solar energy industry, they can continuously improve their engineering and industrial technologies. Furthermore, China's industrial development experience has shown that if a product's industrialization cannot be achieved, then the prices will be high; once a product's industrialization is realized, then the presence of domestic competitors will pull down the prices of imported products considerably. Thus, the development of the PV industry can help China to lower its costs in relation to reducing carbon dioxide emissions. In addition, climate change and carbon dioxide emissions will provide an important international context for China's future development. The country is facing an important challenge in terms of changing its development mode from a high-carbon economy to a low-carbon economy. Clearly, the development of the solar energy industry will be an important component of a low-carbon economy. If China is to fulfil its obligation to reduce carbon dioxide emissions, the overall production costs of its manufacturing industry will need to be pushed higher. Certainly, compared with being burdened with a carbon tax or purchasing carbon quotas, China could do worse than to take the initiative to promote renewable (including solar) energy.

(2) Policy recommendations for the promotion of China's solar energy industry

Given China's current stage of development, the high costs involved in PV power generation are hard to bear for both business and residential users and the government appears to have difficulty in providing large-scale subsidies. Therefore, at this stage in the industry's development, the focus for solar energy use should be on solar thermal utilization, PV construction in regions without electricity and grid-connected PV demonstration systems. PV demonstration projects not only increase PV demand in the short-term, but also help to accumulate vital experience in industrialization and in building PV power generation projects. This will also lay the foundations for a large-scale grid-connected PV power generation market. With the costs of PV power generation continually decreasing, in the medium-term China will start construction of grid-connected PV systems. In order to promote the healthy development of the solar energy industry and solar energy use, China's policies must make adjustments, including: improve goals for solar energy utilization; speed up the relevant legislation; strengthen the incentives for solar energy utilization; provide financial and tax support for solar energy industry; provide R&D in solar energy utilization technologies; supervise production efficiency; secure environmental protection and the safety of its PV industry, especially in terms of the production of polysilicon.

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Below:
Examples of solar powered lighting (left) and solar water heaters (right) in China. Photos reproduced courtesy Creative Commons/Flickr.

