

# SOLAR THERMAL IN CHINA

## Overview and Perspectives of the Chinese Solar Thermal Market

Although China is the biggest solar thermal producer and market in the world, per capita installations of solar hot water systems are still quite low compared to other countries meaning there remains huge market potential in the region. Li Junfeng and Hu Runqing, Energy Research Institute, China describe the current situation of solar water heater industry development in China.

Development of China's solar water heating (SWH) industry started in the 1980s, the market was initially focused on low income families in the countryside or in small towns at that time. The technology was simple, supplying hot water at low cost for domestic use. From the 1990s, the market developed along with the technology into three types of SWH: evacuated tube SWH, flat plate SWH and combined storage SWH. The more technically advanced evacuated tube and flat plate water

heaters were aimed at comparably higher income inhabitants in small and medium-scale cities during that period. In the late 1990s, along with the development of people's quality of living, the increase of hot water demand provided the market space for further SWH development with production expanding, thus bringing a broader awareness of the various SWH technologies and brands. Since 2002, integration of SWH into buildings has become a new hot spot of development, some major SWH enterprises

have begun to develop full time supply SWH systems which are higher quality and more efficient systems that are easy to integrate with buildings. Several SWH pilot projects in which systems have been integrated more seamlessly into buildings have been constructed, and present excellent examples for demonstration and promotion.

### Blooming market

Since the 1990s, China's SWH market has bloomed into the biggest SWH market in the world today. Annual production grew to 13 million square meters in 2004 from 0.5 million square meters in 1991, and the average annual growth rate surpassed 28.5%. At the end of 2004, China's SWH cumulative installations were over 60 million square meters, which was 5 times that of 1997 and also more than 70% of the total world market. At present, SWH has provided hot water supply for more than 35 million families, occupying 12% of the water heater market, competing strongly alongside electric and natural gas water heaters. In towns and small to medium-scale cities, SWH has already become an important product for the improvement of people's quality of life. In 2004, solar-powered water heaters provided 7.2 million tons of coal equivalent (tce) of heat (calculated at 120 kgce per year

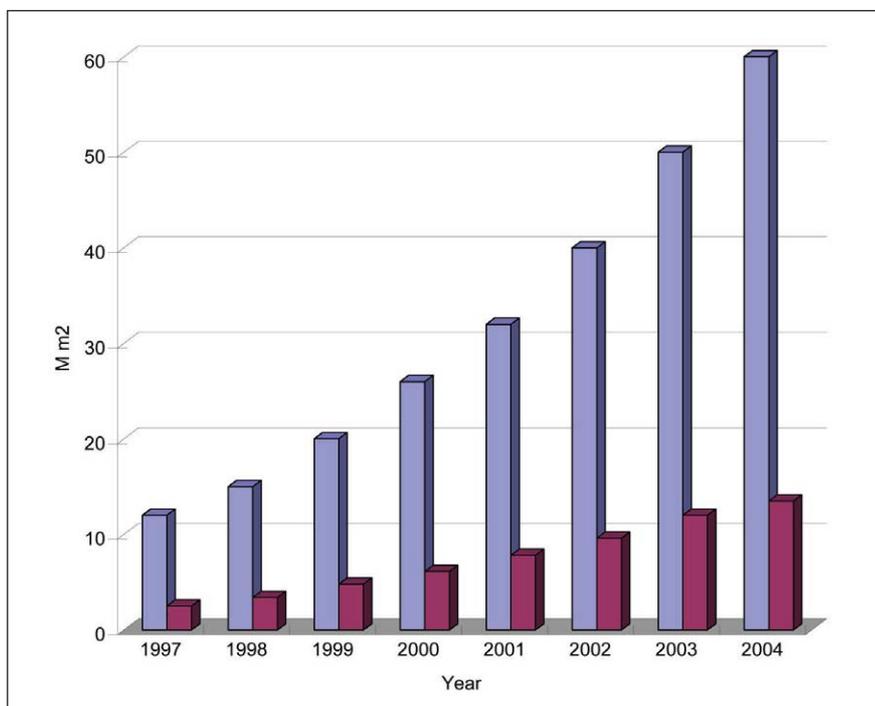


Figure 1: Annual production and cumulative installed capacity (in millions of square meters) of solar water heating systems in China by year.

#### Further information

Contact: Li Junfeng, Energy Research Institute, National Development and Reform Commission, Guohong Mansion, A11 Muxidi Beili, Beijing, 100038, China. Tel: +86 10 63908480, Fax: +86 10 63908468; [lijf@public.bta.net.cn](mailto:lijf@public.bta.net.cn); [run-qingh@163bj.com](mailto:run-qingh@163bj.com)

per square meter collector), providing 12% of China's renewable energy, second only to the contribution of small hydropower at about 70%. The application of SWH in China reduces around 12 million tons of CO<sub>2</sub> emission (calculated at 200 kg CO<sub>2</sub> per year per solar square meter collector).

## Largest production capability

Through more than 10 years effort, China has established a large, mature, and commercial SWH industry. In 2004, the annual sales of SWH was 13 million square meters, and the annual production value was US\$1.4bn. There are more than 1000 SWH companies employing more than 250,000 people, and most of them are private enterprises. But, the problem is that most enterprises' production capability is still relatively small.

## Collector types

There are mainly three kinds of collector in China: evacuated tube collectors (heat pipe evacuated tube collectors), flat plate collectors and combined storage collectors. The evacuated tube collector market share rose to 88% in 2004 from 35% in 1997 occupying the dominant position in China's SWH market. The flat plate collector's share has dropped steadily, from 32% in 1999 to 11% in 2004, and is mainly used in frost-free areas in the south. Combined storage collectors are the most simple and primitive type of collector, so its market share is already very small at 1% in 2004. China's market structure is very different from that of the international market. In the world market, the flat plate SWH has remained the absolute leader and mainstream product. However, along with the development of the construction market for SWH in China, SWH manufacturers in China are starting to pay more attention to flat plate collectors because of their ease of installation and integration with buildings.

## Applications

The main application of SWHs in China is in the provision of domestic hot water, of which approximately 90% provide hot water for single households and about 10% for schools, hotels, restaurants, hospitals, and industry. Demonstration of SWH



*Typical early stage solar collector installations in China*

systems for space heating applications has just begun and SWH for refrigeration applications is still at the research and development stage.

## Market distribution

At present SWH systems are distributed across wide areas of China including the frozen region in north of China and the warmer regions in the south. Regarding market distribution, suburban areas in large cities, small and medium-sized cities and towns make up the main body of the SWH market (60%). Villages and rural areas account for about 10% of market share and await further development.

## Standards, testing and certification

In 2004, there were 12 national SWH standards in China, two of them foundation standards, five testing and evaluation standards, four product standards, and one management standard; in addition, there are another four national industry standards. These standards play a positive role in the development of SWH industry. However, most of the standards are established especially for particular SWH products, only one national standard and one national industrial standard address the design, installment and evaluation of SWHs.

Since 2000, the central government has established national SWH testing centres with the support of international cooperation projects. At present, two national

testing centres, one in Beijing and one in Wuhan, have passed the national approval for laboratory and the testing centres, meaning they can undertake national testing duties. In addition, SWH companies constantly pay attention to product R&D and quality control, and have started to establish their own SWH testing centres, such as the SWH testing centre of Shandong Linuo Solar Energy Cop which was established in March 2005. A Chinese SWH certification system was approved and launched in March 2005. More than 20 SWH enterprises have submitted their application for product certification now.

## Development of SWH market

China is one of the few countries with a commercial SWH market in the world. In China, the government does not offer any benefit policy or subsidy, to SWH enterprises or end-users of SWH systems. Most SWH manufacturers are privately-owned enterprises, running their businesses in the face of real market conditions. The main driver for rapid development of SWH in China is the fact that, SWH can satisfy the daily hot water demands of inhabitants, reliably and at a reasonable price that competes with electric and gas water heaters. Therefore the drive for development of the SWH market in China is quite different from the drive in other countries. In most countries in the world, the renewable energy market is supported by government



*Demonstration of building integrated solar water heaters in Yunnan province*

incentives and policies. Although introduction of the Renewable Energy Law in China in 2006 (see below) should now have an added positive impact on the SWH industry in the region.

China's SWH industry is a growing concern with increasing enhancement of product performance and quality, well established SWH businesses and markets being the internal drivers for the SWH industry development. In addition increasing conventional energy prices, improvement in living standards, the massive construction of new residences, as well as Chinese society's increasing awareness of environmental issues, will all provide further rapid growth of the SWH industry in China.

### Problems in development

There are two problems however that could hinder development of the SWH industry in China. First, despite regular improvements, mass production of SWH technology in China is not as advanced as that in other countries. Because of the difference in production processes used by the many different SWH enterprises and low requirement for enterprises to enter the market, it is difficult for the SWH industry in China to realize an advantage of economies of scale of production and demand is overstressing supply in some sectors. Second, the problem of building integrated SWH systems needs to be solved as soon as possible. Because most SWH products are bought and installed by householders themselves, problems can

occur during installation. Even worse, the installation of SWH can affect the function and aesthetics of buildings and in some bigger cities regulations are emerging which ban the use of SWH systems.

The key point to solving this problem is to combine the planning, designing and installation of SWH with the whole process of building construction. At present, a national project focused on the integration of SWH with buildings, which is being implemented by the National Development and Reform Commission (NDRC) and Ministry of Construction (MOC) and financed by the UN Foundation is doing something to attempt to overcome these problems. Under this project, some building integrated SWH demonstration projects have been conducted, and a National Technical Standard for Solar Water Heating Systems of Civil Buildings, and a Guild Book for Integrated SWH Design in Civil Buildings are being developed in 2005. With these efforts from several different stakeholders, integrating solar thermal technologies into building design is becoming the commonly-accepted approach in China. However, there is still a lot of work to do in this regard.

### Huge market potential

Although China is the biggest SWH producer and market in the world, per capita installations of SWH systems are still quite low compared to other countries. China's per capita installation figure ranks below those of Israel, Greece, Austria, Turkey, Japan,

Denmark, US, Switzerland and Germany. The installment area per thousand householders in Israel, Greece and Austria respectively amount to 600 square meter, 264 square meter and 223 square meters respectively in 2001 whereas China only accounted for 176 square meters in 2004, implying a huge market potential. From the current market distribution and demand trend of customers, the potential capacity of the SWH market in the future will come from the following three areas: First from the demand for economical SWHs in small and medium-scale cities in China; Second from the great potential market for small and simple SWHs in rural areas as farmers' incomes and quality of life in rural areas improves; and third from the demand for high performance and quality SWHs in large-scale cities in China and the international market. If the quality of SWH is good enough and the problem of SWH integrated in buildings can be solved, this market will expand.

### RE Law and future potential

The Renewable Energy Law, which was published on February 28, 2005 and will become effective on January 1, 2006 encourages the use of solar energy technologies in construction projects, and requests that governmental administrative departments implement technical and economic policies and technical standards for the integration of solar energy systems into buildings. For existing buildings, householders can install SWH systems, which fulfill technical and product standards, with the precondition that they do not affect construction quality and safety. The promulgation and implementation of the Renewable Energy Law provides policy measurement for the large-scale application of solar energy on buildings. It will certainly help in the understanding of solar energy use in buildings at all levels in government administrative departments, and build a strong environment for the large-scale promotion of SWH applications. According to this analysis, the SWH market in China will keep on growing rapidly in the future. It is estimated that the annual increase rate will be about 15%. In 2010, the annual production of SWH will be 20 million square meters, and the cumulated installation will rise to 0.15-0.2 billion square meters.