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Strategic outlook of Heat pump development in China

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Abstract

In order to reduce the pollution caused by the burning of coal, China has promoted the use of renewable energy sources. Based on this background, as an energy saving and renewable energy technology, air source heat pumps have achieved rapid growth in recent years. The compound annual growth rate of air source heat pump water heaters is more than 25%. However, air source heat pump industry needs more policy support, like listing air source heat pumps as a renewable energy technology, subsidy for air source heat pump installation in rural area and to set unified energy efficiency standards and labelling for all kinds of boilers. As the most important organization of Chinese heat pump industry, China Heat Pump Alliance will work together with International Copper Association to promote the healthy development of heat pumps.

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At present, China is transforming its economy to a more sustainable development approach, and making significant efforts to cut CO_2 emissions and fossil energy consumption. Heat pumps, as an energy saving and renewable energy technology, have achieved good growth in recent years. But, further market development needs policy support, like listing air source heat pumps as a renewable energy technology, subsidy for air source heat pump installation in rural area and to set unified energy efficiency standards and labelling for all kinds of boilers. The China Heat Pump Alliance and International Copper Association are both actively facilitating industry development.

1. Current market situation

Air to air heat pumps are widely used in China. Annual domestic sales of reversible air to air RAC is around 40 to 50 million units. Around 90% of room air conditioners (RAC) sold in China are reversible with a cooling and heating function. The average heating operation time for each room air conditioner in China is around 300 hours. Compare this to a cooling operation time of around 1000 hours and RAC is mainly a cooling application. VRF (Variable Refrigerant Flow) air to air heat pumps are also growing fast in China. Annual sales increased from 1,034,919 units in 2013 to 1,242,500 units in 2014.

Air to water heat pumps include air to water reversible air conditioning and air source heat pump water

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heaters. Annual domestic sales for air to water air conditioning is around 6 billion RMB, these mostly use screw and scroll compressors and are installed in commercial buildings.

Air source heat pump water heaters (AHPWH) have seen rapid growth in China over the past 5 years. The compound annual growth rate is more than 25%. The domestic sales in China of AHPWH reached 6.3 billion RMB, and 1,211,000 units in 2014. Compared to 2013, the annual growth rate is 26.3% for the domestic market, and 0.9% for the export market. The main growth comes from the domestic market. The air source heat pump market associated with floor heating and radiators for space heating was even smaller at 15,000 units in 2014 where wall-mounted gas boilers dominated with 1,640,000 units.

Table 1. China AHPWH Domestic sales

Year	China AHPWH Domestic sales (billion CNY)		
2013	4.98	Household	843,000 Units
		Commercial	90,000 Units
2014	6.32	Household	1,106,000 Units
		Commercial	105,000 Units
2015	7.15	Household	1,232,000 Units
		Commercial	114,000 Units

**Data source, China Heat Pump Alliance.*

Ground/water source heat pumps, GSHP, in China are mainly used in commercial buildings and have also developed rapidly since 2001 in cold regions with strong support from central and local government. However, the growth rate slowed considerably after 2011, and even began to decrease after 2013. According to the China Refrigeration and Air Conditioning Industry Association (CRAA), water source heat pump sales data in 2013 and 2014 is as below,

Table 2. China water source heat pump sales

Product	2013 Sales (Units)	2014 Sales (Units)	2015 Sales(Units)
Water source heat pump, (water to air)	63,470	55,960	46,570
Water source heat pump, (water to water)	25,892	24,080	19,260

**Data source, China Refrigeration and Air Conditioning Industry Association.*

2. Energy conservation and consumer incentive

2015 is the final year of China's national 12th Five-Year plan outline, in which, energy consumption per unit of GDP is set to fall by 16% (based on 2010 levels) by 2015 and the reduction in carbon intensity of GDP is set to fall by 17%. Over the past four years, the use of energy per unit of GDP has fallen as expected and carbon emissions have also dropped, as shown in Figure 1.

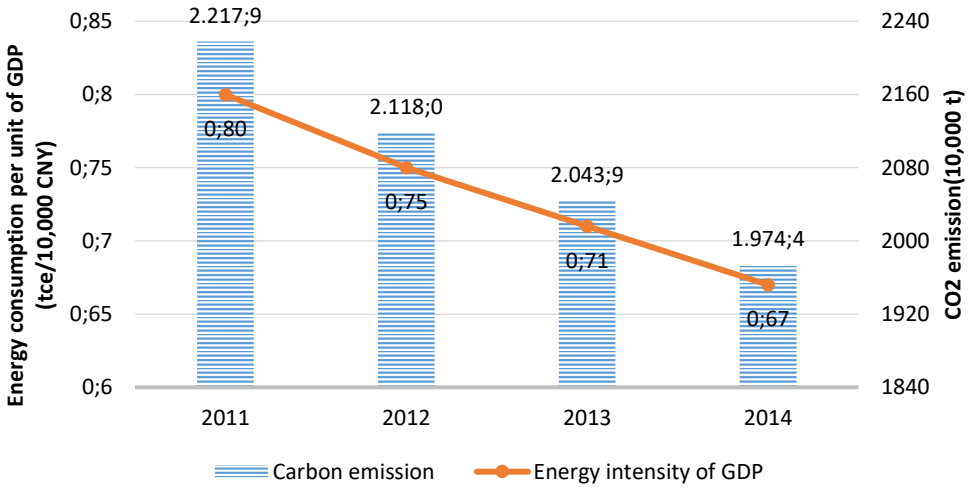


Fig. 1. Energy intensity of GDP and carbon emission in China

**Data source, National Bureau of Statistics of China. GDP used to calculate the energy intensity is based on the 2014 price level. 1 EUR=8.2 CNY, 1 USD=6.2 CNY approximately in 2014.*

The National Development and Reform Commission (NDRC) is generally leading national energy saving and environment protection affairs in China. In order to facilitate energy saving product market growth, NDRC started the "Energy saving production market subsidy scheme" in 2012. AHPWH was included in the scheme from June 1, 2013 to May 31, 2014. AHPWH buyers who were eligible could receive subsidies from 300 to 600 CNY (around 10% of the total retail price) depending on the rated heating capacity and COP.

Table 3. Subsidy to air source heat pump water heaters

	Rated heating capacity（W）	Subsidy (CNY)
3.4≤COP＜4.0	≤4500	300
	>4500	350
COP≥4.0	≤4500	500
	>4500	550

3. Air pollution control

Coal fired boilers for space heating are a key reason for air pollution, especially in the north of China. In the Air Pollution Prevention and Control Action Plan introduced by the State Council in September 2013, heat pump application is recommended as an energy saving and clean energy space heating product to replace coal fired boilers.

The Beijing-Tianjin-Hebei (BTH) region and surrounding areas will continue to intensify efforts to cut coal fired boilers over the next five years. Most of the areas without a district heating supply facility are located in suburbs of cities or rural areas and where it is unlikely that the gas distribution network will reach in the next few years. There will be a big electricity driven heating product market. In 2015, Beijing municipal government gives a subsidy of up to 24,000 to 28,000 RMB per household to families who use clean energy products, like heat pumps, to replace coal fired boilers. The policy is expected to last for 3 to 5 years.

In 2016, the targeted installation is more than 150,000 units in Beijing, comparing with 5,500 units in 2015. There is around 30 times increase. Tianjin, Shandong, and Hebei provinces will follow Beijing in 2017 to support the air source heat pump installation. CHPA estimated the market will increase by more than 200% in 2017.

4. Renewable policy

Since 2009 geo thermal has been defined as renewable energy in Chinese renewable legislation. Being a renewable energy product, a subsidy from central and local government is available for GSHP. For example, in 2009, the GSHP application in rural areas could receive a subsidy of 60 CNY per M2 from central government. In Beijing, GSHP could receive a 50 CNY subsidy per M2 from local government. However, most of these government subsidies were stopped in 2012.

Aerothermal and ASHP so far haven't been incorporated in the renewable energy product list in Chinese national legislation and regulations. However, several provincial governments already recognize it as renewable energy, for example, Zhejiang province, through local legislation, aerothermal has been approved as renewable energy since 2013. In 2015 and 2016, Fujian, Guangxi, Hebei, Shandong and Beijing also published local regulations to accepted ASHP as a renewable energy product. The national level policy is under evaluation.

5. Energy efficiency standards and labelling

In China, the domestic water heater market is around 30 to 40 million units per year. Nevertheless, electrical resistance water heaters still hold the largest market share, around 40% by unit, followed by demand gas and solar thermal water heaters. Despite the rapid market growth of AHPWH over the past five years, it only occupied around a 3% market share by unit in 2014.

One major obstacle is that current energy efficiency labels use different evaluation methods for all four kinds of water heaters. Normal consumers cannot differentiate which one is more energy efficient through these labels. A united evaluation standard for all kinds of water heating equipment is needed on this market and would be beneficial for AHPWH.



Fig. 2. Chinese energy efficiency labels for four kinds of water heaters

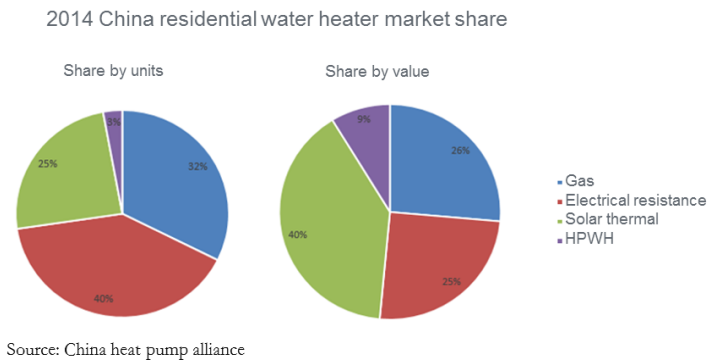


Fig. 3. China residential water heater market share in 2014

6. China Heat Pump Alliance

The China Heat Pump Alliance, CHPA, nowadays is the most important organization for the Chinese heat pump industry. CHPA was initiated by the China Energy Conservation Association (CECA) and the International Copper Association (ICA). The organization aims to facilitate the market growth of heat pumps, especially the air source heat pump water heating equipment, in China.

CHPA spoke for the industry during the central and local government policy and regulation making process, and set up a platform for technology and market information communication. CHPA has already entered into cooperation agreements with international partners, like Heat Pump and Thermal Storage Technology Center of Japan (HPTCJ), European Heat Pump Association (EHPA), and IEA HPC.

7. Conclusion

Although the Chinese economy growth rate is slowing down, and the building and construction sector is entering a difficult phase, the environment protection and energy conservation industry is expected to grow fast in the coming years, with strong policy and financial support from the government.

The question for the heat pump industry is how to make “heat pumps” a priority choice for policy makers to achieve energy saving and air pollution control targets, and how to make more consumers accept a “heat pump” as a main heat source for domestic hot water and space heating.

We expect the Chinese heat pump industry, especially air source heat pumps, to grow rapidly over the next 5 to 10 years. The growth rate will be more than double that of the GDP growth rate.