Member Country Report - China

Yang Lingyan & Xu Wei, China Academy of Building Research

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- Overview
- Policy
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Overview

- Land Area: about 9.6 million km²
- Sea Area: about 4.73 million km²
- Population: 1.4 billion
  urban 0.92 billion (65.2%), rural 0.49 billion (34.8%)
- Households: 0.49 billion
  1-17%, 2-24%, 3-21%, 4-19%, 5-10%, ≥6-10%
- Population density (p/km²)

Source: China National Bureau of Statistics
Overview

Energy consumption curve of China

Source: China National Bureau of Statistics

Percentage of energy consumption types

Source: China National Bureau of Statistics

Percentage of power source

Source: China Electricity Council
Overview

Demand for energy transformation

With the urgency of energy structure transformation and climate change, heat pump technology, as an efficient and environmentally friendly heating method, has received widespread attention.

Market potential

As one of the world’s largest energy consumers, China has great potential for the development of the heat pump market. Promoting heat pump technology is of great significance for reducing energy consumption and environmental pollution.

Policy support

The Chinese government has issued a series of policies to encourage the development of new energy and energy-saving environmental protection industries in recent years, providing strong support for the promotion and application of heat pump technology.
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National Level Policies

National Energy Efficiency Targets

Energy conservation law, Renewable energy——Promote the development and utilization of renewable energy, increase energy supply and improve energy structure.

Climate and Energy Strategy

Air pollution prevention action plan——Government provides subsidies and other financial support to allocate the option of heat pumps, 88 cities, more than 100 billion.

Carbon Reduction

Carbon peak action plan before 2030——Promote clean and low-carbon heating such as heat pump.
Regional Level Policies

Regional energy plans
Heat pumps are often included in regional energy plans as a strategy to reduce fossil fuel consumption and greenhouse gas emissions.

Funding programs
Regional governments may provide funding programs to support the installation of heat pumps in homes and businesses.

Collaboration and partnerships
Regional governments collaborate with manufacturers, utilities, and other stakeholders to promote the use of heat pumps.
Local Level Policies

**Beijing**

Give financial subsidies to ground source heat pumps and thermal storage systems

The proportion of renewable energy capacity in the new heat source is not less than 60%.

**Shanghai**

Prohibit the use of fossil energy heating systems in low-energy buildings

Encourage the application of renewable energy and heat pump technology
Codes and Standards

The capacity of A/W for household unit is lower than 35kW, for industrial & unit is larger than 35kW.

- In severe cold and cold area, the COP at the local design temperature should not be lower than the values.

- 35℃ -floor radiant system
- 41℃ -fan coil
- 55℃-radiator

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**Codes and Standards**

- **Annual Coefficient Of Performance** is used to indicate the comprehensive performance of water-source heat pump units. ACOP=0.56EER+0.44COP

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**Energy Efficiency Rating Table for Ground Source Heat Pump System**

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<th>性能</th>
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<td>供冷能效比</td>
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</tbody>
</table>
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Source: Yearbook of Heat Pump Heating Industry Development in China(2022)
Application markets of air source heat pump

Application division of different air source heat pumps

Source: Yearbook of Heat Pump Heating Industry Development in China(2022)
- Affected by high investment, the number of projects has decreased, and the application in residential buildings has declined.

- Guided by the goal of carbon neutrality, the application of large-scale projects is a good choice for areas with both winter heating and summer cooling.

Source: Yearbook of Heat Pump Heating Industry Development in China (2022)
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Research & Application

**High temperature heat pump**
- Increase the heating temperature of the heat pump unit
- Improve the heating capacity of the heat pump unit
- Heat pump steam supply

**Air source heat pump**
- Low GWP refrigerant
- Low temperature performance improvement
- Improvement of low-temperature heating stability

**High efficiency heat pump system**
- Developing a new medium-deep geothermal heat pump system
- Multi-energy hybrid heat pump high-efficiency system

www.heatpumpingtechnologies.org
Low temperature ASHP

Variable-frequency unit can operate at -40°C, and the heating capacity does not attenuate within the range of -12 to -20°C

Fixed-frequency unit can operate stably at -35°C to meet heating demand

CO₂ as refrigerant, the maximum water temperature of the unit can reach 90°C
- Identify the characteristics of building load and energy consumption habits, consider the stabilizing effect of building thermal inertia on room temperature fluctuations, and actively control heat pump heating from the perspective of supply and demand matching.
- Optimal parameters (frequency, valve position, temperature control range) under target load.
- Optimizing the regulation of multiple units can improve the heat supply regulation, enhance system efficiency, and reduce energy consumption.
High temperature heat pump

120°C Industrial high-capacity high-temperature centrifugal heat pump

80°C high-capacity centrifugal heat pump

Condensation temperature 120°C+
Temperature increase of 65°C+
Refrigerant R1233zdE GWP<1
COP: 4.36/6.14
Capacity: 9MW
The Lingshan project of Ansteel adopts a 9MW heat pump to replace coal-fired boilers to meet the heating needs of 180,000 square meters of residents. 

The COP of HTHP reaches 6.67. 

The heat pump system saves RMB 2.5 million yuan per year compared to municipal heating, reducing carbon emissions by 9450 t/a 

The use of high-temperature heat pumps to recover 30-40°C wastewater during steelmaking has significant energy-saving and environmental benefits.
Heat pump steam supply

We have designed 5000kg/h steam compressor.
High efficiency heat pump system

Different forms of medium-deep heat exchangers

- **Casing pipe** - Low construction costs than U type, low cycle resistance
- **U type pipe** - High heat transfer efficiency, allowing for more heat extraction
The medium-deep geothermal heat pump has high heat transfer efficiency and large heat supply energy density. It is one of the alternative ways to traditional heat supply in severe cold and cold regions. The demonstration project in Qingdao city can reach 6.2, and the system energy efficiency is 4.5
High efficiency heat pump system

- Heat pump + solar energy + electric boiler + water heat storage
- Heating/cooling
- Optimal investment, cost-effective, tailored to local conditions
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Summary

(1) The application of heat pump technology represents the future direction of advanced heating development, is the only way for the re-electrification of building heating and cooling, is an important means for building a new energy system, and is also a key path for building a zero-carbon transformation.

(2) China's carbon neutrality goal has promoted the iteration and advancement of heat pump technology, and the heat pump industry will develop rapidly under the global energy structure and China's energy policy.

(3) Technologies such as hybrid heat pumps and new heat pump systems are important trends in the future development of heat pumps, and the growth of China's heat pump market will accelerate.
Thanks for your attention

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