Member Country Report 2022-China

Yang Lingyan & Xu Wei, China Academy of Building Research




Agenda

- Overview
- Market
- Policy
- Research & Application
- Summary

Overview

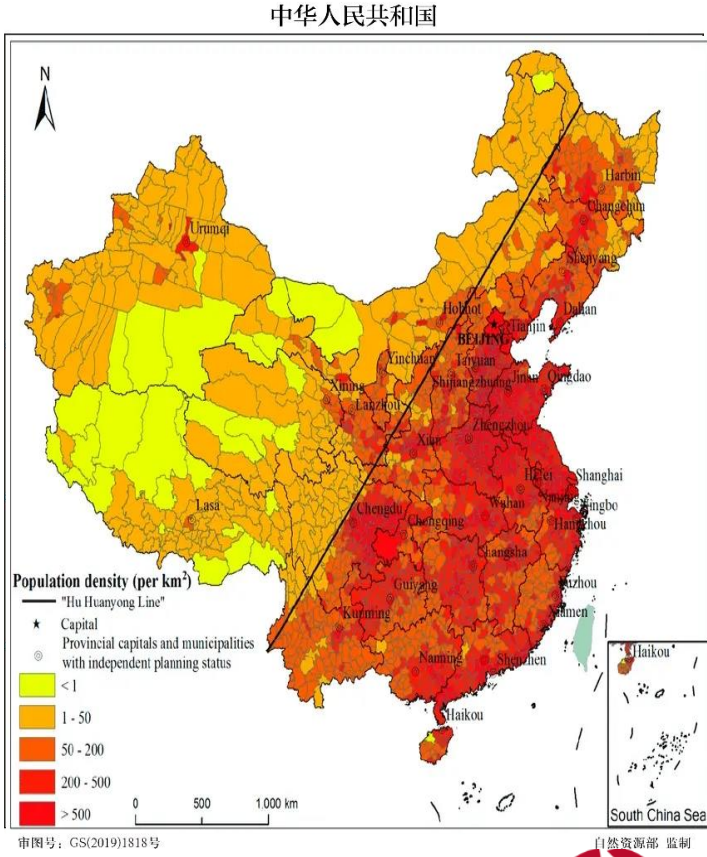
- Land Area: about 9.6 million k㎡
- Sea Area: about4.73 million k㎡
- Population: 1.4 billion

urban 0.9billion(63.89%),rural 0.5billion(36.11%)

- Households： 0.49 billion

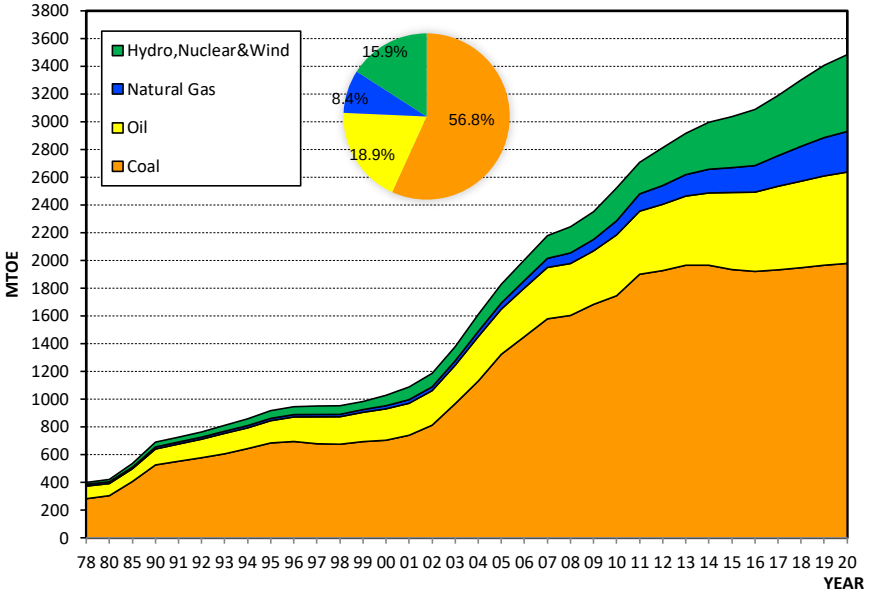
1-25%,2-30%,3-21%,4-13%,5-6%,≥6-5%

- Population density(p/k㎡)



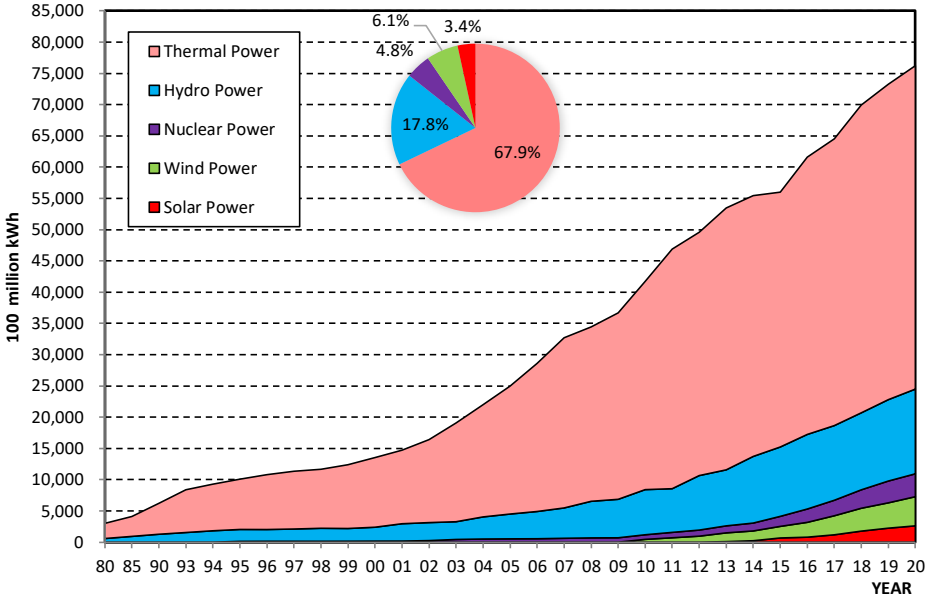
Source：China National Bureau of Statistics

Overview



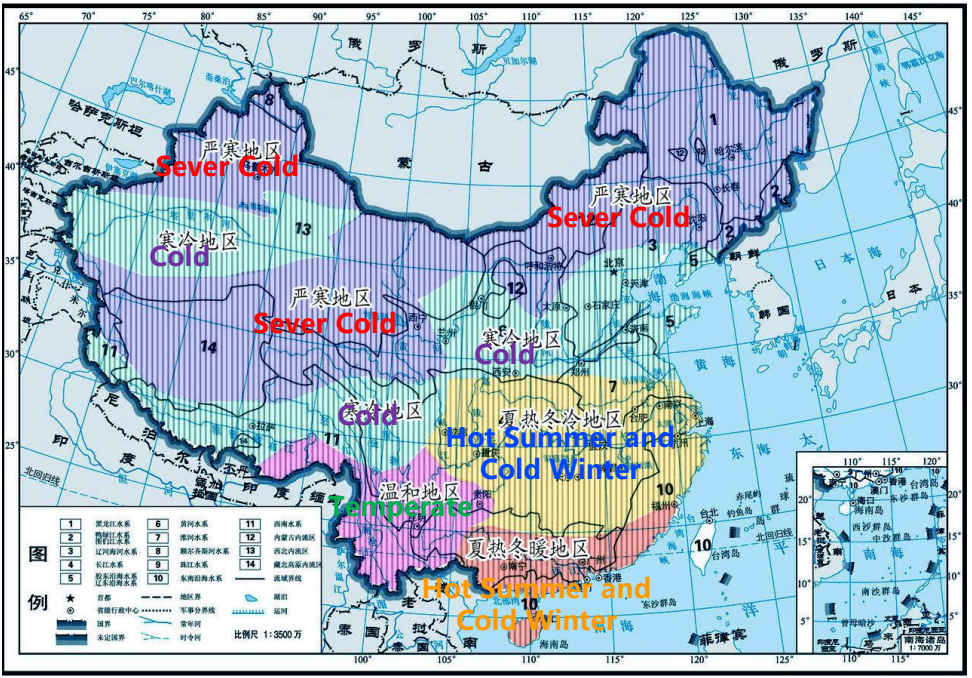
Energy consumption curve of China

Source：China National Bureau of Statistics



Power source curve of China

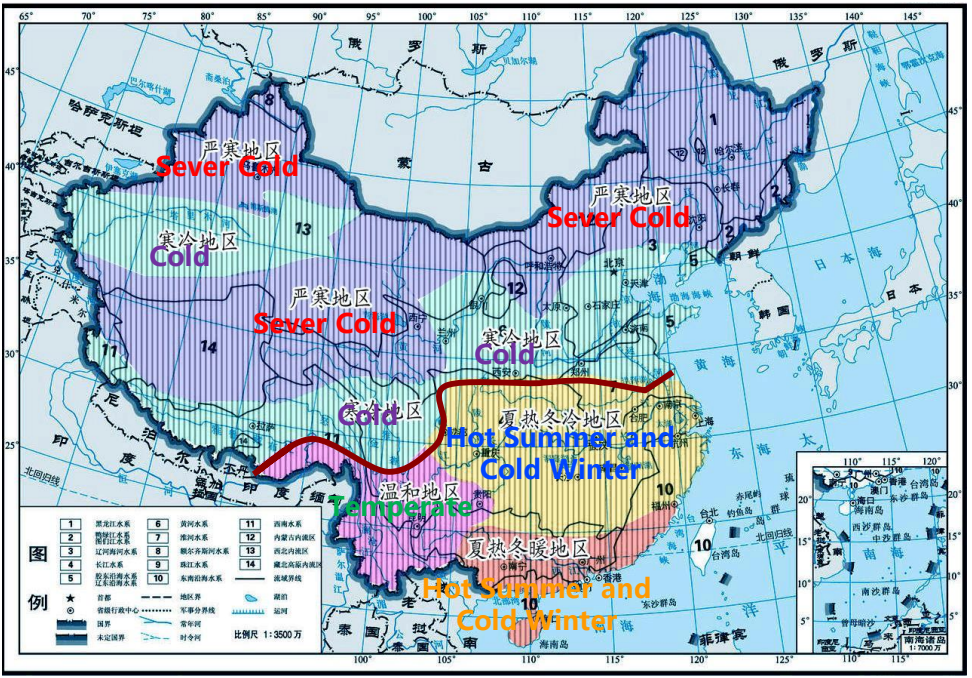
Source：China Electricity Council



Climatic Zones for Buildings Design

Climate Zone	Decided indexs	Supporting indexes	Design principles
Sever Cold Zone	$t_{min.m} \leq -10℃$	$145 \leq d_{\leq 5}$	heating is nesessary, cooling is optional and unnecessary.
Cold Zone	$-10℃ < t_{min.m} \leq 0℃$	$90 \leq d_{\leq 5} < 145$	heating is nesessary, cooling is second demand.
Hot Summer and Cold Winter Zone	$0℃ < t_{min.m} \leq 10℃$, $25℃ < t_{max.m} \leq 30℃$	$0 \leq d_{\leq 5} < 90$, $40 \leq d_{\geq 25} < 110$	Cooling is nesessary, heating is second demand.
Hot Summer and Warm Winter Zone	$10℃ < t_{min.m}$, $25℃ < t_{max.m} \leq 29℃$	$100 \leq d_{\geq 25} < 200$	Cooling is nesessary, heating is optional and unnecessary.
Temperate Zone	$0℃ < t_{min.m} \leq 13℃$, $18℃ < t_{max.m} \leq 25℃$	$0 \leq d_{\leq 5} < 90$	Cooling is unnesessary, heating is needed in part of zone.

$t_{min.m}$: Average temperature of the coldest month.
$t_{max.m}$:Average temperature of the hottest month.
$d_{\leq 5}$:days when the daily average temperature is less than or equal to 5 ℃.
$d_{\geq 25}$: days when the daily average temperature is greater than or equal to 25 ℃.



- Urban buildings in severe cold and cold zones have central heating systems. In rural areas, decentralized household boilers are used for heating, and the fuels include coal, gas, fuel oil, crop straw, etc. They are the areas where the national strategy of clean heating is implemented.
- Decentralized heating is used in hot summer and cold winter zone, Gas boilers and various heat pump systems are used in public buildings. In the residence, household gas boiler, air source heat pump, household air conditioner, electric heater, etc. are used.
- In hot summer and warm winter zone, there is less demand for building heating, and air conditioners are usually used to meet the short-term heating demand in winter.
- The heating market in temperate zone is very small, and various heating forms are used.

CHP

CHP is the main way of central heating in China, which can increase the thermal efficiency to more than 80%. Compared with other clean heating methods, CHP is an effective way to economically and rationally use energy and save energy.

COAL-BOILER

Large ultra low emission coal-fired boiler central heating is still one of the main heat sources of central heating in northern China. After the ultra-low emission transformation, the combustion efficiency is improved, the pollutant emission concentration is significantly reduced, and the air pollution is effectively improved.

GAS-BOILER

Since no particulate pollutants are produced during natural gas combustion, it is helpful to solve the serious environmental problems in China and has been applied in the heating industry. The main application modes include natural gas cogeneration, boiler room heating, wall mounted furnace heating, etc.

INDUSTRIAL WASTE HEAT

Medium and low-grade waste heat has not been effectively utilized. At present, some industrial waste heat has been used for urban heating. In the future, waste heat recovery can effectively save energy and reduce emissions, and achieve the organic unity of environmental, social and economic benefits

ELECTRIC HEAT PUMP

Electric heating is clean and efficient. Electric heating is divided into direct electric heating and heat pump heating. Due to energy saving and high efficiency, all kinds of heat pumps have been widely used in heating, and have achieved good energy-saving and carbon reduction effects.

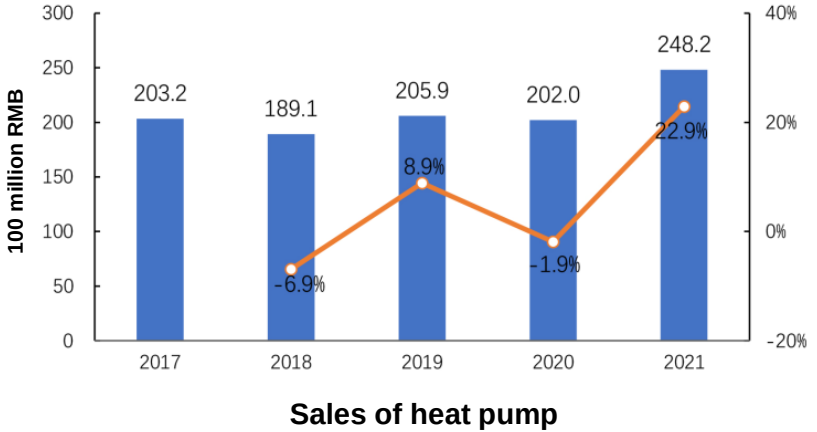
50%

40%

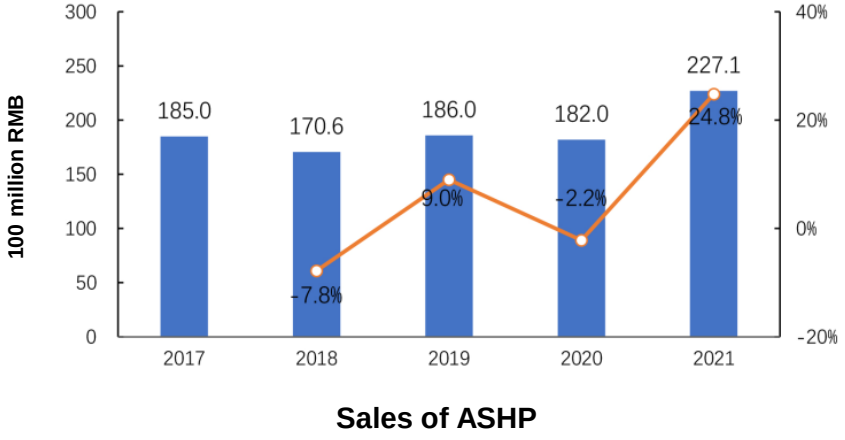
10%

Agenda

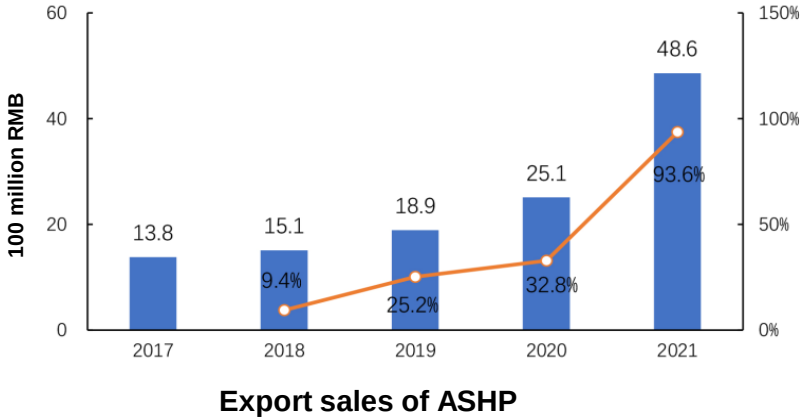
- Overview
- Market
- Policy
- Research & Application
- Summary



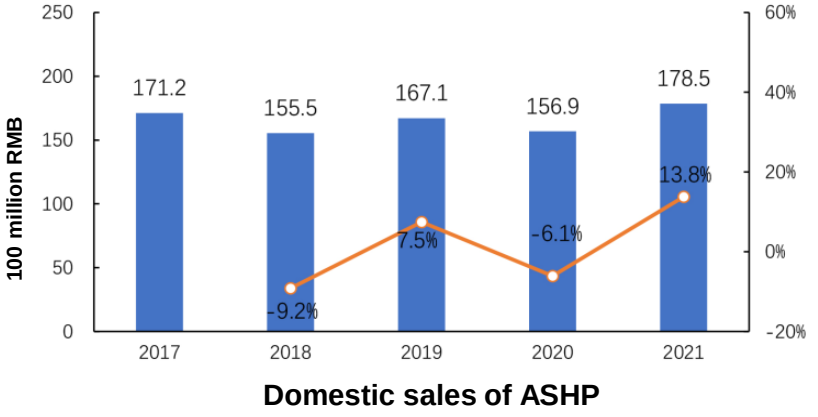
Sales of heat pump



Sales of ASHP

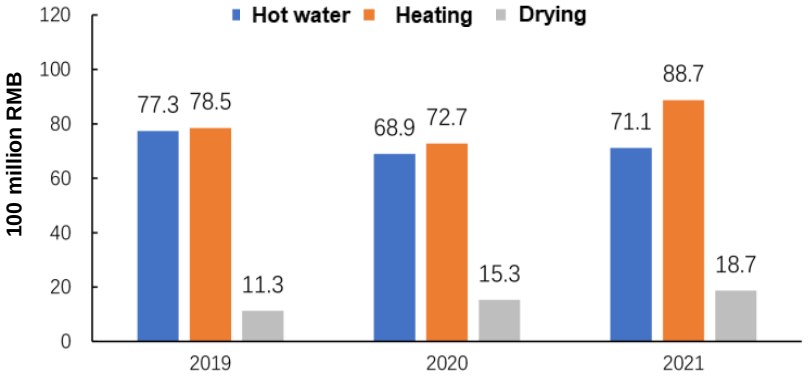


Export sales of ASHP

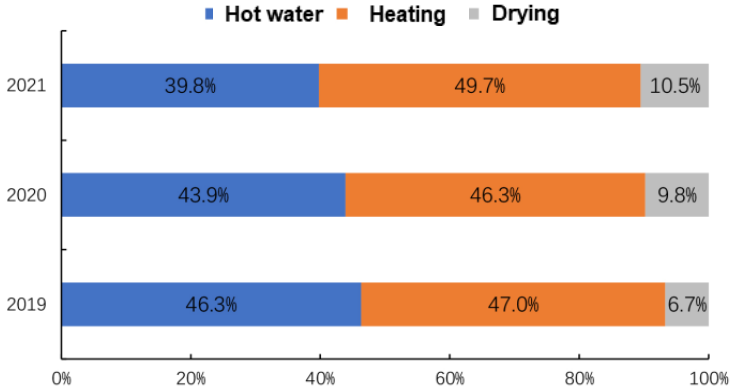


Domestic sales of ASHP

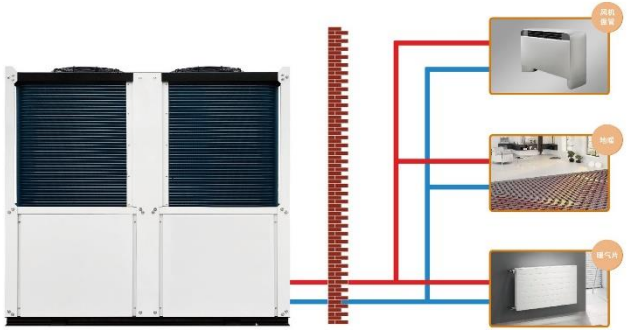
Source：Yearbook of Heat Pump Heating Industry Development in China(2021)



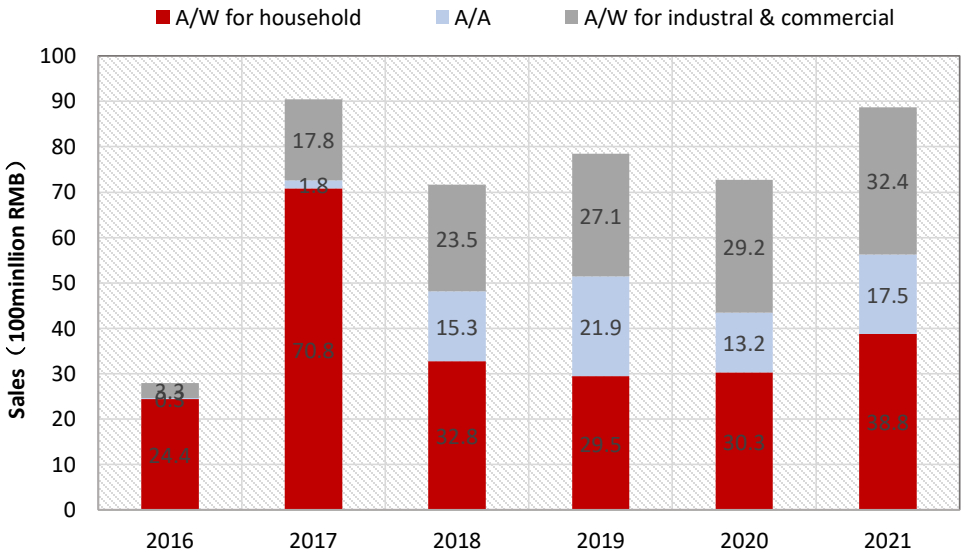
Application markets of air source heat pump



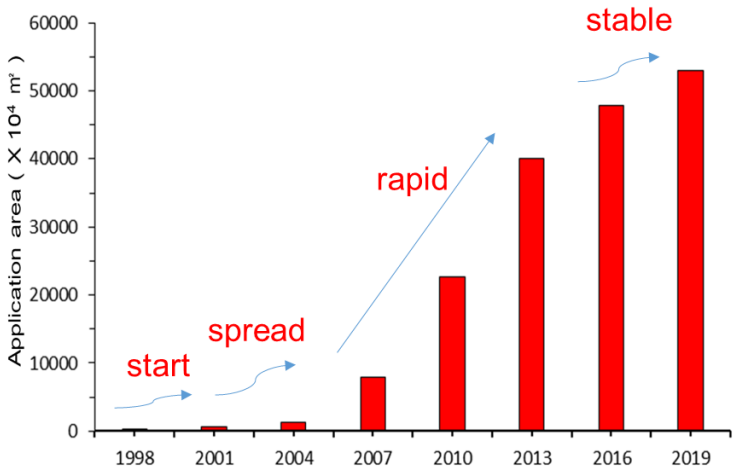
Application division of different air source heat pumps



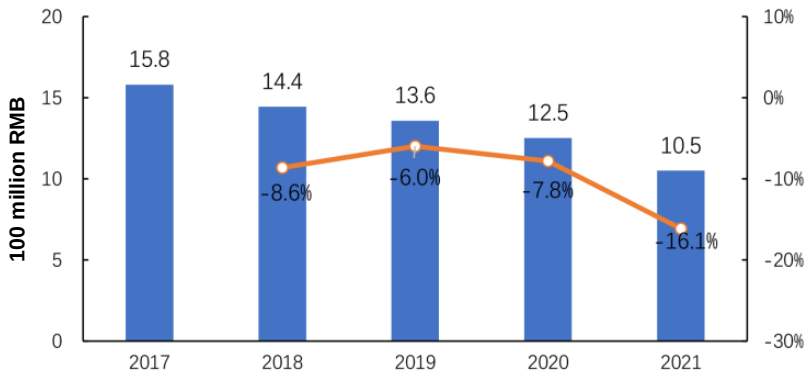
Source：Yearbook of Heat Pump Heating Industry Development in China(2021)



- A/W for household-Air to Water heat pump is used in residential buildings, the capacity of unit is lower than 35kW.
- A/A-Air source heat pump air heater is different with Air conditioner because the environment temperature is different. It mainly used in rural areas in North China, the main function of it is to provide heat for rooms in winter. Although it has the function of cooling in summer, it is rarely used.
- A/W for industrial & commercial-Air to Water heat pump is used in industrial & commercial buildings, the capacity of unit is larger than 35kW.



Application of GSHP

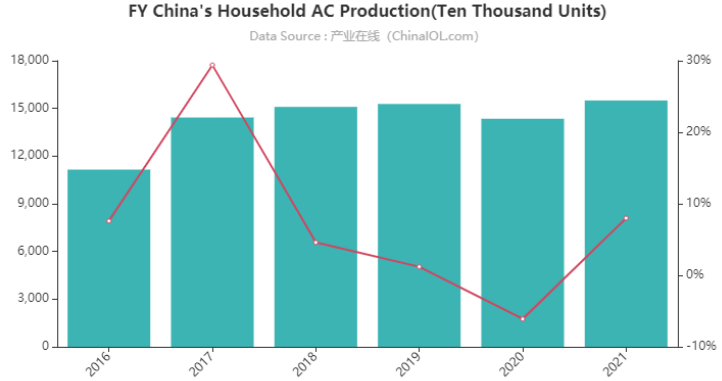


Sales of GSHP

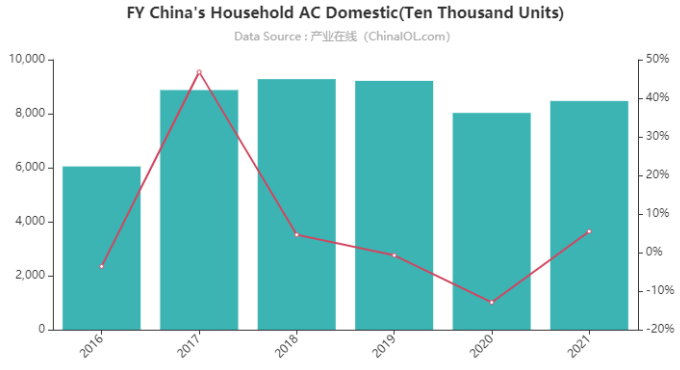
- Ground water source heat pump is greatly reduced
- Transformation of construction market
- Technical risk and economy affect user selection

- Various types of buildings
- Various system types
- Middle-deep geothermal heat pump
- Products development

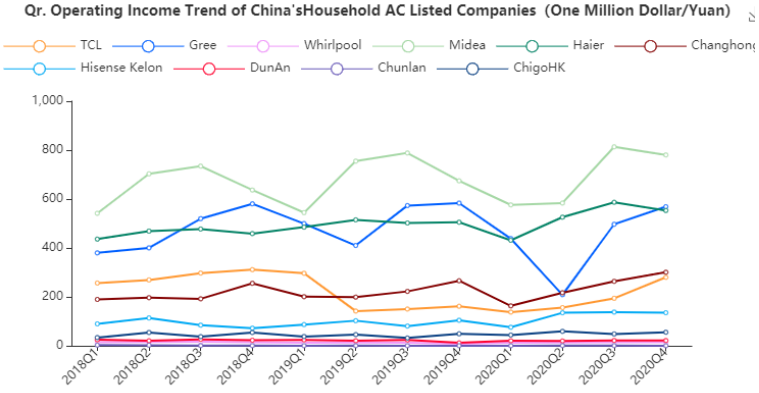
Source：Yearbook of Heat Pump Heating Industry Development in China(2021)



Sales of AC



Domestic sales of AC



Export sales of AC

Source：http://data.chinaiol.com/ecdata/index

Agenda

- Overview
- Market
- Policy
- Research & Application
- Summary

National policies

Ministerial policies

Provincial policies

- **Enact laws to promote the application of renewable energy**
- **Focus on renewable energy in the national social development strategy and policy**
- **Directly support for heat pump applications**

Laws

- Energy conservation law of the people's Republic of China
- Renewable energy law of the people's Republic of China

Promote the development and utilization of renewable energy, increase energy supply and improve energy structure.

National social development strategy

- Medium and long term plan for the construction of major national science and technology infrastructure (2012-2030)

Promote the renewable energy to meet the energy demand of buildings, and promote the large-scale and efficient utilization of renewable energy

Direct support policies

- Air pollution prevention action plan
- Carbon peak action plan before 2030

Promote clean and low-carbon heating such as heat pump

National policies

Ministerial policies

Provincial policies

The ministerial policy is to further subdivide the policy by industry and field to promote the application of heat pump.

- National Development and Reform Commission
- Ministry of Finance
- Ministry of Housing and Urban-Rural Development
- Ministry of Natural Resources
- Ministry of Ecological and Environment
- National Energy Administration

- NDRC—14th five year plan for renewable energy development
  —National cleaner production implementation plan in the 14th five year plan
- MF—Financial support for the pilot project of clean heating in winter in northern China
- MHURD—Guiding opinions on promoting urban clean heating in northern heating areas
- MNR—Notice on promoting the development and utilization of shallow geothermal energy
- MEE—Comprehensive treatment plan for air pollution in autumn and winter from 2021 to 2022
- NEA—Guidance on promoting the development and utilization of geothermal energy

National policies

Ministerial policies

Provincial policies

Provincial and municipal policies respond to national policies, formulate more specific policy measures or incentive mechanisms in combination with local actual conditions, and promote the application of HP technology forms according to local conditions.

North China: Beijing, Tianjin, Hebei, Shandong

East China: Shanghai, Zhejiang, Jiangsu

Central China: Henan, Hubei

Northwest China: Shaanxi

Southwest China: Chongqing

Northeast China: Liaoning, Jilin, Heilongjiang

Summary of policies of heat pump heating

(1) National policies have laid the legal foundation for the utilization of renewable energy. The support of heat pump will continue to be strengthened in the future.

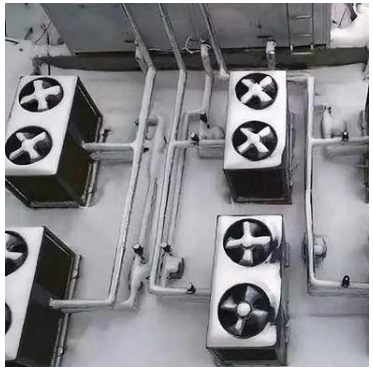
(2) China's ministries and commissions related to heat pump have issued support policies to comprehensively promote the development of heat pump application.

(3) Provincial and municipal heat pump promotion policies are mainly reflected in green building and energy policies, especially in the clean heating policy system.

Agenda

- Overview
- Market
- Policy
- Research & Application
- Summary

Research & Application



Low temperature ASHP

GSHP

Industry heat pump

Low temperature ASHP

2016年

- $COP_{-12℃} \geq 2.1$
- IPLV ≥ 2.4

Temperature≥-25℃

2017年

- $COP_{-20℃} \geq 1.6$

2018年

- $COP_{-12℃} \geq 2.2$
- $COP_{-20℃} \geq 1.8$
- IPLV ≥ 2.6

Temperature≥-30℃

Engage the AHHP application

2019年

- Encourage the variable frequency and split air source heat pumps application

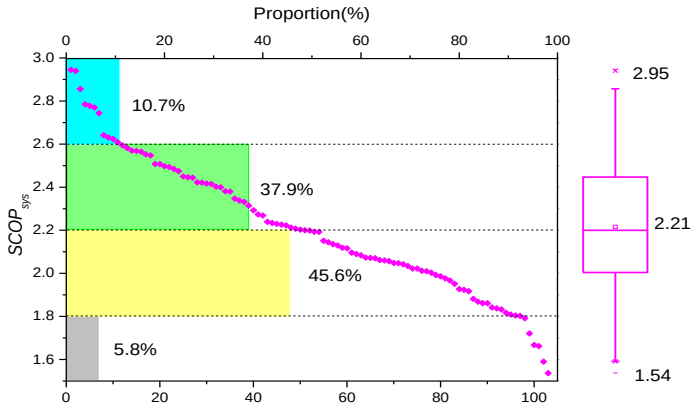
2021年

- $COP_{-25℃} \geq 1.4$ （Tw50℃）
- $COP_{-30℃} \geq 1.4$ （Tw41℃）
- IPLV ≥ 3.2

GB 37480-2019

GB/T 25127.1/2-2020

Mornitoring on the low temperature ASHP application



The average value of SCOPsys is 2.21. The actual operation performance of 103 project systems shows a large gap, with SCOPsys distributed between 1.54 and 2.95.

ITEM	INFORMATION	DATA
Construction	2017	103
Test time	2018-2019 Winter	—
Heating capacity of unit(W)	8000~10000	41
	10000~140000	62
Capacity regulation mode	Constant frequency	54
	Variable frequency	49
Heating areas(m^2)	67~216	—
User' application	Radiant floor	42
	Radiator	61

Large scale GSHP

Beijing Daxing International Airport

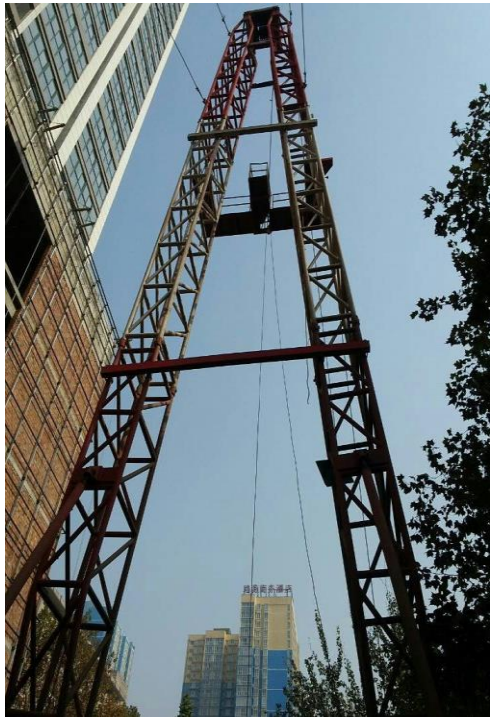
Jinan Olympic Sports Center

Beijing administrative sub-center

Jining Cultural Center

The ground source heat pump system has a competitive advantage in large public buildings with sufficient burial areas in cold regions and hot summer and cold winter regions with both cold and hot demand. Taking the Jining Cultural Center Project as an example, the system's cooling energy efficiency was 4.4, and the heating energy efficiency was 3.6.

Medium-deep geothermal HP



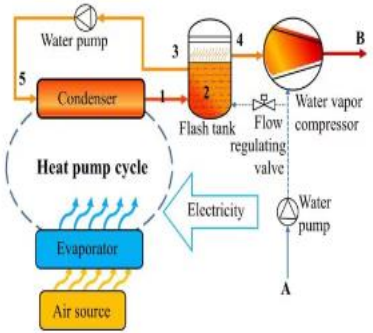
The medium-deep geothermal heat pump has high heat transfer efficiency and large heat supply energy density. It is one of the alternative ways to traditional heat supply in severe cold and cold regions. At present, its application area in China has exceeded 13 million square meters. The average measured unit energy efficiency of the demonstration project can reach 6.0, and the system energy efficiency is between 3.3-3.8.

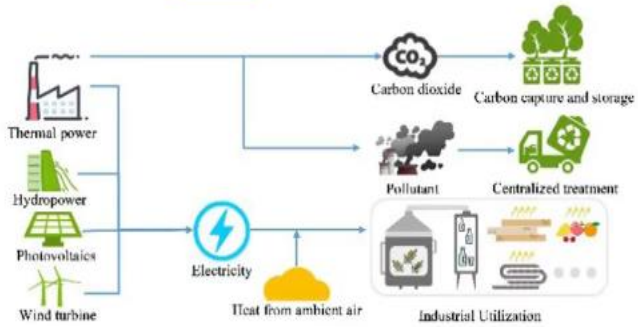
Medium-deep geothermal heat pump system in residential building in Shaanxi Province

ANNEX 58

START DATE: 1 January 2021
END DATE: 31 December 2023

Industry heat pump





Air source heat pump boiler

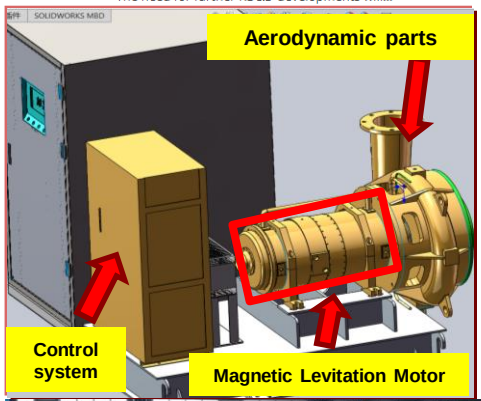
Grain brewing technology
Capacity,0.3t/h，Pressure,0.2MPa
Temperature,120℃，COPsys=1.8

Hongzhi Yan, Bin Hu, and Ruzhu Wang.*Air-Source Heat Pump for Distributed Steam Generation: A New and Sustainable Solution to Replace Coal-Fired Boilers in China, *Adv. Sustainable Syst.* 2020, 2000118

www.heatpumping

High-Temperature Heat Pumps

This Annex gives an overview of available technologies and close-to-market technologies regarding high-temperature heat pumps. The need for further RD&D developments will...



We have designed 5000kg/h steam compressor.

ANNEX
59

START DATE:
1 January 2022
END DATE:
31 December 2024

Industry heat pump

Heat Pumps for Drying

integration

Agenda

- Overview
- Market
- Policy
- Research & Application
- Summary

Summary

(1) Heat pump heating will play a more important role in achieving China's carbon emission reduction and carbon neutralization goals.

(2) Heat pumps have been widely used in the field of medium and low temperature heating such as heating and hot water supplying in buildings. Successful application cases show that they have good energy saving benefits. The focus of future work is to further improve energy efficiency and expand the number of applications

(3) The application of industrial heat pumps is becoming the focus of energy conservation and carbon reduction. Research and development work in the fields of ultra-high temperature heat pumps, high-capacity high temperature heat pumps still need to be carried out to promote the construction of new energy systems on the basis of future electrification

Thanks for your attention

Yang Lingyan & Xu Wei, China Academy of Building Research