

Global Heat Pump Market Report 2024



China Heat Pump Alliance (CHPA)



China Industry On Line (ChinaIOL)



Compiling Units

China Heat Pump Alliance (CHPA) Beijing Zhixindao Sci-Tech Corp., ltd(ChinalOL)



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Preface

As a low-carbon option in the supply of thermal energy, heat pumps are undergoing a record pace of development. They are a key technology in the global response to climate change and energy restructuring. Many countries and regions have implemented sweeping new policies that favor the adoption of heat pumps, accelerate technical upgrading, expand application areas, and diversify the varieties of heat pump systems. Further progress toward net zero carbon can only multiply business opportunities and expand prospects for broad development the global heat pump industry.

The China Heat Pump Alliance (CHPA) proudly joins with Beijing Zhixindao Sci-Tech Corp., Ltd. (ChinaIOL) in the release of a major new report titled "The Global Heat Pump Market Report 2024" (herein the "Report").

The Report draws on multiple research projects by both CHPA and ChinalOL. It embodies the market research data and technical results accumulated over many years by the two parties. It systematically describes the current state of the global heat pump industry, elaborates on trends and predicts future developments. The Report not only sets forth a global policy profile and technical standards but also analyzes local heat pump markets in Asia, Europe, North America and other regions, focusing on the development of the Chinese market.

The Report is divided into five parts: (1) the global industry, (2) regional markets, (3) the Chinese market, (4) global forecast, and (5) brand showcasing. Its content is further subdivided into space heating, sanitary hot water, industrial and agricultural drying, upstream components, and industry forecasts. The Report reasonably predicts the scale of global demand for heat pumps, while focusing on specific markets and applications.

Global market research in the Report includes air-source heat pumps for water heaters and heating but excluding heat pump drying products and swimming pool heat pumps. Chinese market research includes household air-to-water heat pumps, VRF with hydronic heating modules, low-temperature air-to-air heat pumps, commercial air-to-water heat pumps, heat pumps and wall-hung gas boiler 2-in-1 systems, (water) ground source heat pumps, and absorption heat pumps.

Enjoy reading this Report!



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Chapter I Global Industry

1.1 Policy Profile

Under the background of a green-oriented transition, the international community is gradually raising the development of the heat pump industry to a strategic height. Heat pump meets the demand for electrified development of terminal energy consumption and is an optimal technical path for achieving net zero emission in heat applications.

1.1.1 Support Policies of European Countries

In the policies of the European Commission on green-oriented transition and industrial development, the heat pump stands side by side with photovoltaic, wind electricity, and electric vehicles as a main technical path. In May 2022, the EU launched the Joint European Action for More Affordable, Secure and Sustainable Energy (REPowerEU) program, which calls for an investment of 56 billion Euros in the "energy efficiency upgrading and heat pump" project. The goal is to double the sales of heat pumps in the forthcoming five years and increase the installation by 10 million units to 30 million by 2030. In February 2023, the EU released its Green Deal Industrial Plan. At the same time, it began to make the related Net Zero Industry Act, which clearly articulates the need to foster and develop native the key manufacturing industries of heat pumps, photovoltaic, and wind power, including the need for the capacity of heat pumps to meet more than 60% of EU demand. On May 27, 2024, the EU officially adopted the Net Zero Industrial Act, which was made public in the official bulletin of the EU at the end of June to take effect on the day immediately after that.

Fig. 1-1 Joint European Action for More Affordable, Secure, and Sustainable Energy (REPowerEU)



EUROPEAN COMMISSION

Brussels, 18.5.2022 COM(2022) 230 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

REPowerEU Plan

In recent years, some EU countries have continuously provided heat pump installation subsidies. In 2021, Germany introduced its Plan of Federal Subsidies for Building Energy Efficiency (BEG). In principle, the plan provides financial support in two forms: direct subsidies or loan repayment subsidies. Under the plan, heat pumps can receive direct subsidies for about 35% -45% of their installation cost. If heat pumps are used to replace oil-burning boilers, users can receive 45% subsidies. On November 18, 2020, the British government published "The Ten Point Plan for a Green Industrial Revolution" to reach the goal of "net zero emission" of greenhouse gases before 2050. Specifically, to make residences, schools, and hospitals greener and cleaner, the UK stated it would install 600,000 heat pumps each year starting in 2028. In November 2021, the British government released its 2050 Net Zero Strategy, believing that the massive use of heat pumps is the optimal path toward decarbonizing the heating supply to buildings. In May 2023, France promulgated its Green Industry Act, the core target of which is to accelerate the creation of new industries in the key fields of heat pumps and wind power through the incentive measures provided for related projects in taxation and loans. In November 2023, Ireland further expanded its Support Scheme for Renewable Heat, which increases the maximum support for heat pump installation from 30% to 40% of the cost and supports the more extensive application of the heat pumps using waste or residual heat, high-temperature heat pumps and general heat pumps in buildings and regional heating plans.

1.1.2 Support Policies of US

In the period from 2021 to 2023, the United States introduced a number of policies that support heat pumps. In November 2021, the US Department of State issued the Long-Term Strategy of the United States: Pathways to Net-Zero Greenhouse Gas Emissions by 2050, which points out that the efficient electrification of buildings is the most critical method of decarbonization in the field of construction; heat pumps and electric heaters need to reach 60% of the sales ratio by 2030 and rise to about 100% by 2050. In August 2022, the US Inflation Reduction Act provided maximum subsidy cashback of about 8,000 dollars and a substantial increase of 2,000 dollars in a tax deduction for ordinary consumers who purchase heat pumps. On April 11, 2023, the US government held a roundtable conference on heat pump manufacturing and deployment in the White House for the first time. At the conference, heat pump manufacturers and distributors, labor leaders, senior executives, and government officials discussed how to expand the American heat pump manufacturing industry and set up a team of technical workers to satisfy the rising demand for heat pumps throughout the country. In June 2023, the United

* *

States injected 20.4 million dollars under its Technologies for Industrial Emissions Reduction Development Program (TIEReD) to support seven trans-department decarbonization projects and develop innovative technologies that can achieve energy-saving and emission reduction in multiple industrial fields, including the technologies for industrial heat pumps and low-temperature waste heat power generation.

1.1.3 Support Policies of Japan

The Japanese government deems the heat pump system as one of the critical technologies for honoring its commitment to net zero emissions by 2050. It has set quantitative targets for industrial, commercial, and residential heat pumps and household heat pump water heaters based on the long-term strategy under the Paris Agreement, the Plan for Global Warming Countermeasures, and the 6th Strategic Energy Plan. Japan also came up with the "Top Runner Program" to enhance the efficiency of heat pumps, which provides subsidies for industrial heat pumps and commercial heat pump water heaters and incentive measures for improvement of the application efficiency of heat pumps and the application of heat pumps in buildings of zero energy consumption.



Fig. 1-2 Standard under Japanese "Top Runner Program"

1.1.4 Support Policies of China

In recent years, with the further progress of China's green-oriented development, heat pump technology will undoubtedly be popularized strongly in all fields as a key technical path. Under China's vigorous promotion of green-oriented and high-quality development and accelerated cultivation of new-quality productive forces, heat pump technology has received unprecedented attention due to its lower carbon, higher energy conservation, greater efficiency, and better safety. Heat pumps have played a vital role in preventing and treating atmospheric pollution, saving energy resources, clean production and heating, and utilizing renewable energy. At the policy level, it has been repeatedly mentioned that the nation needs to encourage the development and use of heat pump technology in fields that include saving energy resources in public institutions, building drying capability in grain production areas, suppling home appliances to rural areas, updating of clean heating equipment, green microgrids, prevention and treatment of atmospheric pollution, clean production, green buildings, optimization of energy consumption structure and establishment of a standard system. For example, the State Council issued the Notice on Distributing the Plan for Peak CO₂ Emission Action before 2030 (Guo Fa [2021] No. 23), which indicates that the nation will actively promote clean heating in cold regions, advance centralized heating for heat-power cogeneration, speed up the large-scale application of industrial residual heat for heating, reliably carry out the demonstration of nuclear heating, popularize heat pumps and clean and low-carbon heating via biomass energy, geothermal energy and solar energy. The Ministry of Industry and Information, the National Development and Reform Commission, and the Ministry of Ecology and Environment issued the Notice on the Implementation Plan for Peak CO₂ Emission in Industrial Field (MIIT Lian Jie [2022] No. 88), which points out the need to electrify industrial energy, give overall consideration to the power supply and demand situation, broaden the field of electric energy replacement, spread the technologies of electric boilers, electric kilns and electric heating in the key industries of casting, glass, and ceramics, carry out electric energy replacement of high-temperature heat pumps and boilers of high-capacity thermal energy storage, expand the share of using electrified terminal energy using equipment, with focus on the electrified transformation of medium-low temperature heat sources of <1000°C during industrial production.

1.2 Technical Standards

At present, the leading countries are continuously tightening their requirements for the energy efficiency of heat pump products by raising the bar for the energy efficiency of heating supply technology and the field of architecture and clearly

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fixing the time for withdrawal of the heating technology of high energy consumption, thus increasing the competitiveness of heat pump technology and boosting more extensive use of heat pumps.

1.2.1 EU System of Laws, Regulations and Standards

The European system of heat pump standards comprises multiple organizations and standards that have been formulated and are managed by the European Committee for Standardization (CEN). These standards cover design, performance testing, safety, and environmental requirements. These standards and directives ensure that heat pump products have consistent quality, safety, and energy efficiency in the European market, help consumers make wise choices, and advance the industry's technical progress and environmental sustainability.

The primary standards include: 7 22

EN 14511 series

EN 14511 series of standards that mainly aim at heat pumps, air conditioners, and dehumidifiers, including EN 14511-1: terms, definitions, and units; EN 14511-2: performance test conditions; EN 14511-3: performance test methods; EN 14511-4: requirements. EN 14825: seasonal energy efficiency rating (SEER and SCOP) and performance coefficient standard of heat pumps, air conditioners, and dehumidifiers. This standard describes the performance of testing equipment under different partial loads, thereby providing a full energy efficiency evaluation;

EN 16147

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evaluation of the efficiency and capacity of heat pumps in water heating according to the performance requirements and test methods for heat pump water heaters;

EN 378

the safety and environmental requirements for the cooling systems and heat pumps and contains provisions about design, manufacturing, installation, operation, and maintenance, including EN 378-1: basic requirements, definitions, classification, and selection standard; EN 378-2: design, making, testing, marking, and documents; EN 378-3: installation site and protection requirements; EN 378-4: operation, maintenance, repair, and recovery;

EN 12102

measurement methods for the sound power level of heat pumps, air conditioners, and dehumidifiers, which specify the methods of measuring and reporting noise levels.

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The related directives, laws, and regulations include the Eco-design Directive. This EU directive covers multiple energy-related products and requires heat pump manufacturers to consider energy efficiency and environmental impact when designing them. It specifies the energy efficiency standard and requirements for the environment-friendly design of products to ensure that the products in the market can meet the minimum energy efficiency standard. Energy Labeling Directive requires heat pump products to bear an energy label that helps consumers know about and compare the energy efficiency of different products. The label indicates the energy efficiency class of the products, which ranges from A+++ (maximum energy conservation) to D (minimum efficiency).

Certification and label include the EU energy label. Under the energy label directive, all the heat pumps sold in the EU market must indicate their energy efficiency class. A label typically shows the relevant information about equipment, e.g., energy consumption, seasonable coefficient of performance (SCOP), and noise level. Keymark certificate is a voluntary certification mark jointly managed by CEN and the European Committee for Electrotechnical Standardization (CENELEC) to ensure that products meet related European standards. A Keymark certificate proves that a product has been independently tested and certified to meet specific performance and safety standards for heat pumps.

The leading organizations include the European Committee for Standardization (CEN), which formulates and releases the standards related to heat pumps. CENELEC is responsible for the standards of electrical products, including the electrical safety standard for heat pumps. European Association of Refrigeration and Air conditioner Equipment (EPEE) promotes the sustainable development of refrigeration and air conditioner equipment, including heat pumps.

Currently, European air-to-water heat pumps, also known as heat pump space heaters, mainly need to meet relevant energy efficiency laws and regulations, including (EU) 811/2013 + (EU) 2017/254 and (EU) 813/2013 + (EU) 2016/2282, and use the test methods specified in EN 14825:2022 and EN 12102-1:2022.

1.2.2 American System of Laws, Regulations and Standards

The joint effect of the American system of standards and certificates is to ensure that the heat pump products in the American market have the characteristics of high efficiency, reliability, and safety, which can help consumers select suitable products and boost the sustainable innovation and development of the industry, including those of ASHRAE, AHRI, DOE, and EPA institutions.

The leading institutions and standards include:

• ASHRAE Standard 90.1 of the American Society of Heating, Refrigeration and Air conditioner Engineers (ASHRAE) formulated the energy standard for commercial buildings, including minimum performance requirement and energy efficiency standards for heating, ventilation and air conditioner systems; ASHRAE Standard 34; safety standard for refrigerants, which classifies and marks different refrigerants.

• Air-Conditioning, Heating, and Refrigeration Institute (AHRI), which formulated AHRI Standard 210/240, provides test methods and rating conditions for residential air conditioners and heat pumps to make sure that the products of different manufacturers can be compared fairly; AHRI Standard 320; performance rating standard for commercial and industrial heat pumps; AHRI Certification Program, which ensures that products meet the performance and efficiency standard.

• American National Standard Institute (ANSI) cooperates with other standardization institutions to release comprehensive heat pump standards. For example, ANSI/ASHRAE/AHRI issue standards jointly to ensure they are consistent and extensively accepted.

• 10 CFR Part 430 of the Department of Energy (DoE) formulated the energy efficiency standard and test procedure for residential equipment, including heat pumps; 10 CFR Part 431 formulated the Energy efficiency standard and test procedure for commercial and industrial equipment. DoE requirements for the energy efficiency of heat pump products are also being tightened continuously. For heat pumps, performance is measured with "heating seasonal performance factor (HSPF)," and the calculation method is to divide the power consumption of heat pumps (to be measured with the unit Wh) by the heat output of heating seasonal heat pump equipment (to be measured with the unit BTUs). According to the 2015 standard, the lowest HSPF of residential air-source heat pumps is 8.2, which will rise to 8.8 starting in 2023, meaning that only air-source heat pumps with an HSPF of > 8.8 can be sold in the market.

• Environmental Protection Agency (EPA) formulated the ENERGY STAR® Program, a voluntary certification program managed by the EPA, which aims to promote the use of efficient and energy-saving products and specifies the smallest energy efficiency ratio (SEER), heating seasonal performance factors (HSPF) and other relevant performance indexes of heat pumps in heating and refrigeration modes. A heat pump can be certified to ENERGY STAR® if it meets specific requirements for energy efficiency.

• UL (Underwriters Laboratories) formulated UL 1995, which covers the safety standard of heating and refrigeration equipment; UL 60335-2-40 contains the specific safety requirements for heat pumps, air conditioners, and dehumidifiers.

• Federal Trade Commission (FTC) implemented the Energy Guide Label and required manufacturers to affix the label to heat pumps to help consumers compare the energy efficiency of products.

At present, the heat pump products and test methods of the United States need to meet AHRI 210-240-2008 Performance Rating of Unitary Air-Con & Air-Source HP Equipment AHRI_Standard_1230-2021-01 Performance Rating of VRF Air-con & HP Equipment and ENERGY STAR for Central Air-Con & HP Equipment V6.1.

1.2.3 Japanese System of Laws, Regulations, and Standard

The Japanese system of heat pump standards is formulated and managed mainly by the Japanese Industrial Standards Committee (JISC). These standards cover the design, performance testing, safety, energy-saving, environmental protection requirements, product catalogs, and descriptions of heat pumps.

The primary standards include: 中国节能协会热泵专业委员会

• The JIS B 8615 series: Standards for heat pumps and air conditioner equipment provides the terms and definitions of heat pumps and air conditioner equipment to ensure consistency and clarity. Standards include JIS B 8615-1, Non-ducted air conditioners and heat pumps-Testing and rating for performance; JIS B 8615-2, Ducted air-conditioners and air-to-air heat pumps- Testing and rating for performance and JIS B 8615-3, Multiple split-system air-conditioners and air-to-air heat pumps- Testing and rating for performance test methods of the package or split non-ducted air conditioners and heat pumps, air conditioners and heat pumps with connected air ducts, multi-connected split air conditioners, and air-air heat pumps, including evaluating energy efficiency under different operational conditions.

• JIS C 9612 Room Air Conditioners relates to room air conditioners and specifies product performance and test methods. It also defines the methods of calculating the annual energy efficiency index APF and measuring noise. Additionally, it contains detailed provisions about the safety and nameplate of products and the methods of expressing product catalog.

• JIS B8616 Package Air Conditioners relates to small air conditioners, provides for product performance and test method, and specifies the requirements for calculating energy efficiency index APF. It also defines the methods of measuring noise.

• JIS B 8622 Absorption Refrigerating Machines contains provisions about the performance, test conditions, and safety requirements for absorption refrigerating machines, including operation and inspection.

• JIS B 8626 Refrigerating Unit Coolers–Test Methods for Capacity contains provisions about refrigerating unit coolers' performance and test methods.

• JIS C 9220 Residential Heat Pump Water Heaters contains provisions about the performance, test conditions, noise measurement, and product expression methods of residential heat pump water heaters.

Currently, Japanese air conditioner products need to meet the provisions of JIS C 9612-2013 Room Air Conditioners and JIS B8616 Package Air Conditioners about the methods of evaluating annual energy efficiency APF and measuring noise. They must also correctly mark their APF and noise level in the product catalog.

Other relevant laws, regulations, and directives include, among others, the Japanese Energy Conservation Law, which aims to promote energy-saving and reduce energy consumption and covers a wide range of devices, including heat pumps. It provides for energy efficiency standards and requires manufacturers to provide energy efficiency information and promote the certification and marking of energy-saving products.

Top Runner Program is a program implemented by the Japanese government to establish energy efficiency standards and lay down the energy efficiency benchmarks of types of household electrical appliances and equipment (including heat pumps). Manufacturers must reach these benchmarks in a given period. Those products that fall short of the benchmarks will be banned from the market. The program has promoted developing and marketing products with higher energy efficiency. The certificates and labels include Energy-saving labels. Under the Japanese Energy Conservation Law, all the heat lumps sold in the Japanese market must bear the energy-saving label, which indicates the energy efficiency class of products and helps consumers understand and compare the energy performance of different products. Japanese Ministry of Environment introduced the Eco Mark as an environmental protection label, which proves that a product has minimal ecological impact within its lifecycle. Heat pump products can receive the label if they meet a specific standard for environmental protection.

Fig. 1-3 Left: Energy-saving Label; Right: Environmental Protection Label (green fulfillment rate = 100%; orange fulfillment rate <100%)



The leading organizations include the Japanese Industrial Standards Committee (JISC), which formulates and releases the Japanese industrial standard (JIS) related to heat pumps; Japan Refrigeration and Air conditioner Industry Association (JRAIA), which promotes the technical progress and market development of refrigeration and air conditioner equipment, including heat pumps; Ministry of Economy, Trade and Industry (METI), which formulates and implements the policies, laws and regulations related to energy conservation and manages Top Runner Program.

1.2.4 Chinese System of Laws, Regulations and Standards

The Chinese system of heat pump laws, regulations, and standards comprises the standards for heat pump products, energy efficiency, and control of HFC refrigerant. In China, heat pumps are divided into normal ambient temperature air-source heat pumps water chillers (heat pumps), and units of low ambient temperature air-source heat pumps (water chillers). The latter is further divided into units of air-to-water and air-to-air heat pumps. The standards implemented during the production of equipment include water *chilling (heat pump) packages using the vapor compression cycle* (Standard No. GB/T 18430), *Low ambient temperature*

air-source heat pump (water chilling) packages (Standard No. GB/T 25127), Low ambient temperature air-source heat pump air heaters (Standard No. JB/T 13573). The energy efficiency of heat pump water dispensers must meet the mandatory national standard *Minimum Allowable Values of the Energy Efficiency and Energy Efficiency Grades for Heat Pumps and Water Chillers* (Standard No. GB 19577-2024); heat pump air heaters must the mandatory national standard *Minimum Allowable Values of the Energy Efficiency Grades for Room Air Conditioners* (Standard No. GB 21455).

Fig. 1-4 National Standard *Minimum Allowable of the Energy Efficiency and Energy Efficiency Grades for Heat Pumps and Water Chillers*



April 29, 2024, saw the completed revision and official promulgation of the compulsory national standard *Minimum Allowable Values of the Energy Efficiency and Energy Efficiency Grades for Heat Pumps and Water Chillers* (Standard No. GB 19577-2024), which is under the centralized management of the Standardization Administration of China (SAC). The standard specifies the technical requirements for the limit values and grades of the energy efficiency of heat pumps and water chillers, describes relevant test methods, and clarifies the requirements

for implementing the standard. The standard was implemented starting from February 1, 2025 to supersede GB 19577-2015 *Minimum Allowable Values of the Energy Efficiency and Energy Efficiency Grades for Water Chillers*, GB 29540-2013 *Minimum Allowable Values of the Energy Efficiency and Energy Efficiency Grades for Lithium Bromide Absorption Water Chillers*, GB 30721-2014 *Minimum Allowable Values of the Energy Efficiency and Energy Efficiency Grades for Water* (Ground) Source Heat Pump Units, GB 37480-2019 *Minimum Allowable Values of the Energy Efficiency and Energy Efficiency Grades for Air-source Heat Pumps (Water Chiller) Units of Low Ambient Temperature.*

Additionally, to control and reduce the production and use of HFCs, all countries are accelerating the control, reduction, or even elimination of HFC refrigerants. In October 2023, the EU decided to ban the split air conditioners and heat pumps that have a GWP (global warming potential) of more than 150 and contain fluorine gas; in November 2023, China issued a notice on "Setting and Distributing the Total Quotas of Hydrofluorocarbon in 2024", which specifies the total quota for the production, import and internal use of domestic HFCs and the plan for distribution of enterprise quotas.

1.3 Global Production

1.3.1 Scale of Production

The global production of air-source heat pumps is increasing steadily. Multiple countries have introduced policy support and incentive measures in the macro environment of energy conservation, emission reduction, and carbon neutralization. In 2022, the energy shortage worsened due to various factors, e.g., the Ukraine-Russian war, environmental pollution, and instability of the global political situation, thus making it possible for air-source heat pump products to accelerate their penetration and record production of 4,731,400 units, up 30.4% year on year. In 2023, the price of energy, including oil and gas, fell, and national subsidy policies were partially reduced, lowering the market competitiveness of air-source heat pump products. Meanwhile, real estate demand remained sluggish, and consumption willingness abated due to the policies that inhibited inflation and raised interest rates. In 2023, the global production of air-source heat pumps reached 5,038,400 units, up 6.5% year on year (Figure 1-5).





Fig. 1-5 Global Production of Air-source Heat Pumps in 2019-2023 (K Units, %)

1.3.2 Regions of Production

In 2023, the sales scale of air-source heat pumps increased further in Asia. Regarding production end, Asia is a major production market for air-source heat pumps. Secondly, Europe is also an important production market for air-source heat pumps. In the North American market, air-source heat pumps are also developing quickly, with the countries introducing subsidy policies one after another.



China is a major producer of air-source heat pumps in the world. In 2023, China's production accounted for 55% of the global production (Figure 1-6). China has built a fairly complete industrial chain of heat pumps. With global demand increasing year by year, the production of air-source heat pumps in China has also maintained its growth. In 2023, China's production scale of air-source heat pumps exceeded 2,700,000 units.

1.4 Global Sales

1.4.1 Sales Scale

In 2023, global sales of air-source heat pumps reached 4,635,800 units, up 1.9% year on year (Figure 1-7). After the booming growth in 2022, the distribution channels were heavily overstocked, and the year 2023 witnessed the start of a destocking cycle.



Fig. 1-7 Global Sales of Air-source Heat Pumps in 2019-2023 (K Units, %)

1.4.2 Sales Territory

In 2023, the sales scale of air-source heat pumps in Asia reached 2,747,000 units, up 12.5% year on year. Asia is the largest market of air-source heat pumps at the consumption level, followed by Europe, where the sales scale of air-source heat pumps reached 1,519,000 units, down 15.6% year on year. Regarding growth rate, Oceania and other regions fare well, chalking up an increase of 24.3%, followed by North America, which chalked up an increase of about 15.9% (Figure 1-8).



Fig. 1-8 Sales of Air-source Heat Pumps by Continents in 2023 (K Units, %)

1.5 China's Exports

1.5.1 Scale of Exports

In 2023, the export volume of China's air-source heat pump was 1,031,000 units, down 18% from a year ago (Figure 1-9). Under the impact of various factors, including the slowdown of the global economy, a nosedive of demand, and a decrease in subsidies and existing stocks, China witnessed a considerable decline in exports.



Fig. 1-9 China's Export Volume of Air-source Heat Pumps in 2019-2023 (K Units, %)

1.5.2 Export Destinations

The air-source heat pumps of China are mainly exported to Europe, Oceania, and other places. Europe accounts for about 62.0% of the total export volume as a major export destination, followed by Oceania, accounting for 15.9%. Oceania heavily relies on the import of products that are rarely manufactured natively. Asia, North America, and other regions account for 10.3%, 6.9%, and 4.9%, respectively (Figure 1-10).



Fig. 1-10 Export of China's Air-source Heat Pumps by Continents in 2023 (%)

The overall performance of the export markets of air-source heat pumps in 2023 suggests that Europe remains the market with the largest growth potential and development space. The shrinkage of China's air-source heat pumps' export market is associated with the sharp decline of the markets in major export destinations, including Italy and Poland. At the same time, it is necessary to take notice of the rise in demand in Spain, Germany, Belgium, and other European countries. In 2023, demand also rose in Oceania and North America. China's export of air-source heat pumps to Australia, the United States, and other countries has performed well.



20%

Chapter II Regional Markets

In 2023, the sales of air-source heat pumps in Asia reached 2,747,000 units, up 12.5% year on year (Figure 2-1). In 2023, Asia's economic growth gradually took a turn for the better. Thanks to the full-scale adjustment of COVID-19 policies in all Asian countries, the negative impact of the pandemic on the Asian economy faded gradually. Hence, consumption and investment realized a quick rebound.



Fig. 2-1 Asian Sales Volume of Air-source Heat Pumps in 2021-2023 (K Units, %)



China and Japan are the two largest sales markets of heat pumps in Asia, accounting for over 90% of the Asian market shares. The Chinese market accounts for nearly 40% of the global market, and the Japanese market over 15%. In 2023, the Chinese and Japanese markets maintained a growth momentum, while other Asian markets fell moderately from a year ago.

China is now in the post-electricity-to-coal era. In 2023, China recorded a YoY increase of 14.7% in its market of air-source heat pumps. The increase in the sales of heat pumps has resulted mainly from rising consumer acceptance of the energy conservation of heat pumps, policy guidance, and price hikes in coal and natural gas. The penetration rate of heat pump products will have ample space in the future.

In Japan, the market attaches relatively more significant importance to energy efficiency and environmental protection, and the technical strength of its enterprises is in a leading position globally. Therefore, the penetration rate of heat pumps is higher. As a heating and refrigeration technology of high efficiency and energy conservation, heat pumps will have a broad development prospect in the Japanese market in the future.



2.2 Europe

In 2023, 1,519,000 units of air-source heat pumps were sold cumulatively in Europe. Despite the sound development trend of the European heat pump market in 2022, the market slid in 2023 and went down 15.6% YoY (Figure 2-3). Since the installation cost of heat pumps is much higher than that of boilers, the increase in the European heat pump market heavily relies upon subsidies, legislation, and policies. Since the economy of all European countries now generally shows signs of a downturn, the reduction of government subsidies has gradually become an essential factor that restricts the development of the European heat pump market. Additionally, the price fall of natural gas and the slow growth of the construction sector are among the main factors that caused the decline in sales of European air-source heat pumps.

In the European market, the sales of air-source heat pumps are concentrated in France, Germany, Italy, Poland, and Spain, which account for 70% of the total sales thereof in Europe. The development of the European heat pump market is driven mainly by policies. In 2023, European countries other than Germany, Austria, Holland, and Britain witnessed a drastic market fall.



Fig. 2-3 European Sales Volume of Air-source Heat Pumps in 2021-2023 (K Units, %)

France is Europe's largest seller of air-source heat pumps, accounting for about 23% of the total sales. In 2023, the rapidly rising loan interest rate led to a sharp slowdown of new housing projects in the French market, affecting the sales of air-source heat pumps in France and causing a YoY decrease of 16.7%. The runner-up is Germany, where the sales of air-source heat pumps accounted for 19.6% of the total sales in Europe. German policy prohibits the future use of gas boilers. In 2023, the demand for heat pumps rose significantly in the German market. The sluggish economic performance in Italy encumbered the market, so the Italian government canceled the relevant subsidy support for heat pumps under pressure. Heat pump users' high early investment cost imposed certain inhibitions on purchase demand. Additionally, in Poland, the falling price of natural gas and taxes on power rates caused the sales of air-source heat pumps to stagnate.

Fig. 2-4 Sales of Focus European Countries in Air-source Heat Pump Market in 2023 (%)



Although the governments of the EU countries pay great attention to the energy crisis and environmental problems and are seeking a strategic route toward energy substitution and electrification that is represented by heat pump technology, the promotion of the heat pump market confronts serious obstacles because the overall EU economy has fallen into a slump. From another perspective, however, despite the great uncertainty and challenges facing the European market, using heat pumps to replace gas boilers remains a future trend of using clean energy heating in Europe. In terms of the existing demand for heating, the future market still has a large space for growth, and many countries may witness explosive growth in the scale of the heat pump market.

2.3 North America

In 2023, the sales volume of air-source heat pumps reached 197,000 units in North America, up 15.9% year on year (Figure 2-5). Currently, North America features a low penetration rate in its air-source heat pump market. Although the development of the market is speeding up under the push of relevant government policies, the market is still in its infancy compared with that in Europe and Asia.



Fig. 2-5 Sales Volume of Air-source Heat Pumps in North America in 2021-2023 (K Units, %)

The United States is the largest market for air-source heat pumps in North America and one of the largest heating markets in the world. In 2023, the US accounted for 76.6% of the sales of air-source heat pumps in North America and 3.3% in global sales, standing next to Italy only and ranking 6th. The application ratio of heat pumps is currently not high in Canada. Nevertheless, the ratio is expanding rapidly

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under government support for environment-friendly energy and the push of people's demand for energy conservation and environmental protection. The innovations in the technology of heat pump products have further propelled the market application of heat pump products, so sales are expanding further in other North American countries.





As the representative of the air-source heat pump market in North America, the sales of the United States reached 151,000 units in 2023, up 16.2% YoY. This market is expanding rapidly in the United States under the impetus of various factors, including the environmental policy implemented by the Baiden government and the subsidies from state governments and power companies. According to the energy specifications for new commercial buildings that took effect in 2023, more and more state governments are gradually requiring that the water heating system in new commercial and large residential buildings use heat pump equipment to provide at least 50% of water heating capacity. Globally, the carbon neutrality target for 2050 is approaching day after day, and the application of heat pumps is gaining speed. To reach the target, the US federal government is intensifying the energy-saving capacity of buildings and, additionally, actively expanding the application of air-source heat pumps. The quickening decarbonization steps taken by the United States are accelerating the development of the electrification of its heating industry and the application scale of heat pumps.

2.4 Other Regions

In 2023, the total sales of air-source heat pumps reached 172,800 units in other regions, up 24.3% (Figure 2-7). These regions, including Oceania, Central America,

and Africa, basically rely on imports to meet the local demand for heat pumps. Most of the imported products come from the manufacturing powers, e.g., China and some European countries.

Restricted by geographical factors, such as energy structure, climate, and income, the demand for air-source heat pumps is limited in other regions, including Central and South America, Africa, and Oceania, but excluding Australia. In 2023, the total sales of air-source heat pumps were less than 30,000 units in these regions, up 16.7% YoY, most of which were heat pump hot water products.

Fig. 2-7 Sales of Air-source Heat Pumps in Other Regions in 2021-2023 (K Units, %)



In other regions than Asia, Europe, and North America, Australia is a key sales territory in the middle of Oceania. In 2023, its sales of air-source heat pumps accounted for 83.1% of the total sales in other regions, accounting for 3.1% of global sales, next only to the United States.

In recent years, under the governmental promotion of renewable energy, the development of Australian heat pumps has gradually increased speed. In 2023, 144,000 units of air-source heat pumps were sold in Australia, up 26.0% YoY. The Australian market also relies primarily on heat pump water heater products, with minimal demand for space heating. In the Australian market, the energy consumption of water heaters accounts for $15\% \sim 27\%$ of the household energy consumption, while the energy consumption from using air-source heat pumps for water heaters is only 30% of that of electric water heaters, showing the vast potential market of air-source heat pump water heater products. Some overseas

manufacturers are already accelerating their arrangements for the Oceanian market. About 50% of Australian families currently use energy storage systems, so the air-source heat pumps compatible with the energy storage system will also have a large market potential. However, the high power rates in the Australian market may impact the promotion of air-source heat pumps.









Chapter III Chinese Market

3.1 Heat Pump Industry

3.1.1 Overall Scale of Air-source Heat Pumps

In 2023, China's air-source heat pumps (including VRF with hydronic heating modules) achieved an annual sales value of RMB31.0 billion, up 11.9% YoY (Figure 3-1).



Fig. 3-1 Sales of China's Air-source Heat Pumps in 2019-2023 (RMB billion, %)

In the first half of 2023, offline activities increased in China's air-source heat pump market. However, in the second half of the year, the growth rate slowed down in the overall market due to the impact of the economic downturn and sluggish consumption. During the year, the industry resisted the adverse effects brought by the environmental environment and created a growth trend.

In terms of specific products, heating is the core force driving China's air-source heat pumps. The year witnessed the growth of the overall heating market thanks to the continued high growth of the products benefiting from two supporting policies: electricity-to-coal for air-to-water heat pumps and air-to-air heat pumps.

3.1.2 Scale of Domestic and Exprots of Air-source Heat Pumps^{ChinalOL.co}

In 2023, the China's air-source heat pumps chalked up a domestic sales value of

RMB24.7 billion, up 18.7% YoY (Figure 3-2), in addition to the satisfactory growth in electricity-to-coal and the channel market. Overall, household heating fared even more prominently, plus the favorable development of commercial heating. Compared with heating products, the growth of water heater products was relatively weak in 2023. In the year, the China's air-source heat pumps recorded RMB6.4 billion worth of exports, down 8.5% YoY (Figure 3-3). The withering demand in overseas markets, including Europe, became one of the important factors behind the export decline of China's air-source heat pumps.

Fig. 3-2 Domestic Sales Value of China's Air-source Heat Pumps in 2019-2023 (RMB billion, %)



Fig. 3-3 Exports Value of China's Air-source Heat Pumps in 2019-2023 (RMB billion, %)



3.1.3 Brand Concentration Ratio of Air-source Heat Pumps

In 2023, China saw a decrease in the market shares of its TOP3, TOP5, and TOP10 air-source heat pump enterprises, with the TOP3 enterprises sawing a YoY decrease of 0.9%, a ratio smaller than the 1.6% decrease of TOP5 and TOP10 enterprises (Figure 3-4). While the enterprises with a larger share of export sales were seriously affected, the enterprises relying on domestic sales primarily and strongly expanding exports fared more satisfactorily in 2023.

Fig. 3-4 Change of Brand Concentration Ratio of China's Air-source Heat Pumps in 2019-2023 (by domestic sales value)



3.1.4 Application Structure of Air-source Heat Pumps

In 2023, China brought domestic sales value of RMB16.7 billion, RMB 5.8 billion, and RMB 2.2 billion from air-source heat pumps for sanitary hot water, space heating, and industrial and agriculture drying (Figure 3-5). In terms of sales volume, air-source heat pumps for space heating, with a domestic sales volume of 1,669,100 units, exceeded air-source heat pumps for sanitary hot water to take first place in the market; air-source heat pumps for industrial and agriculture drying recorded a domestic sales volume of 155,700 units(Figure 3-6).





Fig.3-5 Domestic Sales Value of China's Air-source Heat Pumps by Applications in 2019-2023 (RMB billion)

Fig. 3-6 Domestic Sales Volume of China's Air-source Heat Pumps by Applications in 2019-2023 (K Units)



In terms of applications, the share of the air-source heat pumps for space heating rose again, with domestic sales volume accounting for 67.8% of the total, compared with a certain slide of the air-source heat pumps for sanitary hot water and industrial and agriculture drying (Figure 3-7).



Fig. 3-7 Share of China's Air-source Heat Pumps by Applications in 2019-2023(by Domestic Sales Value,%)

3.1.5 Overall Scale of Heat Pump Industry

In 2023, the China heat pump industry, including air-source heat pumps (including VRF with hydronic heating modules), (water) ground source heat pumps, and absorption heat pumps, achieved an annual sales value of RMB33.1 billion, up 11.4% YoY (Figure 3-8).



Insofar as the application end of the domestic market is concerned, the total sales value of Chinese heat pumps was RMB26.8 billion, up 17.5% YoY. Increasing market demand and promoting encouraging policies, laws, and regulations have led to more extensive applications of (water) ground source heat pumps. In 2023, (water) ground source heat pumps recorded a YoY increase of 4.3%. In 2023, Chinese absorption heat pumps saw a YoY increase of 4.1% (Table 3-1) under the impetus of various factors, e.g., the stable development of large-scale key industrial projects, including petroleum, chemical and ferrous projects, expansion of investment demand, utilization of industrial residual and waste heat, development of distributed energy station projects.

Product **Domestic Sales YOY Change** Туре Application Segmentation (RMB billion) (%) Sanitary hot heat pump water heater 5.8 -1.7% water air-to-water heat pumps 7.6 50.3% VRF with hydronic heating 3.1 20.5% household modules Heating Space heating Air-source low ambient temperature 1.8 10.1% air-to-air heat pumps 14.5% commercial air-to-water heat pumps 4.2 Industrial and air-source heat pumps 2.2 10.9% agricultural Water Ground 1 (water) ground source heat pumps 1.2 4.3% Source Absorption 1 absorption heat pumps 0.9 4.1% Total of heat pumps 26.8 17.5%

Table 3-1 Domestic Sales Value and YOY Change of China's Heat Pumps in 2023 (RMB billion, %)

3.2 Air-source Heat Pump Space Heating

3.2.1 Air-to-water heat pumps

In 2023, the domestic sales value of air-to-water heat pumps reached RMB7.6 billion, up 50.3% (Figure 3-9). The rapid growth of air-to-water heat pumps in electricity-to-coal projects played a driving solid role.



Fig. 3-9 Domestic Sales Value of China's Air-to-Water Heat Pumps in 2021-2023 (RMB billion, %)

In 2023, the market shares of TOP3, TOP5, and TOP10 enterprises dropped from 33.9%, 50.9%, and 73.7% in 2022 to 32.9%, 48.9% and 68.4% (Figure 3-10).



Fig. 3-10 Change of Brand Concentration Ratio of Air-to-Water Heat Pumps in 2021-2023 (by

The competition among air-to-water heat pumps in electricity-to-coal projects is concentrated on heat pump enterprises. The enterprises that performed well mostly participated in many electricity-to-coal projects earlier. In 2023, the enterprises focused more on the electricity-to-coal market, and the number of them participating in the bidding projects of converting coal to electricity increased gradually. More enterprises, including some enterprises producing air conditioners,
also involved themselves in industry competition through the electricity-to-coal projects to open up the northern market, broaden retail channels, and increase their shares in the heat pump market.

In 2023, the domestic sales value of the air-to-water heat pumps for the replacement of coal with electricity was RMB2.04 billion, up 154.0% YoY; the retail value of air-to-water heat pumps was RMB5.58 billion, up 30.8% YoY (Figure 3-11). In the recent three years, the retail share of air-to-water heat pumps accounted for over 70% (Figure 3-12).

Fig. 3-11 Domestic Sales Value of China's Household Air-to-Water Heat Pumps by Channels in 2021-2023 (RMB billion, %)



Fig. 3-12 Domestic Sales Value Share of China's Household Air-to-Water Heat Pumps by Channels in 2021-2023 (%) 中国节能协会热泵专业委员会



In 2023, the domestic sales value of air-to-water heat pumps through retail channels reached RMB5.6 billion, up nearly 30.8% YoY (Figure 3-13). This benefited from the investment made by heat pump enterprises in recent years in the R&D of heat pump products and their effective service development in the northern market. It also benefited from the acceptance of heat pump products by the related government departments in northern regions, as reflected by the government's actions to strongly advance the retain market in some areas.

Fig. 3-13 Domestic Sales Value of China's Household Air-to-Water Heat Pumps in 2021-2023 (RMB billion, %)



In 2023, the ratio of retailed air-to-water heat pumps in housing amenities was low due to their performance in a sluggish real estate market. Although high-end estates are conducive to meeting the needs of some consumers for upgrading and comfort and enlarging profit space, the growth of high-end amenities is limited by the capital chain, national economic environment, and other factors, further restricting the move of retained air-to-water heat pumps toward housing amenity market. The southern market still has a large development potential. With the ongoing implementation of energy-saving, environmental protection, and lowcarbon policies in various regions, air-source heat pumps will be bonded more closely with real estate.

In 2023, the TOP3, TOP5, and TOP10 enterprises in the retail of China's air-towater heat pumps all experienced a minor drop in their market shares (Figure 3-14). Fig. 3-14 Change of the Brand Concentration Ratio of the China's air-to-water heat pumps by Retail Channel in 2021-2023 (by domestic sales value, %)



In 2023, China's household air-to-water heat pump retail market was distributed mainly in East China and North China. The market shares of the two regions account for more than 80% of the total. They are followed by Central China and Southwest, which account for 9.5% and 7.4% of the total, respectively (Figure 3-15).



Fig. 3-15 Share of China's Household Air-to-Water Heat Pumps by Regions in 2022-2023 (by domestic sales value, %)

In terms of domestic sales value, North China, East China, Central China, and the Southwest performed well. North China recorded RMB2.56 billion in the retail value of air-to-water heat pumps, up 40.1% YoY; East China RMB1.92 billion, up 26.1%

YoY; Central China RMB530 million, up 26.9% YoY; Southwest RMB410 million, up 19.5% YoY.

3.2.2 VRF with hydronic heating modules

In 2023, the domestic sales value of China's VRF with hydronic heating modules reached RMB3.1 billion, up 20.5% YoY (Figure 3-16).

Fig. 3-16 Domestic Sales Value of China's VRF with hydronic heating modules in 2021-2023 (RMB billion, %)



As far as the VRF with hydronic heating modules regional market scale and structure in 2023 are concerned, the sales territories of VRF with hydronic heating modules are relatively concentrated, with East China accounting for more than 60% of the market shares, followed by the markets in Central China, North China, and the Southwest, which account for 9.2% and 8.5% respectively (Figure 3-17).

In 2023, the growth rate of VRF with hydronic heating modules was the highest in North China, as proven by a sales value of RMB280 million, up 32.2% YoY. On the one hand, the development of air-to-water heat pumps was spurred in the North China market to meet the rising demand for cooling and heating products; on the other hand, the products of high differentiation and comfort are easier to find favor with middle and high-end customers. Moreover, all regions find themselves in a circumstance where the applications of natural gas are restricted, and the profits of traditional air duct machines fall year by year, so multiple parties are boosting the growth of air-to-water heat pumps. VRF with hydronic heating modules are now promoted mainly by Japanese brands and sold the most in East China.



Fig. 3-17 Share of China's VRF with hydronic heating modules by regions in 2022-2023 (by domestic

3.2.3 Low Ambient Temperature Air-to-Air Heat Pumps

In 2023, influenced by the recovery of the northern market for IFB transformation, the domestic sales value of low ambient temperature air-to-air heat pumps reached RMB1.8 billion, up 10.1% YoY (Figure 3-18).



In 2023, the market shares of the TOP5 enterprises of low ambient temperature airto-air heat pumps rose moderately, while those of the TOP3 and TOP10 enterprises showed a certain downslide, including a fall of 3% for the TOP10 enterprises (Figure 3-19).

Fig. 3-18 Domestic Sales Value of China's Low Ambient Temperature Air-to-Air Heat Pumps in 2021-



Fig. 3-19 Change of Brand Concentration Ratio of China's Low Ambient Temperature Air-to-Air Heat Pumps in 2021-2023 (by domestic sales value)

In recent years, we have witnessed decreasing profits in the low ambient temperature air-to-air heat pumps market, contraction of the overall market, and fading attention from enterprises. For the product, most of the brands of better development now belong to air conditioner enterprises, which seize market shares by leveraging the strong edges of their industrial chain in manufacturing and cost. As a result, quite a number of heat pump enterprises have already given up their investment in the product.

3.2.4 Commercial air-to-water heat pumps

In 2023, the domestic sales value of China's commercial air-to-water heat pumps was RMB4.2 billion, up 14.5% YoY(Figure 3-20).

Heat pumps are used for centralized heating in northern estates and show great market potential in hotels, schools, and municipal institutions. Heat pump heating is now a mature application in estate heating. Additionally, with the continuous dissemination of inverters and the development of low or ultralow temperature heat pump technology, heat pump products have found more and more widespread application in northern regions, thus driving the adoption of heat pump products in more and more small or large projects and the large-scale growth of the commercial heating market.



Fig. 3-20 Domestic Sales Value of China's Commercial Air-to-water Heat Pumps in 2021-2023 (RMB

In 2023, the market shares of the TOP3 enterprises of commercial air-to-water heat pumps decreased slightly. The TOP5 enterprises chalked up the most noticeable increase in market shares, up 3.2% YoY (Figure 3-21).





Compared with air-to-water heat pumps, commercial air-to-water heat pumps are insensitive to the demand for brands but sensitive to the initial investment price of the project. Accompanying the escalating competition in the commercial market,

the areas with competitive edges are becoming more concentrated, and the competition among enterprises is fiercer.

In 2023, the municipalities and provinces in North China and East China, e.g., Beijing, Tianjin, Hebei, Shanxi, and Shandong, took up a share of nearly 60%; Hebei Province ranked first with a market share of 17.9% and was followed by Shandong Province accounting for 16.6% (Figure 3-22).

Fig. 3-22 Share of China's Commercial Air-to-Water Heat Pumps by Regions in 2021-2023 (by domestic sales value, %)



3.2.5 Heat Pump and Wall-Hung Gas Boiler-in-1 System

Guided by the national policies for energy conservation, emission reduction, and consumption upgrading of comfortable homes, a composite energy comfort system that uses air-source heat pumps as the main cold or heat source equipment and uses gas heating boilers as the auxiliary heat source is catching increasingly extensive attention as a new cooling-heating home system that is energy-saving, comfortable, efficient and reliable and has gradually become an important form of a comfortable home system of clean energy.

The system that uses the equipment combining the two heat sources of air-source heat pumps and gas and uses water as a heat-transfer agent to meet the needs for heating, air conditioner, and sanitary hot water through joint control is known as a composite system of heat pumps and gas equipment. In the application field of comfortable homes, air-source heat pumps are coupled with gas-fired heating and hot water boilers to have the essential functions of heating, air conditioner, and sanitary hot water, with fresh air and water treatment as optional functions. The primary operation mode of such a comfortable home system with the above two coupled parts is as follows: In summer operation, air-source heat pumps cool, and the boilers supply sanitary hot water; in winter operation, the boilers assist the airsource heat pumps in heating to supply sanitary hot water.

The composite system of heat pumps, gas-fired heating, and hot water boilers features cutting edges in investment cost. The configuration of the boilers can significantly reduce the installed capacity of air-source heat pumps for extremely cold weather and provide sanitary hot water. In actual use, when air-source heat pumps cannot support the supply of space heating and sanitary hot water under extremely low outdoor temperatures in winter, the system will activate the gas-fired heating and hot water boiler to satisfactorily meet the needs for heating and sanitary hot water under extremely low temperature. For the users who use interval heating in winter, when it is necessary for rapid temperature rise to quickly meet the need for heating upon the startup of interval heating, the characteristic of higher leaving water temperature of the gas-fired heating and hot water boiler can be leveraged to provide more heat output that will quickly enable a room to reach the comfortable heating temperature expected by the owner. The combined use of the boiler can also make reasonable use of the advantages of low ladder gas price to reduce the energy consumption costs of heating in winter and lower overall operation expenses through energy allocation.

CECA Heat Pump Professional Committee organized the formulation of the Technical Specification for Air-Source Heat Pump & Gas-Fired Hot Water Boiler Composite Energy Intelligent Comfort System (T/CECA-G 0095-2021) for residential use and the Technical Specification for Air-source Heat Pump & Gas-Fired Equipment Composite Heating System (T/CECA-G 0237-2023) for industrial and commercial use. The standards standardize the design, construction, system debugging, and acceptance of heat pump and gas-fired equipment composite systems to ensure that they are technically advanced, cost-effective, safe, applicable, and high in quality.

Thanks to its excellent energy conservation, environmental protection benefits, and comfort performance, the system has found more and more favor with consumers. More and more enterprises have begun to roll out the composite system, e.g., A.O. Smith, which launched its AI-LiNK chilling-heating air and water integration system in 2021; Rinnai, BDR, and Viessmann, which introduced their compound solutions to heat pumps and gas-fired equipment.

3.3 Air-source Heat Pump Water Heaters

3.3.1 Household Water Heaters

In 2023, the domestic sales value of China's household water heaters reached RMB3.3 billion, down 5.7% YoY (Figure 3-23), reflecting contraction of the product's overall market and increasing competition among different brands.



Fig. 3-23 Domestic Sales Value of China's Household Water Heaters in 2021-2023 (RMB billion, %)

Judging from the development trend, despite the sliding market scale of China's household water heaters, the internal driving force for the technical reform of the product still guides the continuous development of the industry. As can be seen from the structural upgrading performance of the product, on the one hand, industrial restructuring is picking up speed to even more highlight a tendency toward high-end furnishings in the context of continuous hikes of the prices of raw materials, logistic costs, and workforce cost; on the other hand, in the era of the stockpile, updating has become the theme of water heater consumption, meaning that consumers have posed higher requirement for water heater products.

In 2023, TOP3, TOP5, and TOP10 enterprises all experienced an increase in their market shares. With the gradual enhancement of the product technology and stabilization of brands, there was a relatively small change in the concentration ratio of the brands in different sections.

Fig. 3-24 Change of Brand Concentration Ratio of China's Household Water Heaters in 2021-2023 (by domestic sales value,%)



3.3.2 Commercial Water Heaters

In 2023, the domestic sales value of China's commercial water heaters reached RMB2.5 billion, up 4.2% YoY (Figure 3-25). With the recovery of catering, entertainment, and tourist industries, China's demand for commercial heat pump water heaters rebounded. Driven by the green building policies implemented in various places, commercial water heaters have steadily grown by relying on extensive application and the market foundation accumulated over the years.



In 2023, the change in brand concentration ratio was relatively small for the TOP3, TOP5, TOP10 enterprises, reaching 45.1%, 69.3%, and 88.4%, respectively (Figure 3-26).

Fig. 3-26 Change of Brand Concentration Ratio of China's Commercial Water Heaters in 2021-2023 (by domestic sales value)



3.4 Industrial & Agricultural Applications

Heat pumps have made significant progress in industrial and agricultural applications. With the maturation of heat pump technology, the application boundary of heat pumps is continuously branching out against the historical background of the national transition toward low carbon and the promotion of high-quality development. So far, heat pumps have found good application in the industrial fields of food, leather, timber processing, minerals, petroleum, lithium batteries, electroplating, slaughter, printing, dyeing, chemical engineering, ceramics, and pharmaceutics. They are also being spread more and more extensively in the agricultural fields of crop drying, heating for livestock or poultry breeding, and heating in greenhouses.

3.4.1 Industrial Applications

Industrial energy consumption plays a decisive role in the makeup of the total social energy consumption of the whole world, as proven by the fact that about 1/3 of the energy is used in industrial fields. Currently, industrial heat consumption in China accounts for more than 70% of the total national heat consumption and constitutes a major field of heat consumption. Unlike the apparent seasonality of the household heating market, the demand for industrial heat shows the characteristics

of continuity, high requirement for temperature parameters, and large amount. Despite efforts to continuously introduce energy-saving measures during industrial production, substantial afterheat is lost through gaseous, liquid, and solid emissions. It is estimated that at least 50% of the energy waste is discharged in the industrial sector of China, where it is discharged in the form of low-grade afterheat. The wasted energy can be used as a heat source on the same industrial site.

Heat pumps are the only known devices that can recycle the waste heat generated in the environment and industrial processes for reuse in the production process of heat energy. Afterheat can be recovered through the device for reuse to reduce energy consumption and CO_2 emission drastically. Industrial heat pumps refer to those in the range of medium and high power, which are mainly used for heat recovery and upgrading during industrial processes. They can also be used for heating and refrigeration in industrial, commercial, and multi-residence buildings and regional heating. As an active heat recovery device, industrial heat pumps can raise waste heat temperature in industrial processes to meet the heat demand of the same process or other neighboring processes.

Based on the temperature requirements of industrial applications, heat pumps can be divided into four types: low-temperature heat pumps, medium-temperature heat pumps, high-temperature heat pumps, and ultrahigh-temperature heat pumps (Figure 3-27). In actual applications, output temperatures differ based on the various heat sources, refrigerants, and heat pumps used. Heat pumps of different types are defined strictly based on the heating temperature (Tout). When the heating temperature is >160°C, high-pressure water steam with a saturation temperature of 160°C can be generated directly in normal industrial steam processes. Therefore, such a new classification scheme defines the output temperature of 160°C as the dividing line between high-temperature heat pumps and ultrahigh-temperature heat pumps and defines the typical 100°C boiling point of water as the dividing line between medium-temperature heat pumps and high-temperature heat pumps; defines 60°C as the dividing line between low-temperature heat pumps and medium temperature heat pumps.





Fig. 3-27 Classification of Industrial Heat Pumps Based on Heating Temperature

3.4.2 Agricultural Applications

In 2023, China recorded RMB2.18 billion worth of delivered air-source heat pumps for industrial and agricultural drying products, up 10.9% YoY, maintaining a relatively high growth rate.

Heat pumps are widely used in controlling agricultural production environments. The major application scenarios include heating in livestock and poultry breeding, heating in agricultural greenhouses, and drying crops. In agricultural applications, they receive attention from the governments at all levels and sectors of agricultural machines and farm product processing, with huge market development potentials. Air-source heat pumps have an extensive application field in drying. In terms of the products for specific fields, delivery is stable for the heat pumps of fruit and vegetable dryers, sludge dryers, and grain dryers. They are the mainstream products of heat pumps for agricultural drying and directly promote the increase in the sales value of the industry. Heat pump products have also begun penetrating numerous other specific application fields (Table 3-2). More and more heat pump enterprises received certificates and appraisals to promote agricultural machines. They started to nudge their products into the lists of agricultural machine subsidy policies of all provinces.



Table 3-2 Specific Drying Areas of Heat Pumps

Category		Industry	Applications		
中国 ⁻ Heat Pump	中国 市能协会热泵专业委员会 Committee of China Energy Conservation Association		Grains Tobacco Vegetables Edible mushrooms and garden crops		
Primary Industry	Farming forestry, animal husbandry, side-line production and fishery	 Agriculture Fishery Farming, forestry, animal husbandry fishery and service sectors 	 Fruits Tea Traditional Chinese medicinal materials Areca Wolfberries Soybeans Peppers Roses Momordica grosvenori 		
	Ch	业在线	 Red dates Aquatic products Primary processing of agricultural products Timber 		
Secondary Industry	Manufacturing industry	 Farm and side-line product processing industry Food manufacturing industry Tobacco product industry Printing and recording media reproduction industry Leather products and shoe-making industry Manufacturing industry of chemical raw materials and chemical products Metal product industry 	 Deep processing of agricultural and non-staple food Noodles Preserves and other foodstuffs Tobacco redrying Printing Cardboard cylinder Leather manufacturing Cloths Rubber Explosives Pyrotechnics and firework product manufacturing (firecrackers) Metal finishing and hot-working treatment (electroplating) 		
Tertiary Industry	 Accommodation and catering industry Water conservancy, environment, and public facility management industry 	 Accommodation industry Ecological protection and environmental governance industry 	を业委员会 · Tourist hotel (laundry) · Solid waste management (sludge)		

Thanks to their environmental protection features, high efficiency, intelligent operation, and low operation costs, air-source heat pumps have stood out from a large number of clean heating products and have become the top pick for breeding heating. Breeding is one of the pillar industries of Chinese agriculture. The breeding industry launched the reform of using clean energy to enable green breeding. With this background, the industry has embarked on the road toward intensive, largescale, modern, green-oriented, and healthy development. The traditional heating mode for livestock breeding mostly uses coal-fired boilers, which causes serious environmental pollution and makes it hard to control temperature, affecting the overall benefits of farms. Air-source heat pumps enable automatic intelligent control and, thus, can considerably lower workforce costs and operation expenses and shorten the investment recovery cycle so that power consumption is significantly reduced compared with other heating equipment.

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The low-temperature heating of air-source heat pumps makes it easier to control temperature and more suitable for heating in greenhouses than traditional heating modes. The greenhouses that need heating in winter are generally connected structures. When coal-fired water heating boilers are used, greenhouse heating will consume about 24kg/m² of coal each year, with coal cost accounting for 30%~50% of the production cost. The heating coal consumption may exceed the above indexes if a greenhouse is high in pollution, unreasonable in design, or located in a cold area. Air-source heat pumps feature energy conservation, environmental protection, and zero pollution to meet the existing environmental protection policy. Farmers who use air-source heat pumps can apply for subsidies in some areas. The product is more convenient because the whole-process intelligent control is unattended to bring actual convenience to growers.

3.5 Upstream Components

3.5.1 Compressors



Fig. 3-28 Sales Volume of China's Heat Pump Compressors in 2021-2023 (K Units, %)

Note: The statistical data in the figure are the compressors used by the entire heat pump industry, including those for space heating, sanitary hot water, and industrial and agricultural drying.

In 2023, the sales volume of China's heat pump compressors was 6,673,500 units, up 3.0% YoY (Figure 3-28). Driven by the growth of the downstream air-source heat pump market, China's heat pump compressors remained stable and grew, with the growth trend being the same as that of the downstream air-source heat pumps.

In terms of specific products of heat pump compressors, in 2023, rotary compressors recorded a rise of 2.4% by dint of products of large refrigeration capacity; screw compressors with a smaller base grew by 15.6% and scroll compressors by 8.0% (Figure 3-29).



Fig. 3-29 Sales Volume of China's Heat Pump Compressors in 2021-2023 (K Units, %)

China's heat pump compressors are mainly used in sanitary hot water, space heating, and industrial and agricultural drying. In terms of specific products, most of the rotary compressors are now used in heat sanitary hot water and space heating, with the proportions of the two accounting for nearly 99% of the total; scroll compressors of a relatively high proportion are used in the field of sanitary hot water, accounting for 52.7% of the total, followed by space heating, accounting for 35.1%. In recent years, the share of the models used for Industrial and agriculture drying rose quickly to 12.2%; screw compressors are now mostly used for space heating (Figure 3-30).





Fig. 3-30 Market Share of China's Heat Pump Compressors in 2023(%)

In terms of sales channels, the overall reliance of China's heat pump compressors on the overseas market is relatively low, and the domestic market remains the main force that drives the growth of the industry.

Fig. 3-31Change of Brand Concentration Ratio of China's Heat Pump Compressors in 2021-2023 (by sales volume,%)



In recent years, the market shares of the TOP3 enterprises have all stood at >60%, while those of the TOP5 and TOP10 enterprises have stood at >84% and >98%. In 2023, the concentration ratio of the TOP3, TOP5, and TOP10 brands increased at different degrees (Figure 3-31). With the continuous boom of the heat pump market,

all leading compressor manufacturers started to intensify R&D and roll out specific heat pump models.

3.5.2 Valves

In 2023, the sales volume of Chinese HVAC valves reached 602,787,000 pieces, up 16.5% YoY. From the perspective of the downstream four application fields, in 2023, the valves for household air conditioners, commercial air conditioners, refrigeration, and air-source heat pumps all experienced different degrees of increase. Under the impact of global El Nino and the base, the market of household air conditioners saw double-digit growth, compared with a growth rate of around 5% in the other three application fields.

From the perspective of air-source heat pumps, their export markets did not perform as well as a year ago. But, domestic markets present a good momentum. In 2023, the domestic sales volume of the valves of air-source heat pumps reached about 13,842,000 pieces, up 6.5% year on year (Figure 3-32).



Fig. 3-32 Domestic Sales Volume of China's Air-source Heat Pumps Valves in 2021-2023 (K pieces, %)

For heat pump valves, the structure of the products is consistent with that of the valves of commercial air conditioners, including globe valves, four-way reserving valves, electronic expansion valves, thermostatic expansion valves, solenoid valves, and ball valves. For the three major categories of globe valves, 4-way reserving valves, and electronic expansion valves, the demand for products is the largest, and the share of product structure is 42.0%, 26.7%, and 27.4%, respectively, with a total share of >96% (Figure 3-33).



Fig. 3-33 Share of China's Air-source Heat Pumps Valves in 2023 (by domestic sales volume, %)

From the perspective of the brand characteristics of the valves in the heat pump market, the pattern has remained stable in recent years. For the domestic brands led by Sanhua and Dun An, the product line features a wide coverage and complete varieties, holding most of the market shares; the foreign brands led by Danfoss and Saginomiya focus more on the products with higher added value, e.g., solenoid valves (Table 3-3).

Brand/ Products	Globe Valve	Electronic Expansion Valve	Four-Way Valve	Solenoid 숙초 Valve 중 문	Globe Valve	Thermostatic Expansion Valve
Sanhua			\checkmark			
Dun An			\checkmark			
Saginomiya			\checkmark			
Okayama	\checkmark					
Danfoss		\checkmark				\checkmark
Hengsen		\checkmark				
Fujikoki						
Carel					产	业在线
Emerson					Chin	aloL.c.qm

Table 3-3 Product Distribution of Focus Suppliers of China's Air-source Heat Pumps Valves

3.5.3 Heat Exchangers

In 2023, the domestic sales value of the heat exchangers for China's air-source heat pumps was RMB3.2 billion, up 9.8% YoY (Figure 3-34), including about RMB1.9 billion worth of finned heat exchangers, about RMB80 million worth of Micro-channel heat exchangers and about RMB301 million worth of shell-tube heat exchangers, about RMB770 million worth of coaxial tube heat exchangers and about RMB170 million worth of brazed plate heat exchangers.

Fig. 3-34 Domestic Sales Value of Heat Exchangers for China's Air-source Heat Pumps in 2021-2023 (RMB billion, %)



From the perspective of specific products, all the heat exchangers of the outdoor units of heat pump products are finned heat exchangers. Hence their high market shares. Meanwhile, the heat exchangers of the indoor units of air-source heat pumps come in multiple categories. For example, micro-channel heat exchangers are extensively used in air-source heat pump water heaters and pose a rapid development trend.

Different types of heat exchangers have different characteristics. Therefore, heat exchangers differ in specific application characteristics and development trends.

1) Finned heat exchangers

Finned heat exchangers feature mature technology and extensive application. Their largest application is in household air conditioners, followed by commercial air conditioners, with a relatively limited application in commercial refrigeration and heat pump fields. In 2023, the domestic sales value of finned heat exchangers for Chinese HVAC was about RMB71.88 billion, up 11.5% YoY, including RMB1.88 billion worth of the products for air-source heat pumps, up 7.0% YoY.

2) Micro-channel heat exchangers

These are highly compact heat exchangers. In 2023, the domestic sales value of micro-channel heat exchangers for Chinese HVAC was about RMB 748 million, up 8.0% YoY, including RMB80 million of the products for air-source heat pumps, down 1.4% YoY.

3) Coaxial tube heat exchangers

Coaxial tube heat exchangers suit the heating condensers, heat pump water heaters, and (water) ground source heat pumps in the north. In 2023, the domestic sales value of Chinese coaxial tube heat exchangers was RMB 770 million, up 18.0% YoY. From the perspective of specific applications, they are mainly used in heat pumps for heating only due to the restrictions on refrigeration.

4) Shell-tube heat exchangers

Shell-tube heat exchangers have extensive applications in the northern commercial (engineering) heating market, including modular machines, low-temperature commercial modular machines, and household water heaters. In 2023, the domestic sales value of shell-tube heat exchangers was about RMB 1.494 billion, up 11.4% YoY, including RMB 300 million worth of the products for air-source heat pumps, up 11.0% YoY.

5) Brazed plate heat exchangers 中国节能协会热泵专业委员会

These are used extensively in southern heating, commercial air conditioners, and commercial refrigeration and have a broad market prospect. The growth of export markets and the swift growth of the domestic dual-supply market are accompanied by the rapid increase in the scale of brazed plate heat exchangers. In 2023, their domestic sales value was about RMB 1.38 billion, up 10.5% YoY, including RMB 171 million worth of the products for air-source heat pumps, up 9.8% YoY.

Overall, the industry of heat exchangers for air-source heat pumps features a low brand concentration ratio. Different products have a differentiated brand pattern and characteristics. Most finned heat exchangers are home-made, and the outsourcing demand is relatively weak.



Fig. 3-35 Share of Heat Exchanges for China's Air-source Heat Pumps in 2023 (by domestic sales

3.5.4 Inverter Controllers of Heat Pumps

In 2023, the demand in China for commercial inverter controllers for air-source heat pumps was 480,000 units, up 30.8% YoY (Figure 3-36).



Fig. 3-36 Demanded Volume of China's Commercial Inverter Controllers in 2021-2023 (K units, %)

These controllers are divided into two types: those used by complete machine or compressor enterprises to match their products and those supplied to external users, with the former being the overwhelming majority. According to incomplete statistics, in 2023, the former took up a share of nearly 90% and the latter about 10%.

3.5.5 Water Pumps & Tanks

3.5.5.1 Water Pumps

In 2023, China heat pump industry used about 1,035,000 water pumps, up about 23% YoY. From the perspective of specific applications, heat pump space heating products used about 713,000 water pumps, including about 652,000 units used by household space heating heat pump products and about 61,000 units used by commercial space heating projects of heat pumps. Heat pump water heaters use about 322,000 water pumps, including about 139,000 units used by household heat pump water heaters and about 183,000 units used by commercial heat pump water heaters.

3.5.5.2 Water Tanks

In 2023, the domestic sales volume of water tanks of China heat pump industry was about 1.288 units, down 6% YoY. The main reason is the continuous downslide of household heat pump water heaters. The sales volume of the water tanks for household heat pump water heaters was about 843,000 units, accounting for 65.5%; that of the water tanks for the household space heating market was about 445,000 units, accounting for 34.5%.





Chapter IV Global Forecasts

4.1 Production Forecast

and their sales volume by 6.7%. In the year, the global market of air-source heat pumps will face hard times, including escalating risks of global economic recession, reduction of subsidy policies in some countries, and lasting high stockpile of the industry.

Fig. 4-1 Production Scale of Global Air-source Heat Pumps in 2020-2024F (K Units, %)



Fig. 4-2 Sales Scale of Global Air-source Heat Pumps in 2020-2024F (K Units, %)



In the short term, the subsidy policies of various countries and the continuous progress of their carbon neutrality actions will become the main driver for the further development and applications of air-source heat pumps. As some countries gradually cancel or weaken their financial support due to a downturn in the economic environment, the development of air-source heat pumps will face certain impediments. In the long term, heat pump technology is the best choice for developing clean heating and electrification with enormous potential space.

4.2 Focus Markets

From the perspective of market segment, the Asian market will continue to develop stably under the drive of the development of the Chinese and Japanese markets; the European market is expected to slide by 29.6% in 2024 from a year ago due to the great impact of policy changes and the heavy development pressure confronting most countries before release of a new round of explicit subsidy policies; North America is expected to record a YoY growth rate of >16.2% in 2024. Compared with other mature markets, heat pump applications in other regions are still in market fostering. Hence, the penetration rate of air-source heat pumps has a large room for enhancement and will continue to maintain a momentum of growth in the future.



Fig. 4-3 Sales Volume Change of Global Air-source Heat Pumps in 2023-2024F (%)

Chapter V Brand Showcasing

Haier

Northwest Oilfield Petroleum Heating Renovation Project

Project Overview

At a particular oilfield located in the northwest region, the crude oil extracted necessitated heating and dehydration processes. Initially, the heating method employed was a 120-kW electric boiler system, presenting several challenges: high electric power consumption, impacting the power supply for oil extraction equipment, and an inefficiency, with only 0.95 kWh of heat generated per 1 kWh of electricity consumed; and a maximum output water temperature of only around 50°C, failing to meet process requirements and resulting in suboptimal oil-water separation efficiency. To address these issues, Haier's inverter modular heat pump was adopted to overhaul the existing petroleum heating system, achieving stable heat generation, enhancing energy efficiency, and reducing carbon emissions.

Project Design

Calculations showed that the project's process heat load was 96.84 kW, comprising both the heat necessary for increasing oil temperature and mitigating heat loss from oil storage tanks. Accounting for a redundancy factor of 1.2, it was determined that two units of Haier's inverter modular heat pumps (with a maximum output water temperature of 90°C) were selected to replace the original electric boilers. This configuration ensures a stable supply of processed hot water at 70°C, with the electric boilers remaining as backup heat sources for the system.





Application Effects

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A comparative analysis between the original electric boiler heating system and the Haier heat pump heating system installed during the renovation revealed the advantages of the heat pump system, listed as follows: (1) The heat pump system demonstrates consistent operation even under low temperatures and adverse weather conditions such as rain and snow. (2) The heat pump system's output water temperature is 5°C to 10°C higher than that of the electric boiler system, resulting in enhanced oil-water separation efficiency during petroleum heating processes. (3) The heat pump system requires a lower electrical power capacity, reducing the required power capacity by 28%. (4) The heat pump system consumes reduced electricity consumption per ton of heated petroleum, achieving energy savings exceeding 45% compared to the electric boiler system. (5) The heat pump system has a higher heating efficiency, measuring 2 to 2.5 times greater than that of the electric boiler system.

This project utilizes both air-source and water-source heat pump water heaters for thermal energy provision. It comprises a total of 11 energy stations. The system operates by circulating water from the waste heat pool through a 1:1 water-source heat pump, which preheats the tap water through waste heat cascade utilization.

Any deficit in heating is compensated by the air-source heat pump system, with the heated water stored in a newly constructed constant-temperature hot water tank. Subsequently, a variable frequency water supply pump delivers water to the bathrooms, maintaining a constant temperature and pressure. A variable frequency water supply pump then delivers water to the bathrooms, maintaining a consistent temperature and pressure. This integrated approach establishes a sustainable cycle, ensuring a continuous and reliable supply of hot water.

Centralized Heating Renovation Project in Guyefanlyu District, Tangshan City

Project Overview

The centralized heating renovation project in Tangshan City's Guyefanlyu District covers a construction area totaling approximately 860,000 m², with a corresponding heating coverage area of around 640,000 m², serving aged residential communities. Previously reliant on residual heat sourced from steelworks, the heating supply encountered operational inconsistencies due to the intermittent production processes, resulting in temperature fluctuations. After the mandated demolition of the steelworks in compliance with environmental preservation directives, residents were left without a viable heating solution.



Project Design

For the eight distributed heating stations, 489 units of Haier Chiyan+ series modular heat pumps were employed as replacements, integrated with Haier's proprietary clean energy smart control platform, ensuring efficient, stable, and reliable performance. Simulations of heat load energy consumption revealed a rate of 69.8 W/m², enabling on-demand matching of heating loads. The installation spacing of the units was optimized using CFD airflow simulations, with a spacing of 2 meters between groups and 1 meter between units. Additionally, the system's supply and return water temperature differential was set at 15°C, preserving the original hydraulic conditions within the piping network.

Application Effects

(1) Indoor temperatures consistently reached and maintained a comfortable level of 20°C or above, ensuring stability and comfort for residents. Since its implementation in November 2022, the system's return water temperature has remained consistently above 45°C, and its indoor temperatures at or above 20°C, with minimal fluctuations, providing a stable and comfortable indoor environment. (2) Nighttime indoor noise levels were measured at 41 decibels, with no complaints were reported. Despite the proximity of the equipment, located just 18 meters from residential buildings, and recording noise levels of 60 decibels in its vicinity, indoor noise levels during nighttime were measured at 41 decibels, below the national standard of 45 decibels, resulting in no complaints from residents.(3) Users expressed unanimous praise and 100% satisfaction. Following multiple visits conducted by Haier personnel in January 2023, users unanimously expressed 100% satisfaction with the clean heating solution.

OUTES

Hebei Wanquanzhen Heat Pump Heating Renovation Project by OUTES Covering Over 200,000 Square Meters

Project Overview = 1 = 2

Wanquan Town is located in Wanquan District, Zhangjiakou City, Hebei Province. Within a year, OUTES has installed a total of 94 units ultra-low temperature heat pump in Wanquan Town, covering a heating project area of over 200,000 square meters. The heating projects include the Wanquan Ying'en Community Heating Project, the Wanquan Town Heating Renovation Project, and the Wanquan Under-Construction Ancient City Heating Project. All of these projects are now operational, ensuring warmth for hundreds of households throughout the winter.



Project Design

The Wanquan Town Heating Renovation Project involves 2 residential communities, 1 school, and several other units, covering a total of 36 buildings. The current heating users include nearly 10,000 residents, street-side shop owners, school staff and students.

Among these, the Wanquan Town Heating Renovation Project covers a heating area of 120,000 square meters, making it the largest heating area in this project. OUTES has equipped this project with 41 60HP ultra-low temperature heat pump two-stage units. Installation began in October 2023, and the local OUTES team completed the installation of all 41 units in less than a month, putting them into operation.

Application Effects

From the initial 30,000 square meter residential community heating project to the cumulative installation covering over 200,000 square meters, OUTES achieved this in Wanquan Town in just one year. With the various heating projects undertaken by OUTES in the town now in operation, green and clean heating has been brought to hundreds of households. During the 2023 heating season, indoor temperatures in the Wanquan Town Heating Renovation Project reached 23-25°C, earning high praise from users.^{OL.com}

OUTES Floor Heating Heat Pump Air Conditioning Extreme Cold Heating Project in Mohe

Project Overview

Mohe is the northernmost city in China and the county with the lowest temperatures, earning the title of the "Arctic of China." Starting in late November 2023, OUTES, in collaboration with China Electric Power Research Institute (CVC) and Weikai, launched a nearly three-month field trial for extreme cold heating in Mohe's harsh climate testing grounds.



Project Design

The experimental chamber tested covers an area of 16 square meters and is a glass room, with total heat loss similar to that of a 100 square meter building in Mohe. The heat pump unit used in this extreme cold heating test is the OUTES Floor Heating Heat Pump Air Conditioning Twin Stars Pro series, which meets the trial's requirement of a heating capacity of approximately 12 kW at low temperatures (-20°C). The system is equipped with OUTES ultra-thin silent air handling units and a 100L buffer water tank.

During the testing period, the laboratory staff continuously monitored and tested the OUTES heat pump air conditioning unit from various aspects, including operational performance, electrical safety, and noise levels, to verify OUTES's heating capability in extreme cold environments.

Application Effects

During the nearly three-month field operation, the outdoor temperature dropped below -30°C on 74 days. Despite the harsh and extreme winter conditions in Mohe, the OUTES Floor Heating Heat Pump Air Conditioning Twin Stars Pro series continued to operate stably.

On January 9, 2024, with the outdoor temperature at -30°C and the chamber temperature at 0°C, the staff set the unit's water temperature to 57°C. The unit started up normally and entered heating mode. After one hour of operation, the chamber temperature stabilized at 30°C, achieving a successful temperature differential of 60°C between indoors and outdoors.

Hien®

Anhui Normal University Huajin Campus Student Apartment Hot Water System and Drinking Water BOT Renovation Project

Project Overview 专业委员会

The Anhui Normal University Huajin Campus project received the prestigious "Best Application Award for Multi-Energy Complementary Heat Pump" at the 2023 "Energy Saving Cup" Eighth Heat Pump System Application Design Competition. This innovative project utilizes 23 units of Hien KFXRS-40II-C2 air source heat pumps to meet the hot water needs of over 13,000 students on campus.

Project Design

This project utilizes both air-source and water-source heat pump water heaters for thermal energy provision. It comprises a total of 11 energy stations. The system operates by circulating water from the waste heat pool through a 1:1 water-source heat pump, which preheats



the tap water through waste heat cascade utilization. Any deficit in heating is compensated by the airsource heat pump system, with the heated water stored in a newly constructed constant-temperature hot water tank. Subsequently, a variable frequency water supply pump delivers water to the bathrooms, maintaining a constant temperature and pressure. A variable frequency water supply pump then delivers water to the bathrooms, maintaining a consistent temperature and pressure. This integrated approach establishes a sustainable cycle, ensuring a continuous and reliable supply of hot water.

产业在线

Application Effects

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1. Energy Efficiency: The advanced heat pump waste heat cascade technology significantly enhances energy efficiency by maximizing waste heat recovery. Wastewater is discharged at a low temperature of 3°C, and the system utilizes only 14% of electricity to drive the process, achieving 86% waste heat recycling. This setup has resulted in a savings of 3.422 million kWh of electricity compared to traditional electric boilers.

2. Environmental Benefits: By utilizing waste hot water to produce new hot water, the project effectively replaces fossil energy consumption in university bathrooms. The system has produced a total of 120,000 tons of hot water, with an energy cost of just 2.9 yuan per ton. This approach has saved 3.422 million kWh of electricity and reduced carbon dioxide emissions by 3,058 tons, contributing significantly to environmental protection and emission reduction efforts.

3. User Satisfaction: Prior to the renovation, students faced unstable water temperatures, distant bathroom locations, and long queues for bathing. The upgraded system has greatly improved the

bathing environment, providing stable hot water temperatures and reducing wait times. The enhanced convenience and reliability have been highly appreciated by the students.

Central Heating Project in New-built Residencial Complex in Tangshan

Project Overview

The Central Heating Project is located in Yutian County, Tangshan City, Hebei Province, serving a newly built residential complex. The total construction area is 35,859.45 square meters, comprising five standalone buildings. The above-ground construction area spans 31,819.58 square meters, with the tallest building reaching 52.7 meters high. The complex features structures ranging from one underground floor to 17 floors above ground, equipped with terminal floor heating. The heating system is vertically divided into two zones: the low zone from floors 1 to 11 and the high zone from floors 12 to 18.

Hien has provided 16 ultra-low temperature air source heat pump DLRK-160II units to meet the heating demands, ensuring room temperatures remain above 20°C.



Project Design

1. Integrated High-Low Zone System: Given the significant building height and vertical partitioning of the heating system, Hien implemented a design where high-zone direct-connected units are utilized. This integration allows the high and low zones to function as a single system, ensuring mutual support between zones. The design addresses pressure balance, preventing vertical imbalance issues and enhancing overall system efficiency.

2. Uniform Process Design: The heating system employs a uniform process design to promote hydraulic balance. This approach ensures the stable operation of the heat pump units and maintains consistent terminal heating performance, delivering reliable and efficient heat distribution throughout the complex.

Application Effects

During the severe winter of 2023, when local temperatures plummeted to record lows below -20°C, the Hien heat pumps demonstrated exceptional stability and efficiency. Despite the extreme cold, the units maintained indoor temperatures at a comfortable 20°C, showcasing their robust performance.

Hien's high-quality products and services have earned significant recognition from property owners and real estate companies. As a testament to their reliability, the same real estate company is now installing Hien heat pumps in two additional newly built residential complex, underscoring the trust and satisfaction in Hien's heating solutions.

Tongfang

Changchun Green Park Wuyue Integrated Energy Project

Project Overview

Wuyue Plaza is a nationally recognized commercial complex, which has laid out many cities in China; in 2022, Wuxi Tongfang Renhuan established cooperation with it and completed the supply project of air source heat pump units for Tianjin Wuyue Plaza and Changchun Green Garden Project; in early 2023, Wuxi Tongfang Renhuan signed a strategic cooperation with Wuyue Plaza commercial complex, and will continue to use our company's air source heat pump units to create dozens of projects for green, energy-saving Remodeling and construction. We have completed the supply of air source heat pump units for the commercial plots of Huangshi Daye New City Wuyue Plaza, Xiantao Nancheng Wuyue Plaza, Tianjin Ninghe Wuyue Comprehensive Energy Project, and Tangshan Lunan Wanda Comprehensive Energy Project.



Changchun Green Park Wuyue Plaza is located in Green Park District, Changchun City, Jilin Province, with a commercial area of more than 137,600 square meters, which is a multi-functional large-scale urban complex project integrating commerce, residence, office and hotel. The heating commercial area is about 137,600 square meters and the cooling commercial area is about 130,100 square meters.

The project adopts cold and hot double storage technology to build an energy-saving and low-carbon integrated energy system, with 34 Tongfang air-source heat pump modular units plus 2 electric boilers + cold and hot water storage tanks. Provide cold and hot energy supply services for the shopping mall. It helps to reduce the heating cost of the square in the whole cycle and effectively improves the economy, safety and reliability of the square's energy supply.

Application effect

During non-business hours at night in the square in winter, the Tongfang heat pump and electric boiler are started to use low-priced off-peak electricity to store heat and store it in a hot water storage tank. During the daytime when the plaza is open, the heat storage device releases heat energy; during non-business hours at night in summer, the off-peak electricity price is used to store heat. Cooling during the day.

(1) Cheap valley electricity heat storage and cold storage, daytime release of heating and cooling, cost reduction and efficiency;

(2) Technological innovation, heat supply is stable and reliable;

(3) Peak shaving and valley filling to the power grid, alleviating the pressure of power supply to the power grid;

(4) Highly intelligent, less manned;

(5) In line with the national policy of heating cleanliness.

Inner Mongolia Youran Herd Clean Energy Heating Project

Project Overview

The green industry chain created by Inner Mongolia Youran Herding establishes green standards, produces green products, and promotes all links in the industry chain to realize common sustainable green development. Since Wuxi Tongfang Artificial Environment Co. Ltd. and Inner Mongolia Youran Herding built a pilot project in Hohhot, Inner Mongolia, in 2019, it has continued to provide its newly built ranches with ancillary equipment that can generate clean and renewable energy for its heating purposes. As of 2023 has completed Hohhot, Bayannur, Tongliao, Chifeng, Shandong, Gansu, Shaanxi and many other places more than a dozen pastures nearly 300,000 square meters of clean energy heating projects, and more than 100,000 square meters of Inner Mongolia, Shandong, Hebei and other places in the construction of the pasture.



Project Design

The end form of ranch heating is mostly heater, which has high requirements for the water outlet temperature of heat pump, therefore, according to Party A's requirements of high efficiency, greenness and environmental protection, Wuxi Tongfang Renhuan Co., Ltd. is specially equipped with Tongfang air-cooled heat pump unit (low-temperature and strong heat type) model FS-L-R-150G, which is in full conformity with the green development needs of Youran Ranch Industry.

Application effect

Up to now the project has been put into use, through the air source heat pump this clean heating method to replace the coal burning, can save 5000 tons of standard coal per year, reduce CO2 emission 13100 tons/year, reduce SO2 emission 42.5 tons/year, reduce NOx emission 37 tons/year.

E**&**Tek

Zhejiang Extek Technology Co., Ltd. is a high-tech enterprise specializing in the research and development, production and sales of high-efficiency heat exchangers which mainly including high-efficiency new shell and tube heat exchangers, coaxial coils, plate heat exchangers, falling film heat exchangers and other products as well as system accessories such as distributors. Widely used in heating, hot water, refrigeration, industrial and agricultural production and other fields. With advanced R&D capabilities, high-level production technology and strict quality control, the company has established a high brand awareness and influence in the industry, and has become a major R&D and manufacturing enterprise in the heat exchanger field. From 2018 to 2023, it has been selected as an excellent parts supplier in the heat pump industry by the Heat Pump Committee of China Energy Conservation Association for six consecutive years.

Extek plate heat exchanger

Plate heat exchanger is a kind of high efficiency heat exchanger made by a series of metal plates with certain corrugated shape, which are processed by stacking and brazing. A thin rectangular channel is formed between the plates, and the heat is exchanged between the plates.

Plate heat exchanger will provide superior performance and high cost performance. Plate heat exchanger has the advantages of high heat transfer coefficient, low fouling coefficient, small volume, light weight, strong bearing capacity, less liquid , variable plate combination type, flexible process combination and so on.

Application

R290 Super Aqua GT Series Air to Water Heat Pump

Haier Intelligent Buildings


SUPER AQUA ATW Heat Pump Enjoy The Warmth



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Wilo Solutions







Wilo-Para MAXO High-Efficiency Circulator



Wilo-Yonos Para High Flow High-Efficiency Circulator



Wilo-MHI/MHIL Horizontal Multistage Centrifugal Pump



Wilo-Medana CH1-L Horizontal Multistage Centrifugal Pump





Cooling capacity: 0.1-16HP Application field: HP Water Heater, HPDryer, Communication, Refrigeration, Vehicle Application, etc

PAC(Light Commercial AC)



Cooling capacity:4-16HP Application field: Unitary ,VRF ,Modularity

Compressors for household inverter ACs

size	Series	Structure	2.0kw	2.5kw	3.0kw	3.5kw	4.0kw	4.5kw	5.0kw	6.0kw	7.0kw	7.5kw	8.0kw
\$88	A	Single	5.8	7.3	8.8								
Ф107	D	Single	7.1	8.8	9.8	10.2		13.0					
		Twin	13.0	14.1	15.0		16.3	18.6		21.6	22.6		
om	press	ors for	unitar	y ACs									
size	Series	Structure 3	5.0kw 7.	0kw 8.0	kw 9.0	kw 10.0	0kw 11.	0kw 12.	0kw 14)	0kw 16.	0kw 18.	0kw 19	-70.0k
Ф132	TH	Twin	41.8	3	43.8	48.8	50.8	53	55		R22	, fixed :	3-4HPs
		Twin	20.1	25.5	28	32.5	35.6	5 4 2	48.1	8 55	R41	0A/R32	
Ф160	TE	Twin	R22, fixe	d 4-6 H	Ps	63.8	3 68	80	88.	0	fixe	d 3-5 H	PS
			R410A/F	32, fixe	4-7 HF	-s 4	4 49	8 55	65	75.2	108		
			R410A/F	32, fixe	d, in par	allel 10-	28 HPs		19.8	59	75.2		
Com	press	ors for	multi	conn	ected	ACs							
ize S	ieries S	tructure 7.	0kw 8	.0kw 1	1.0kw 1	2.0kw	14:0kw	16.0kv	/ 18.0k	w 20.0k	w 22.0	kw 24-3	.44.0k
Þ122	TL	Twin	36 4	2 F	410A/R	32, <mark>sma</mark>	II O.D.	INV 5-	6 HPs				
Þ132	тн	Twin	30.7 3	5.6 42	55	65	R410	A/R32	INV 4-1	2 HPs			
Þ160	TE	Twin	R410A/	R32, INV	10-16H	Ps		65	75	84.8			
						10 1	1.1.1.1.						



