

China Heat Pump Forum Heralds a Green Future



As average temperatures continue to rise globally and weather events become more extreme and erratic, demands for green policies are becoming more acute with each passing year. Mining, manufacturing and construction have been mastered. Whole cities can be built in a few years. Yet this very act of creating comfortable spaces is taking a heavy toll on our atmosphere. Now the survival of more than eight billion inhabitants of Earth depends upon harnessing and repurposing our know how to create green energy sources and net-zero living spaces.

Living standards can be raised while minimizing the release of greenhouse gases (GHGs) into our atmosphere. It may seem to be a daunting undertaking, but one need only look at what has been accomplished so far. Technologies in support of this massive undertaking include low-cost solar and wind energy as well as battery electric vehicles and energy storage. Heat pumps represent yet another technology that can greatly improve energy efficiency and moderate climate change. The advances in heat pump technology have been at least as impressive as the celebrated advances in alternative energy sources and battery electric vehicles.

Growth of Heat Pumps in China

Several prominent global organizations recognize the essential role of heat pumps as part of broader

plans to phase down dependence on fossil fuels. Heat pumps support decarbonization, electrification and energy efficiency. It is now broadly acknowledged by international organizations such as the International Energy Agency (IEA) and the International Institute of Refrigeration (IIR) that the challenge of residential and commercial heating is best met with heat pumps. Regional organizations such as the EHPA, HPTCJ and DBC also recognize that heat pumps offer a path to a green future.

This paper focuses specifically on the role of heat pumps as one part of the global strategy with a focus on China. Presently a major challenge is the deployment of heat pumps. Different regions of the world face common hurdles in deploying heat pumps on a massive scale. Chief among these challenges are providing heating in cold climates and the equitability of the deployment of heat pumps.

The Heat Pump Forum (HPF) is a major accelerator for the global deployment of heat pumps. It is an annual event organized by China Heat Pump Alliance (CHPA) and sponsored by its members. Since its founding 15 years ago, the CHPA has grown from six members to more than 600 members today. For many years, the HPF was a regional event attended mainly by members of the CHPA.

Today the HPF is an event of global importance. It is the only global event that is 100 percent focused on

heat pump technology, bringing together big HVACR appliance OEMs, successful startups focused on new heat pump technology, and policy makers and pioneers in new heat pump technologies from all over the world.

Considering its leading position in heat pump design and production, China is perhaps underrepresented at scientific conferences dedicated to heat pump technology. That is unfortunate because China has much to offer the heat pump community. China is already renowned for new products and manufacturing methods in the fields of solar panels and electric vehicles. The HPF is now a unique event for forming partnerships with the key stakeholders in the global heat pump industry. The HPF is widely recognized as the foremost event for discourse on the future of heat pumps not only for China but also for the world.

2024 Heat Pump Forum in Shanghai

The most recent HPF was held this past summer at the Convention Center in the Songjiang New City International Ecological Business District. This setting was appropriate because Shanghai is living proof of what can be accomplished in a short period of time. The rapid development of Shanghai and indeed all of China is a modern miracle [1].

More than a thousand heat pump professionals espoused the continual improvement and sustainable development of heat pump industry. See Figure 1. Speakers addressed the "hot topics" of markets, policy and technology in nine specialized sessions:

1. High-Temperature Heat Pumps and Industrial Applications
2. Heat Pump Market Growth and Breakthroughs
3. Clean Heating Development Forum
4. International Policies and Market Development for Heat Pumps
5. Heat Pump Exports and Refrigerant Substitution
6. Multi-Energy Complementary Technologies
7. Commercial Heating and Regional Energy Digitalization
8. Comfort Systems Development
9. Drying and Special Applications.

To facilitate communications, spoken words were translated in real time and projected onto screens along with the slideshow presentations. Simultaneous translators provided audio translations through headsets in select sessions as well. Technical papers were printed and bound with many of the abstracts, figure captions and charts translated into English.

CHPA executive general secretary Hengyi Zhao emphasized how heat pump technology is characterized

by energy savings, low carbon emissions and other environmental benefits. According to Zhao, the reason for the rapid replacement of fossil fuels by heat pumps is that they optimize thermal energy production, especially in middle and low temperature ranges. "Heat pumps are the key to new, high-quality, productive forces in the thermal energy field. The technologies have significant implications for green, low-carbon transitions in heating sectors in China and globally," says Zhao. See Figure 2.

What is a Heat Pump?

One topic frequently discussed was the definition of a heat pump, especially in the context of industry statistics. It was noted by several attendees that the definition varies depending on the region of the world. In China, for example, split-type reversible residential appliances are not counted in heat pump statistics, even though the number of units sold is very large. Most split-type room air conditioners can now also provide heating by running them in a reverse cycle. These are not counted as heat pumps in market statistics for China. On the other hand, in the United States and other regions, these reversible split units would be considered heat pumps, which distorts the market statistics.



Figure 1 – The 2024 China Heat Pump Forum, Plenary conference, Shanghai, China. More than a thousand heat pump professionals espoused the industry's continual improvement and sustainable development.



Figure 2 – The General Secretary of CHPA Hengyi "Cooper" Zhao presented the 2024 China heat pump industry annual report at the China Heat Pump Forum.

In the most general sense, a heat pump is any machine that uses mechanical work to transfer heat-energy from one location or environment to another. Technically these are all heat pumps:

R: Refrigeration equipment removes heat from a freezer or refrigerated space. This heat can be redirected for space or water heating.

AC: Air-conditioning systems and chillers remove heat from indoor spaces or chilling fluid, respectively.

HP: A heat pump pumps heat from an outdoor ambient (air, water or ground) into a commercial or residential building, to raise the temperature of the indoor spaces or water supply; or pumps heat from an indoor space to the outdoors when in cooling mode.

“R” and “AC” are well established industries. The technology disruptor is the “HP” in RACHP. Heat pumps are known as *pompa di calore* in Italy, *pompe à chaleur* in France and *Wärmepumpe* in Germany. Whatever the language or country, OEMs are eager to enter markets with practical HP heating solutions for their region and for export. One of the remarkable things about the HP revolution is that no one size fits all. Heat pumps must be tailored to the climate and demographics of the region in which they are sold.

Air Source Heat Pump (ASHP) technology has greatly improved over the past decade. These systems are more economical than ground source heat pumps (GSHPs) especially with respect to installation costs. The heat collected at the outdoor evaporator of an ASHP can be used to raise the temperature of air in an air-to-air (ATA) HP; or more commonly in China, it can be used to raise the temperature of water in an air-to-water (ATW) HP.

In recent years, ATW heat pumps have become popular across residential, commercial, industrial and district heating applications in China. One of the main advantages of such ATW system is that the refrigerant stays in a sealed unit outdoors, and cold or hot water is sent to the building. This enables the use of flammable natural refrigerants such as propane at higher charge levels. ATW hot water output can be used to heat spaces as well as domestic hot water (DHW) which is stored in water tanks and comes in contact with humans. The versatility and environmental friendliness of ATW HPs has led to their high popularity and an accelerated rate of adoption across China's climate zones.

The IEA has provided a detailed schematic of all the major heat pump types and their applications [2]. *Schematic: Heat pump types and applications – The Future of Heat Pumps in China – Analysis - IEA*

Global Statistics for ATW Heat Pumps

JARN recently published a special issue on “The World ATW Heat Pump Market – 2024 Update.” [3]

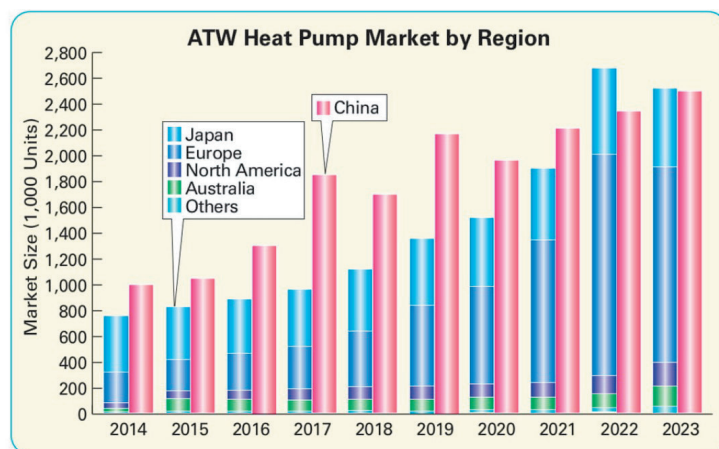
The update lists the major players in each region of the world including North America, Europe and Asia with further breakdowns by countries. Note that the JARN data is limited to ATW heat pumps. Nearly 5 million air-to-water (ATW) heat pumps were produced in 2023. China is the largest market for ATW heat pumps. The ATW market in China grew to 2.47 million units in 2023. See Figure 3. China not only manufactures heat pumps for its domestic use, but exports heat pumps, especially to Australia, France, Germany, Italy, the Netherlands and Spain.

In every year for eight years from 2014 to 2021, ATW heat pump sales in China exceeded the sales in all other countries combined. Meanwhile, sales of heat pumps in Europe caught up with and exceeded sales in Japan. This growth of heat pumps in Europe slowed in 2023.

The European Heat Pump Association was represented at the HPF by Mélanie Auvray, Policy Manager, who traveled to Shanghai to present in the session on International Policies and Market Development for Heat Pumps. Also, EHPA's new President Patrick Crombez shared his insights through a special video message. [4]

Auvray attributes the lower numbers in 2023 to natural gas prices, electricity prices, high interest rates, political debate, reduced ambition and uncertain subsidy schemes. EHPA released a four-page manifesto for the European Union in February 2024, stressing these five points:

1. Set Clear Policy Direction and Targets
2. Make Heat Pumps Affordable for All
3. Strengthen Industrial Leadership and Skills
4. Unlock the Full Potential of Large Heat Pumps
5. Use Heat Pumps' Flexibility to Support the Energy System



Source: JARN database
Figure 3 – The ATW market in China grew to 2.47 million units in 2023.

“Heat Pumps: The Heart of Europe’s Energy Future: EHPA priorities for EU policy 2024-2029” is the title of the Manifesto, which serves as an excellent executive level briefing on European heat pump markets and policies. It is available for free download [5].

Novel ATW heat pumps from China have been exhibited at major expos such as Interclima (Paris, France), Chillventa (Nuremberg, Germany), ISH Expo (Frankfurt, Germany) and MCE Mostra Convegno Expocomfort (Milan Italy) as well as the AHR Expo (USA), China Refrigeration (Shanghai, China) and many other regional expos [6].

Jan Dusek, Co-founder, Group COO & Head of APAC, ATMOsphere traveled to the HPF to make the case for the use of natural refrigerants [7]. Dusek presented in the session on Heat Pump Exports and Refrigerant Substitution. He described the trend toward natural refrigerants over the past 15 years in parallel with the emergence of the heat pump marketplace. He pointed out the many models of heat pumps on display at the ISH in March 2023. Many models use ultralow-GWP propane refrigerant in residential heat pumps as well as commercial-sized heat pumps. Dusek also reviewed the success of the R744 residential hot water heat pumps in Japan, commenting on how the cost came down dramatically thanks to competition.

At the HPF, Panama Bartholomy reviewed the American heat pump markets and policy trends in a well-received presentation. Bartholomy is currently the Executive Director of the Building Decarbonization Coalition (BDC), a cross-sectoral initiative to eliminate greenhouse gas emissions from the built environment [8]. He worked for many years with the California Energy Commission before joining the BDC. Bartholomy concurs that the ATW market has not developed in the USA in part because blown-air furnaces are more prevalent in the USA compared to hydronic systems. He pointed to the importance of legislation at the state level in driving the adoption of heat pumps.

Caroline Haglund Stignor, manager of the Heat Pump Centre, the program office of the Technology Collaboration Programme on Heat Pumping Technologies (HPT TCP by IEA) delivered a second IEA presentation titled “The Heat Pump Global Market and Technology Development” in the session on “Heat Pump Export and Refrigerant Substitution Forum”. See Figure 4.



Figure 4 – Caroline Haglund Stignor described existing IEA Heat Pumping Technology Annexes at the 2024 China Heat Pump Forum, Shanghai, China.

A Major New Global Market Report

A highlight of the HPF was the debut of The Global Heat Pump Market Report (2024). This major global report was jointly produced by the China Heat Pump Alliance (CHPA) and Beijing Zhixindao Sci-Tech Corp., Ltd. (ChinaIOL). The Report is available for free download [9]. See Figure 5.

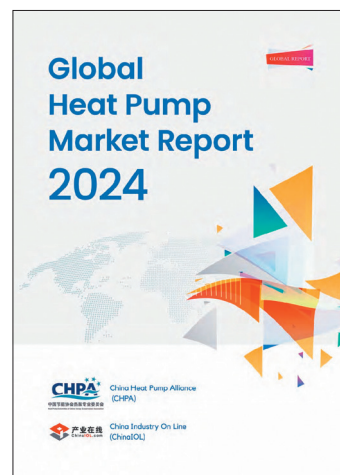


Figure 5 – A new market report from the CHPA and ChinaIOL debuted at the Heat Pump Forum and is now available for free download [9].

The Global Heat Pump Market Report draws on multiple research projects by both CHPA and ChinaIOL. 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. It is divided into five parts:

1. The global industry
2. Regional markets
3. The Chinese market
4. Global forecasts, 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. The market research encompasses air-source heat pumps for water heaters and heating but excludes 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.

The Procurement Process

The HPF would not be complete without the procurement exhibition. Next generation cold-climate heat pumps from innovative companies boasted good efficiency at ambient temperatures as low as -36°C (i.e., -33°F).

Manufacturers included Grundfos for water pumps; Highly, Danfoss and Copeland for compressors; and many others for expansion valves, distributors, pipe connectors, water tanks and much more. A designer could identify economical and reliable suppliers of high quality products for practically any heat exchanger system design.

More than one-hundred companies showcased premium heat pumps and heat pump components in spaces just outside the conference rooms. These companies typically have manufacturing plants on multiple continents. See Figure 6.



Figure 6 - Exhibit Floor at the 2024 China Heat Pump Forum.

Conclusion

China today is at the center of heat pump research, product development and manufacturing. The HPF is an annual event that typically draws more than 1500 participants from around the globe. Even more participants are expected in 2025 as the uptake of heat pumps accelerates globally. There is no question

that traditional heating by fossil fuels will be replaced by heat pumps. It is now only a matter of when this will happen. Current models of climate change warn that this transition needs to be scaled up in a matter of years not decades. Already we are halfway through the decade of the heat pump, and the transition is just beginning. Anyone involved in decision making in the HP sector should make plans to attend the 2025 Heat Pump Conference. [10] ■

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