The Largest ASHP Central Heating Project in China

—Heat Pump Promotes Carbon Neutrality

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1. Company Profile

- Guangdong New Energy Technology Development co,. Ltd.
- Established in 2003.

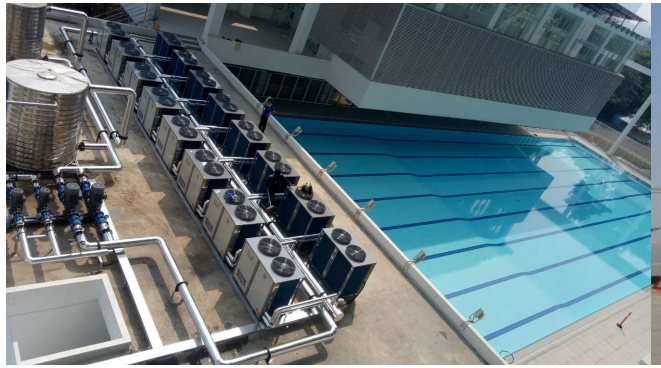
1. Company Profile

- The leading enterprise of heat pump industry for ten consecutive years.
- Annual sales of 2 billion CNY, the total production capacity is over 2 million sets/year.
- Official supplier of the 18th and 19th Asian Games.
- Zhao County project has maintained the record as the largest-scale ASHP central heating project in Asia.

1.Company Profile

Typical Applications of New Energy ASHP

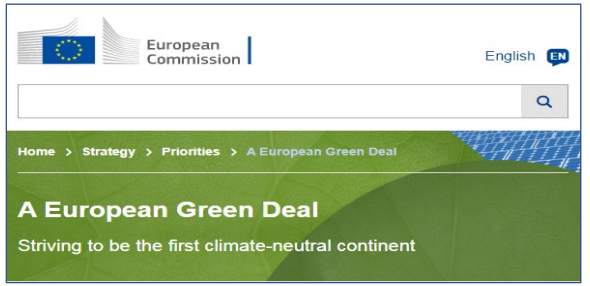
- 18th Asian Games
- 19th Asian Games
- The project in the Arctic and The Antarctic area
- The ‘coal to electricity’ projects of northern China



2. Global Neutrality and China's scheme

Global neutrality process

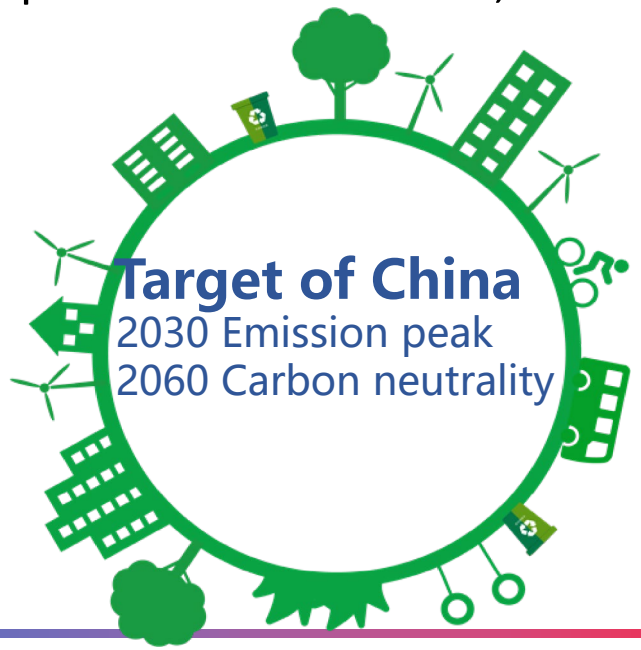
- More than 100 countries and regions around the world have announced carbon neutral targets, including the United States, China, the European Union, Russia, Japan, Germany and other major economies in the world. Setting carbon-neutral targets has become one of the biggest highlights of global climate governance.
- Eu Green Deal: 55% emission reduction in 2030



2. Global Neutrality and China's scheme

Heat Pump and Carbon Neutrality

- "15% of Social carbon reduction target can be achieved by heat pumps."(The construction field can replace 350 million tons, the northern heating field: can replace 150 million tons, and the industrial production field: can replace 1 billion tons.)



Chinese Academy of Engineering academician—Jiang Yi

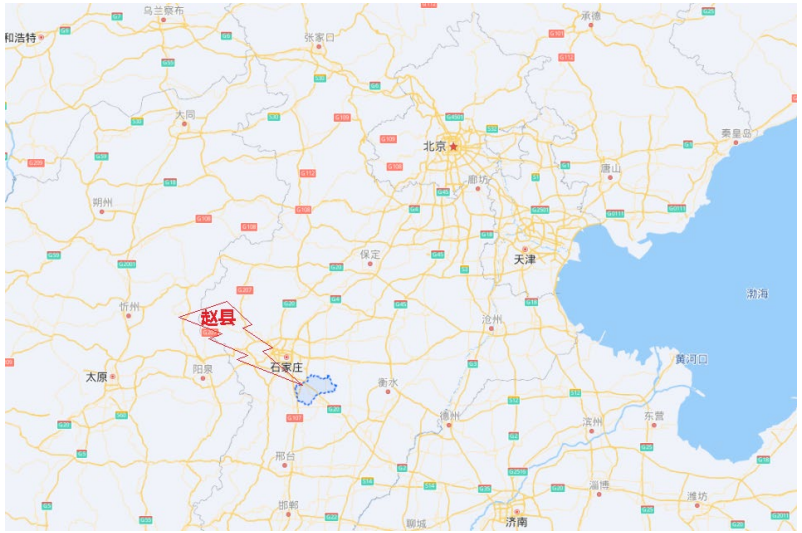
2. Global Neutrality and China's scheme

Heating methods and Clean Energy Application in China

- Since 2010,Chinese government has begun to implement a series of policies, such as reducing coal consumption for heating, promoting coal to air source Heat pump, coal to solar energy and other means of heating.
- After 2014, ASHP was increasingly adopted for heating which was due to its excellent performance in heating field. Moreover, the residential communities have begun to undergo a secondary transformation , using ASHPs instead of natural gas and electric heating.

3. Typical Case of Heat Pump Central Heating Application in China: Zhao County Project

Case Overview



- Location:Hebei Province, North of China.
- Area:675 square kilometers
- Population: 600,000
- Average temperature in winter (outdoor): -6.6℃
- Extreme minimum temperature: -19.3℃
- Space heating in winter is managed by the government.
- Before 2019, the heat source came from two coal-burning power plants caused serious air pollution.

3. Typical Case of Heat Pump Central Heating Application in China: Zhao County Project

- 1200 ASHPs for this project (each with an input power: 44KW, 120KW of heat production under heating condition）
- 42 distributed ASHP installation sites.

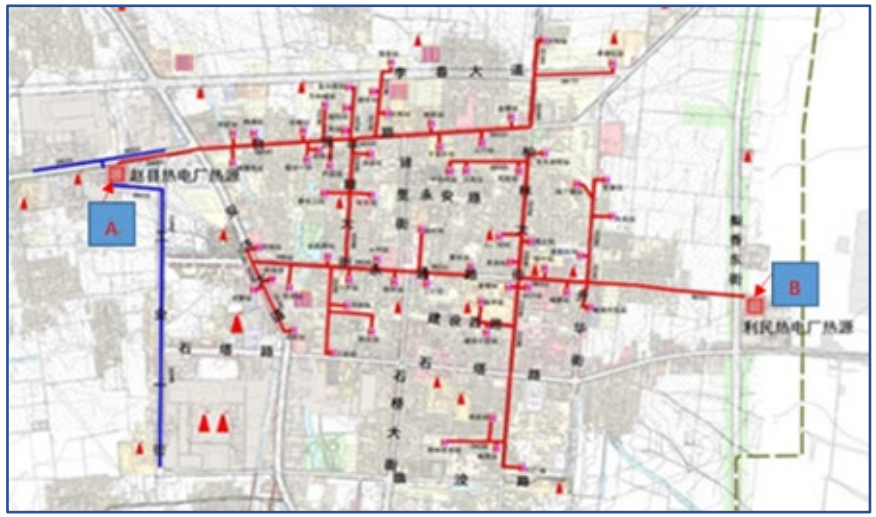


Fig.1 Before:Two coal-burning power plants（A 和 B）previous heat supply pipelines（red）

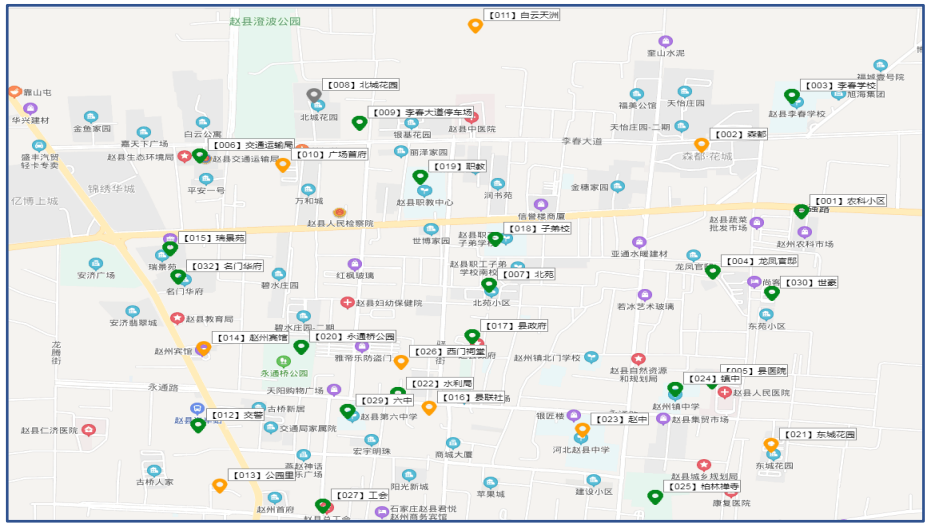


Fig. 2 After: 42 ASHP installation sites(green)distributing 1200 units

3. Typical Case of Heat Pump Central Heating Application in China: Zhao County Project

- The building area of the heating terminals is 4.07 million square meters
- Distributed heat source arrangement for the urban heating project is recommended to minimize the heat loss of the pipe network.

Fig.3: ASHP installation sites

4. Project difficulties and Performance analysis

Project difficulties

- Large in scale
- Short in the cycle
- Complex at the end
- Diverse in construction conditions
- Noise reduction

4. Project difficulties and Performance analysis

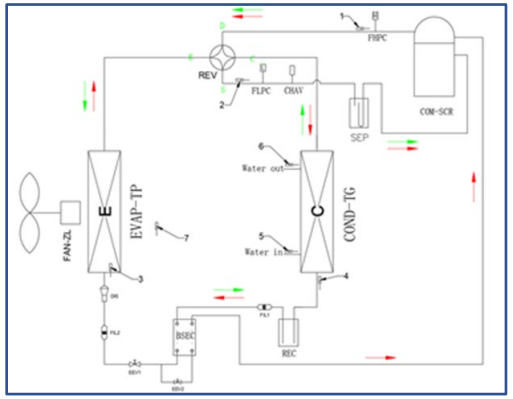
Project Optimization scheme

1. Optimized the installation spacing of ASHP.
2. Optimized the installation height of ASHP.
3. Combination of radiator and floor heating.
4. With IOT technology, to real-time monitoring the change in heat output and automatically adjust the ASHPs for a better system efficiency and energy saving.
5. Sound insulation wall is installed on field to reduce the noise impact.

4. Project difficulties and Performance analysis

Performance Analysis: EVI technology benefits

- According to the lab test result by Emerson Climate technology, it shows 21% - 40% heating capacity improvement and 7% - 22% efficiency improvement with EVI technology.



Ambient temperature (°C)	Heating capacities improve (%)	Efficiency improves (%)
7	21%	7%
2	23%	6%
-7	37%	16%
-12	40%	22%

Fig.5.

4. Project difficulties and Performance analysis

Performance Analysis: EVI technology benefits

- The system can be used under -30℃ ambient area and deliver high enough temperature water even for radiators.

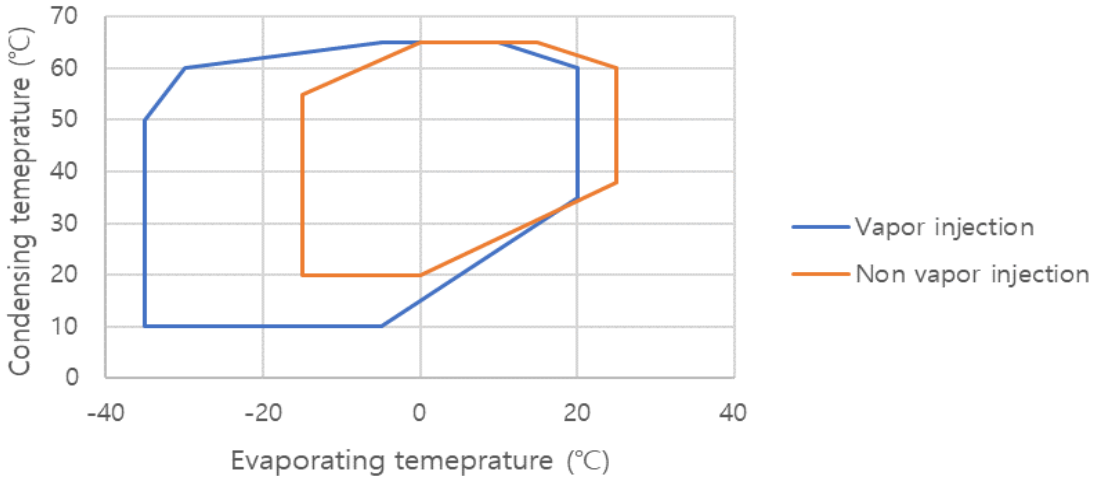


Fig.6 compressor envelop with and without vapor injection.

4. Project difficulties and Performance analysis

Performance Analysis : COP

- The average COP is 2.93 during the whole heating season.

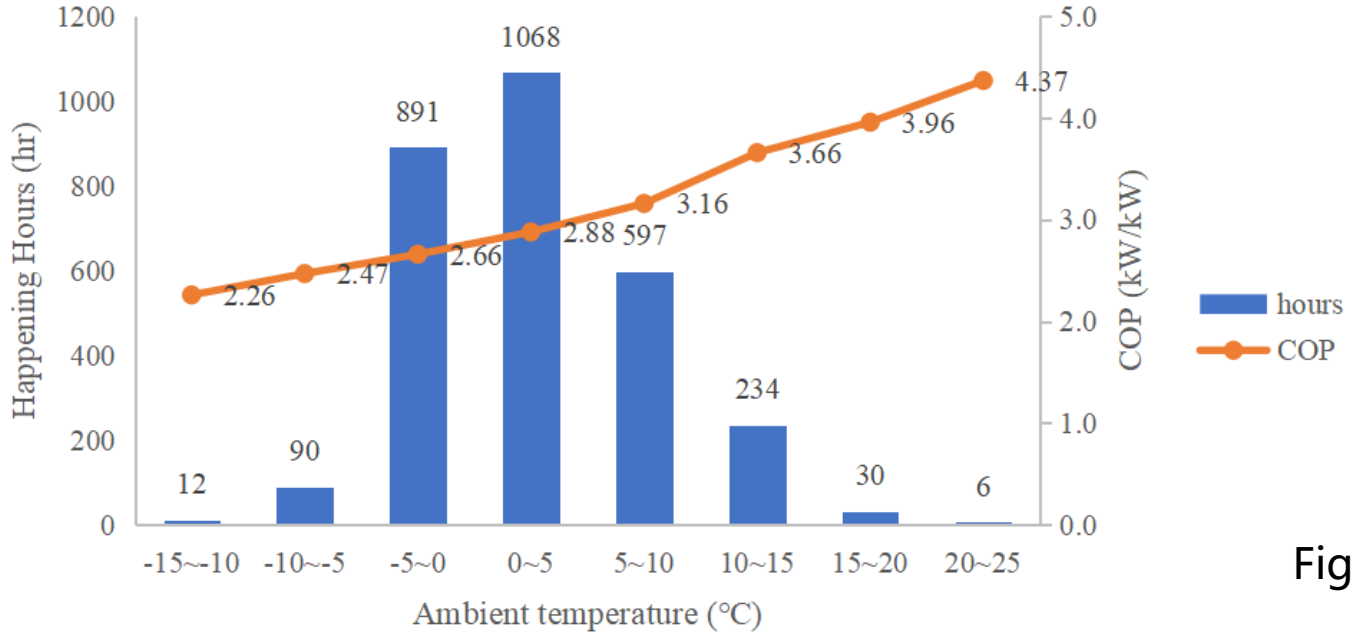


Fig.7

5. Energy-Saving benefits

Economic calculation

Actual Heating area	Mil. m^2	**3.25**
Total electrical energy consumption	Mil. kWh	**100.37**
Total water consumption	ton	155678
Total electricity fee	k CNY	43000
Average electrical consumption	kWh/m^2	**30.88**
Ave. Electric price of the power	CNY/kWh	0.43
Average heating cost	CNY/m^2	**13.23**

Fig. 8

	ASHP	Gas Boiler
Energy cost (million CNY)	43	6
Heating area(m^2)	3.25Mil.	22k
CNY/m^2	**13.23**	**27.27**

Fig. 9

5. Energy-Saving benefits

CO^2 emissions comparison

- Compared with coal-fired boilers, ASHP can reduce carbon dioxide emissions by about 38%.

	ASHP	Coal boiler
Efficiency	293%	60%
CO2 emission unit	0.997 kg/kWh	2.7 kg/kg
Heating energy per unit	10548 kJ/kWh	17584 kJ/kg
CO_2 emission per kJ	0.095 g/kJ	0.154 g/kJ

Fig.10

6. The Blueprint Value of Heat Pump Application

Conclusion

1. By on site interview, the average indoor temperature can reach 20-22 ℃, no air pollution in Zhao County, residential people are satisfied with the heating project.
2. The COP of the air source heat pump stations selected was above 2.8. When the outdoor temperature was -15 ~ -10 ℃, the heat pump COP could still reach 2.26
3. The cost of gas boiler heating is more than twice that of air source heat pump heating.
4. ASHP can reduce carbon dioxide emissions by about 38% compared with coal-fired boilers

6. The Blueprint Value of Heat Pump Application

Blueprint Value

1. The Energy-saving benefits of ASHP
2. The reliability and flexibility of ASHP for urban central heating project
3. Heat pump as an important resource solution for ‘carbon neutrality’.
4. Blueprint scheme for the large-scale ‘Coal to Clean Energy’ programs

6. The Blueprint Value of Heat Pump Application

Air Source Application in Multi-fields

Heating/cooling
House/Apartment
(Floor heating and central heating)

Clean Energy Heating
Office/Mall/ Hotel/Farm
(Cooling and Heating)

Gas to Electricity Applications (Europe and America)
(residential/commercial)

Water Heating
House/Apartment/Hotel/ School
(central heating for water)

Industrial and Agricultural energy-saving Drying
Food/tobacco/ Fruit /medicine

Thanks for your listening !