



Business Case for
Natural Refrigerants

11-12/04/2018 – Beijing

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Application and Development of CO₂ Heat Pumps in China



ATMO
sphere

The development history of Chinese CO2 heat pump industry:

The study of CO2 heat pumps started in 2009. Dongqi, as a pioneer of the CO2 heat pump industry, has witnessed its growing process.

Now, almost 10 years have passed, and the products have become more and more reliable and progressive.

30kW



70kW



100kW



140kW



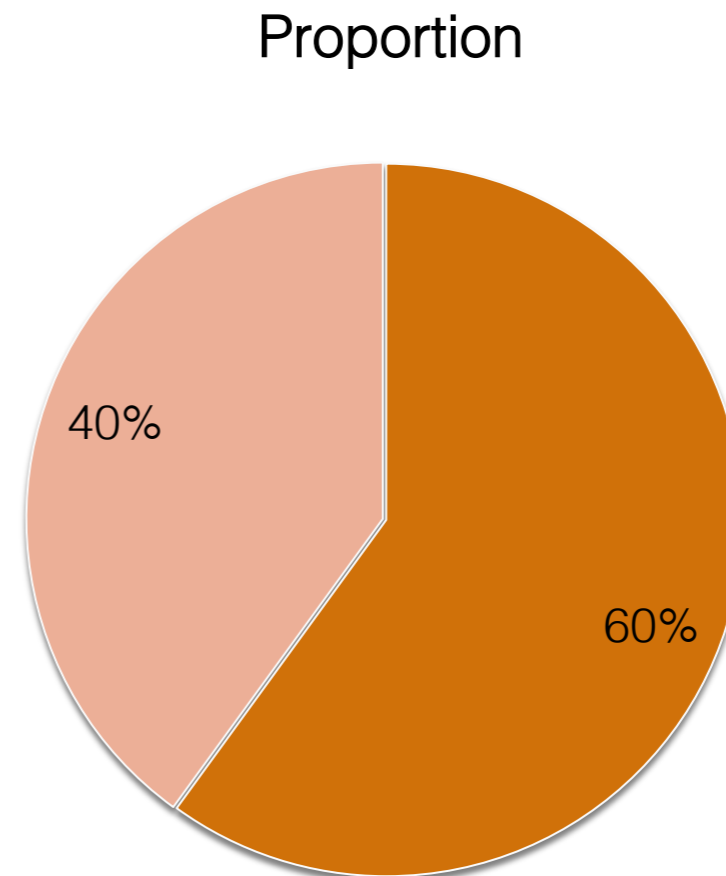
The development history of Chinese CO2 heat pump industry:

As of the end of 2017, the total amount of CO2 heat pumps in the Chinese market is around 700 units.

By application:

Water Heating: 60%;

Heat Supply: 40%;



• Products distribution map:

South: East coast、Southwestern.

North: North coast、Northeastern、Northwestern.





The application of Chinese CO2 heat pump:

- For water heating, our general customers are hotels, schools and hospitals.

Hotels: More than 140, examples: Hong Qiao State Guest Hotel, Intercontinental, Holiday Inn, Regal and so on;

Schools: More than 40, examples: Tongji University, East China University of Political Science and Law, Shanghai Normal University and so on;

More than 50 customers from other fields.



**Hong Qiao State
Guest Hotel**



Holiday Inn



**Shanghai Normal
University**



**Yunnan General
Hospital**

Performance of CO₂ heat pump for Water Heating:

Summary of real test:

| Electricity consumption per ton 60°C hot water | |
|--|-------------------------------|
| Annual average temperature (°C) | Electricity consumption (kWh) |
| 0~10 | 16~19 |
| 10~15 | 13~16 |
| 16~20 | 11~13 |
| 20~26 | 8~10 |

CO₂ heat pump has showed unique advantage for heating water and archived great success in application. Requirements from customers are satisfied.

CO2 Heat Pump for Heat Supply

Application:

Application test of Heat Supply started in 2014; more than 10 testing cases were built in different areas by different manufacturers. Examples:



Chinese
northeastern area



Chinese
northwestern area

Present condition:

Compared to water heating, the examples for heat supply are relatively less.

The main reasons are the requirements of heat supply and the limit of the natural property of CO2.



Performance



Heating ability

CO₂ Heat Pump for Heat Supply

Disadvantages:

Problems of machine:

1、 frozen 2、 Frost frequently 3、 the stability below $-20\text{ }^{\circ}\text{C}$



Frozen



Frost

Reliability



CO2 Heat Pump for Heat Supply

Case Study:

Where: Liao Ning Province

Area for heat supply: 10000 square meter, heating radiator

Average temperature in winter: -10--5 °C



CO2 Heat Pump for Heat Supply

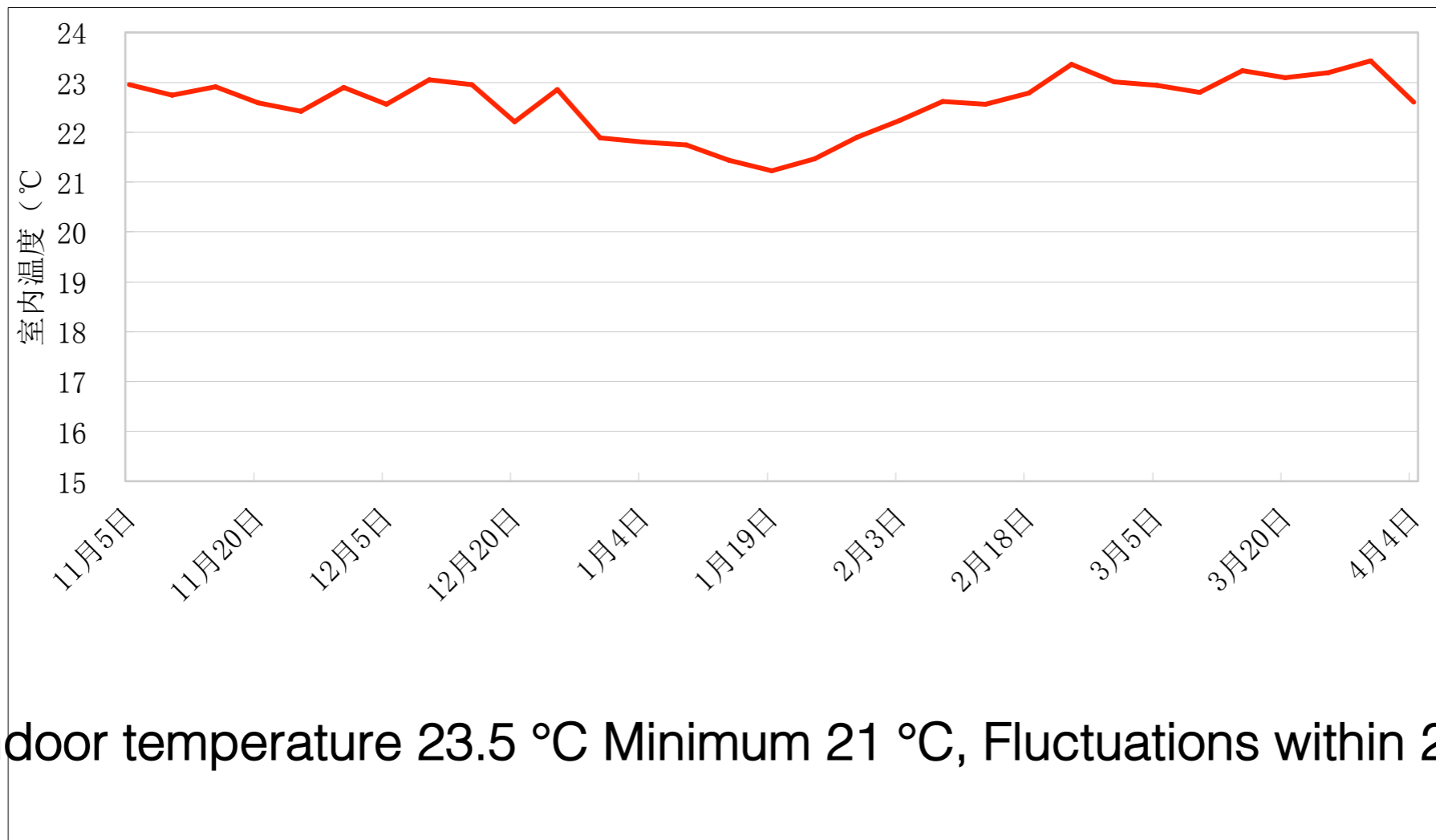
Technique adjustment:

- 1、 Set the machine into multiple parts
- 2、 Speed changing by compressor
- 3、 Add auxiliary to remove frost and ice
- 4、 Supply by requirements



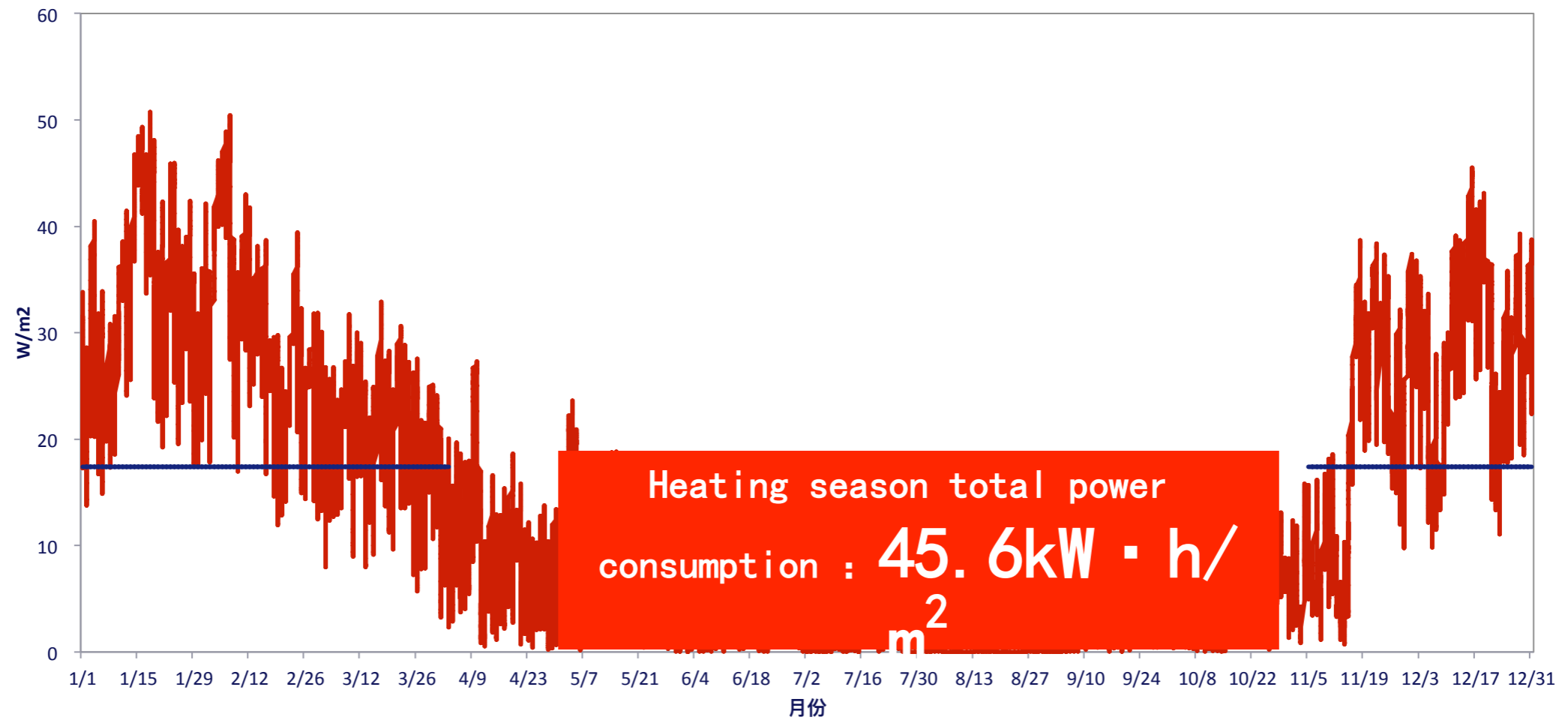
CO2 Heat Pump for Heat Supply

Figure for temperature change inside the room



CO2 Heat Pump for Heat Supply

Heat load and Electricity consumption



CO₂ Heat Pump for Heat Supply

From practical application, we have found the research direction of using CO₂ heat pumps as heat supply in extremely cold area. Besides, the possibility of this application has showed in previous study.

Summing-up:

- 1、 Above -20°C, the machine is reliable and is energy efficient;**
- 2、 Below -20°C, the application of heat supply needs future study;**
- 3、 Compare to other heat pump, CO₂ heat pump are well-adapted and more efficient;**

In north china, CO₂ heat pump shows great efficiency and comfortable for residents in the application of heat supply during winter. (above 20 °C)



The future of CO2 heat pump:

In the past 10 years, after a long period of researching and popularization, the development of CO2 heat pumps in China has gone from theoretical study to model test and finally to the batch production. Recently, as the international new energy development strategy coming into stage and F-gas being eliminated, the market requirement has shown strong increasing trend. It is reasonable to predict that by the end of 2020, the market occupancy for CO2 heat pumps will be more than 10,000 units.

Thanks to everyone for concern and support of the development of Chinese CO2 heat pumps ! !



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Thank you very much!

