



ATMO
sphere

Technology attempt for the wide-use of CO₂ Condensing Unit

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Panasonic Appliances Company
Refrigeration and Air-Conditioning Devices Business Division
Refrigeration System department
General Manager : Manabu Onishi

- 1) Refrigerant Strategy of Panasonic (for refrigeration)
- 2) Background and Achievement
- 3) Technology development to solve issues for spreading CO2
- 4) Issues and Action Plan

**Pursue Environment-friendly and Energy-saving
Introduce & expand the use of appropriate natural
refrigerant for each equipment to lead the industry.**

Promotion of Natural Refrigerant

Post HFC refrigerant
(GWP<1500)
But, after 2029
there is **risk of ban**

Promotion of **natural-refrigerant**,
considering **the risk of re-investment
in the future (refrigerant re-
conversion)**

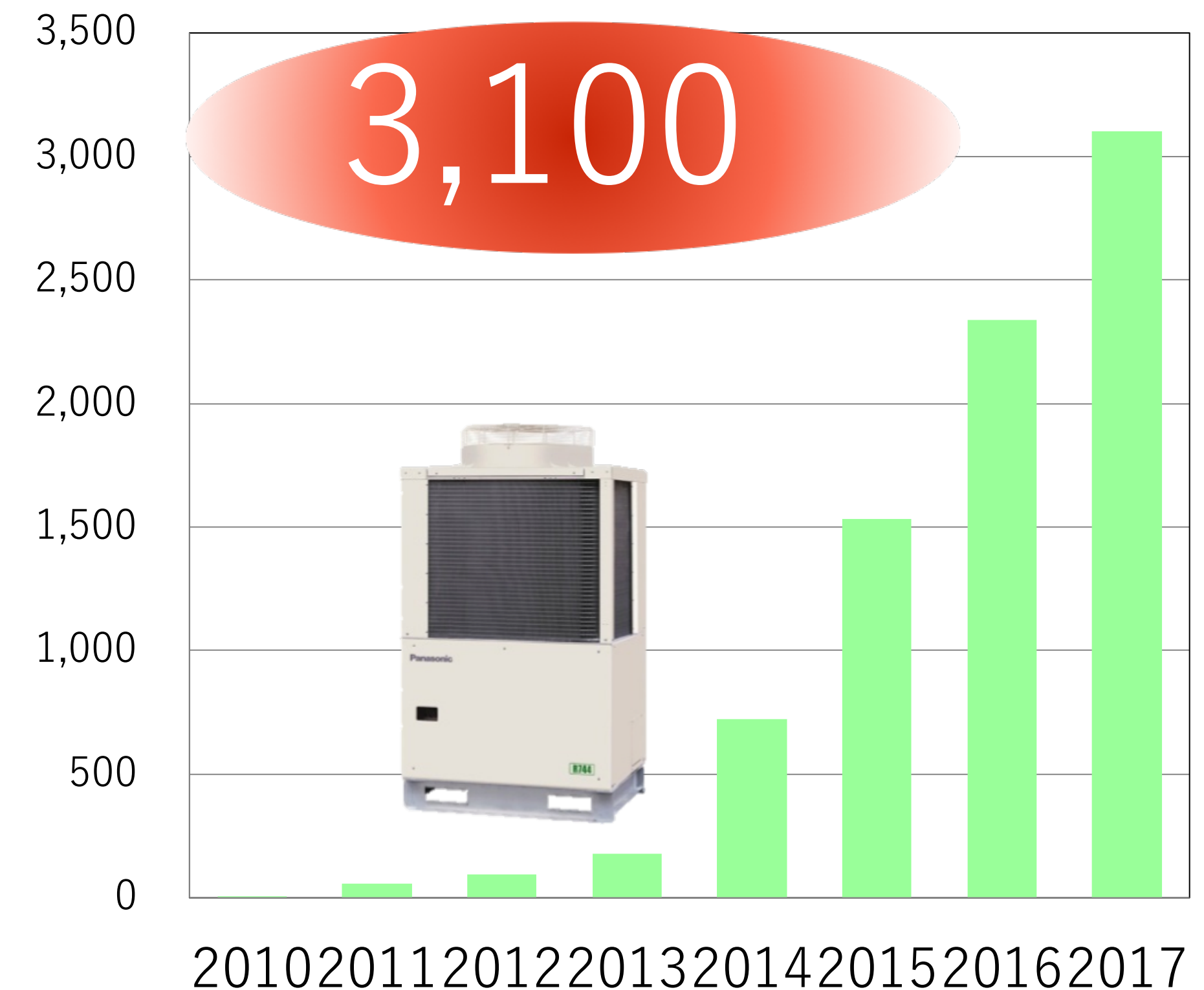
Background & Achievement of CO2 Condensing Unit System



The Promotion of CO2 system by government support and evaluation

- 2005 YR** participated in **Ministry of Economy Trade and Industry (NEDO)** project  Basic research period
- 2009 YR** Start of demonstration experiment in the supermarkets.
- 2010 YR** **Launch the CO2 refrigerant adopted condensing unit**
 - ★Protect the Ozone Layer, Prevent Global Warming Grand Prize (2010 YR)
 - ★Energy Conservation Grand Prize (2013 YR)
- 2014 YR** Ministry of Environment (MOE) MOE project to accelerate the usage
 - “Energy efficient refrigeration and Air-conditioning Equipment based on Natural Refrigerant Good Practices”
 - ★Electrical Science and Engineering Promotion Award (2014 YR)
 - ★Chairman Prize of ECCJ (2014 YR)
- 2015 YR** Launch **Pressure Adjust Control type condensing unit & side flow type 10HP condensing unit**
 - ★Protect the Ozone Layer · Prevent Global Warming Grand Prize (2015 YR)
 - ★Minister of the Environment’s 2016 Commendation for Global Warming Prevention Activity (2016 YR)
- 2017 YR** Start to Export **2 HP for Europe** (2018 YR : 10HP)
Start to manufacture in China the **2HP for China** (2018 YR : 10HP)

Cumulative Number of stores Installed CO2 as of 2017YR end





Introduction of CO2 unit to overseas

Verification test & Installation started at

Asian and European local

stores



Denmark
Sweden
Norway
Belgium

July, 2017

Start of sales ·
installation



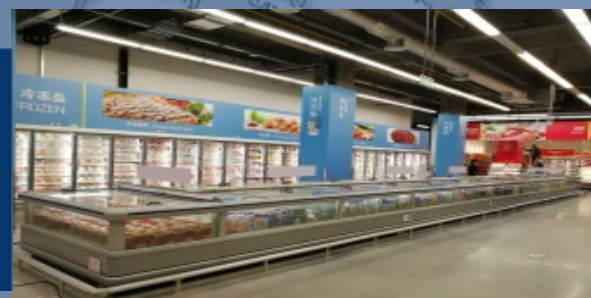
【test installation】

Iceland
Germany
Poland
Hungary
Spain
Swiss
England
Italy others

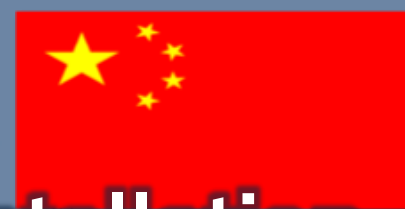


Malaysia

Malaysia, NRE support
“Multilateral fund
for the implemen-
-tation of
Montreal Protocol
May, 2017 opened



China



13 stores installation

Wuhan 3rd store
Sep, 2017 opened



Indonesia

13 stores
installation



Taiwan



Linkou Wenvi store
Jan. 2016 installation



1. Capacity Maximization

- Address to the heavy cooling load
- Total cost reduction by reducing the number of refrigeration cycles

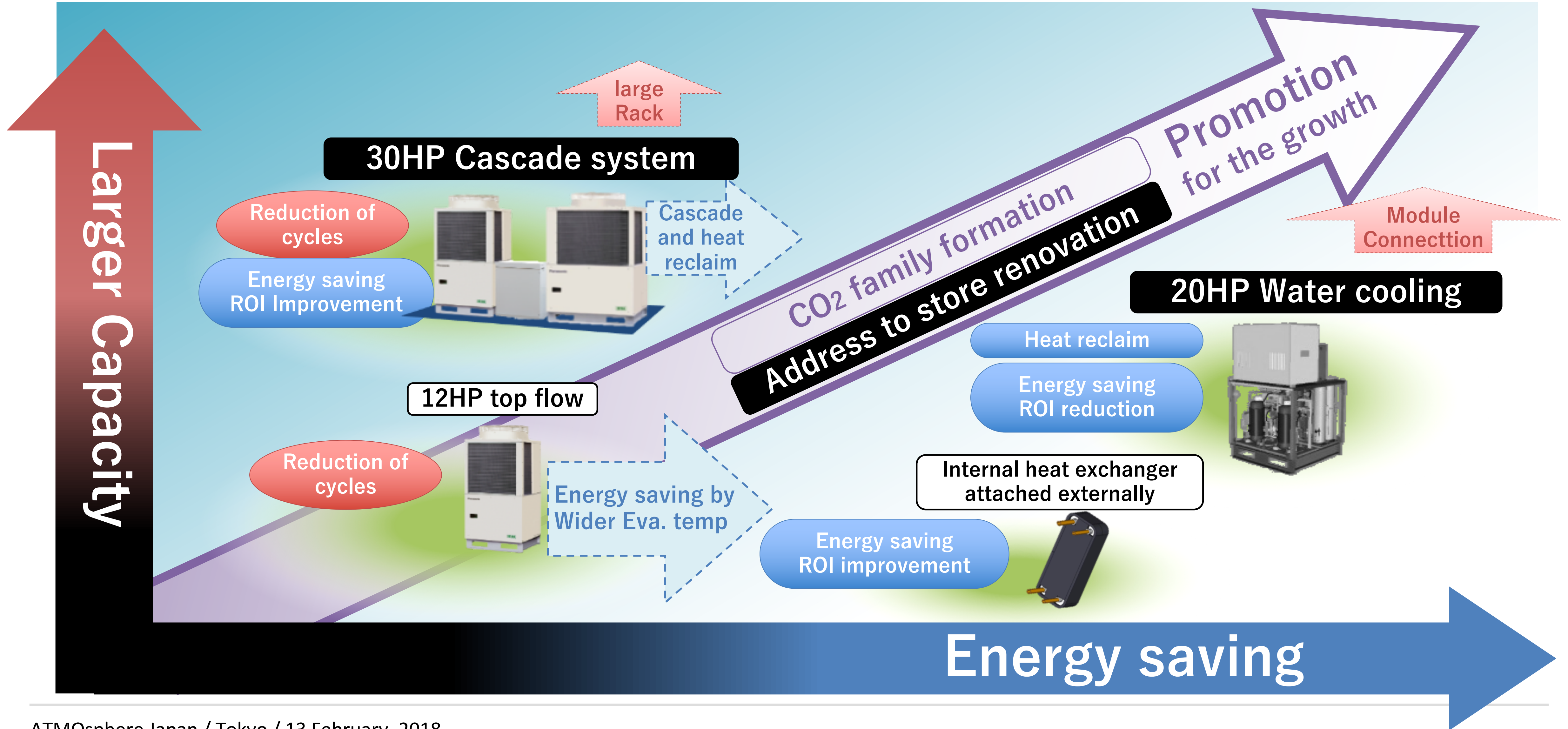
2. Further energy saving

- Total energy saving by heat reclaim

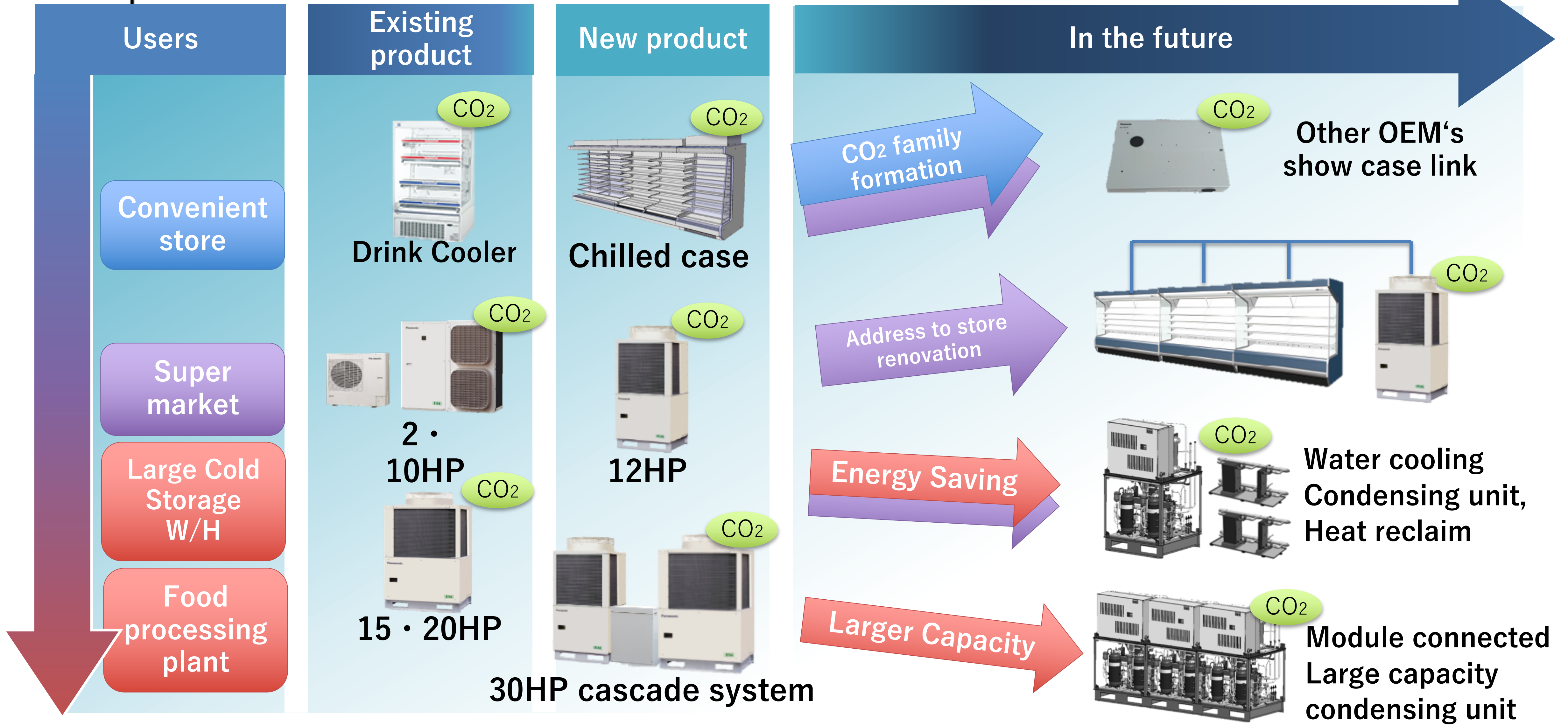
3. Address to store renovation

- Reduction of man hour for installation

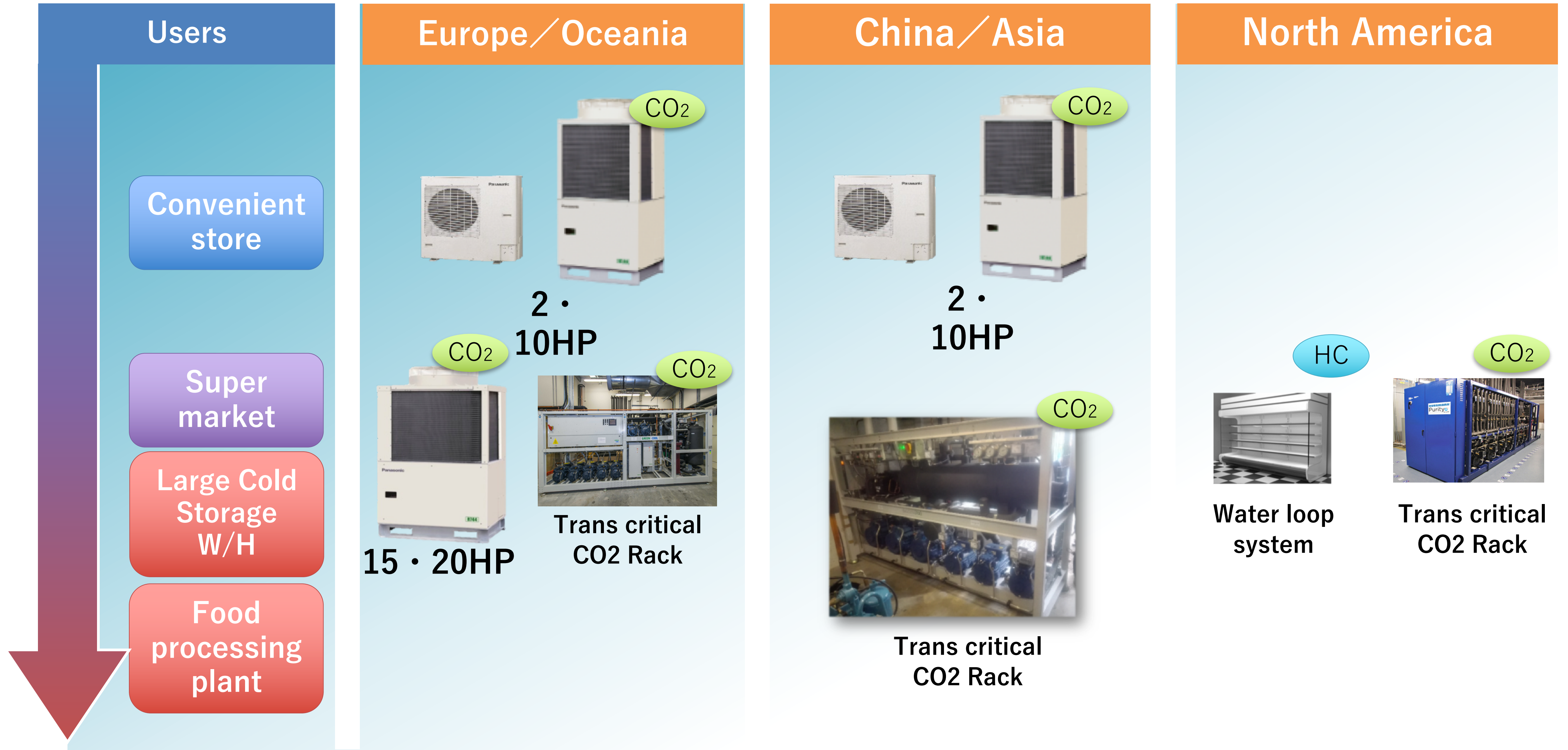
“Larger Capacity” and “Energy saving” for CO2 promotion



Concept of Natural Solution (Japan)

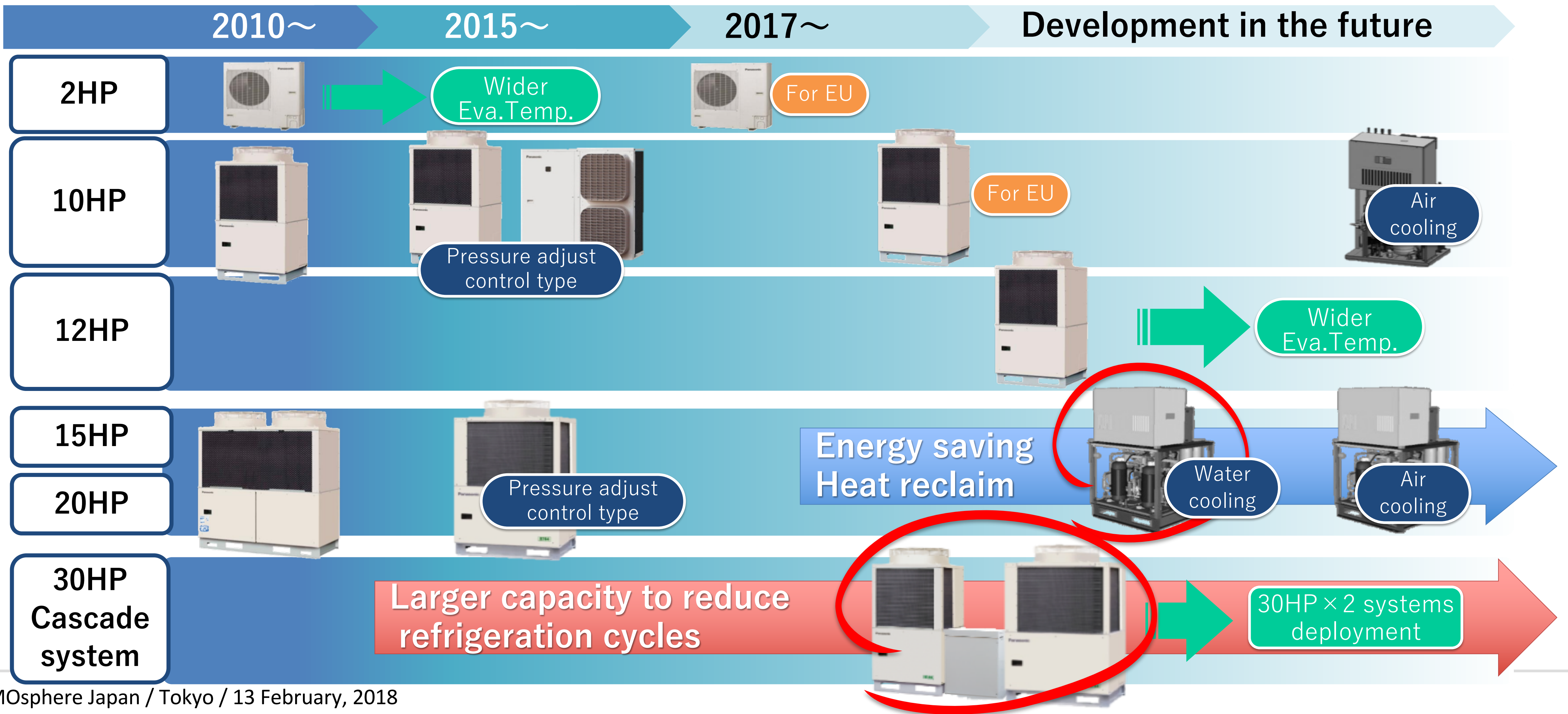


Concept of Natural Solution (Overseas)



Roadmap of CO2 condensing unit

“Reducing the number of cycles by larger capacity unit” + “Achieving further energy saving”
→ promotion for the growth



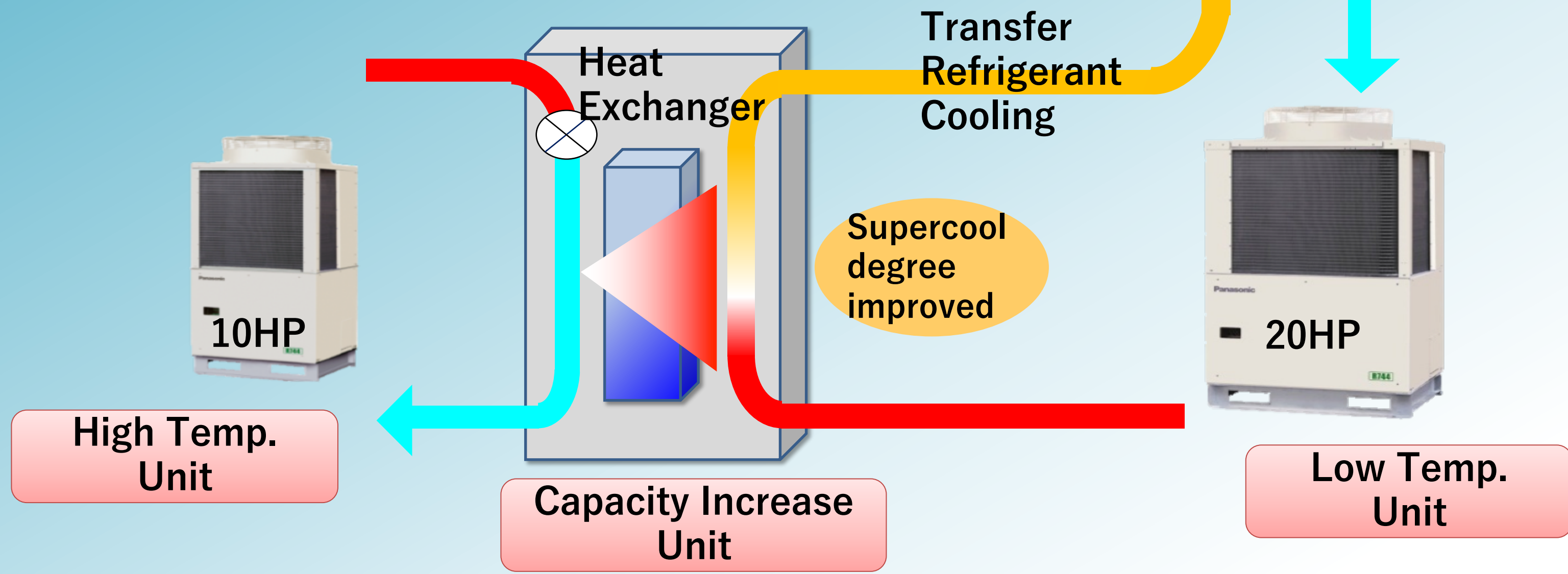
CO₂ 30HP Cascade System

Concept of New Cascade System

Increase the Supercool by Cascade to maximize the capacity



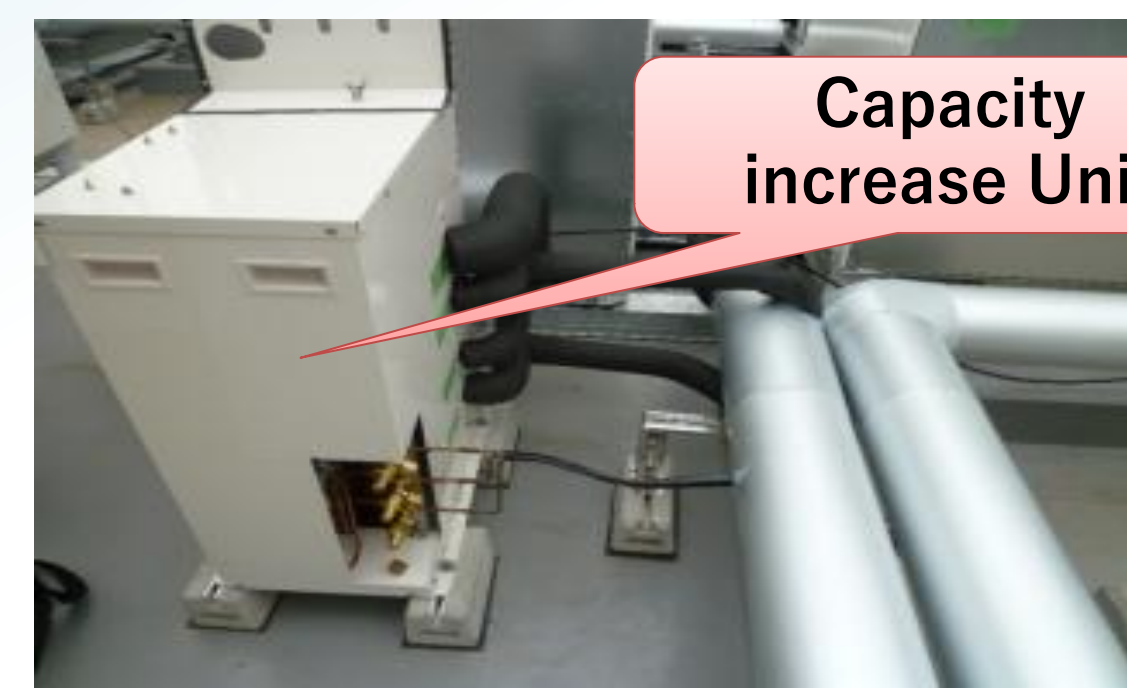
Showcase



Performance trial calculation

	Eva.T	AT4 3°C	
		30HP Cascade	10HP × 3
Capacity (kW)	-10°C	36.3 (105%)	34.6 (100%)
	-40°C	16.0 (99%)	16.2 (100%)
Input (kW)	-10°C	27.4 (94%)	29.2 (100%)
	-40°C	23.7 (93%)	25.5 (100%)
COP	-10°C	1.32 (112%)	1.19 (100%)
	-40°C	0.67 (106%)	0.64 (100%)

In progress field test

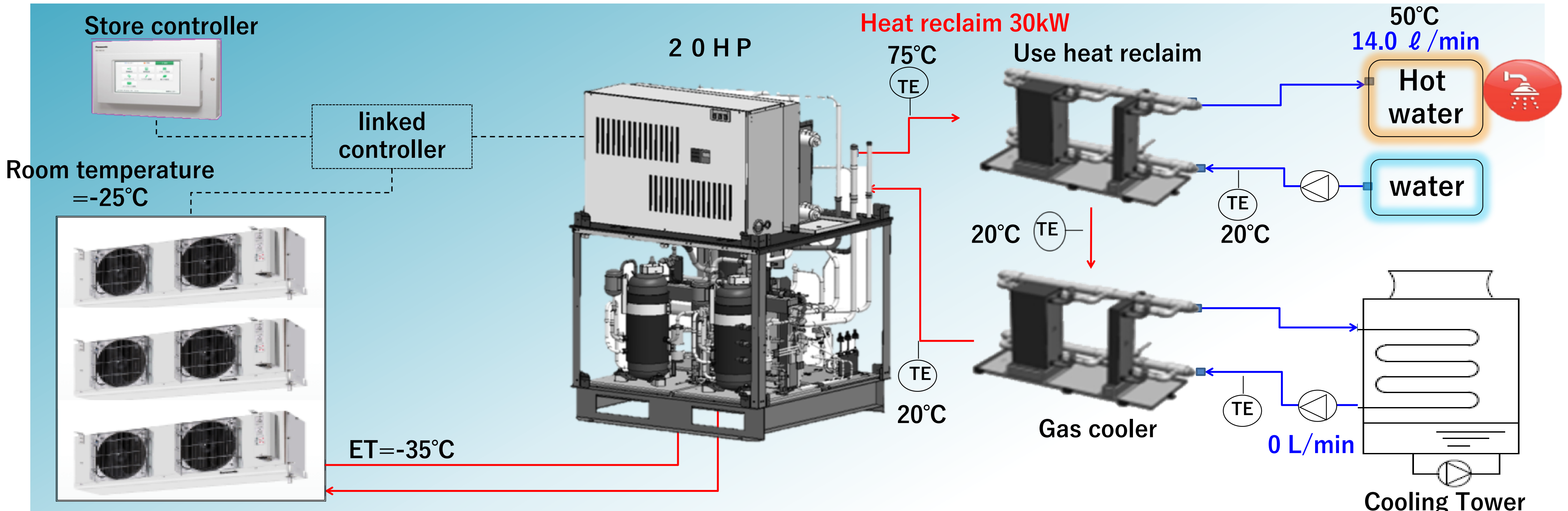


Refrigerated Showcase at supermarket



Heat reclaim for CO2 water cooling condensing unit

With the feature of CO2 gas, heat reclaim can deliver high temperature water and improve the total efficiency



- Mass flow control of gas cooler to achieve high temperature water & high efficiency at the same time

Address to Store Renovation

Investigation to shorten Construction period for Condensing unit installation

Countermeasures for the faster installation stores in each process

	Process	Current	Countermeasure
1	Advanced construction	—	Piping construction in advance except for in-stores
2	Piping construction	Sockets are used for all connecting parts	Reduce the number of welding points by “ expander ” Starting Practical verification of “ Welding-less joint ”
3	Showcase	Solenoid valve for backup & internal heat exchanger are installed at stores	Solenoid valve for backup / internal heat exchanger are semi-assembled as a kit , installed in advance
4	Refrigerator -Cold storage	Controller of refrigerator & Electrical expansion valve controller are separated	Wiring becomes easier by integrating their controllers
5	Air tightness test	Air tightness test pressure is as high as 8MPa, Which requires longer time to ensure safety.	Construction period can be shortened by “ high pressure corresponding connecting valve ” & “ Nitrogen gas Booster ”
6	Refrigerant Charge & commissioning	It is not easy to judge the proper refrigerant amount and takes time	Development of the tank unit for refrigerant recovery & charging amount adjustment soft program

Issues and Action Plan

Product Development

- Capacity Maximization : Introduce even larger capacity line-up
- Energy Saving : Total Thermal Utilization by heat-reclaim and optimum control

CO2 Family Formation

- Address to Store Renovation : Collaborative Development of Tools for efficient installation
- Installation Training : Continue effort of training, set up Certification rules
- Alliance with other Show-case OEMs : Develop the Controller to enable the operation

Further Cost Reduction

- Accelerate the Value Engineering at every aspects (Material, Parts, Installation, System)

