

CO₂ cascade heat pump for CVS

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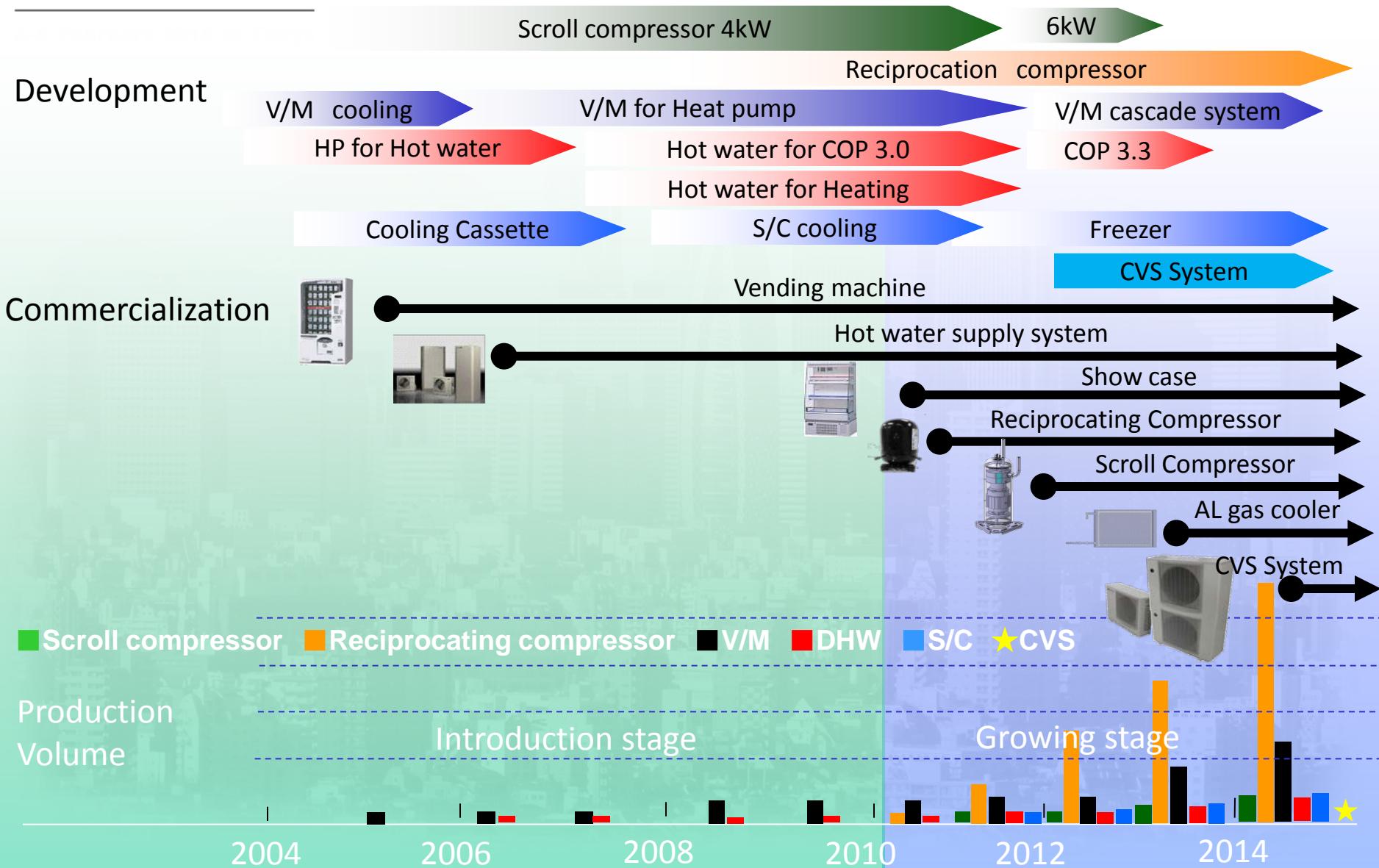
SANDEN CORPORATION



Agenda

1. History of SANDEN activity for natural refrigerant
2. Key products
3. Case study as on 2014-2015
4. Conclusion

History



Key product profile 1

3-5 February 2015 in Tokyo

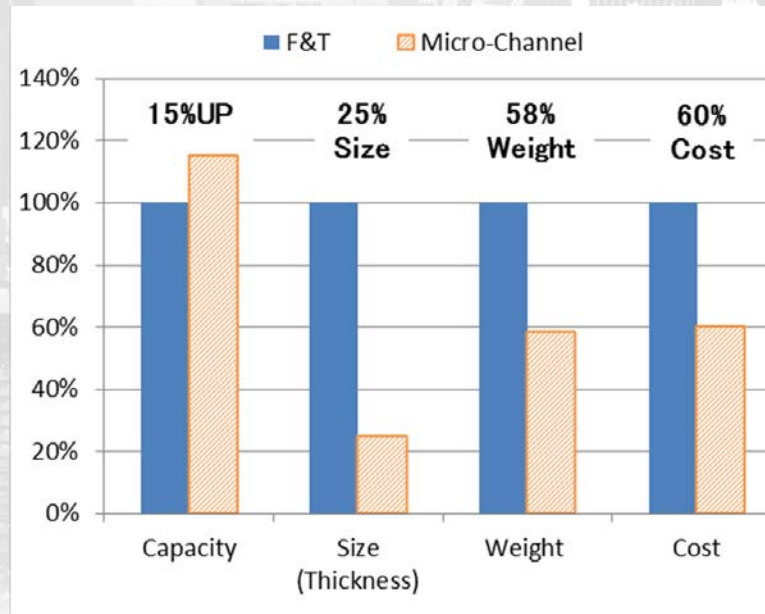
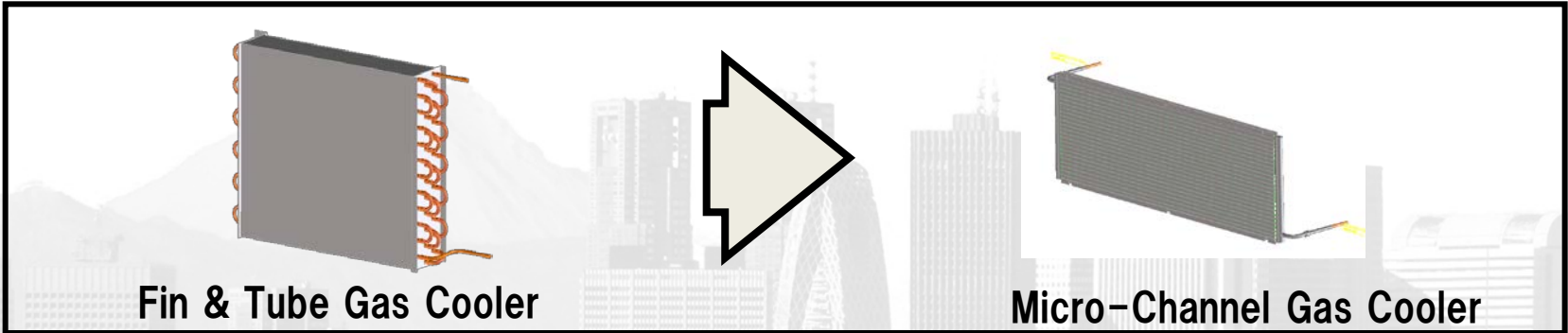
Reciprocating Compressor

	SS	Msc	Sc	Mc	L	Msc-Inv	Sc-Inv
Capacity (kW)	0.2	0.45	0.66	0.9	1.4	0.3-0.7	0.45-1.0
Experience (Produced qty)	15k	73k (200k)	48k (150K)	SOP '14/11 (50k)	SOP '14/12	25k	SOP '14/10
Application	Counter top S/C, Water server	Visi-cooler -300L, V/M	Visi-cooler -550L, V/M	Visi-cooler -1000L	Visi-cooler -1500L, Fountain, Open S/C	Visi-cooler -300L, V/M	Visi-cooler -550L, V/M, Open S/C

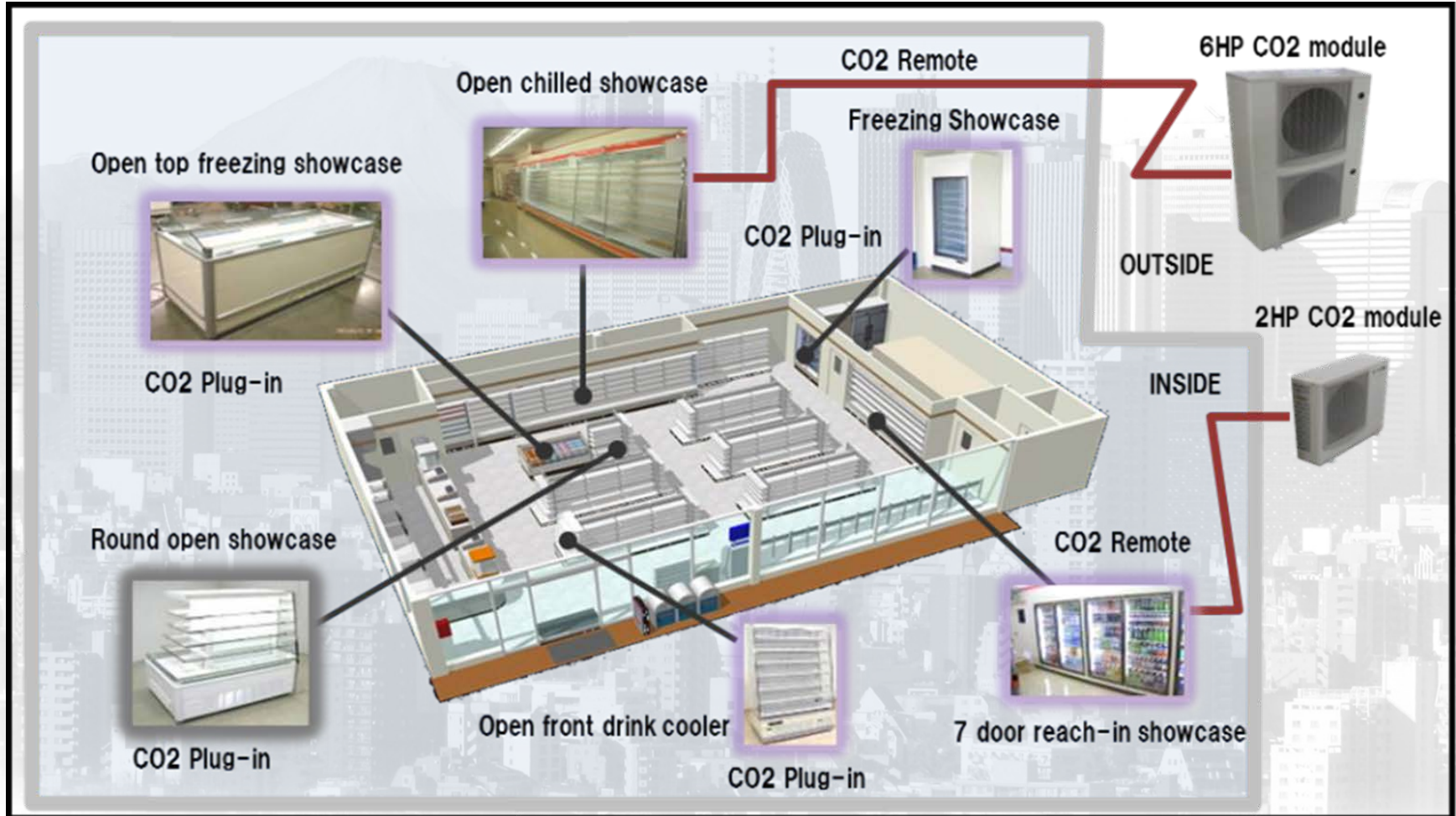
Scroll Compressor

	Vertical	Horizontal
Capacity	3.5kW (ET:-10°C, 70Hz)	
Manufacturing capacity	20k (2014), 50k (2015), 200k (2016)	
Application	Domestic hot water, Space heating	Chilled Show case (Frozen show case)
Notice for use	Reliability should be examine with actual system	

Key product profile 2



Case study on CVS system



Case study on CVS system

◆ Feature of SANDEN refrigeration system

Refrigerant ASHREA Number	Feature of Refrigerant	Greenhouse warming potential
R404A	HFC Mixed(R125/R143a/R134a)	3920
R744	CO₂	1

◆ Effect to reduction of global warming gas

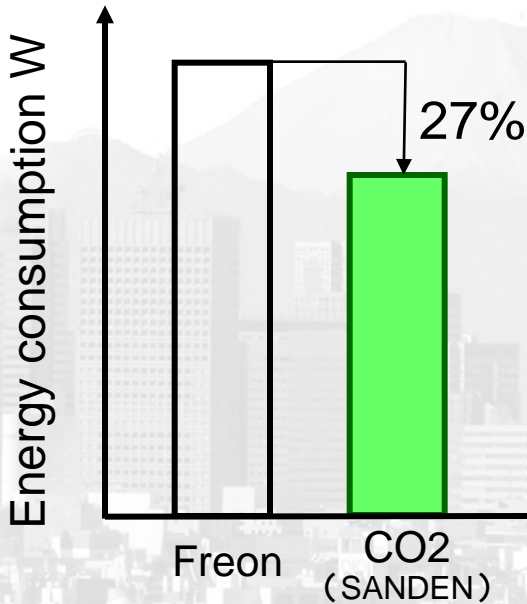
- Using natural gas
- Reduced amount of refrigerant

	Refrigerant	Amount of refrigerant (in case of Japanese CVS)	Direct impact as CO ₂
SANDEN's solution	R744	8kg	8kg
Current system	R404A	21kg	82,320kg

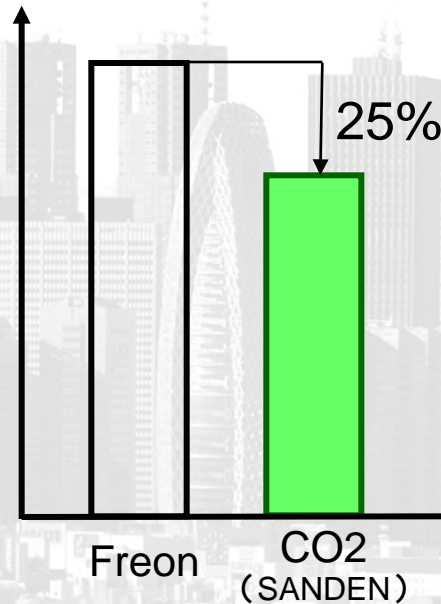
Case study on CVS system

3-5 February 2015 in Tokyo

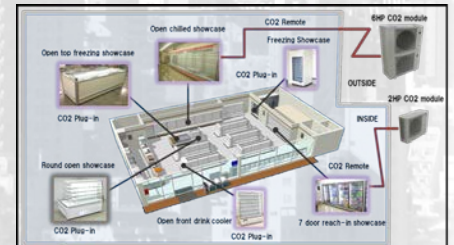
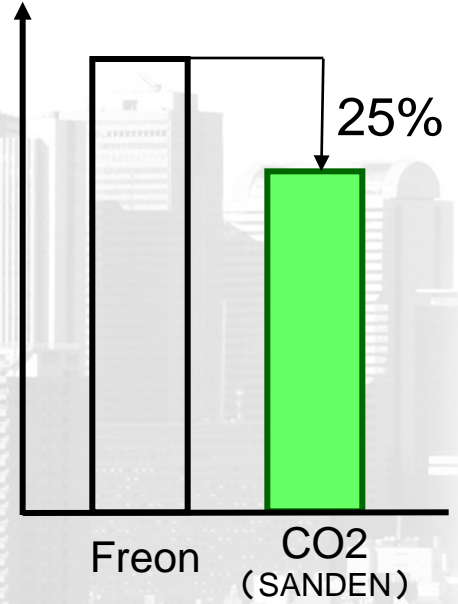
Freezing Show Case



Open Show Case

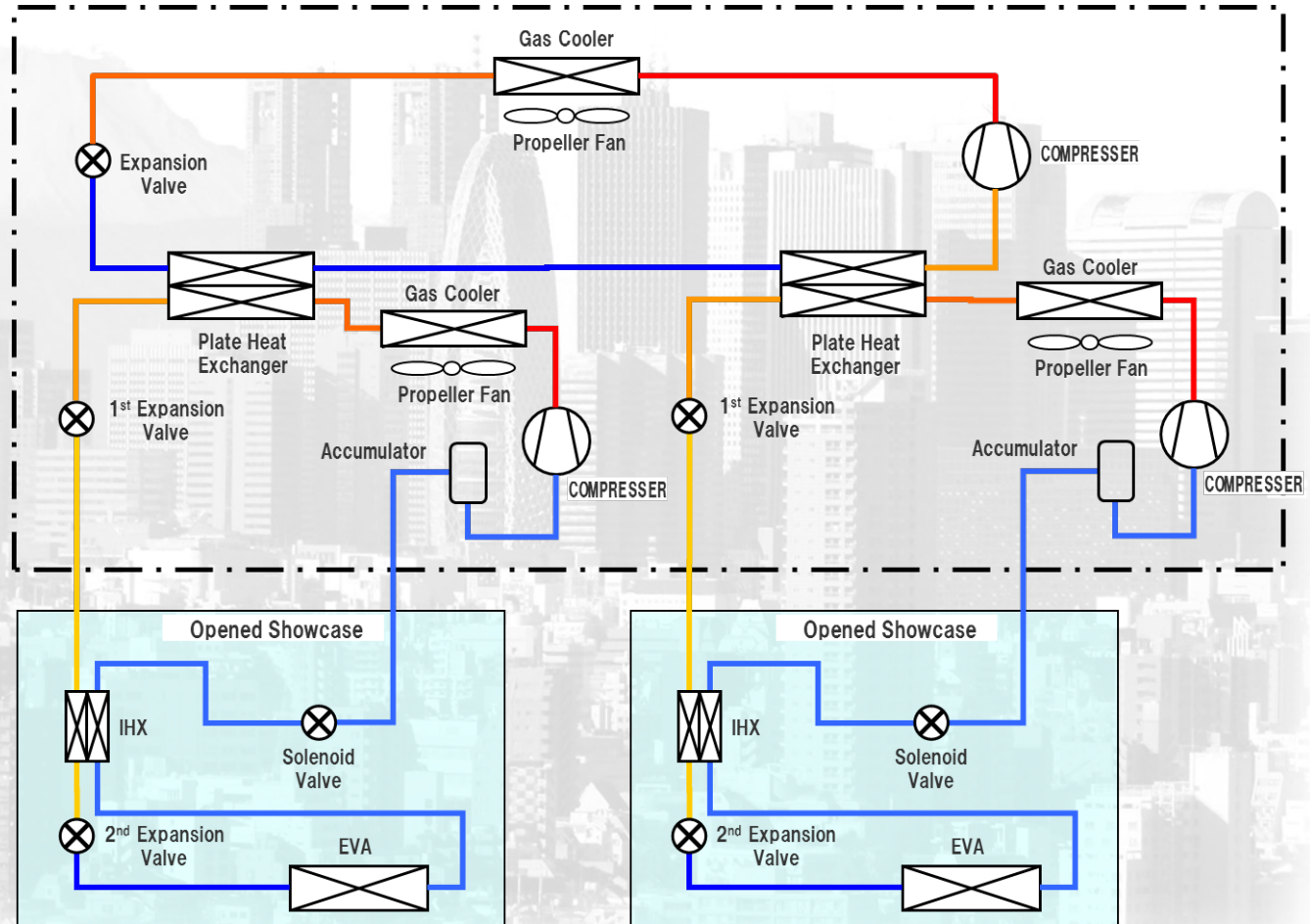


Total store system

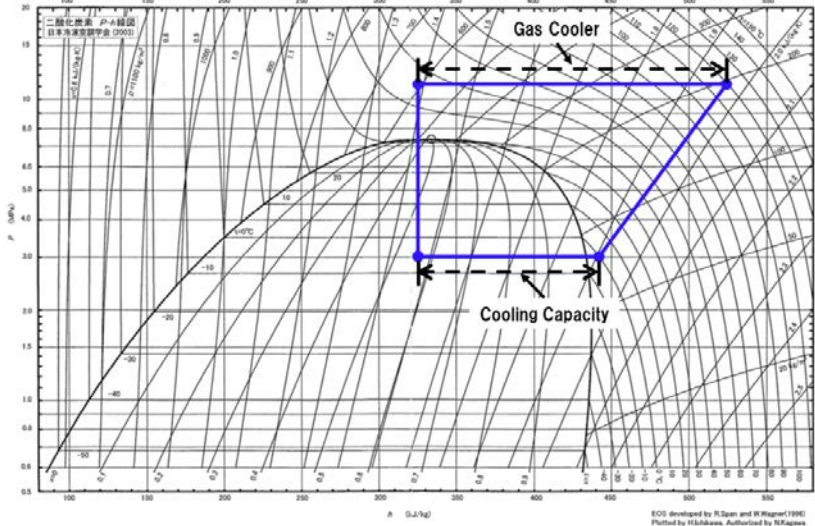


Energy saving: 25%

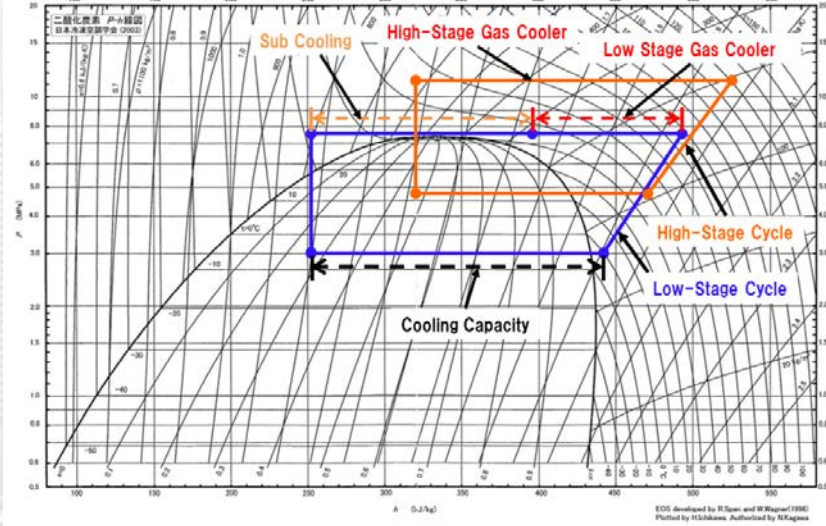
System configuration



System improvement



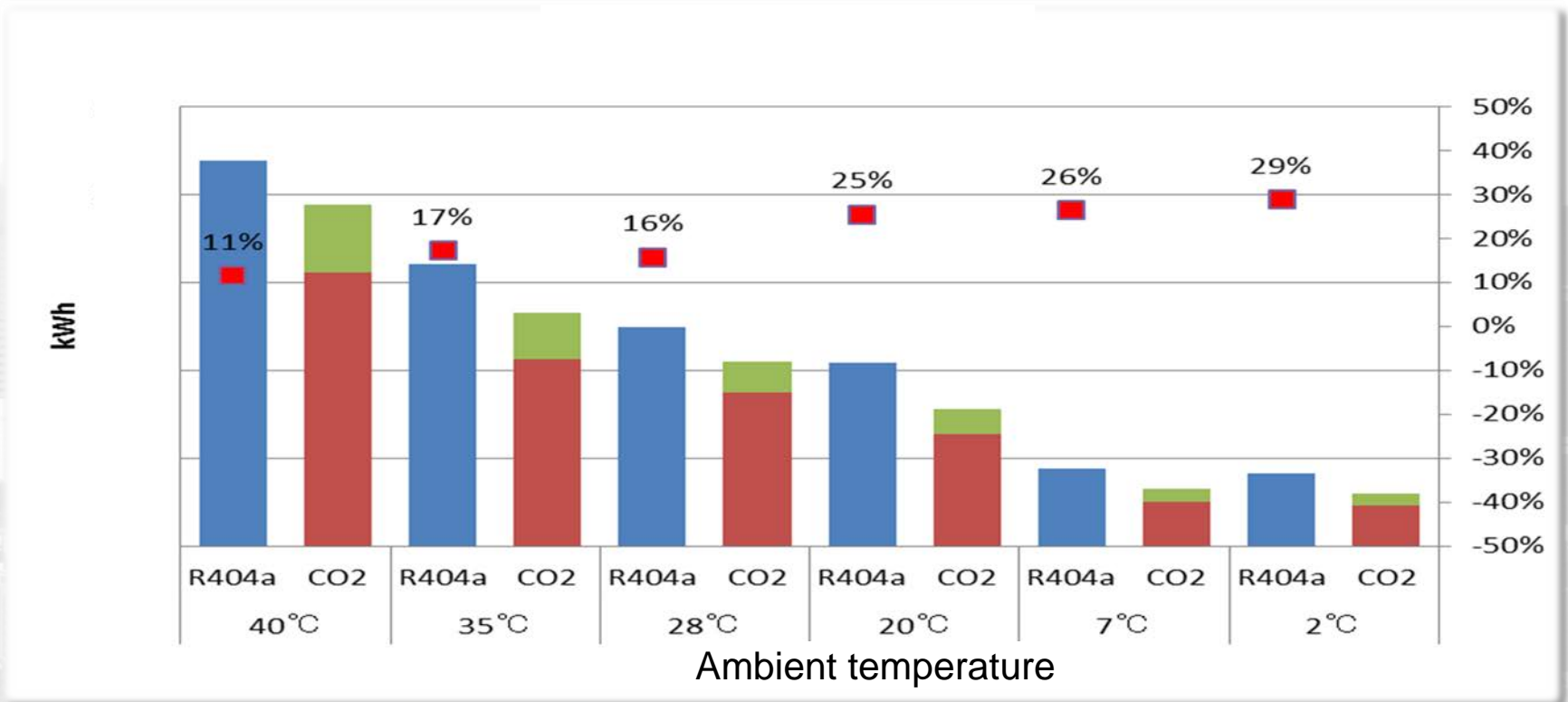
Theoretical COP=1.05



Theoretical COP=1.52

Improve COP 1.5 times by Cascade System

System improvement


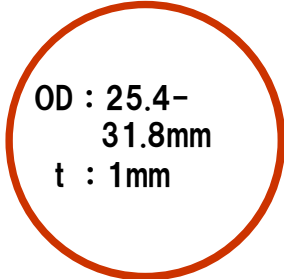




Annual energy saving: 23%

Solution for Cost reduction

SANDEN' unique technology makes it possible to reduce cost

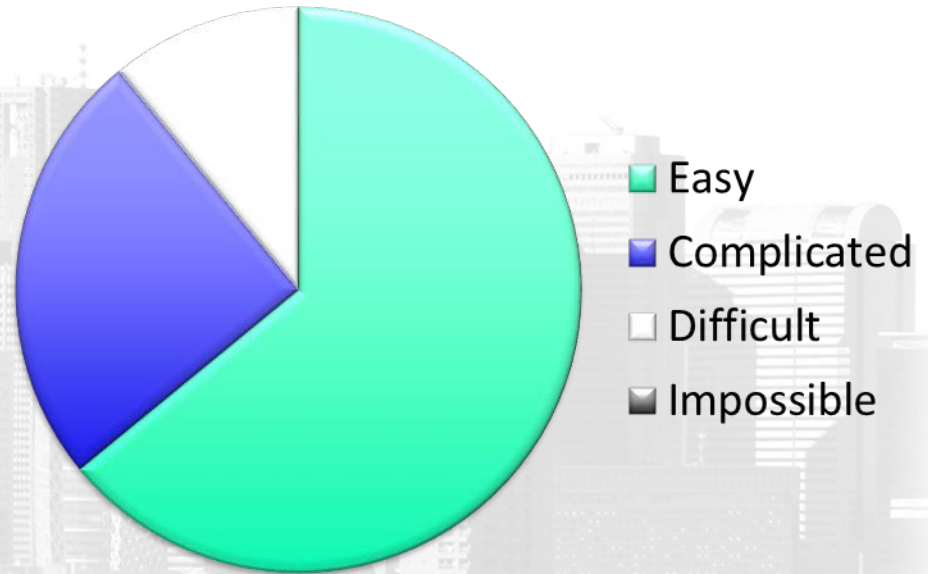
- Material cost**

	Separated CO2	Existing HFC
Copper tube dimension of Low pressure side	OD : 9.53mm thickness : 0.8mm 	OD : 25.4-31.8mm t : 1mm 
Copper tube dimension of High pressure side	OD : 6.35mm t : 0.8mm 	OD : 19mm t : 1mm 
Bend	Available	Available
Piping cost	40%	100%

- No ventilation system/ CO2 sensor**

Installation

3-5 February 2015 in Tokyo

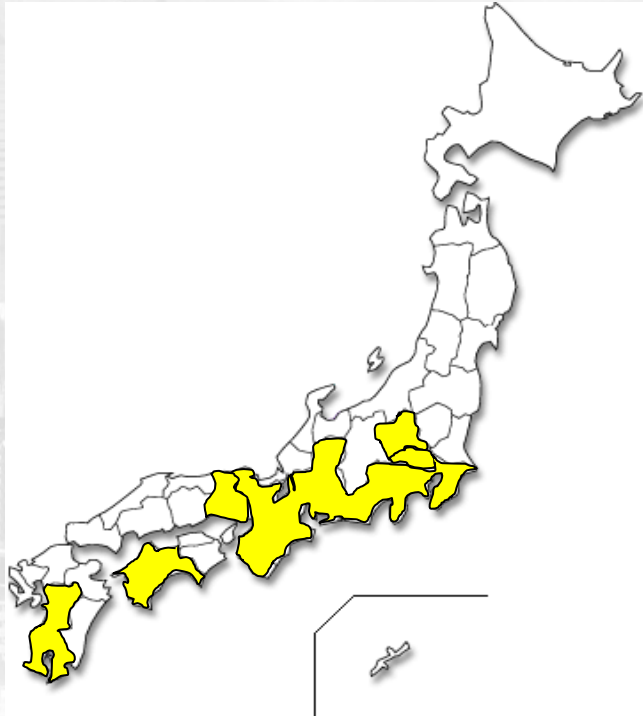


- **Easy: same procedure with existing system
small amount of refrigerant**
- **Complicated: divided system**
- **Difficult: Charging process**

Result of 2014 activity

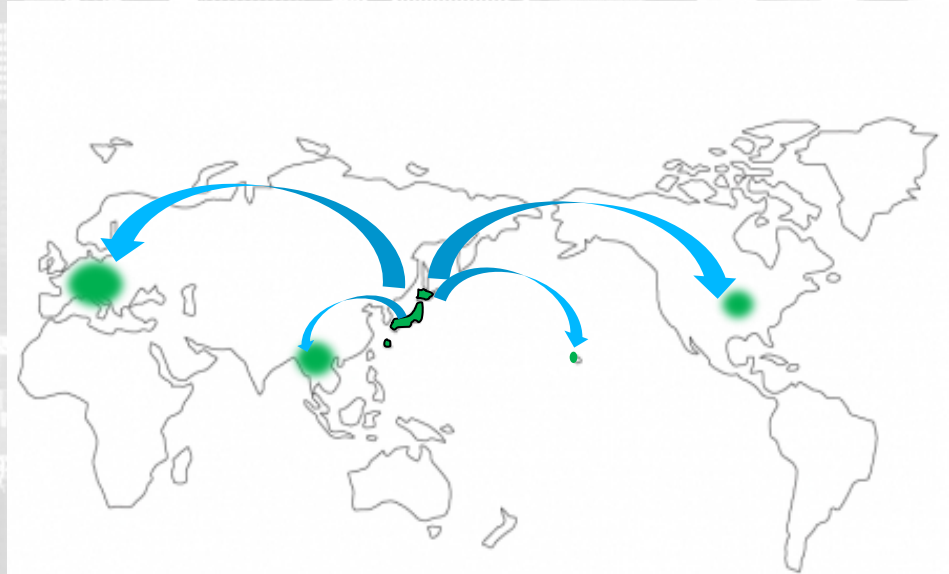
FY2014 Result

➡ **Half of Japan**



FY2015 Target

Act globally



Summary

SANDEN confirmed, CO₂ refrigerant is one of the best solution for preventing the global environment

➤ **Acceleration**

- **Effective process of regulatory approval**
- **Make sure the Life cycle cost reduction**
- **Appropriate regulation /HFC tax, etc.**
- **Continuous training**



solutions for asia

natural refrigerants

3-5 February 2015 in Tokyo

Thank you very much!

