

# CO2 devices and systems

## CO2 cascade system for smaller supermarket



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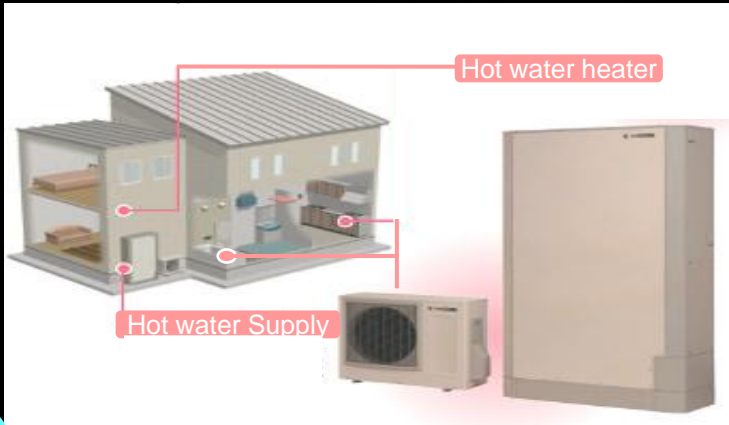
# Company profile



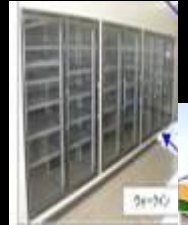
Vending Systems



## Sustainable Technology



Living and Environment Systems



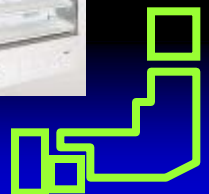
Retail Systems



Auto Motive Systems

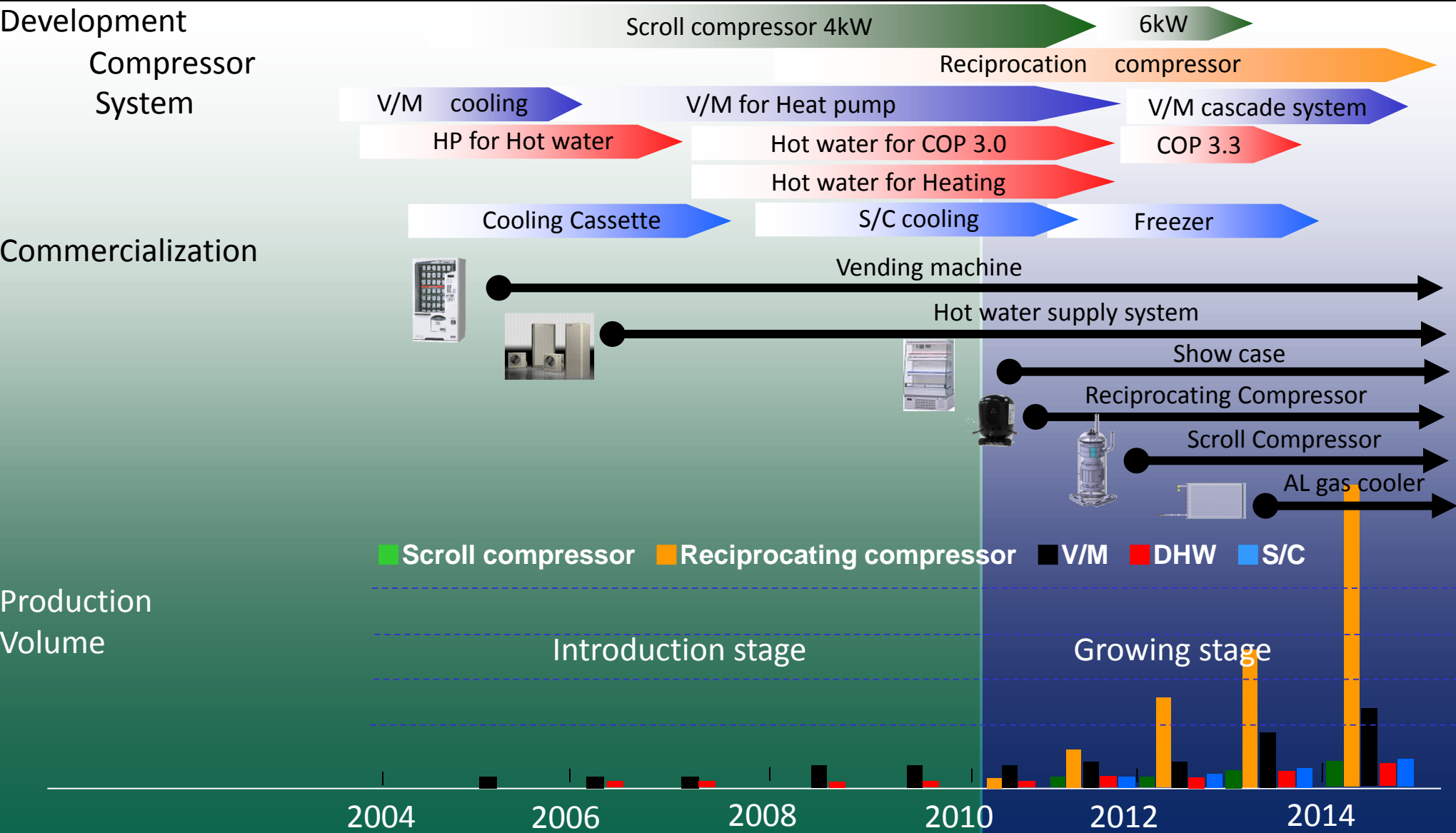


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# History of CO2 products introduction of SANDEN



## Vending machine

- Japan : 100% CO<sub>2</sub>
- Europe: Launched
- USA : Launched

## Heat pump for DHW

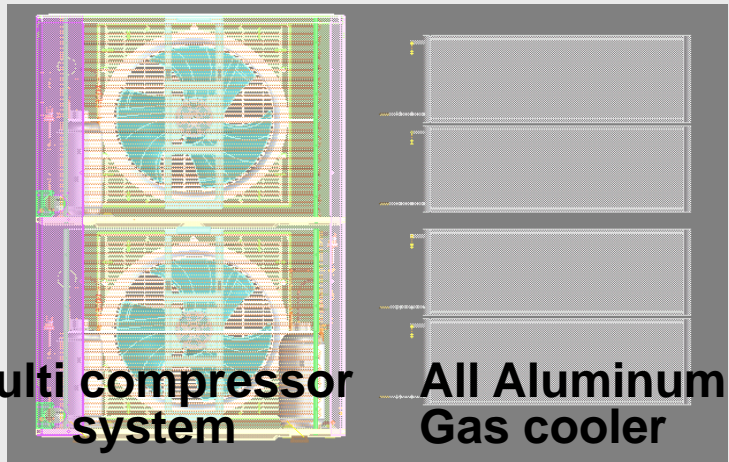
- Japan : Launched
- Europe : Launched
- Australia : Launched

## Show case/ CDU

- China: 100% CO<sub>2</sub>/ GDM
- Japan: Post on sales  
Remote system  
⇒has been started

## Auto mobile

## ① CO2 Cooling module

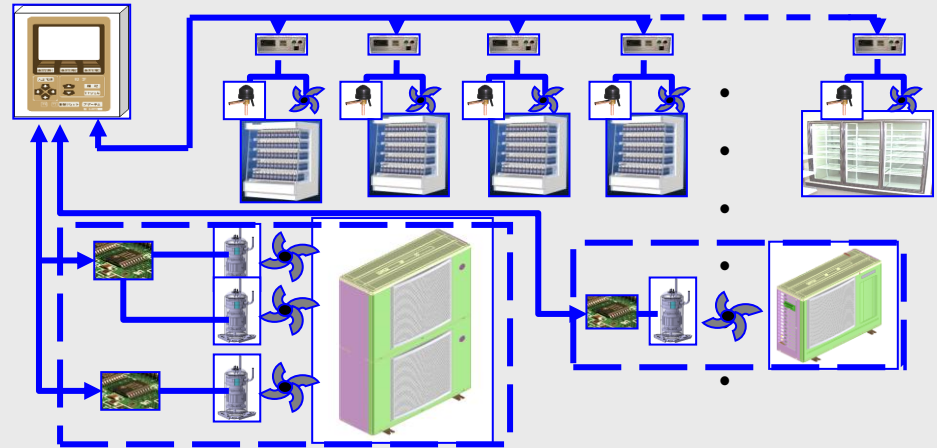


## ② CO2 Compressors



- High efficiency
- Low noise & vibration
- High reliability

## ③ Multi control system



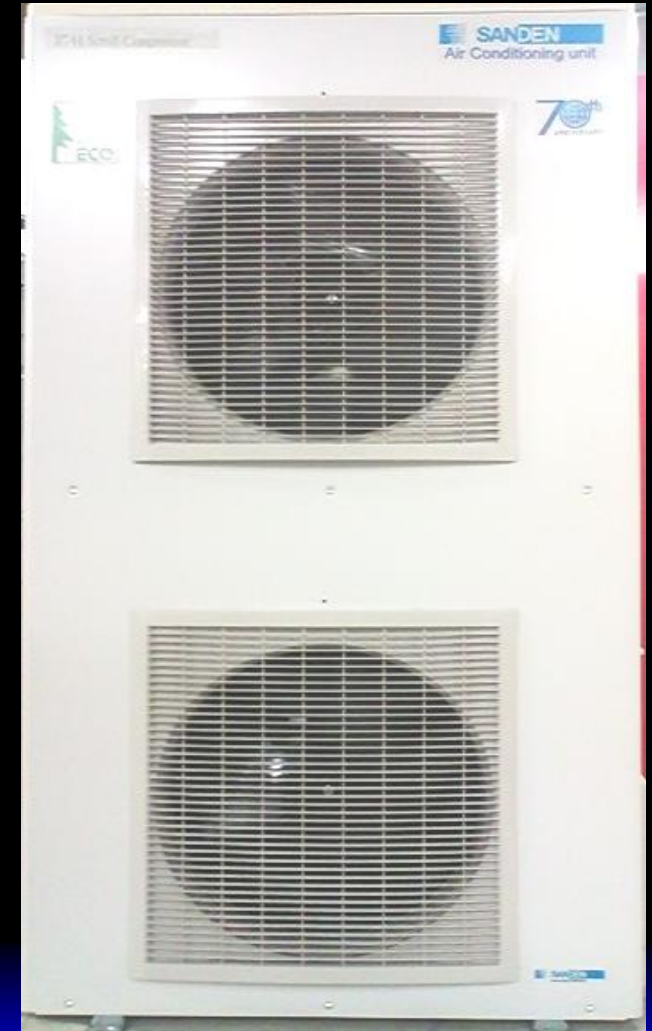
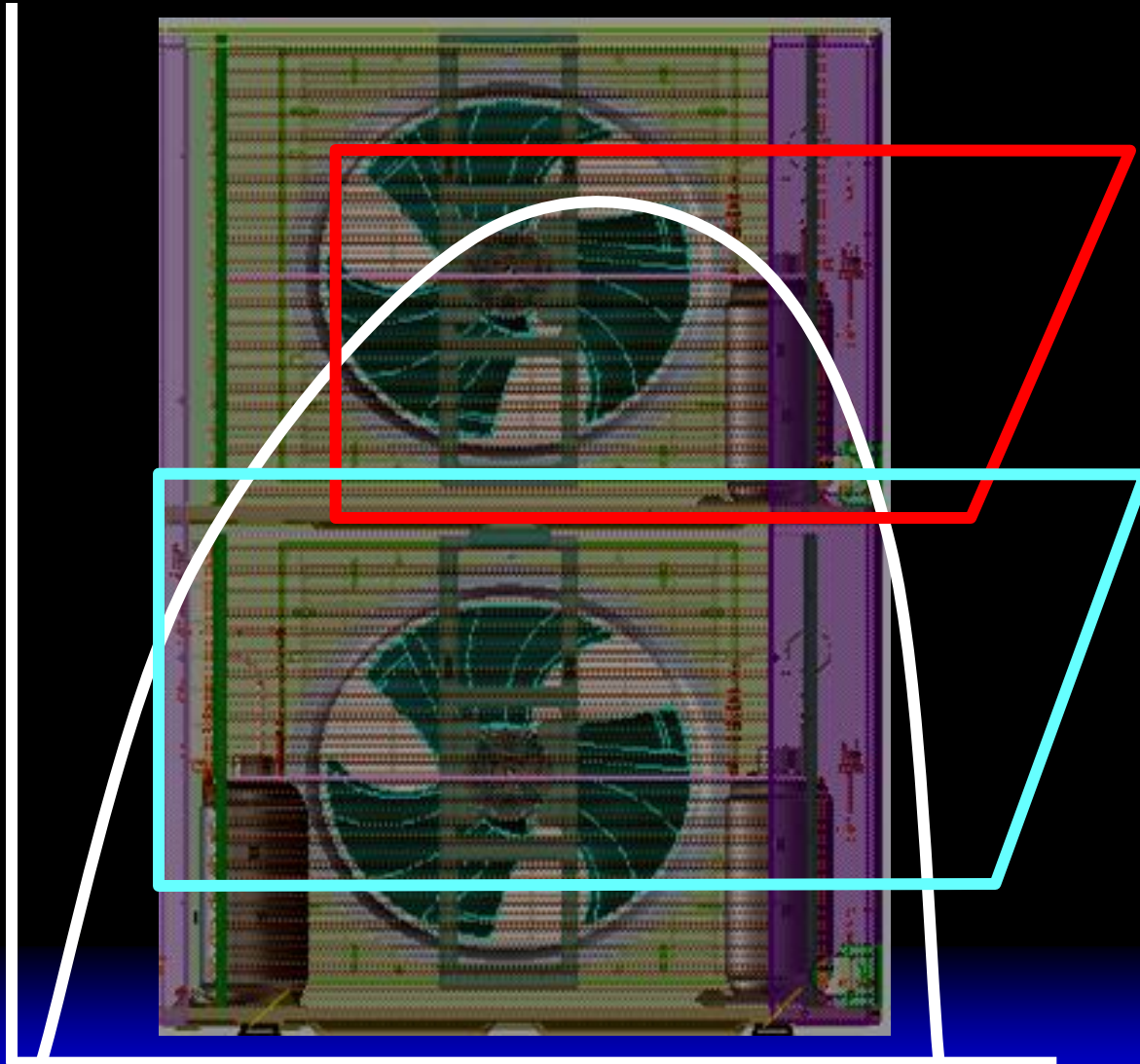
## ④ Line up

SANDEN provide valuable module



3kW      4.5kW      9kW

# Cooling module with cascade system




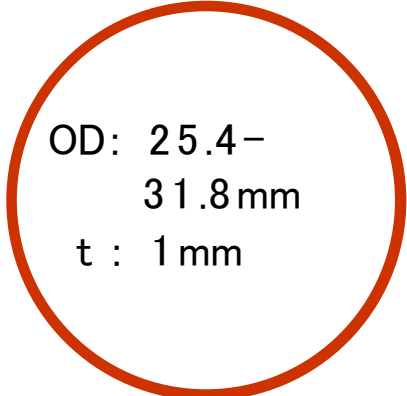

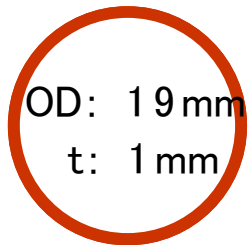
## Comparison table between SANDEN's system and relative system

|   | SANDEN's system                             | Existing HFC system |
|---|---|---------------------|
| Refrigeration method  | Multiple cycle Cascade system               | Single cycle        |
| Refrigerant   | CO <sub>2</sub>                             | R404A               |
| Cooling capacity  | 9kW+3kW                                     | 12kW                |
| Amount of refrigerant   | 1.5+2.0x3 kg                                | 20kg以上              |
| Weight of CDU   | 150kg                                       | 170kg               |
| Density of CO <sub>2</sub> when refrigerant leakage accident happened | 0.3% (In store)<br>2.9% (Walk-in cooler)    | —<br>—              |
| Dimension (mm)  | W 8 2 8 × D 2 8 2                           | W 1 1 7 0 × D 3 9 0 |
| Application   | Cooling or Freezing<br>Cooling and Freezing | Cooling or freezing |
| Effect at broke down  | A part of show case                         | All show case       |

# Feature of SANDEN CO<sub>2</sub> refrigeration system

## Reduction of material cost

Our CO<sub>2</sub> system use slender tube, the divided refrigeration system made it possible.

|   | Separated CO <sub>2</sub>  | Existing HFC   |
|---|--|--|
| Copper tube dimension of Low pressure side  | OD: 9.53 mm<br>thickness: 0.8 mm<br> |  OD: 25.4–31.8 mm<br>t : 1 mm |
| Copper tube dimension of High pressure side | OD: 6.35 mm<br>t: 0.8 mm<br>        |  OD: 19 mm<br>t: 1 mm        |
| Bend  | Available  | Available  |
| Piping cost                                 | 60%  | 100%   |



# Field test at SANDEN forest



Show case (6,3,4 feet at 5°C)



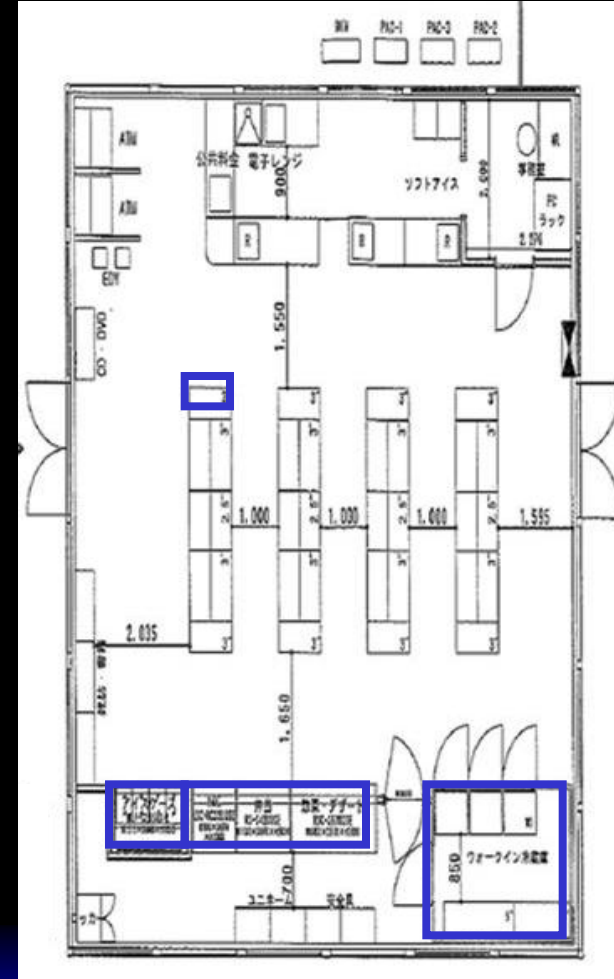
CO2 Cooling module 9kW



Walk-in show case (3 doors)

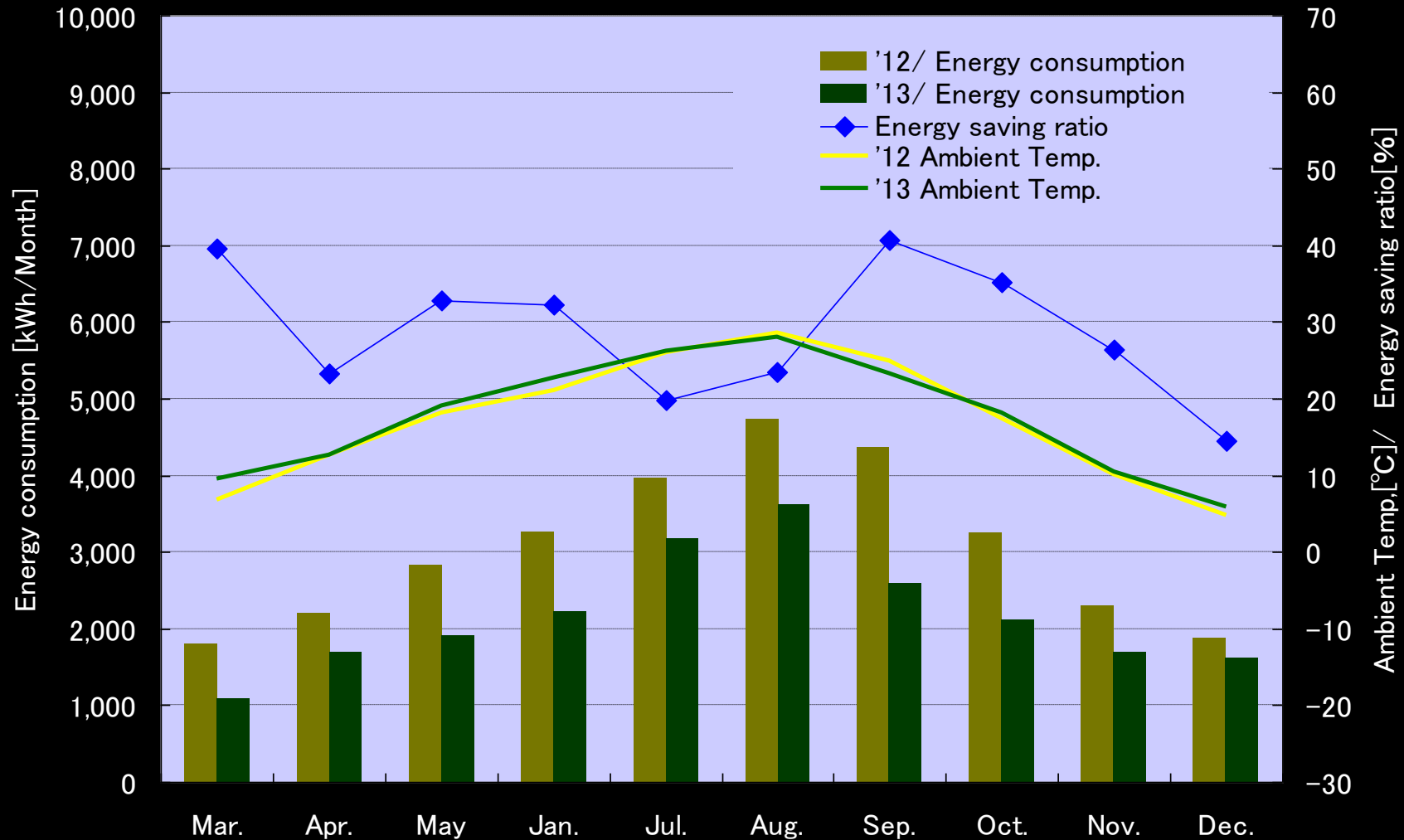


CO2 drink case



CVS layout

# Result of field test at SANDEN forest



**Total energy saving = 29%**

## Installed CO<sub>2</sub> equipment

- 9kW cooling module
  - 3kW cooling module
  - Walk-in cooler (@5°C)
  - Open front show case (@ 5°C)
  - Open freezing showcase (@-25°C)
  - Open front drink case (@5°C)
  - Freezer (@-25°C)
- } Plug-in

→ **Significant results came up**

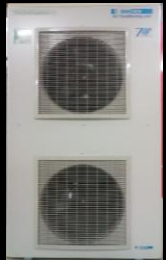
# Capability of SANDEN CO<sub>2</sub> cooling module

Example-1



7.2m (24Fts)

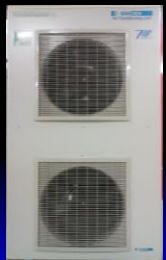
Example-2



3.6m (12Fts)

11doors

Example-3



3.6m (12Fts)

3doors

# What SANDEN offer to customer.

P12/14

## SANDEN



## Customer

- Environmental conservation
- Energy saving
- Life time cost reduction
- Business innovation

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**CO<sub>2</sub> refrigerant is recognized as one of the best solution for the global environment**

- **Barriers against Acceleration**
  - **Effective process of regulatory approval**
  - **Initial cost vs Life cycle cost**
  - **Unclear volume perspective**
  - **Establish after-service net work**

**➡ Collaborate each other to accelerate Environmental technology**

# Conclusion

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- Sanden is determined to contribute to the protection of our environment by supplying equipment, where CO2 the working fluid, as the ultimate commercial & environmental solution.
- To accelerate implementation of CO2, governmental incentives for NR equipment or charges tax to HFC's one should be considered.
- The active promotion by users are required.



**ATMO**  
**sphere**  
technology & innovation  
**natural refrigerants**  
3-5 February 2014, Tokyo

Thank you very much!