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

Latest developments with CO_2 technology in convenience stores

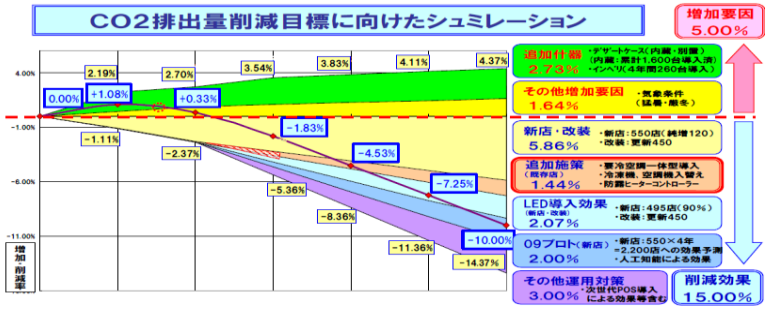
Lawson, Inc.

CO_2 Emissions Reduction

Action for Energy Conservation (Indirect Effect Reduction)

Voluntary target of CO_2 emissions reduction

Reducing CO_2 emissions per store compared to the FY2006 based on electricity consumption by 10% by FY2012.



9.6% Reduction Achieved in 2012 to the Target of "10% Reduction"

Natural Refrigeration (Direct Effect Reduction)

1. Refrigerant Leakage Management

Annual Leakage rate: 16% of Charge Amount

2. Replacing HFCs with Natural Refrigerant

HCFC ⇒ HFC ⇒ Non F-gas(CO_2 and Other NRs)

Frequent Capital Investment for Each Step

"1 Step" Change Saves Capital Cost

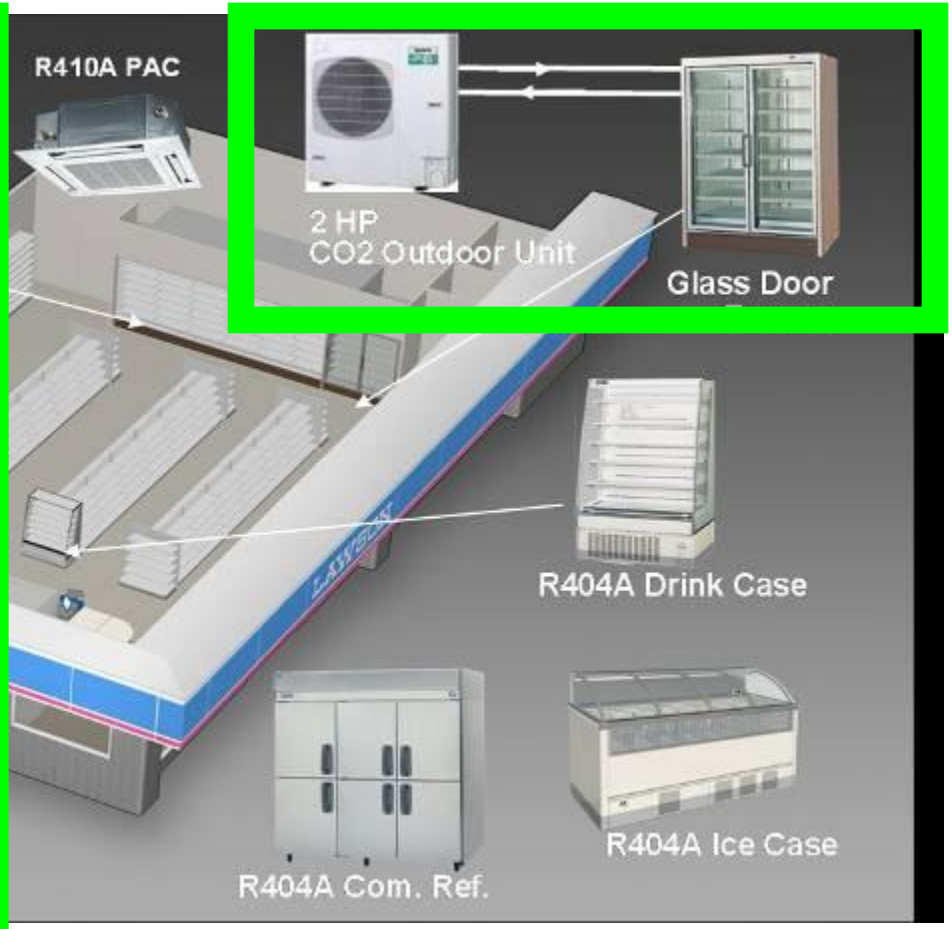
Global Warming Impact: CO_2 vs. R404A

	HFC System (R404A)	NR System (CO_2:R744)	Reduction
GWP (Global Warming Potential)	3920	1	–
Refrigerant Charge (ton)	0.0309	0.01	–
Refrigerant Charge (ton-CO_2)	121.12	0.01	▲121.02
Refrigerant Leakage (ton-CO_2)	19.38	0.0016	▲19.38
Annual Electricity (kWh)	83,483	60,563	▲22,920
GHG from Electricity (ton-CO_2)	38.65	28.04	▲10.61
Total GHG Emission (ton-CO_2)	58.03	28.04	▲29.99

Japanese proven CO_2 technology for CVS (Lawson&Panasonic)

Outdoor units for Refrigerators and Freezers were replaced by Panasonic CO_2 Units (10HP and 2HP)

The Total Energy Save: 27%



Challenges for the Spread of CO_2 Systems

① Safety (Product, Installation)

- Launching CO_2 Refrigerant Working Group
  - Co-operation between Manufacturers, Installers and Industry Groups
  - Cross-Checking by Different Member Companies for System Safety

- **Benchmarking CO_2 Refrigeration echnologies in EU**

  2011: Regulation and Training for CO_2 Refrigeration in EU Countries

  2012: CO_2 Refrigeration Systems and Components (Chillventa 2012)

- **Reliability Test of Brazed Copper Tube**
  - PTV Test according to EN 16084 by CETIM (Tightness Test under Cyclic Pressure, Temperature and Vibration)
  - With Normal Copper Tubes and High Strength Copper Tubes

③Tightness Test on Brazed Joint of Copper Tubes

[Testing Method]

Tightness Test after Cyclic Pressure, Temperature and Vibration according to EN16084, with Thick Copper Tubes, under Higher Pressure and Variable Quality of Brazing Connection

[Test Report by CETIM]


cetim

Tests according to EN16084 standard july 2011

[Specifications of Test Pieces]

Test Joints No	Application	Size of brazed Socket Joints	Length inserted into the socket 100%	50%	30%	Dimension (Drwg No)
S01-S15	Sub-critical	9.52mm	n=5	n=5	n=5	SAN20110913-952
S16-S30	Sub-critical	19.05mm	n=5	n=5	n=5	SAN20110913-1905
T01-T15	Trans-critical	9.35mm	n=5	n=5	n=5	SAN20110913-935
T16-T30	Trans-critical	15.88mm	n=5	n=5	n=5	SAN20110913-1588

Table 1. Test condition and the number of samples

Quality of tubes	Alloy Name (JIS)	Alloy Name (ASTM)	Thickness	Type (Hardness)
S01-S15	H3100 C1220 <Cu: 99.9% or Higher, P: 0.015-0.04%>	C12200	1.2mm	O
S16-S30			1.6mm	1/2H
T01-T15			1.2mm	O
T16-T30			2.0mm	1/2H

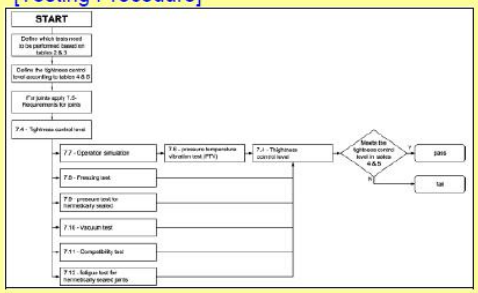
Table 2. Tube specification

③Tightness Test on Brazed Joint of Copper Tubes

[Testing Facilities]

[Samples in PTV Chamber]

[Testing Procedure]



[PTV Data]

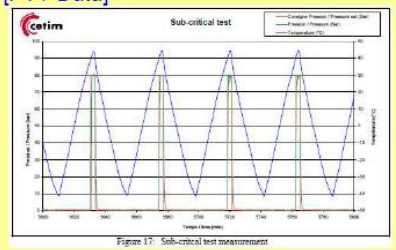


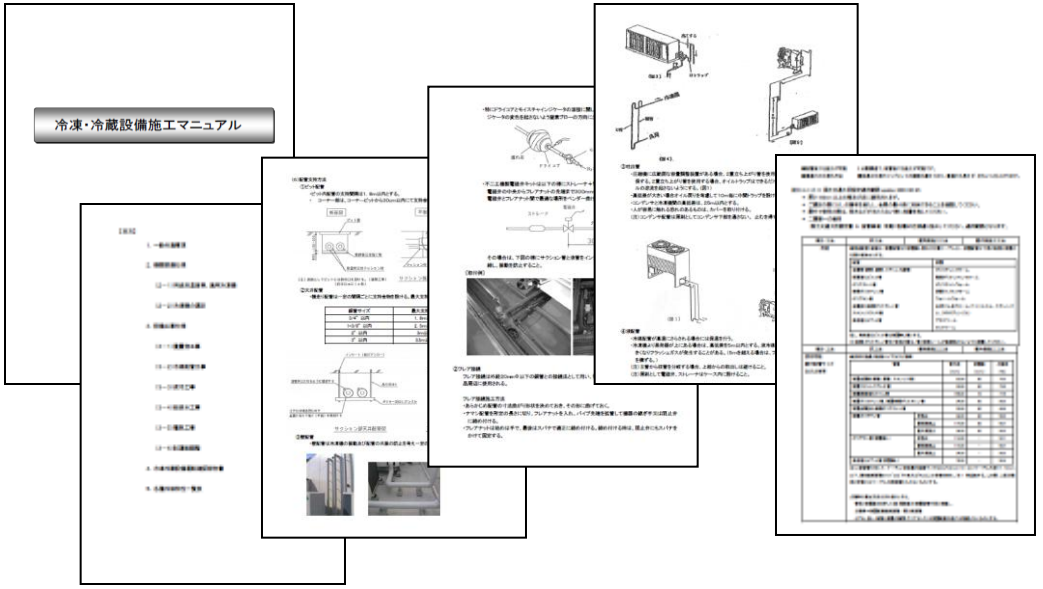
Figure 17: Sub-critical test measurement

Challenges for the Spread of CO_2 Systems

② CO_2 Technician Training

- Training for technicians working for installers, regularly held at Panasonic.

374 trainees completed by the end of 2013

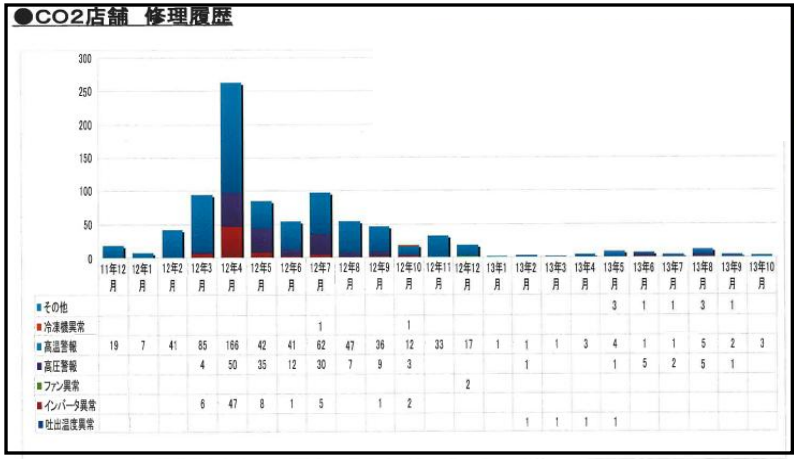


③ Maintenance

- Early Detection and Measures of System Failure using Remote Monitoring

Preventing Incidents by “Action on Pre-Alarm”

- System Improvement (Software or Hardware) based on Failure Cases and Monitored Data



Barriers to be Removed for Spread

■ Technical Challenges

Barriers to be Removed for the Spread of CO_2 Systems

1. Small Number of Technicians ⇒ Training Programs , Remote Monitoring
2. Higher Equipment Cost ⇒ Cost Reduction by Volume Efficiency
3. Higher Installation Cost ⇒ High-strength Copper Tube

■ Regulatory barriers

Required National-Level Policy Change

1. Re-considering Direct Effect from Refrigerant Leakage During Use
2. Support for F-gas Emission Control with Regulation and/or Subsidy
3. Support for "Leapfrog" Change to Natural Refrigerant
4. Introducing Credit for Refrigerant Leakage Reduction During Use

Japan is behind EU countries in natural refrigeration. But CO_2 technology has been proven and the number of stores almost reach to 180 in Japan. (157 by Lawson and the remaining by other retailers) Japan can catch up with Denmark in several years by these policy change.

Lawson aims "No.1 Natural Refrigeration Retailer" in the world.

Preferable Action

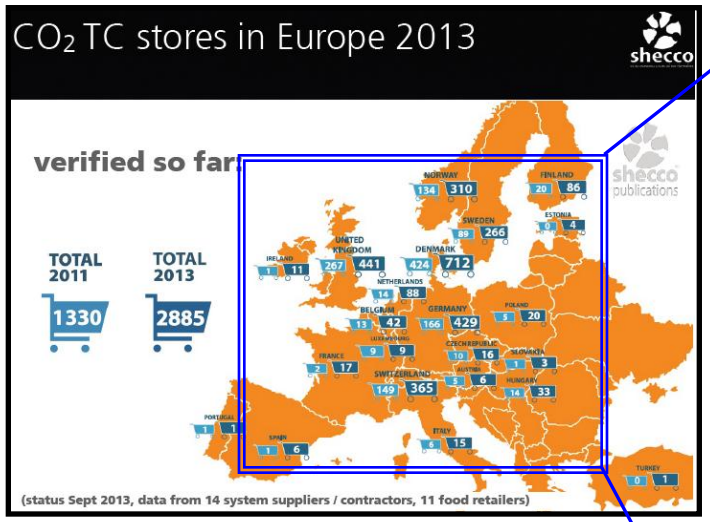
■ Number of Stores with CO_2 Refrigeration (Lawson)

FY 2010: 1
FY 2011: 50
FY 2012: 24
FY 2013: 82 (Estimated)
⇒157 Stores Installation

FY 2014: 400 Installation (Planned)

FY 2015: 800 Installation(Planned)
⇒Standard Equipment for All New Stores

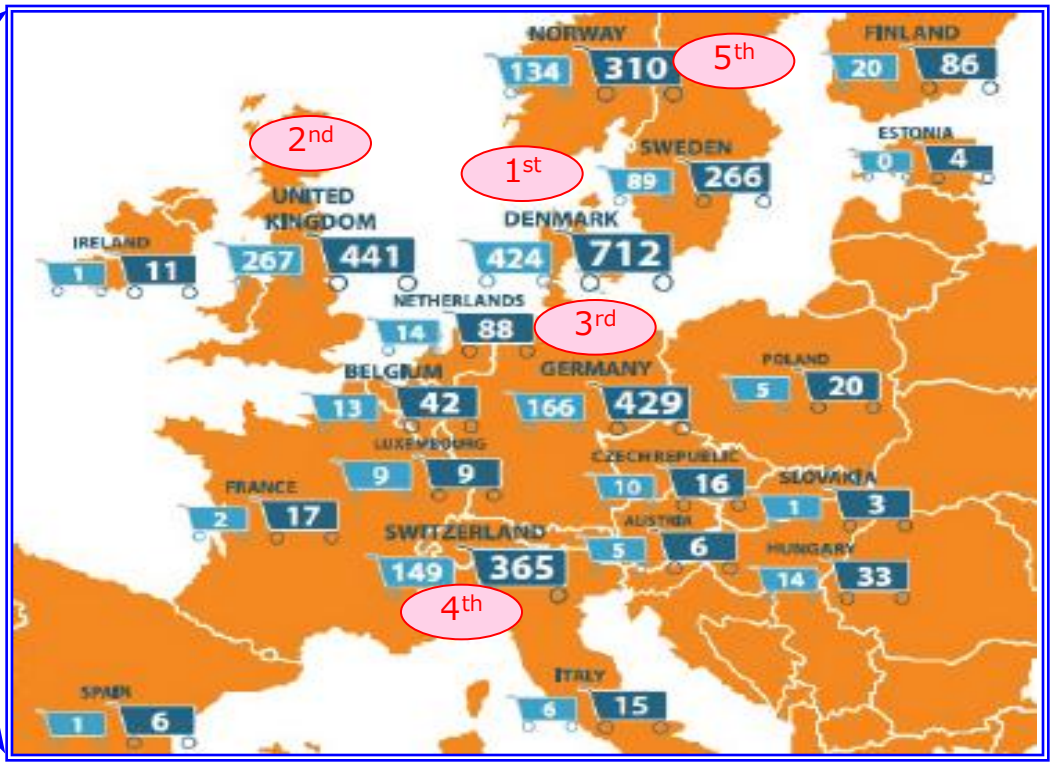
■ Number of Stores with CO_2 Refrigeration (EU Region)



Rank	Country	Stores
1	Denmark	712
2	UK	441
3	Germany	429
4	Switzerland	365
5	Norway	310

Total
2,881
Stores

※Increased in
2years **+116%**



※Shecco TOKYO ATMOsphere network Presentation

Energy Saving and Leakage Reduction with CO_2

① Japan

(from Aomori to Kagoshima

27% Saving

from R404A

51% CO_2 Reduction

■Global Warming Impact: CO_2 vs. R404A

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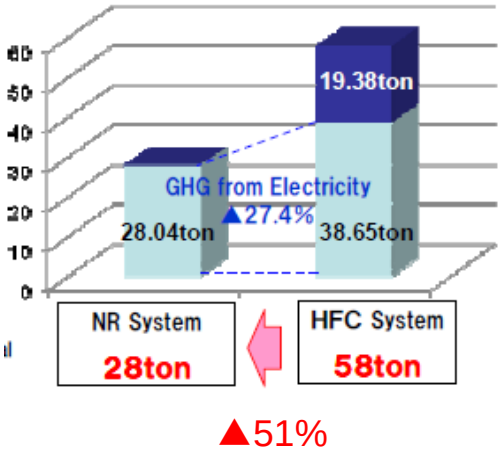


▲51%

② Okinawa

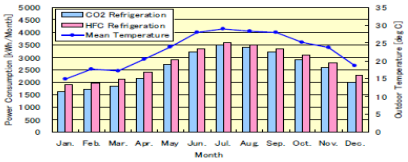
21% Saving

from R404A

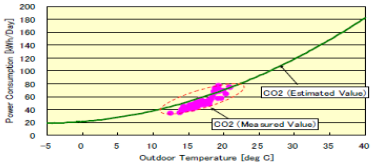
49% CO_2 Reduction

Annual Power Consumption		Energy Saving with CO_2	Saving on Energy Bill (14 JPY/kWh)
R404A	CO_2		
80,605 kWh	63,801 kWh	21%	235,256 JPY

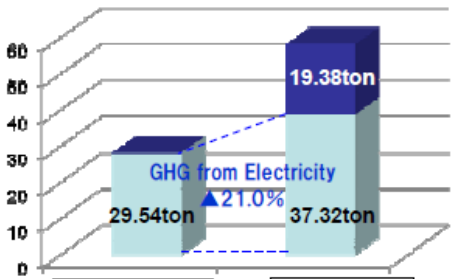
- Estimation Based on Measured Data of the Store in Okinawa
- Opened in Dec. 2012
- Power Consumption of Outdoor Units and Display Cabinets (Freezing & Refrigeration)



15hp CO_2 Outdoor Unit Power Consumption by Months



15hp CO_2 Outdoor Unit Power Consumption to Daily Mean Temperature



▲49%

③ Indonesia

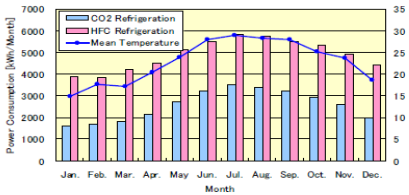
39% Saving

from R22

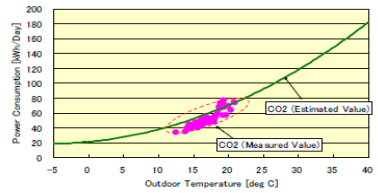
63% CO_2 Reduction

Annual Power Consumption		Energy Saving with CO_2	Saving on Energy Bill (14 JPY/kWh)
R22	CO_2		
105,359 kWh	63,801 kWh	39.4%	581,812 JPY

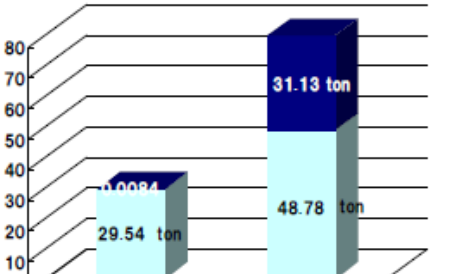
- Estimation Based on Measured Data of the Store in Okinawa
- Opened in Dec. 2012
- Power Consumption of Outdoor Units and Display Cabinets (Freezing & Refrigeration)



15hp CO_2 Outdoor Unit Power Consumption by Months



15hp CO_2 Outdoor Unit Power Consumption to Daily Mean Temperature

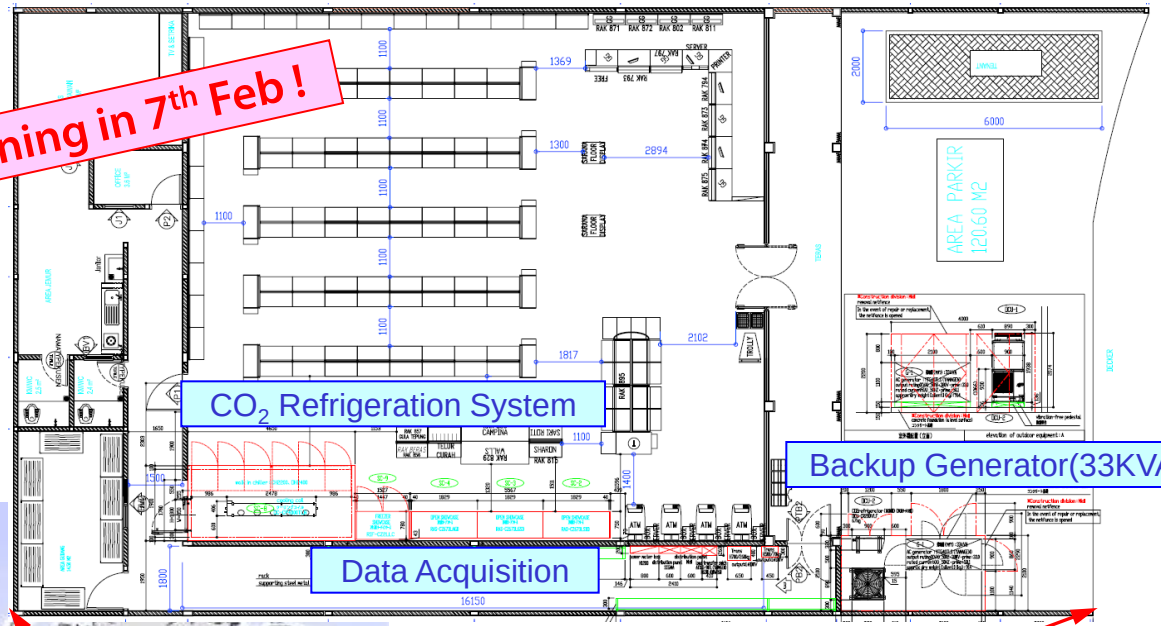


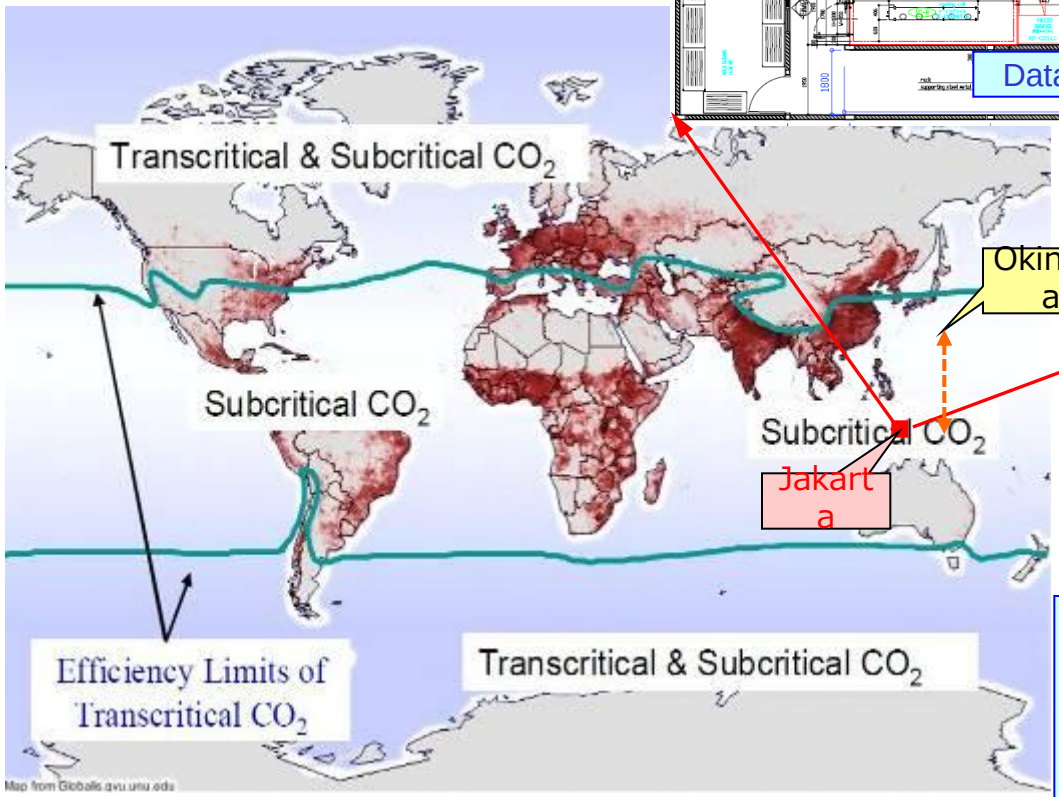
▲63%

1st Pilot Store of JCM FS Project in Jakarta

■PETA BARAT (Alfamidi)

- Location: Jakarta
- Sales Floor: 236m^2
- Equipment:
  - CO_2 Refrigeration System
  - Data Acquisition
  - Backup Generator (33KVA)





【PT MIDI UTAMA INDONESIA Tbk】
- President Director: Rullyanto
- Established: Jun. 2007
- Number of Stores: 652 (End of 2012)
- Consisting of 452 Alfamidi, 116 Alfaexpress and 84 Lawson

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Thank you for your kind attention !