

**NATURAL REFRIGERANTS  
IN DIFFERENT  
INDUSTRIAL APPLICATIONS**

## MYCOM Compressor and Development



1924: Piston Compressor



1964: Screw Compressor



1978:  
4°K Super Low temp.  
Particle Accelerator  
(Helium)



1981:  
Nuclear Fusion  
(Helium)



1984:  
Mag-Levi Train  
(Helium)



1989:  
Rocket Fuel  
(Hydrogen)



1993: Super GE  
(Superconduct-  
EL-Generator)



1958: Multi-Cylinder  
Piston Compressor



Ethylene Plant



LNG/LPG Tanker



Organic (EOEG)



Inorganic:  
(NH<sub>3</sub>)



Pharma Plant

1924

1960

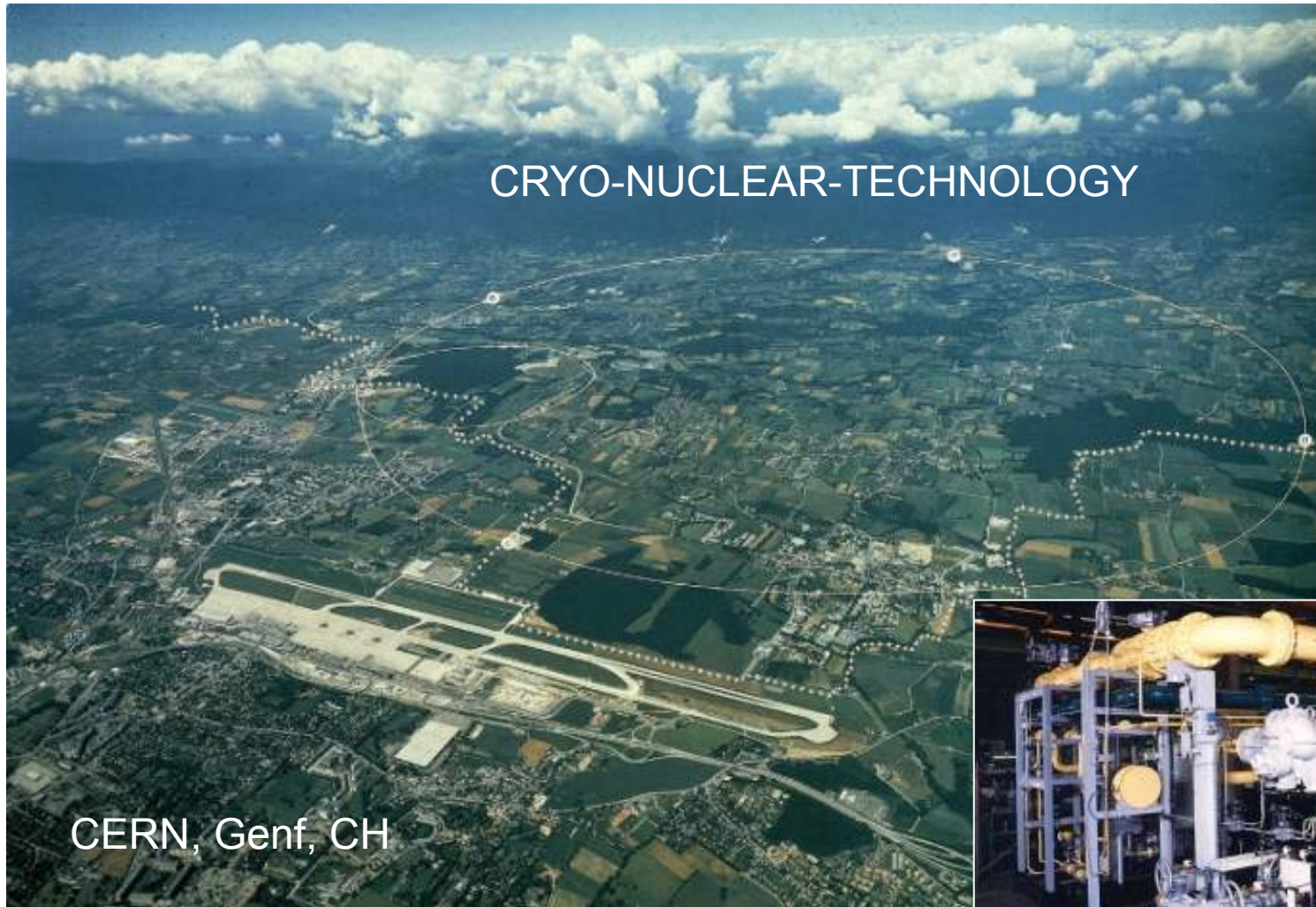
1970

1980

1985

1990

● More than 100.000 Screw and Piston Compressors have been installed over 100 countries.





PETROCHEMICAL



# LINE-UP NATURAL 5

## FIELD CASES

Mayekawa Mfg.Co,Ltd  
Kunuaki Kawamura

## Commitment on Natural Refrigerants



-  Semi-Hermetic Screw Compressor Unit
-  Commercial / Industrial Eco-Cute System
-  Adsorption Chiller
-  Commercial / Industrial  
Air-Conditioning / Water-Supply Heat Pump
-  Dehumidifying Air Refrigerant System [Air Ref]

## "Natural Five" Refrigerants and Product Solutions

Refrigerant (Natural Five)	NH <sub>3</sub> R-717	CO <sub>2</sub> R-744	HC Hydrocarbon	H <sub>2</sub> O R-718	Air R-728
90°C		Utility hot water			
60°C	Utility hot water Heating		Utility hot water Heating HVAC	Heat recovery	
10°C	Chilled water Ice making	Chilled water Ice making		Chiller	
-15°C	Cold storage, Freezer, Fish boat				
-25°C	Specific Refrigeration needs				
-40°C	Freezer, Freeze-dry, Super Low temp storage				
-50°C			Cryogenics		Cryogenics
-60°C					
-100°C					
Notes	<ul style="list-style-type: none"> <li>•Conventional system</li> </ul>	<ul style="list-style-type: none"> <li>•Eco-Cute</li> </ul>	<ul style="list-style-type: none"> <li>•Nat'l Proj.</li> <li>•Butane + Propane</li> </ul>	<ul style="list-style-type: none"> <li>•Nat'l Proj.</li> <li>•Adsorption</li> <li>•Heat recovery</li> </ul>	<ul style="list-style-type: none"> <li>•Nat'l Proj.</li> <li>•Air-cycle</li> </ul>

# FIELD CASES



NH<sub>3</sub>



Ammonia





CO<sub>2</sub>

- CO<sub>2</sub> Compression Refrigeration

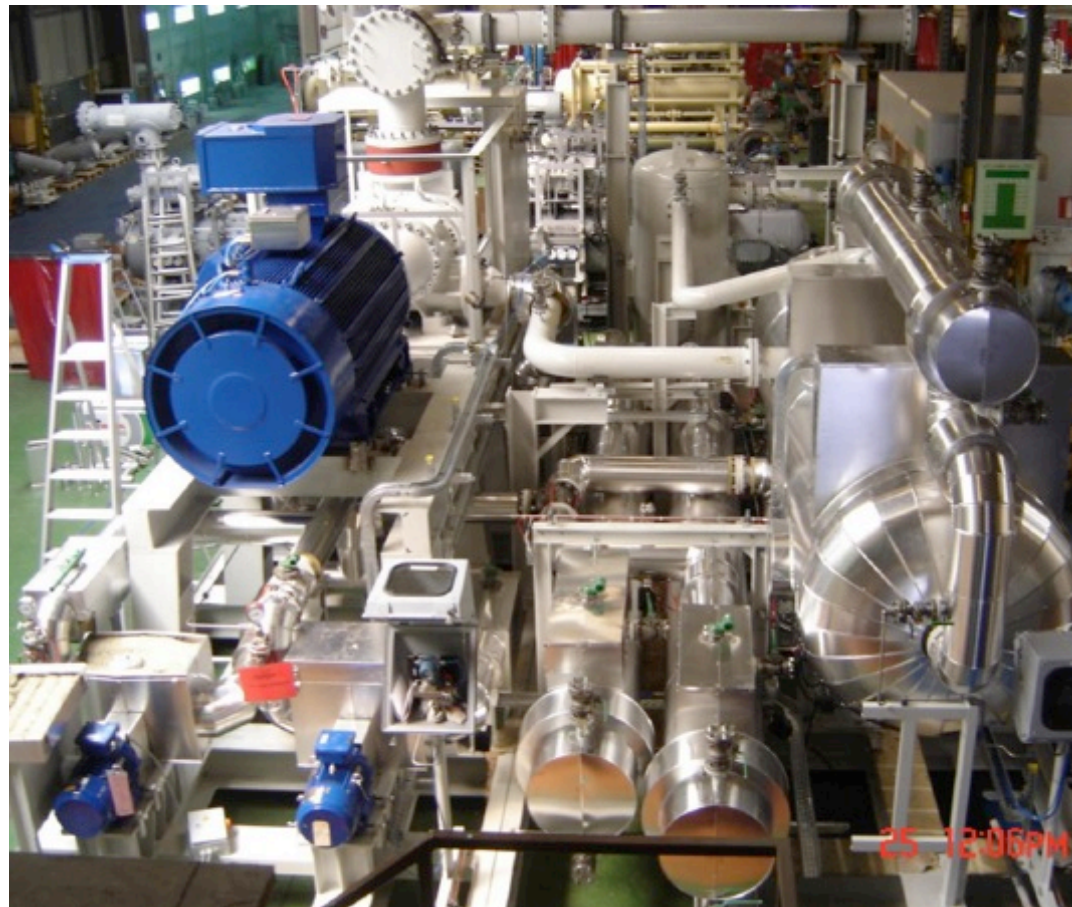


INDONESIA SO41433 2010

Carbon dioxide



HC



Hydrocarbon

## Hydrocarbon Refrigerant Packaged Unit

2005  
~2007 NEDO [ Energy-Saving Non-Freon Air-Conditioning and Refirgeration System ]

([Industrial Technology Development Subsidizing Company])



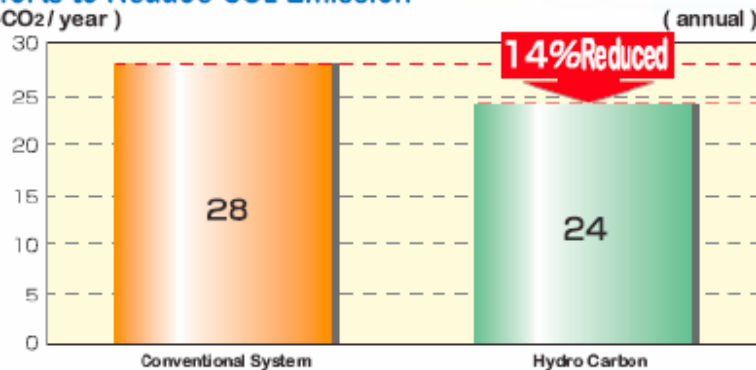
## 14% Reduction of CO2 Emission

Cooling C O P	COP=3.7 (Air-Cooled)
Heating C O P	COP=3.7 (Air-Source)
Supplying Water C O P	COP=3.3 (Supplying temperature 65°C, air-source)

Targets: Commercial / Industrial Air-Conditioning, Water-Supply

Supply Temperature	Applications	Suitable Markets
70°C	65°C Hot Water-Supply / Heating System	Food factories, hotels
50°C	45°C Heating System	Office buildings, factories
0°C	+7°C Chilled Water Chiller System	Office buildings, factories
-5°C	+2°C Chilled Water Chiller / SupercoolIce Making System	Food factories
-15°C	Ice on Coil Ice Thermal Storage System	Food factories

Efforts to Reduce CO2 Emission  
( t-CO2 / year )



### Case Study

40USRT Chilled Water Supply Machine  
Chilled Water Temperature : 7°C

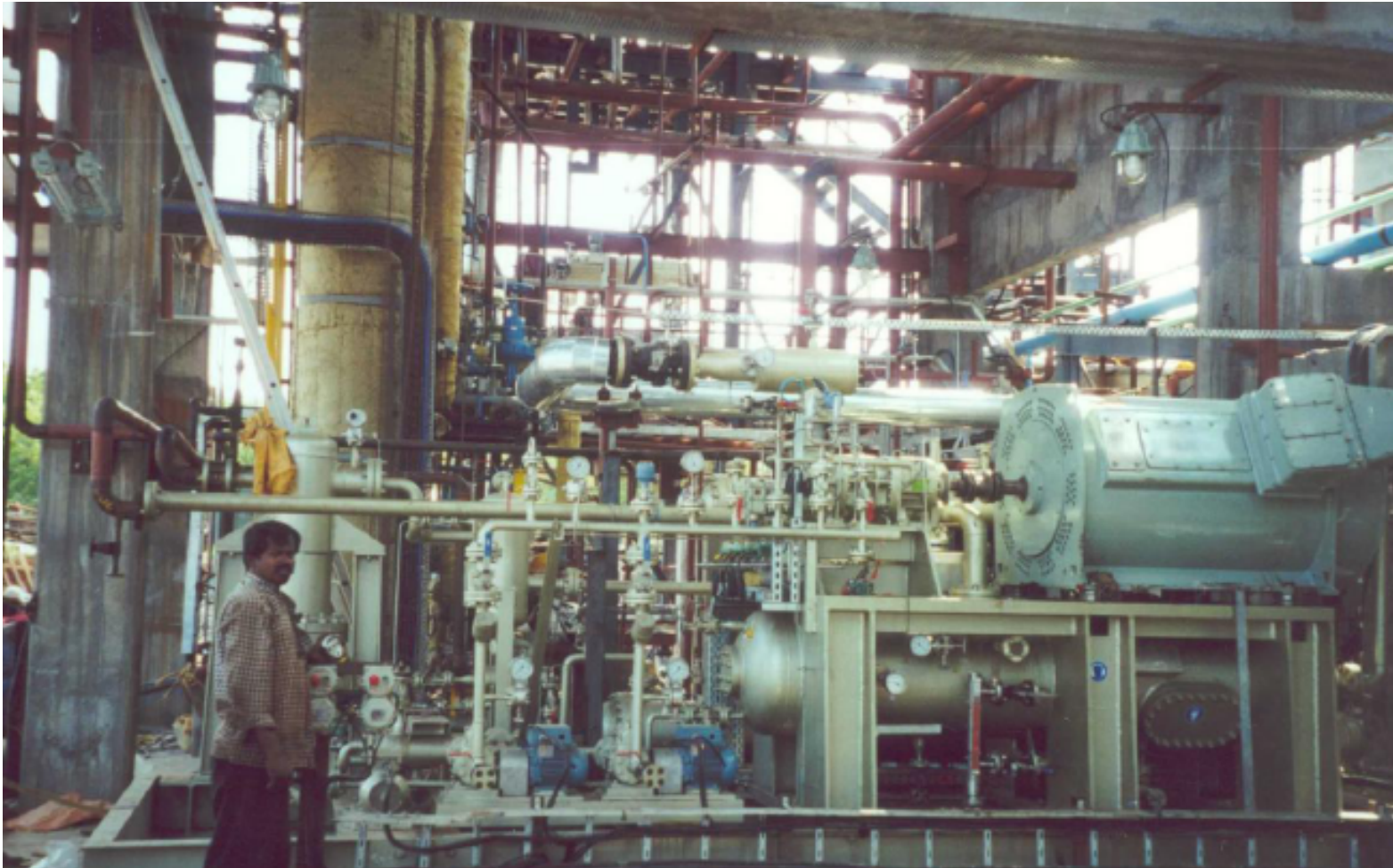
#### Power Consumption

< Conventional System >  
R134a  
Chilled Water Supply Machine  
**43kW**

< Hydro Carbon >  
**36kW**









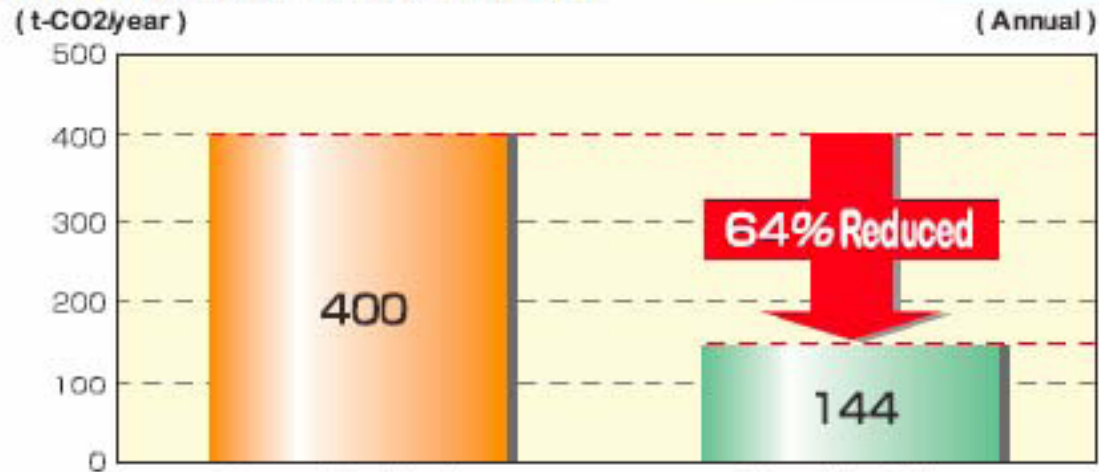


**H2O**



**Water**

## Efforts to Reduce CO<sub>2</sub> Emission



### Case Study

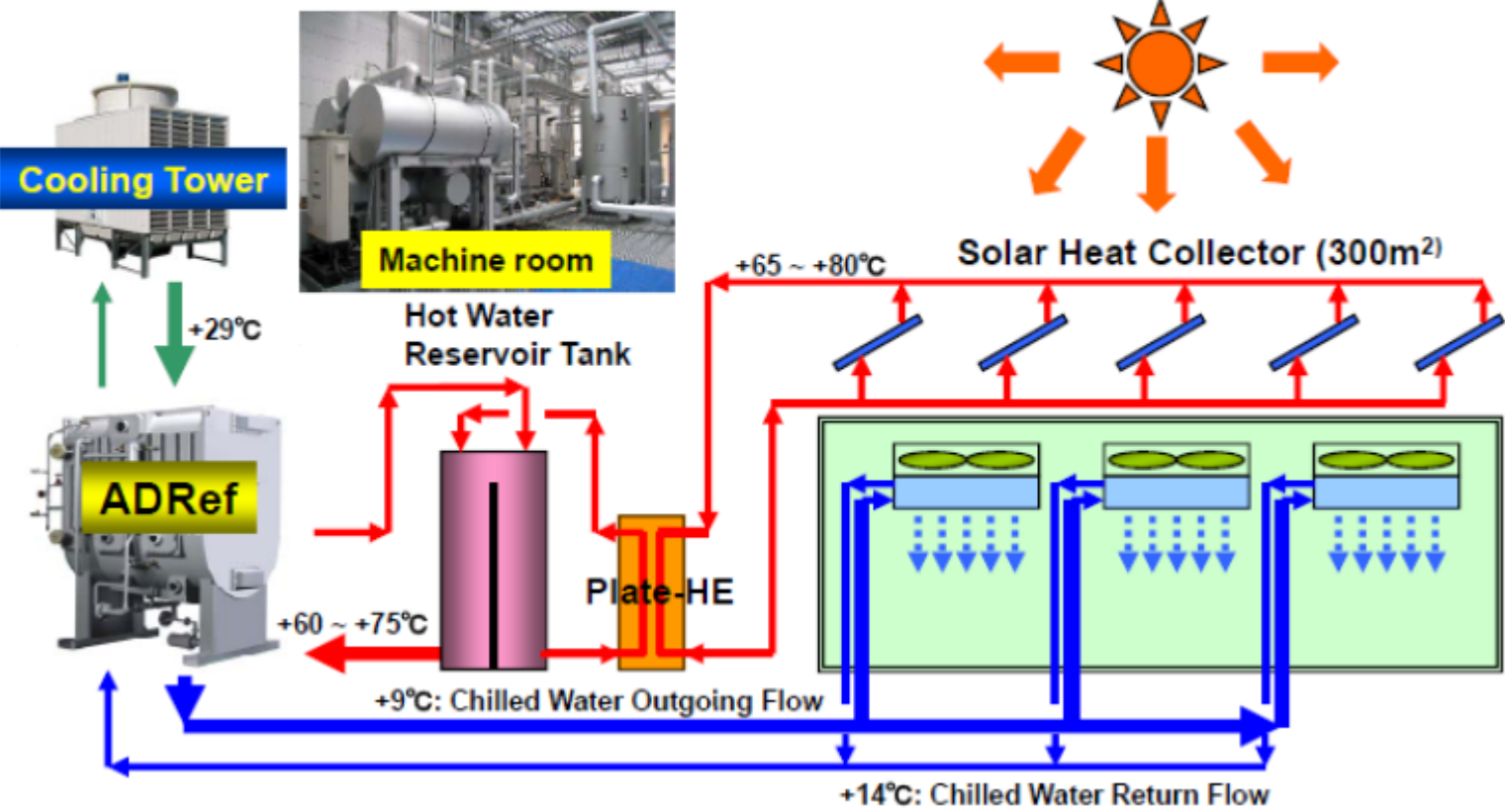
100USRT Industrial Process Cooling  
Cold Water Temperature : 9 °C

### Power Consumption

<Conventional System>  
R134a Cooling Water  
**100kW**

<Adsorption Chiller>  
**36kW**

**Heat Source: Solar Heat Energy**  
**(Application: Air-Conditioning of Shopping Center)**





- Air Cycle Refrigeration System
- For Low Temperature Applications  
-50 ~ -120 °C

AIR

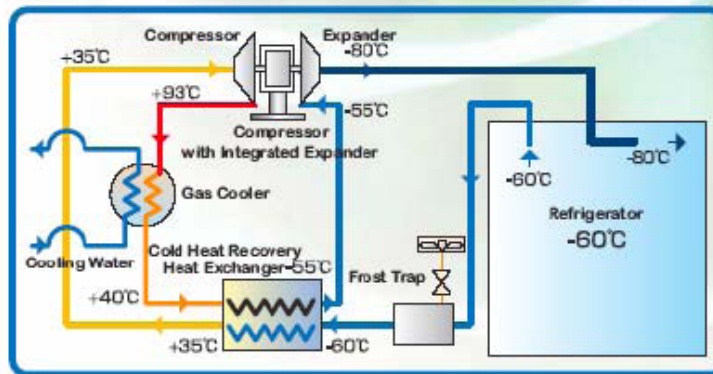


# Air Cycle Refrigeration Packaged Unit

2003 Developed at [Technical Strategy for Rationalization of Energy Consumption Project]  
~2005 NEDO



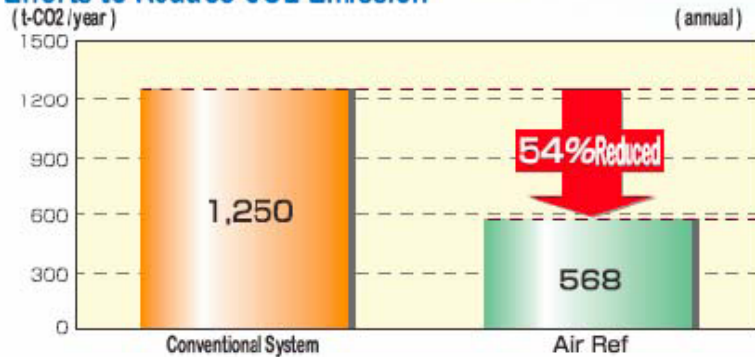
## 54% Reduction of CO2 Emission



**Target:** Ultra cold refrigerator for tunas and bonitos, rapid freezer, frost-破碎 etc.

- Using [Air] as the ultimate natural refrigerant, [Air Ref] is safe and eco-/people-friendly.
- Due to the turbo compressor with integrated expander, high COP can be achieved, saving energy by 50% comparing the conventional types.
- Due to its low operating pressure, exempt from legal regulations.
- Directly cooling the air, Air Ref does not require a fan coil unit or piping for refrigerant in the storage.
- Dehumidifying agent reduces frosting in the storage. Defrosting is not required.

### Efforts to Reduce CO2 Emission



### Case Study

2,000 ton Refrigerator Interior Temperature : -60°C	
Power Consumption	
< Conventional System > R22 2 Stage Compression Refrigerator	< Air Ref >
<b>281kW</b>	<b>128kW</b>

**THANKS FOR YOUR  
ATTENTION!**

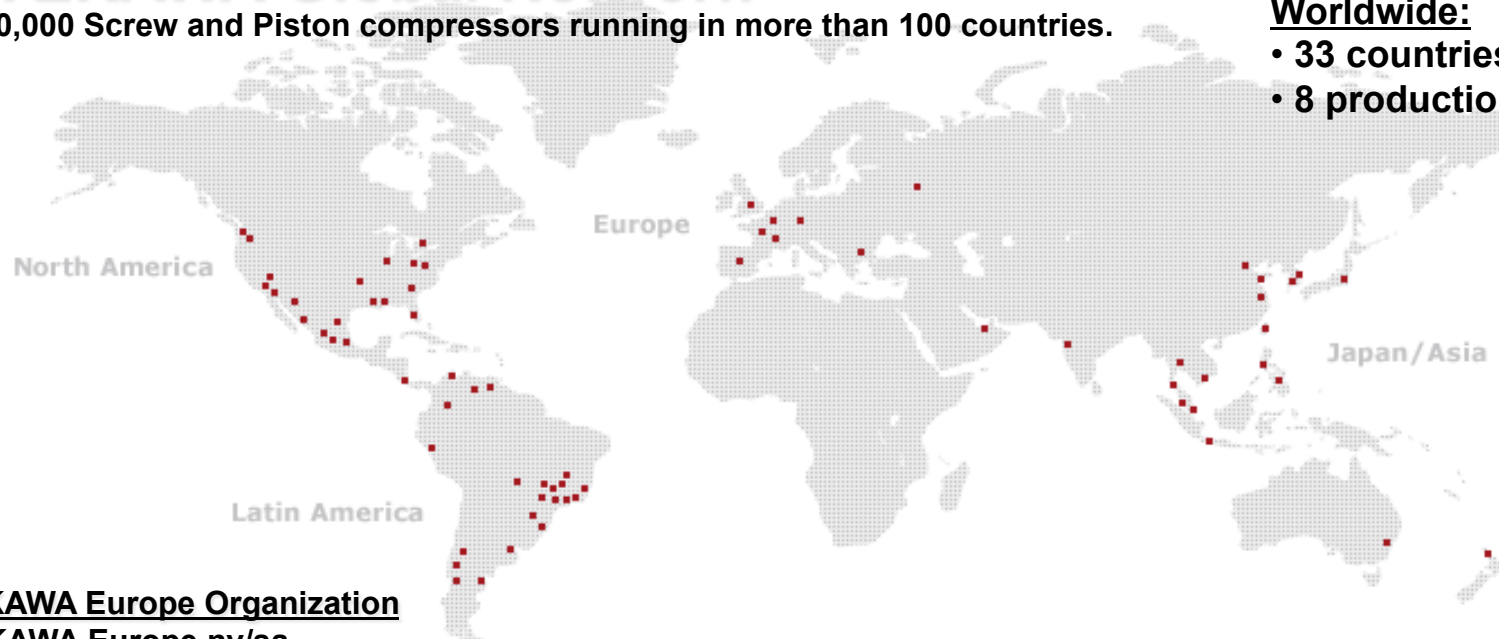
# MAYEKAWA Global Network

Over 70,000 Screw and Piston compressors running in more than 100 countries.

# MYCOM

## Worldwide:

- 33 countries / 119 offices
- 8 production plants



## MAYEKAWA Europe Organization

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