

# Global Solutions for Industrial Refrigeration with “Natural Refrigerants”

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**Mayekawa Mfg. Co., Ltd.  
Kuniaki Kawamura**

# Head Office of MAYEKAWA Japan



**Founded: 1924**  
**Location: Tokyo, Japan**  
**Turnover: \$1.5 Billion**  
**Employees: 3,350 (33 countries)**

# History



縦型冷凍機

1924

Vertical low speed reciprocating refrigeration compressor



C シリーズ 単機二段スクリュー圧縮機  
モデル141モデル

1964

Screw compressor



1978

Ultra low temperature accelerator



Refrigerated cargo vessel



Maglev train



Rocket fuel



1998

Nagano Olympic Winter Games



W シリーズ 単機二段レシプロ圧縮機  
モデル141モデル

1958

Multi-cylinder reciprocating compressor



Offshore platform



Freezer



Chicken whole leg deboning robot



Comprehensive food production system

1924

1960

1970

1980

1985

1990

2000

- Established in 1924, Capital 1,000,000,000 yen, Number of employees (2,200 domestic employees and 1,150 overseas employees), 57 Domestic offices and 82 overseas offices
- Manufacturing and sales of various gas compressors based on industrial compressors (More than 40% share of the international market)
- Plant engineering and consulting engineering services for agricultural and livestock industries, food industries and energy industries
- The manufacturer of individually make-to-order type industrial goods (capital goods)

# Around the world



## Main operations

Mayekawa is doing business globally, having 57 domestic offices and 3 plants, and 90 overseas offices including 6 plants.

- Corporate offices  
3-14-15 Botan, Koto-ku,  
Tokyo 135-8482, Japan  
Established in 1924  
Capital 1,000,000,000 yen  
President Tadashi Maekawa

Domestic plant: Moriya,  
Higashi-Hiroshima, Saku  
Overseas plant: Mexico,  
Brazil, USA, Belgium, South  
Korea



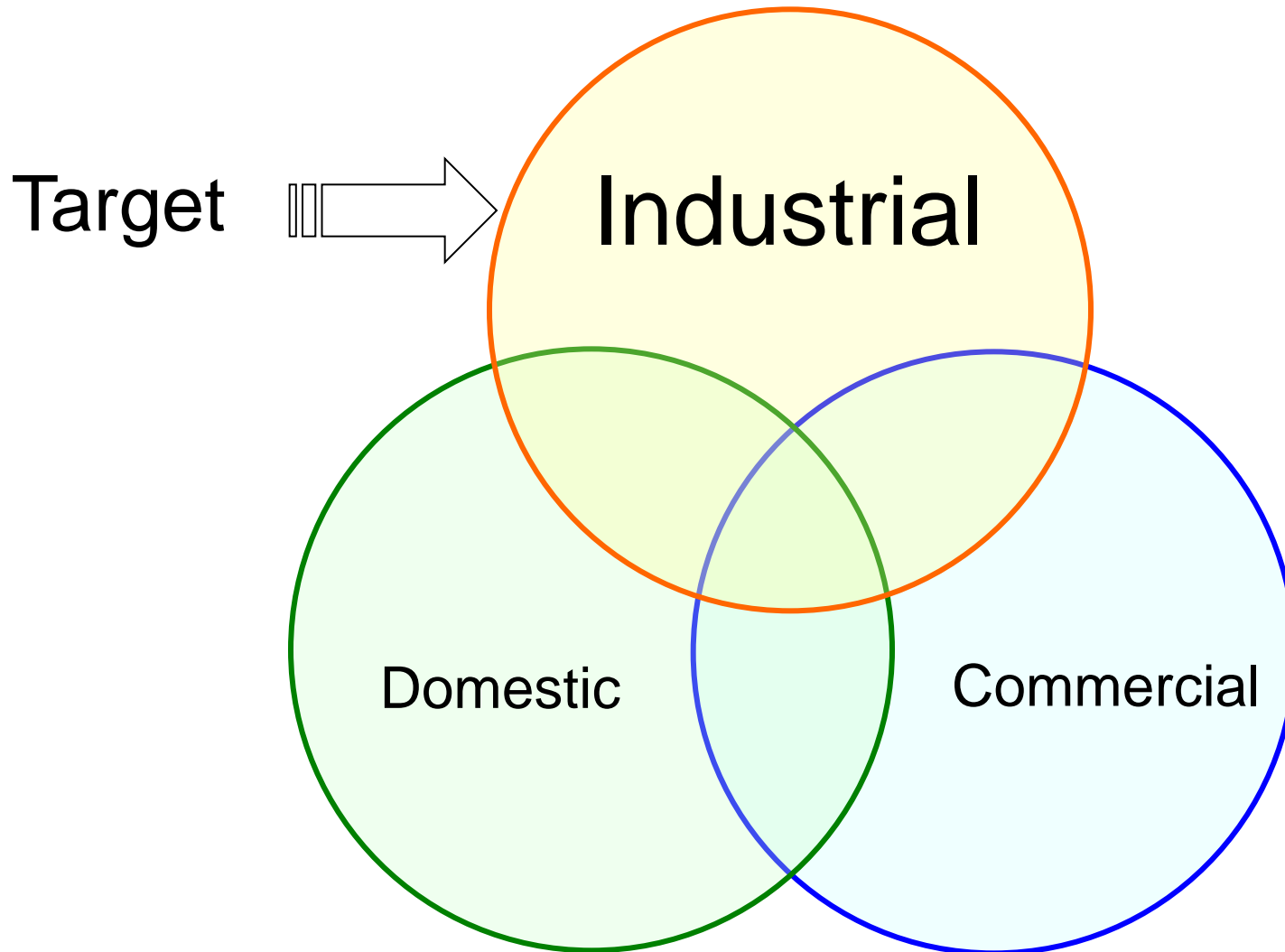
Brazil plant



Moriya plant







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# Industrial Refrigeration with Natural Refrigerants



# Development Concepts

- High efficiency
- Low refrigerant charge
- Less leakage
- High reliability

Refrigerant (Natural Five)	NH <sub>3</sub> Ammonia	CO <sub>2</sub> Carbon Dioxide	HC Hydro Carbon	H <sub>2</sub> O Water	Air
120°C  60°C 10°C -15°C -25°C -40°C -50°C -60°C -100°C	Utility hot water Heating Chilled water Ice making Cold storage, Freezer, Fish boat Specific Refrigeration needs Freezer, Freezed-dry, Super Low temp storage 	Utility hot water Hot Air Chilled water Ice making Cold storage, Freezer, Fish boat Specific Refrigeration needs Freezer, Freezed-dry, Super Low temp storage 	Utility hot water Heating HVAC 	Heat recovery Chiller 	 Cryogenics
Notes	<ul style="list-style-type: none"> <li>Conventional system</li> <li>National Projects</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 Recov.</li> </ul>	<ul style="list-style-type: none"> <li>Nat'l Proj.</li> <li>Air-cycle</li> </ul>

# Semi-hermetic Refrigeration Package

2007 Ministry of the Environment  
[Enterprise of Technical Development Against Global Warming]

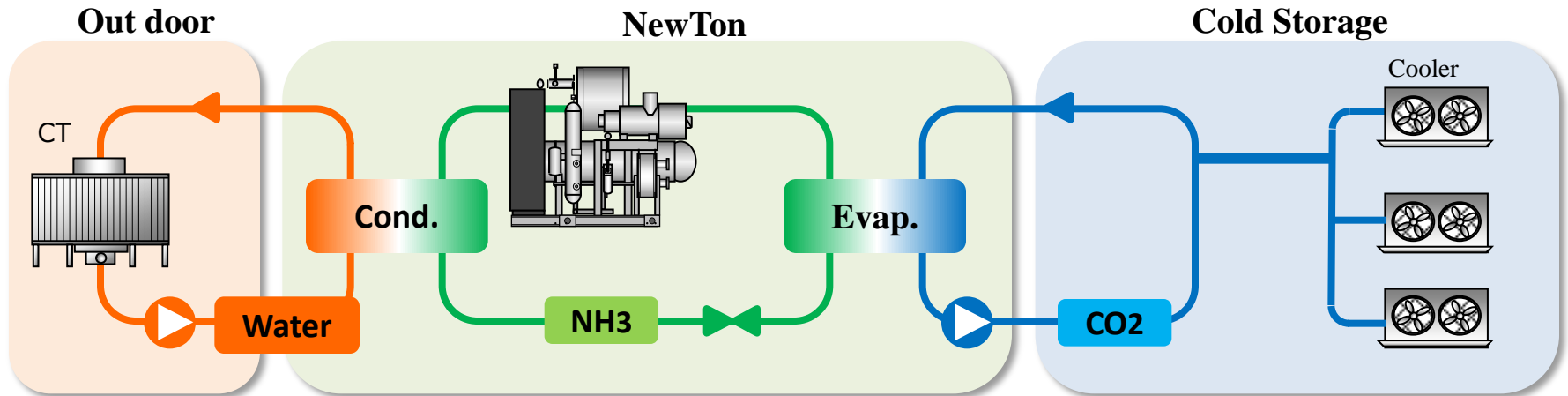


NewTon  
3000

Natural Five™



# Basic Concept of *NewTon*



## Water cooled

- Energy saving
- NH3 charge min.
- Free layout
- Easy Maintenance



## NH3 Package

- New Screw compressor
- Semi-hermetic IPM motor
- Flooded Evaporator
- Double economizer
- Automatic operation



## CO2 brine

- Safety
- Low pump power
- No trouble by oil
- High heat transfer



「Safety」 「Energy saving」 「Easy maintenance」

## Power reduction through renewal with NewTon

Customer	Volume	Age	Refrigerant formerly used		Power reduction
	(m3)	(year)	Refrig.	Comp.	(%)
<b>Tokyo Toyomi</b> (Case 2)	<b>45,000</b>	<b>29</b>	<b>HCFC-22</b>	<b>Screw</b>	<b>31.1</b>
<b>Niigata Reizo</b>	<b>10,000</b>	<b>33</b>	<b>HCFC-22</b>	<b>Recip.</b>	<b>41.2</b>
<b>QP “Kewpie”</b>	<b>16,250</b>	<b>27</b>	<b>HCFC-22</b>	<b>Recip.</b>	<b>24.9</b>
<b>Sensui Reizo</b>	<b>6,125</b>	<b>38</b>	<b>HCFC-22</b>	<b>Screw</b>	<b>29.3</b>
<b>Ajinomoto</b>	<b>7,500</b>	<b>25</b>	<b>HCFC-22</b>	<b>Recip.</b>	<b>28.0</b>
<b>Gliko</b>	<b>30,000</b>	<b>30</b>	<b>HCFC-22</b>	<b>Screw</b>	<b>19.8</b>
<b>Showa Reizo</b>	<b>32,500</b>	<b>22</b>	<b>HCFC-22</b>	<b>Recip.</b>	<b>28.0</b>
<b>AMB Funabashi</b>	<b>30,000</b>	<b>25</b>	<b>NH3/Brine</b>	<b>Recip.</b>	<b>34.0</b>

# “NewTon” for ASEAN

“1<sup>st</sup> NewTon system” will be installed to P.T. ADIB Global Food Supplies in Indonesia.



**P.T. ADIB**  
A cold storage warehouse nearby Jakarta

## Joint Crediting Mechanism Host Country : Indonesia

### JCM Project for Cold Chain Industry in Indonesia with “NewTon”

This project was funded by the MOEJ in FY 2013 as the 1<sup>st</sup> project to Joint Crediting Mechanism .

Most advanced Japanese energy efficient non-fluorocarbon cooling system

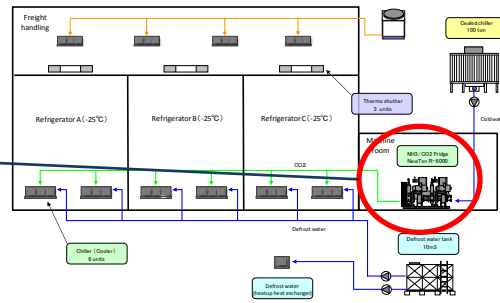


Indonesia  
On August 26, 2013  
(Jakarta)

NewTon R-6000



Entity:  
Mayekawa Mfg CO. Ltd



Demonstration Site:  
PT.ADIB Global Supplies

Energy Consumption reduction	570,000 kwh /year	Estimated GHG reductions	Without consideration of HFC leakage emissions: 213 (tCO2/year) With consideration of HFC leakage emissions: 902 (tCO2/year)
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## Energy Efficient Refrigeration Technology

• MOEJ introduce the Energy Efficient Refrigeration Technology of “NewTon” as **Japanese Good Practices.**

<http://www.env.go.jp/en/earth/ozone/goodpractice/full.pdf>

CO<sub>2</sub>

- Hot water and Hot dry air supply Heat-Pump
- Source : Air and Water

Carbon dioxide

# “CO2 Heat Pump”

## unimo



**Eco-Cute “unimo A/W”**



**Eco-Cute “unimo W/W”**



**H<sub>2</sub>O**

- Ad-sorption Chiller Utilizing Solar Energy

**Water**

# Adsorption Chiller Packaged Unit

2005  
~2007 NEDO [ Research and Development of New System Utilizing Solar Energy ]



# AIR

- Air Cycle Refrigeration System
- For Low Temperature Applications  
-50 ~ -100 °C

AIR



# Air Cycle Refrigeration Packaged Unit

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



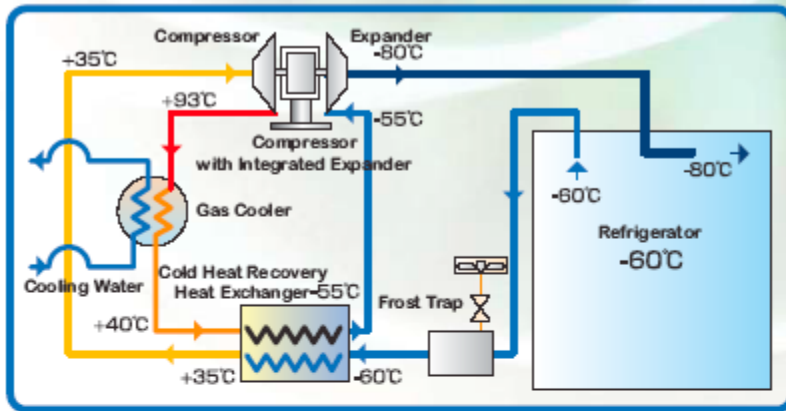
# Installation in Japan



-60°C ultralow cold storage



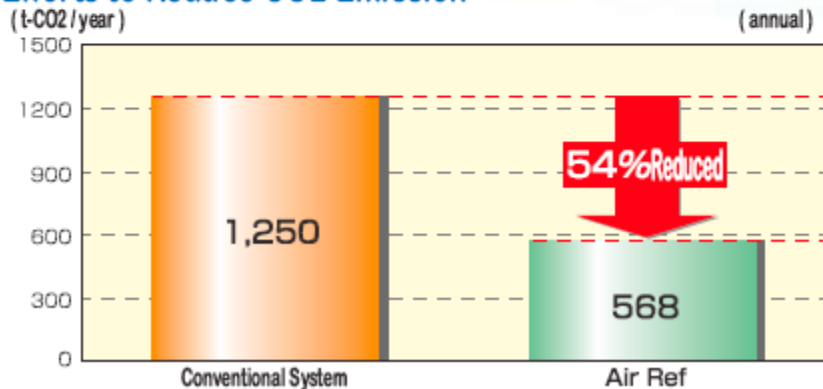
# 54% Reduction of CO2 Emission



**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

**281 kW**

< Air Ref >

**128 kW**

**Conclusion**

In the industrial refrigeration application natural refrigerants can be selected without green house gas.

In the view of prevention of global warming we would like to offer a proposal below;

1. Promoting natural working fluids aggressively in the proven industrial field

Thank you very much for  
your Attention.

**MAYEKAWA**

NATURE IS WHAT WE DESIGN FOR

