A Presentation By: **Mayekawa (Thailand) Co., Ltd.**

ENERGY SAVING SOLUTIONS FOR INDUSTRIAL REFRIGERATION

February 2025
Mayekawa Thailand

100th ANNIVERSARY

MAYEKAWA MYCOM

Content

MAYEKAWA MYCOM

Company Profile

Company Profile

Regional headquarters and office in Japan

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MAYEKAWA MFG. CO. LTD.

Founded : May 1924

Capital : 1 billion Yen

Headquarters : Tokyo JAPAN

No of Employees : 2300 (Japan)

: 2500 (overseas)

Business Activities (B to B / B to G)

- Manufacture and Sales of Industrial Refrigeration Compressor and various gas compressor, as well as food processing robots.
- Plant Engineering
- Consulting and After-sales Service

MAYEKAWA MYCOM

HISTORY

Market

現在でも「低温物流」「水産加工」「農産・畜産」「飲料」「船舶」「食品・食肉加工」「石油・ガス・ケミカル」「空調」「レジャー」と様々な市場で新たな製品が採用されています

1924 1934 1950 1960 1970 1980 1990 2000 2010

Screw Compressor


Reciprocating Compressor


Screw type refrigeration compressor


"K series" i.e. medium-sized reciprocating compressors.


Chicken whole leg deboning robot

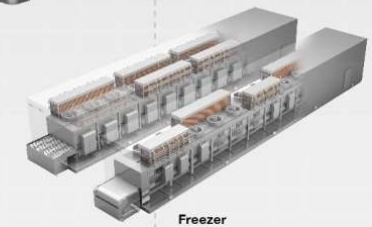

NH3/CO2 cooling system NewTon


Eco Cute unimo


Air refrigeration system PasucalAir

Reciprocating Compressor


High single stage speed multi-cylinder reciprocating compressor


Freezer


Screw compressors for vapor re-compression system


"M series" i.e. new-type reciprocating compressors.


"J series" i.e. new type screw compressors.

Product

100 YEARS / MAYEKAWA JAPAN — 1924

35 YEARS / THAILAND — 1988

MAYEKAWA MYCOM

GLOBAL NETWORK

EUROPE (18 Countries)

Germany	Bulgaria
Poland	U.A.E
Belgium	Hungary
UK	Spain
Russia	Egypt
Ukraine	Turkey
France	Italy
Denmark	Serbia
Saudi Arabia	
South Africa	

ASIA-PACIFIC-India (14 Countries)

Thailand	Australia	Taiwan
Indonesia	New Zealand	China
Philippines	India	South Korea
Singapore		
Malaysia		
Vietnam		
Bangladesh		

Japan

AMERICA (13 Countries)

Canada	USA
Argentina	Peru
Colombia	Chile
Costa Rica	Brazil
Venezuela	Mexico
Ecuador	Panama
Guatemala	

*Operation in 45 countries with over 105 offices

*Production in 7 overseas & 3 Japanese factories

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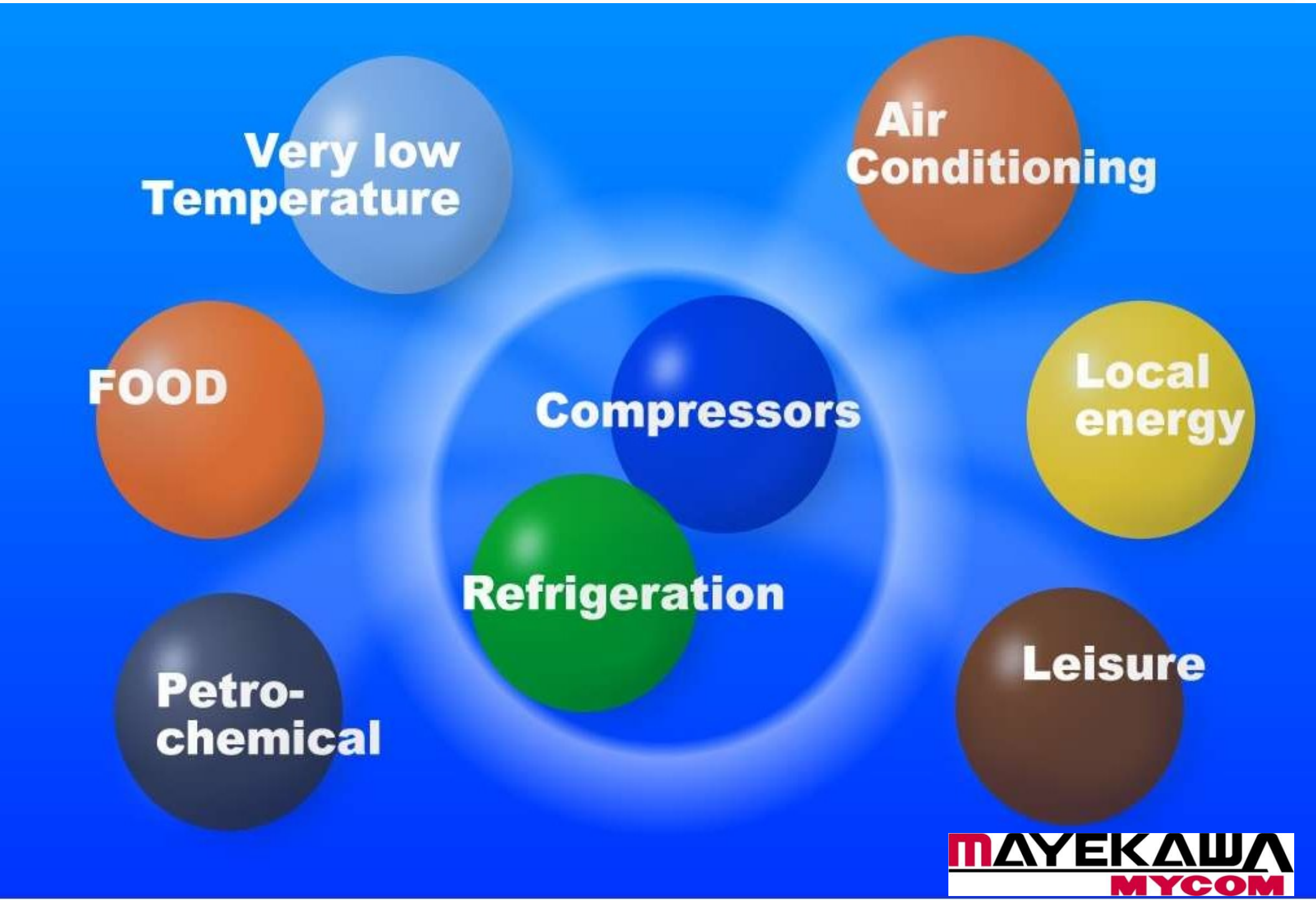
BUSINESS FIELD



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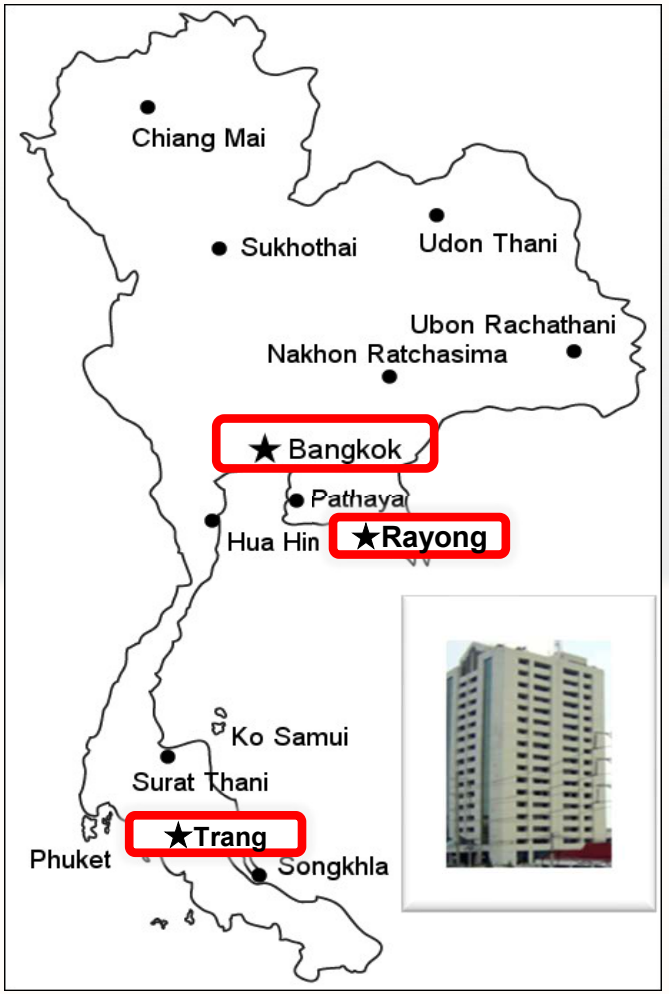
Company Profile
Thailand

MAYEKAWA (THAILAND) CO., LTD.

Corporation : 1988

- **No. of employees : 210++**
- **Branch Office : Rayong / Trang**
- **Workshop & Food laboratory : Bangna Road (6.5km)**



Business Activities

- **Refrigeration Engineering and Installation**
  - **Cold Storage / Blast Freezer / Processing Plants**
    Water Chiller / Beverage
- **Sales of MYCOM Compressors and other equipment**
- **After-Sales Service (Component & system)**
- **Industrial Freezer (IQF/Spiral/Fluidized base/Batch freezers)**
- **Food robots (Deboning and automation machines)**

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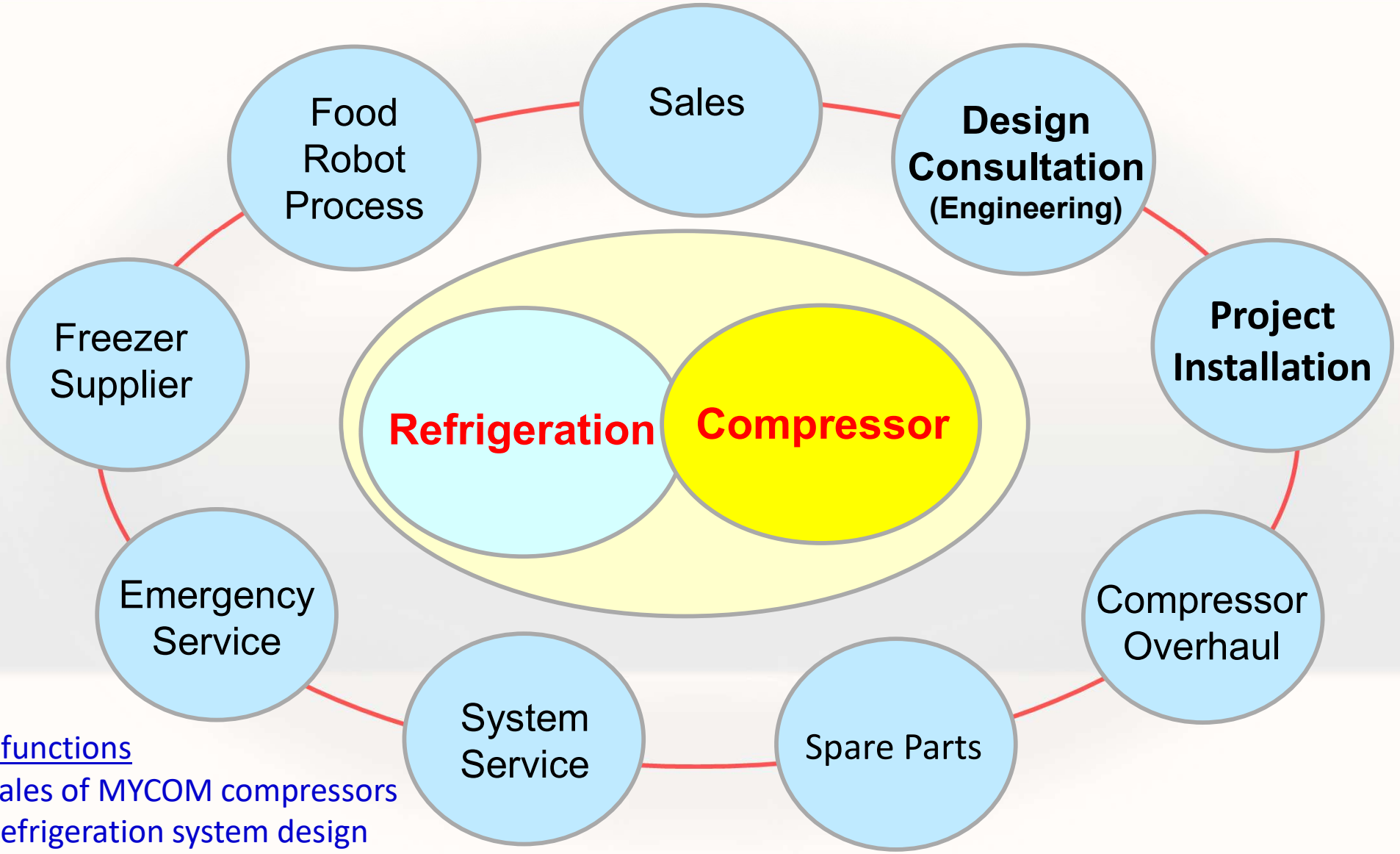
OUR FUNCTION



Our functions

- Sales of MYCOM compressors
- Refrigeration system design
- Installation of refrigeration plants/cold storage
- **Engineering and consultation of old refrigeration system**
- After sales services (compressor, refrigeration system and emergency services) with available spare parts at Bangkok/Rayong/Trang offices.

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OUR REFRIGERATION ENGINEERING PROJECT

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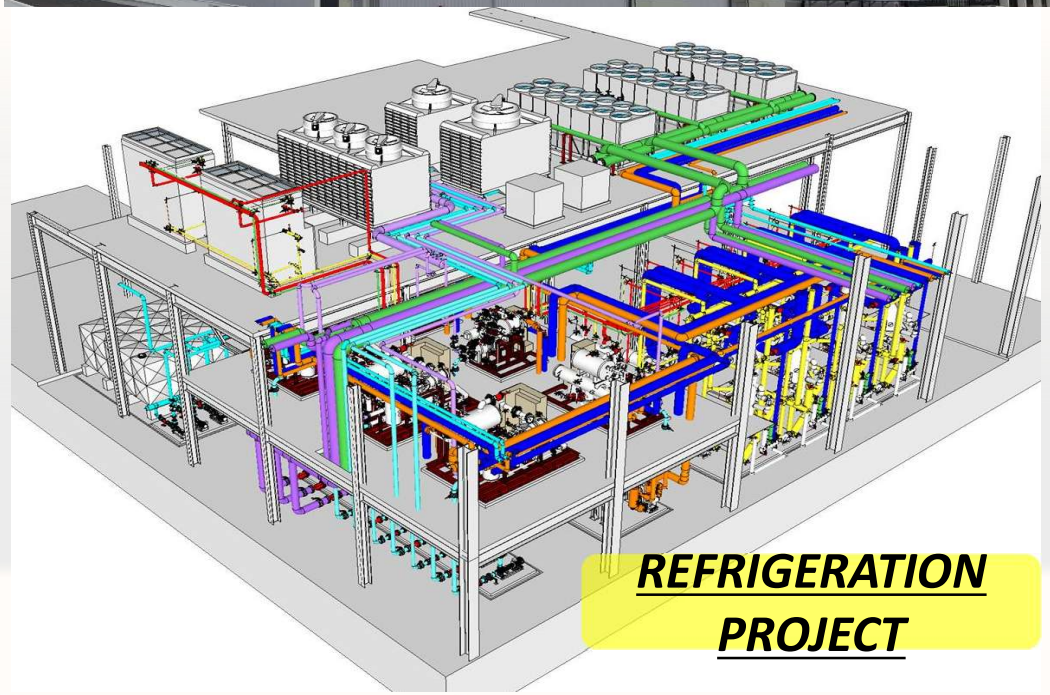
OUR REFRIGERATION ENGINEERING PROJECT



MAYEKAWA
MYCOM

Corporate pursuit

CORPORATE PURSUIT

『Stop GLOBAL WARMING』

	HC	CO_2	NH_3	H_2O	AIR
120℃		Dry Heat			
90℃		Hot water	Heat A/C Cooling Refrigeration Freeze		
60℃	Hot water A/C Cooling	Cooling		A/C	
10℃		Secondary brine			
-15℃					
-40℃		Freeze			
-50℃					
-100℃					Freeze

NATURAL FIVE

HC | CO_2 | NH_3 | H_2O | AIR

HC

Heat pump package system for building air conditioning with hydro carbon refrigeration

CO_2

"UNIMO", a CO2 heat pump system for industrial use. (hot water / hot air)

NH_3

"NewTon", NH3/CO2 refrigeration system for cold store and food processing factory.

H_2O

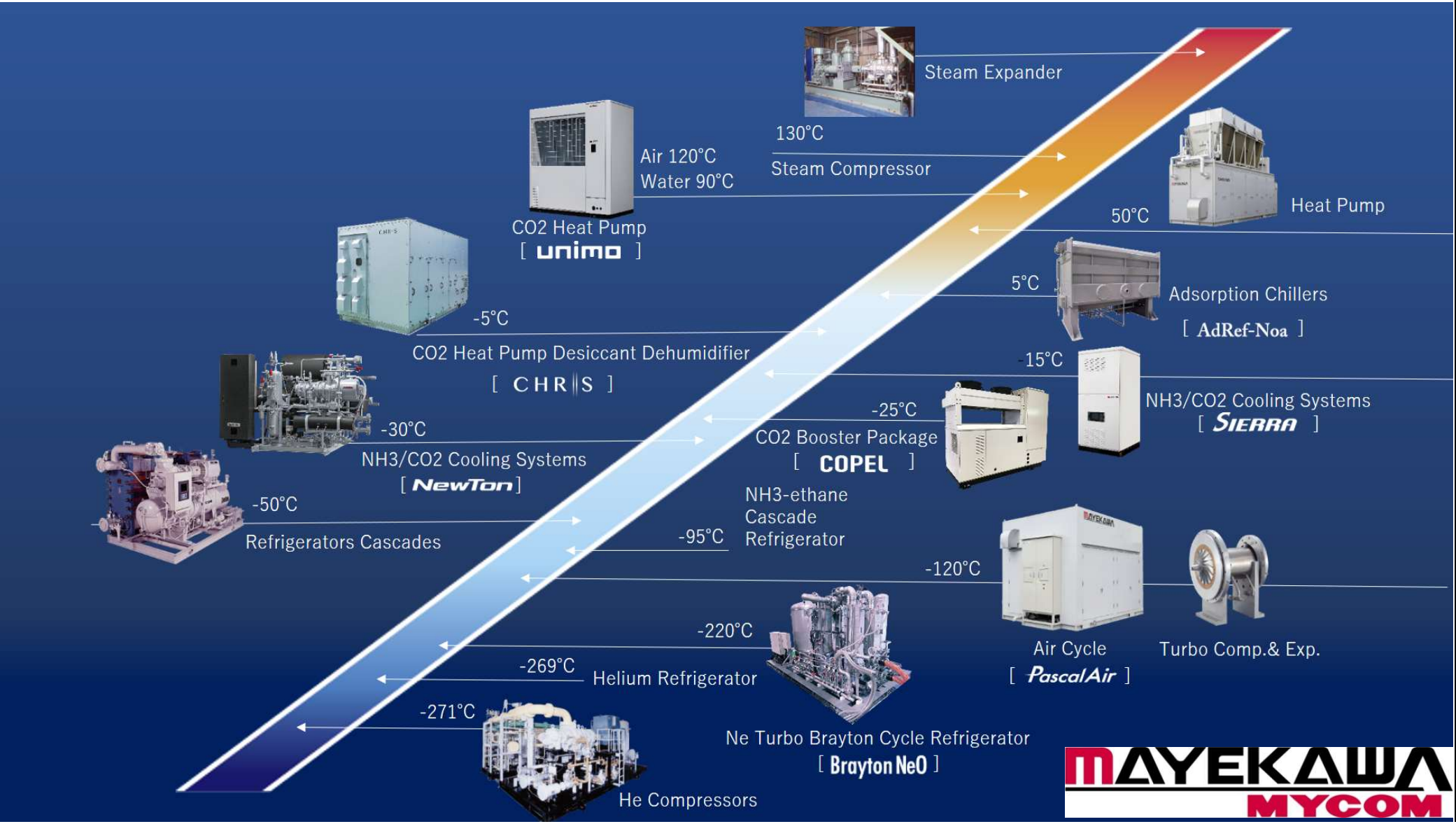
"ADREF NOA", Adsorption chiller

AIR

"PASCAL AIR", air cycle system for replacing R22/R23 cascade system

OUR CHALLENGES AND COMMITMENT FOR SUSTAINABLE SOCIETY

Non-Freon + Energy Reduction with Refrigeration System & Heat Pump System using natural refrigerants



Energy Saving Solutions/Products

- Merits of natural refrigerant
- High efficiency equipment
- Engineering Solutions

Merit of natural refrigerant

IMPACT TO THE GLOBAL WARMING

Type of refrigerant		HCFC	HFC				Natural
No		R22	R507A	R404A	R448A	R449A	NH^3 (Ammonia)
ODP	*1	0.055	0	0	0	0	0
GWP	*2	1810	3990	3920	1273	1397	h→0

Remarks
ODP = Ozon Depletion Potential
GWP= Global Warming Potential (4th report of IPCC/Intergovernmental Panel on Climate Change)

Impact of GWP (e.g. R404)
1kg of R404A leaking out to the atmosphere = 3,920kg of CO2 emission
$3920_{kg\text{-}co2} \div 0.488kg\text{-}CO2/kWh \fallingdotseq 8033_{kWh}$ *(in case CO2 emission factor by electric generation is 0.488* $_{kg\text{-}CO2/kWh}$ *)*

As compared with any HFC refrigerants, impact of NH3 on climate change is almost zero.

NOTE :
NH3 refrigerants have higher chronic toxicity than any other refrigerants above and investment in system/equipment tends to be high.

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IMPACT TO THE ENERGY CONSUMPTION

Refrigeration effect

Type of refrigerant		HCFC	HFC				Natural
No		R22	R507A	R404A	R448A	R449A	NH^3 (Ammonia)
Refrigeration effect	kJ/kg	**144.79**	**87.91**	**91.41**	**125.90**	**124.07**	**1039.78**
Theoretical power	kJ/kg	58.60	43.97	45.02	61.37	60.08	407.98
COP	-	**2.47**	**2.02**	**2.03**	**2.05**	**2.07**	**2.55**
Capacity per m^3	kJ/m^3	986.22	916.69	890.46	842.90	841.34	983.98
Power per m^3	kJ/m^3	399.16	453.50	438.57	410.84	407.40	386.09

*Refrigerant condition at **-32C** evaporation temp.(TE)*
*and at **+38C** condensing temp.(TC)*

As compared with R404A refrigerants, refrigeration effect of NH3 is much higher. Its COP is 1.26 times higher.

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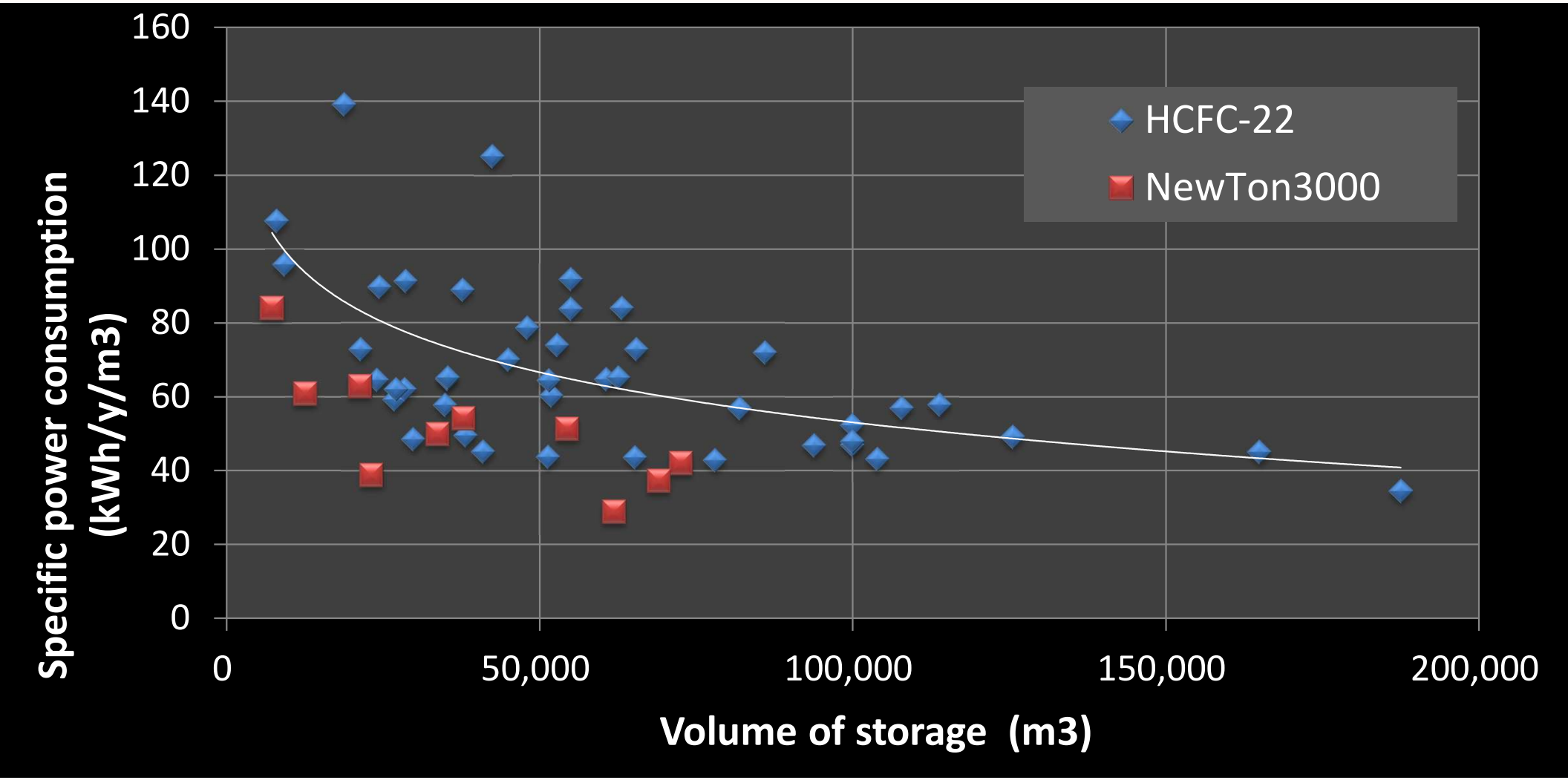
ENERGY CONSUMPTION ~ R22 DX vs NH3/CO2 CIRCULATION SYSTEM

Specific Power Consumption

Conventional R22 DX system

Latest NH3/CO2 circulation system



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High efficiency equipment

Heat Pump System

New Refrigeration system (NH_3/CO_2)

HEAT PUMP SYSTEM

Enteral Nutrition

Processing Flow

Air conditioning

Raw material

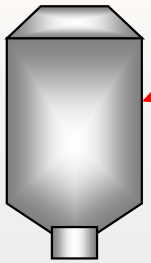
Drying

Steam

Powder

Mixture

Packing



Spray Drier

Pharmaceutical Company

Processing Flow

Air conditioning

Chilled Water

Raw material

Pre-Processing

Dissection

Cooking

Cooling

Hot Water

Steam

Poultry Slaughterhouse

- Most plants require heating and cooling process.
- Boiler/steamer/chillers are most installed

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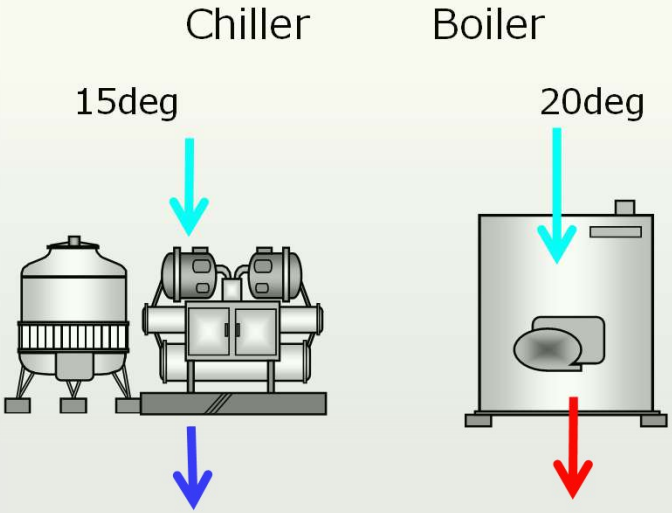
HEAT PUMP SYSTEM

Heat Pump Technology for Poultry Slaughterhouse

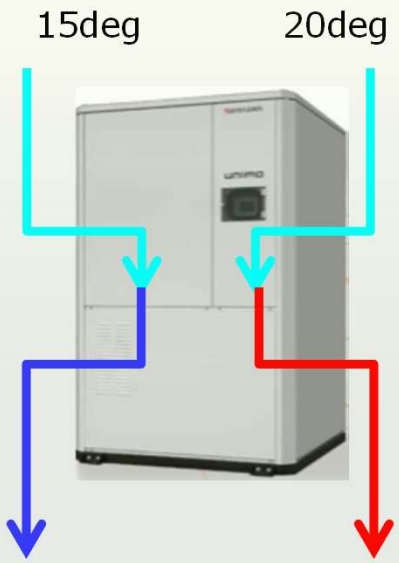
Standard System



10deg **COP=3** 90deg **COP=0.9**

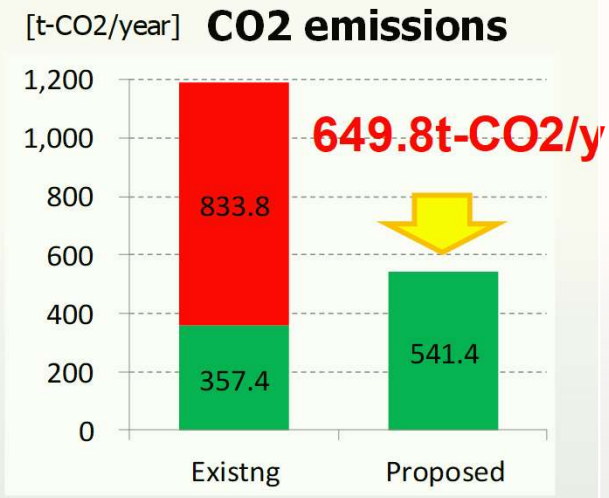
Total COP=3.9

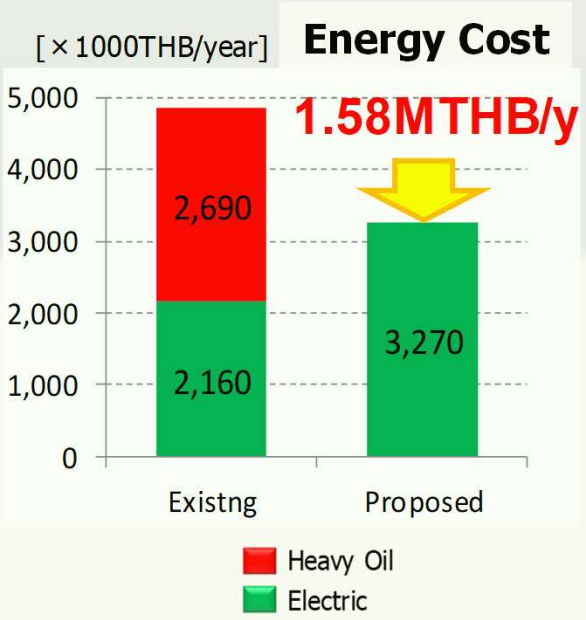
Heat pump System



10deg **COP=3** 90deg **COP=4**

Total COP=7.0





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HEAT PUMP SYSTEM

NH3 Heat Pumps

Separate Heat Pumps
for Air Conditioning

FUNCITION

- Water to Water
- Water to Air
- Air to Water
- Air to Air
- Water circulation

CO2 Heat Pumps

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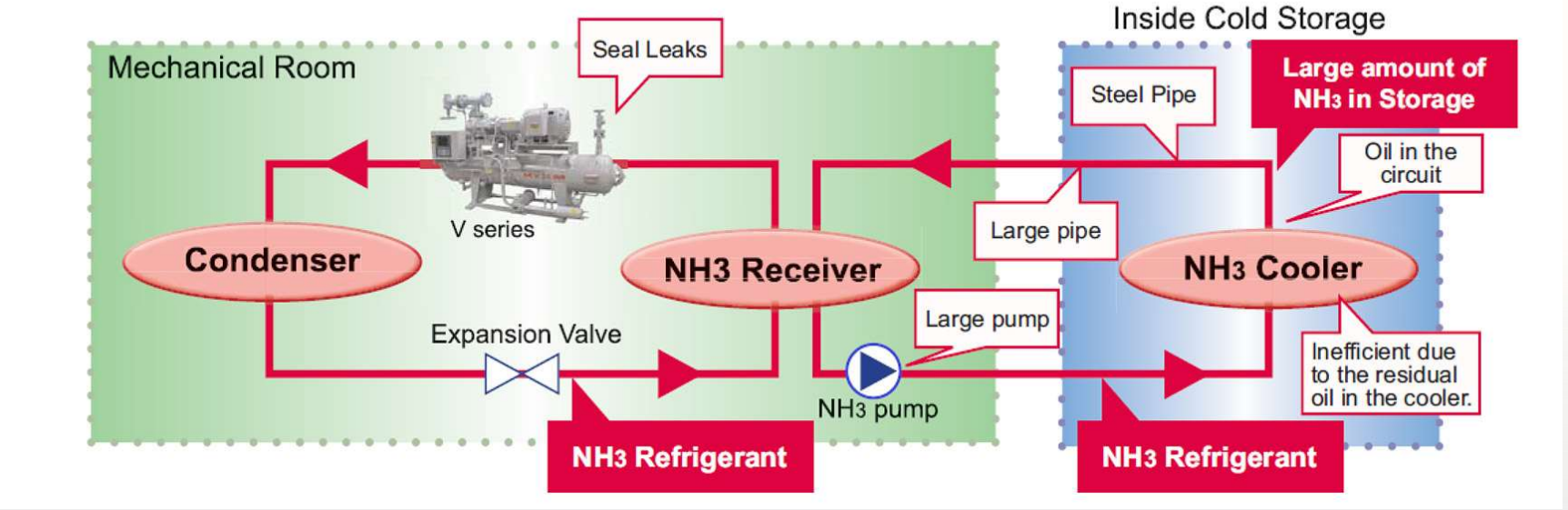
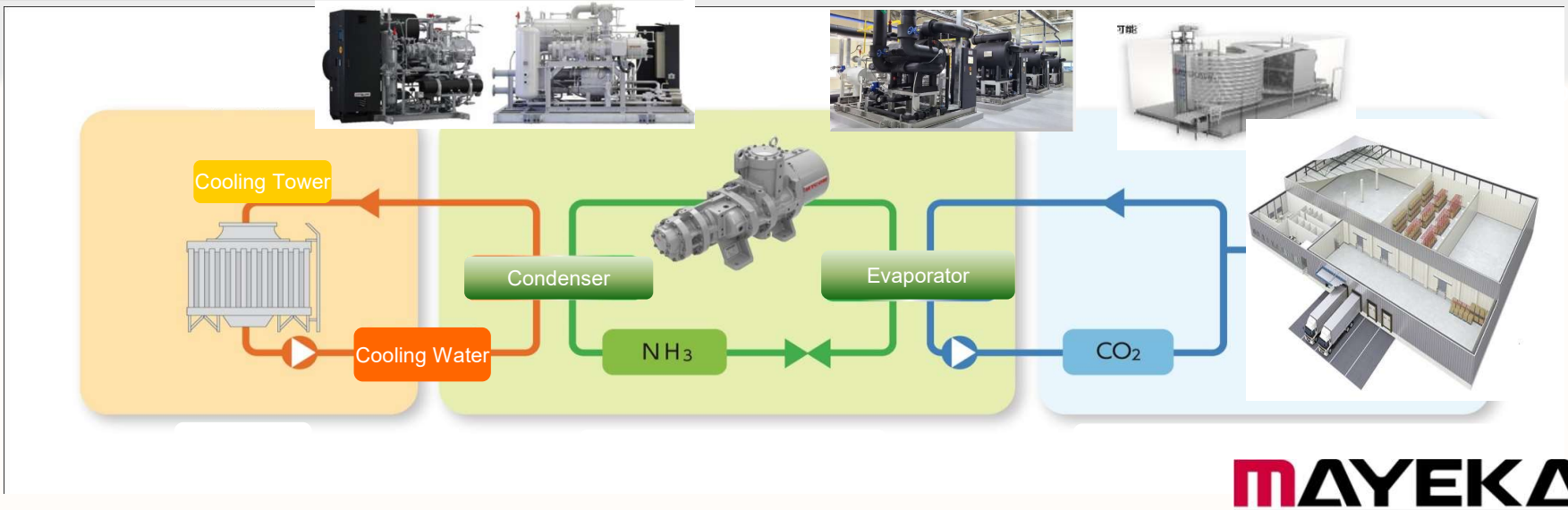
NEW REFRIGERATION SYSTEM (NH3/CO2 Circulation System)

NH3 Pump System (Conventional)



NH3/CO2 Pump Circulation System (New)



CASE STUDY (1-1)

Design with different refrigeration system

Cold warehouse design condition

Room temperature : -25℃
Room dimension : 30mW x 35mL x 8mH (3,000 Tons)
Product turn over : 100 tons/day
Inlet temperature : -15℃
Cooling Capacity : 90.5 kW_R

Case Study with following four (4) different system

1. NH_3/CO_2 Circulation System (Most advanced refrigeration system / NewTon)
2. Conventional NH_3 Circulation System
3. New HFO (1234fy) Direct Expansion System
4. Conventional HFC (R404A) Direct Expansion System

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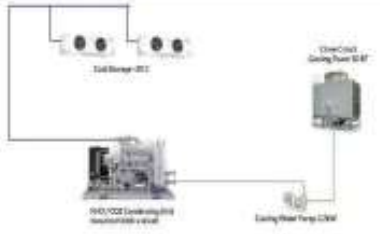
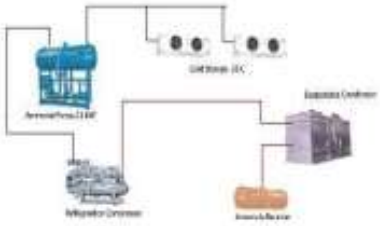
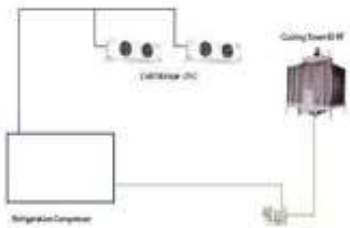
CASE STUDY (1-2)

Design with different refrigeration system

	NH_3/CO_2 System	Convetional NH_3 Pump System	New HFO System	Conventional HFC System
System Oreintation				
Compressor	NewTon R3000 Install motor 45 kW Capacity 93.7 kW Absorbed Power 43.8 kW Refrigerant NH_3 & CO_2	N160SE Install motor 75 kW Capacity 101.3 kW Absorbed Power 60.3 kW Refrigerant NH_3	F160LE Install motor 90 kW Capacity 90.5 kW Absorbed Power 73.4 kW Refrigerant R1234yf	MHS74CW Install motor 2 x 37 kW Capacity 101.0 kW Absorbed Power 67.0 kW Refrigerant R404A
Condenser / Cooling Tower	KMB-50R Fan motor 2.2 kW Pump motor 1.5 kW Circulation pump 2.2 kW (Absorbed Power 4.72 kW)	RIC-200SA Fan motor 2.2 kW Pump motor 1.5 kW (Absorbed Power 2.96 kW)	KMB-60R Fan motor 3.7 kW Pump motor 1.5 kW Circulation pump 2.2 kW (Absorbed Power 5.92 kW)	KMB-60R Fan motor 3.7 kW Pump motor 1.5 kW Circulation pump 2.2 kW (Absorbed Power 5.92 kW)
Refrigerant Pump	CO_2 Pump 1.1 kW (Absorbed Power 0.88 kW)	NH_3 Pump 1.5 kW (Absorbed Power 1.2 kW)	N/A	N/A
Unit Cooler	Fan motor 2 (Absorbed		Fan motor (Absorbed	
Total Power Consumption	56.76	71.82 + 20%	90.52	80.28
Differential	(kW)	15.06	33.76	23.52
Power Different /year	(kW.hr/year) 24 hrx365day/year	131,925.60	295,737.60	206,035.20
Electricity fee Different /year	(Baht) 5.5 Baht/Unit	THB 660,000	THB 1,480,000	THB 1,040,000

NATURAL REFRIGERANT

FREON REFRIGERANT

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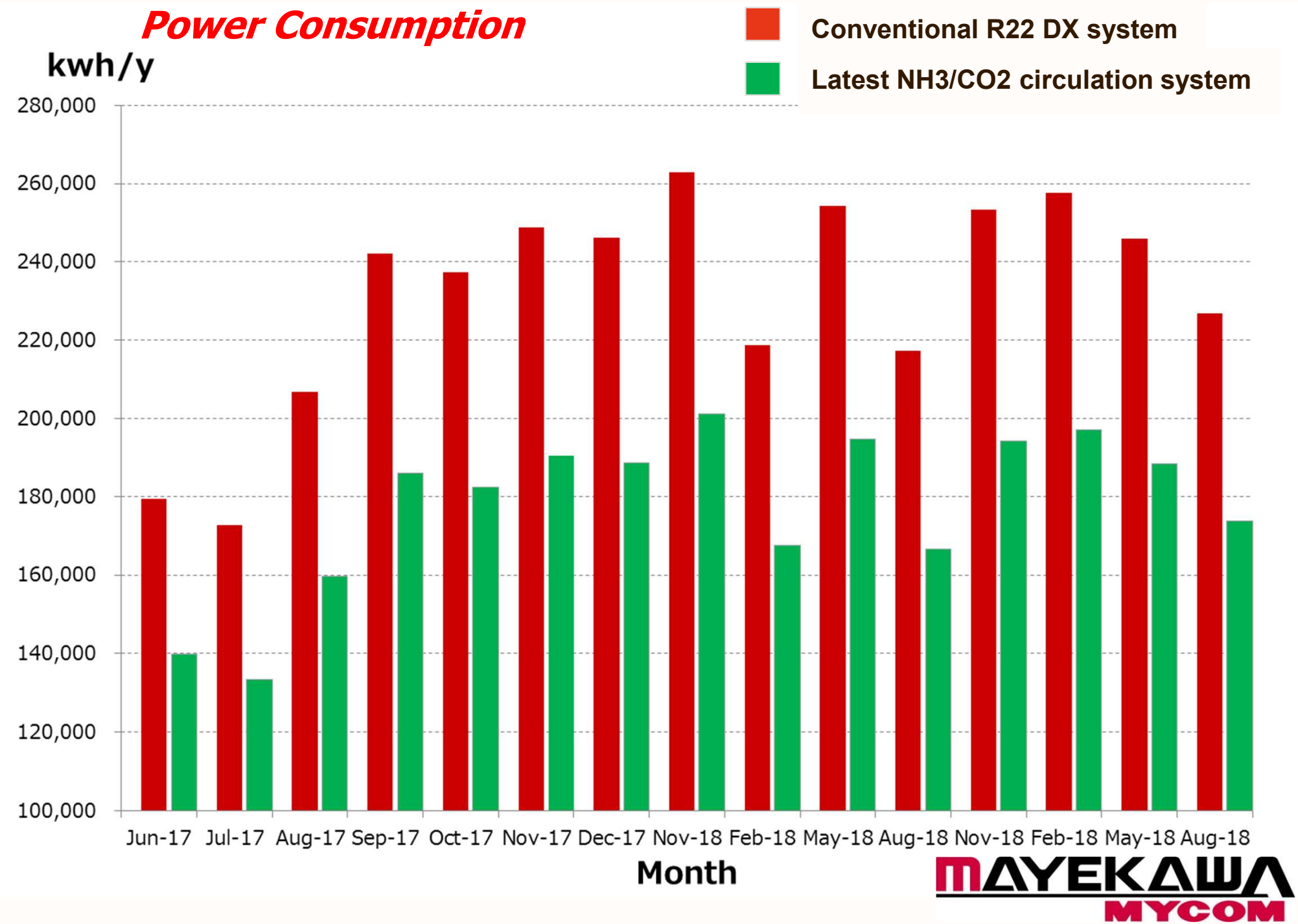
ENERGY SAVING EFFECT IN JAPAN



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ENERGY SAVING EFFECT IN BANGKOK

Condition

1. Comparison of energy consumption at different system & site, based on different construction & refrigeration design concept
2. Study at several different cold warehouse in Bangkok area (similar climate)
3. Similar business model, temperature range (at -25C) and products fully loaded
4. Different establishment year
5. Average kWh is used for calculation
6. Overall energy consumption of the entire warehouse (incl. office)

Group	Year	Capacity	kWH/m3/ year	Refrigeration system	Energy reduction (approx.)	
A	Over 30 years	Over 20,000m^3	Ave. 85.0	HFC (DX)	----	----
B	Approx. 5-10 years	Over 30,000m^3	Ave. 44.0	NH3 Liquid pump	Approx. 49% less than “A”	----
C	Approx. 3 years	Over 60,000m^3	Ave 33.0	NH3/CO2 (by Mayekawa)	Approx. 62% less than “A”	Approx. 25% less than “B”

Conclusion

Energy cost entirely depends on how to design the entire system.

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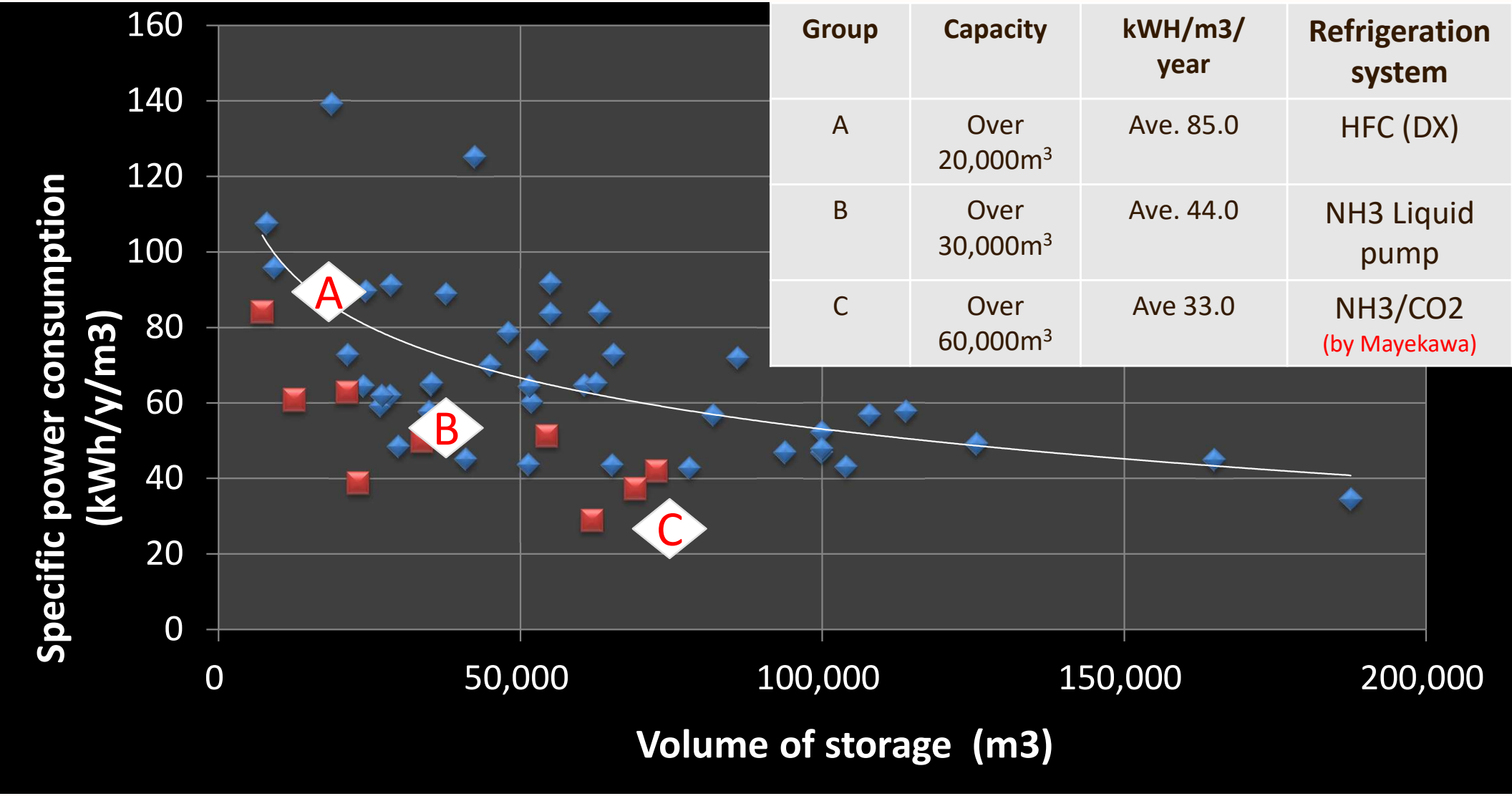
SPECIFIC POWER CONSUMPTION GRAPH

Specific Power Consumption

Conventional R22 DX system

Latest NH3/CO2 circulation system



Group	Capacity	kWH/m3/ year	Refrigeration system
A	Over 20,000m^3	Ave. 85.0	HFC (DX)
B	Over 30,000m^3	Ave. 44.0	NH3 Liquid pump
C	Over 60,000m^3	Ave 33.0	NH3/CO2 (by Mayekawa)

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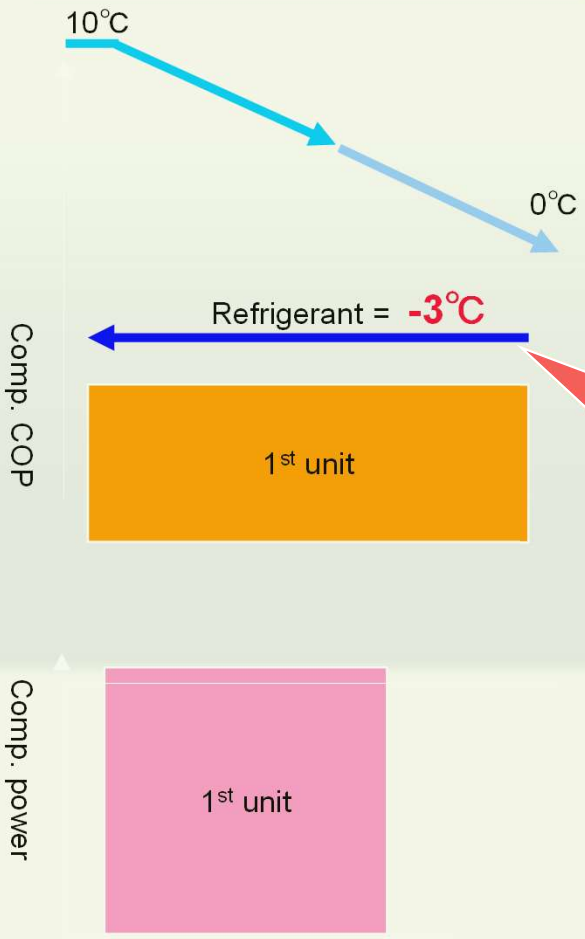
Engineering Solutions

- Cascade Cooling System
- Thermal Stratification System

CASCADE COOLING SYSTEM (1)

I. Cooling one step (conventional)

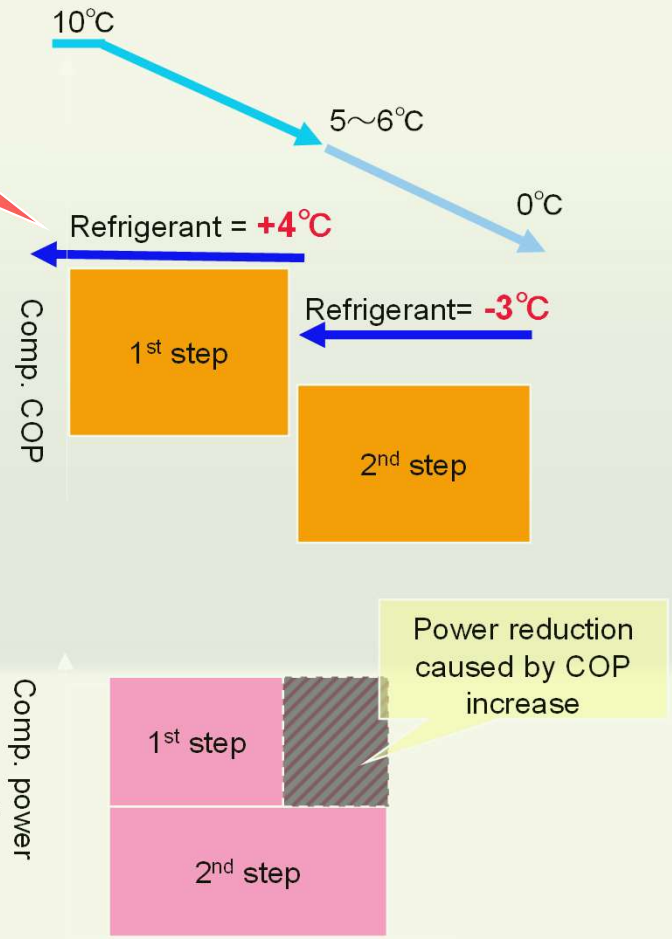


Cooling of big temp. difference at one TE (refrigerant temperature

Higher evaporative temperature = High efficiency (High COP)

Obliged to select low evaporative temperature

II. Cascade system (adopted)



Possible to improve the COP by operating stepwise evaporation temperature (Te) as close load temperature.

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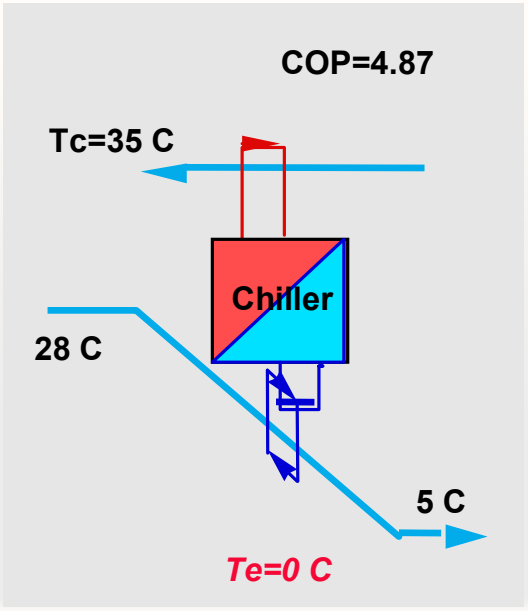
CASCADE COOLING SYSTEM (2)

Case Study

Chilled water production from 28℃ to 5℃
Based on cooling capacity 500TR (or 1763kW)

I. Conventional cooling



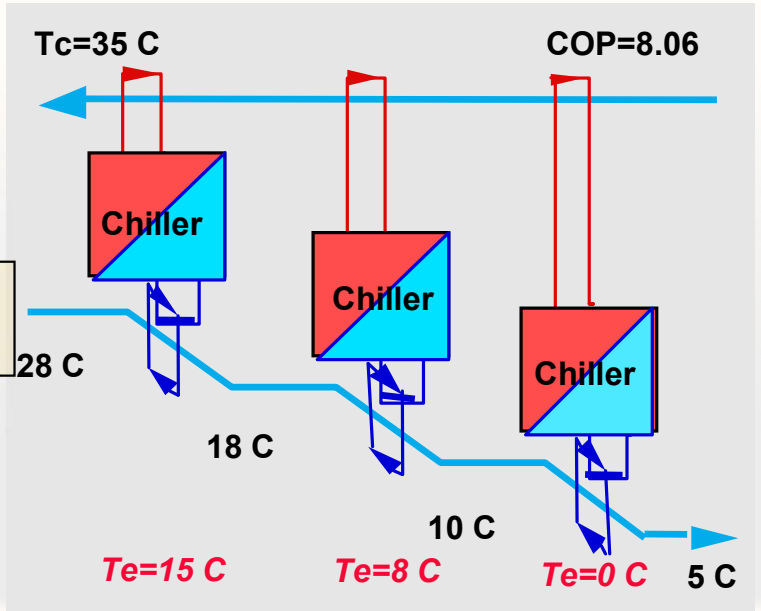
Compressor Swept volume

Base 1763kW (500TR)

	Tc	Te	dT	kW	M3/h
i	35	0	35	362	1992
	35	15	20	70	463
	35	8	27	73	463
	35	0	35	76	463
	II Total			219	1389
	II /I			60%	70%
	I -II			143	603

ii

II. Cascade cooling



Result

Energy consumption (bkW) : Approx. 60% reduction
Compressor size : Approx. 70% downsizing

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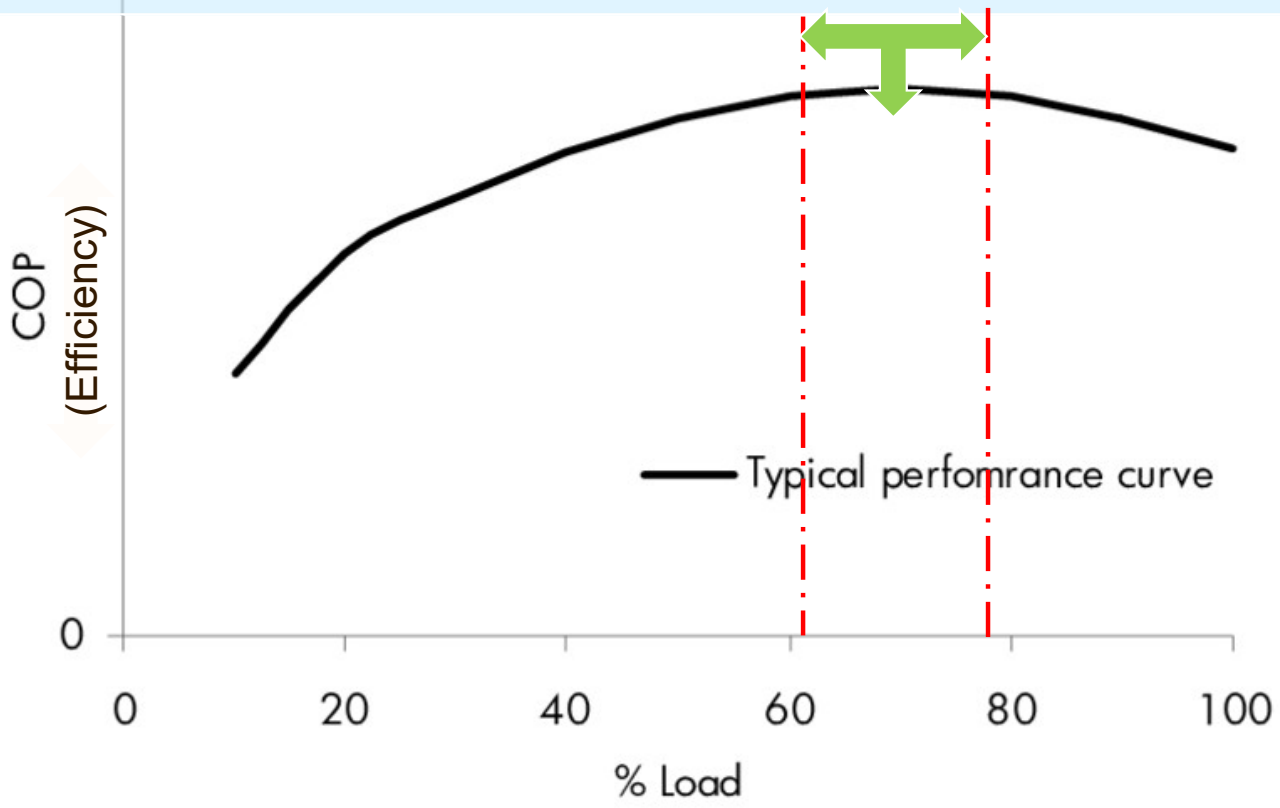
THERMAL STRATIFICATION SYSTEM (1)

Cooling load of centrifugal water chillers commonly used in industrial plants and large commercial buildings are **typically influenced by process changes that do not correspond to a linear change in condenser water temperature.**

Typical chiller efficiency curve is often designed with **maximum efficiency at 60%-80% of full load**.

Factory engineers/operators often **try to** control the operating conditions of especially old chillers by either turning off the system or adding more chillers to **optimize the operating condition** while fail to do so as no one can provide enough refrigeration engineering knowledge to operate the chiller at the optimal condition.



The question is

How to operate chillers at the optimal operating condition (maximum COP) while responding to the process changes of water temperature at the production plant ?

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THERMAL STRATIFICATION SYSTEM (2)

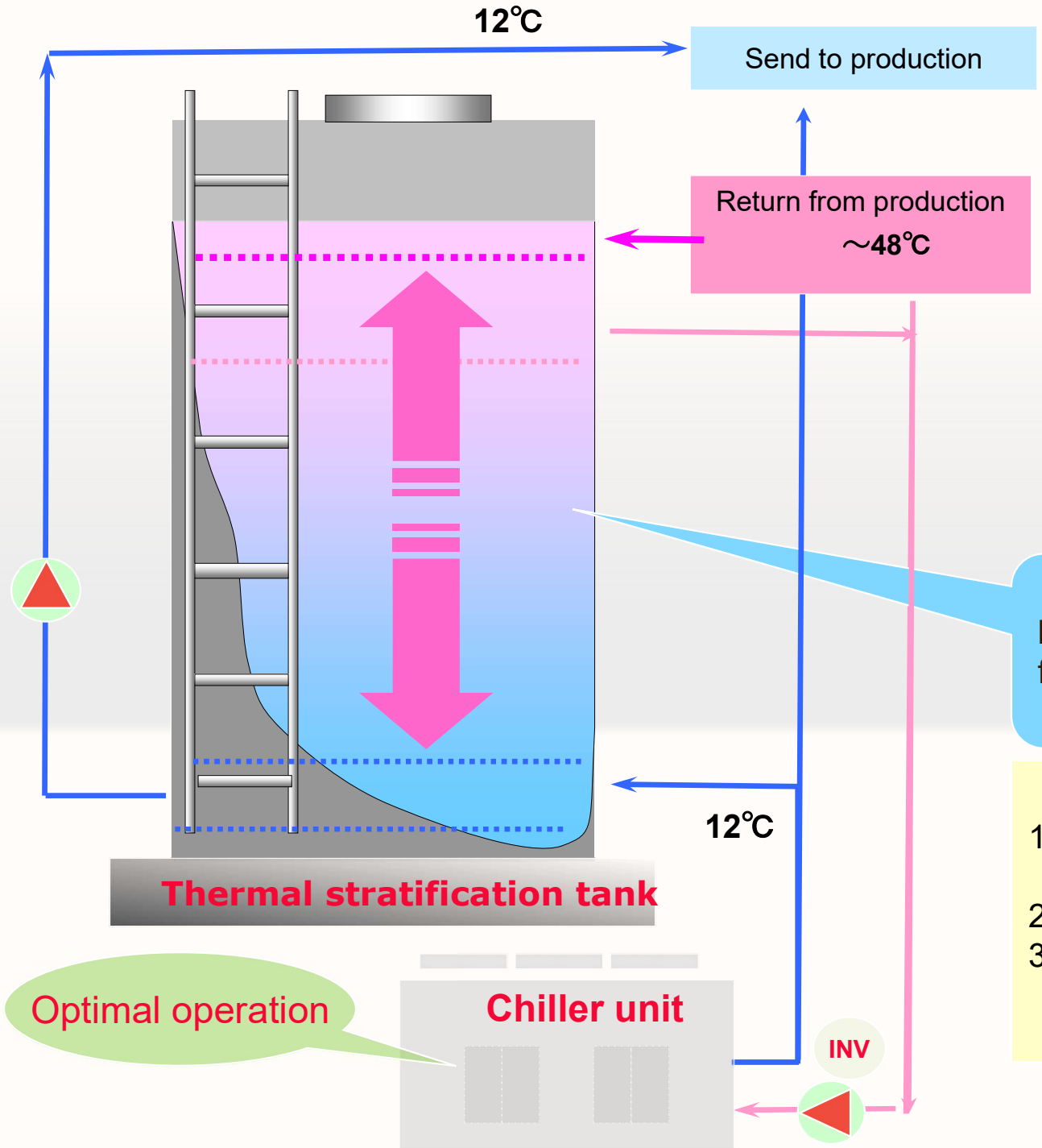

Photo: Thermal stratification tank

Thermal stratification is created inside tank by controlling the water temperature and flow inside the tank.
(Higher is warmer, lower is cooler)

Merits

1. Chiller operates steadily without load fluctuation from the process side.
2. Chiller will be operated at max COP.
3. Water temperature and flow rate to the process will be stable.

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Make
Your
Concern
Our
Motivation

Main Office & Workshop / Food Laboratory
Address
2/3 Moo 14 Bangna Tower, Tower A, 4th Floor, Bangna-Trad Rd., Bangkaew, Bangplee, Samutprakarn 10540 Thailand

Phone : +66(0) 2-27519610-7; +66(0) 2-2751-9565-6
URL : www.Mayekawa.co.th

Rayong Service branch Office & Workshop
Address :46/13 Khlong Nam Hu Road, Noen Phra, Muang Rayong
Phone : +66(0) 3301-3431-2

Trang Service branch Office
Address :346/5 Kantang Road, Thap Thiang, Muang Trang
Phone : +66(0) 7582-0511