LARGE SCALE HEAT PUMPS

KIEV HP SEMINAR 29.10.2025

By Jan Boone

MAYEKAWA

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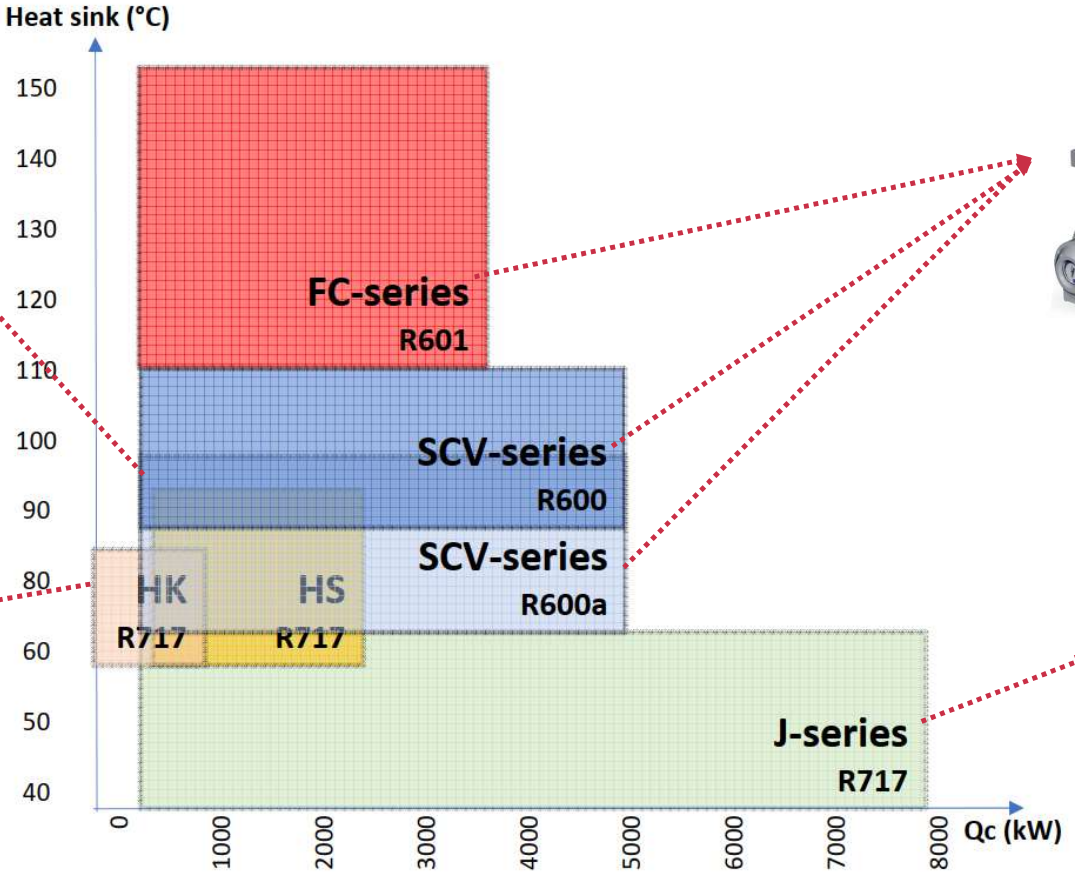
OVERVIEW OF HEAT PUMP COMPRESSORS



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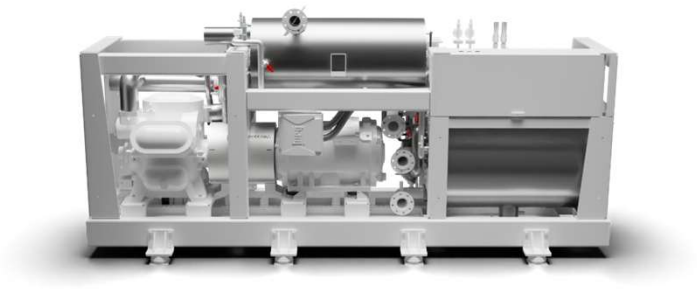
NH3 APPLICATIONS

PRODUCT PORTFOLIO

STANDARD

m-Heat

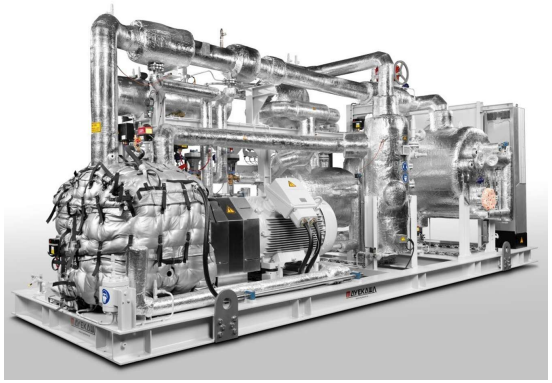
(coming soon)



MODULAR SPEC

HK- customized plug & play

HS- customized plug & play



CUSTOM MADE

non-STD systems

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HK-compressor

>20 years of experience

>= 50 projects in Europe

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HK-COMPRESSOR PLUG & PLAY

Reciprocating compressor
N6HK
Pressure : 40bar
50bar (available February 2010)
Speed : 900~1600rpm at 40bar
900~1450rpm at 50bar
Swept volume; 120~193m3/h 100%Load

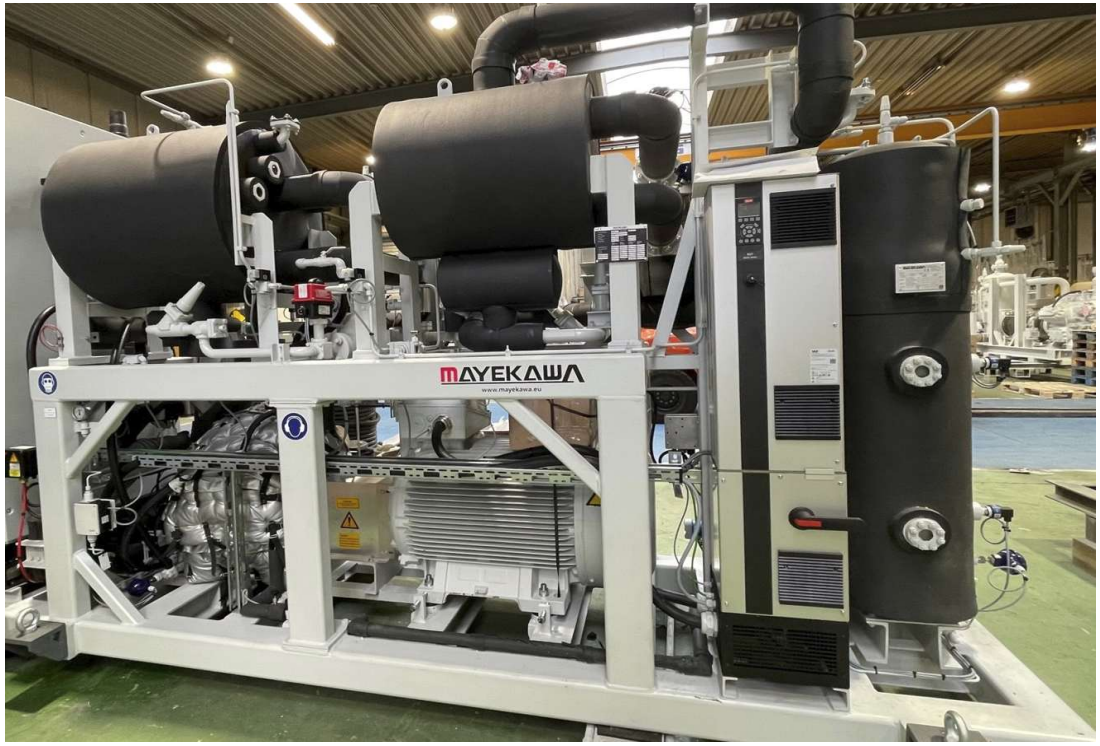
Reference project:

4,1 x 1,4 x 2,65 m (L x W x H)

Water to water

<= 32 kg NH3

420 kW heating, COP: 5



Reference SO 107623, N6HK, 27/73 °C

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HK-COMPRESSOR TRIPLE HEAT PUMP

Triple N6HK heat pump

Water to water

30/80°C

800 kW

COP 4.4

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HS III COMPRESSOR

HSIII-compressor

>10 years of experience

>= 60 projects in Europe

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HS-COMPRESSOR PLUG & PLAY CONCEPT

Reference project:

6,3 x 2,2 x 2,4 m (L x W x H)

<= 120 kg NH3

1000 kW heating , COP: 5.1 – 5.5

Reference SO 115555, N4HS, 35/81.5 °C

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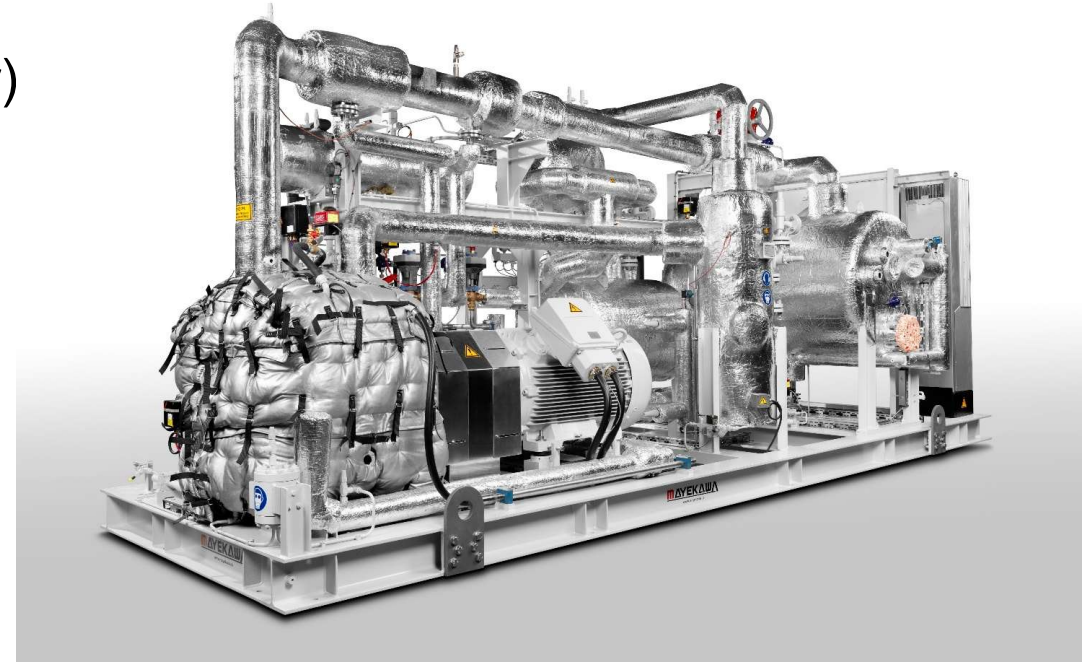
HS-COMPRESSOR PLUG & PLAY CONCEPT

- 4HSIII and 6HSIII
- Fixed dimensions (+/- 20ft container)
- Adjustable HEX size:
  - ✓Sub cooler, DSH, Condenser
  - ✓Evaporator
- Adjustable motor size & supply
- Adjustable oil separator size
  - ✓OSF400Y, OSF500Y
- Other specifications possible



Reference SO 115555, N4HS, 35/81.5 °C

= Optimal/customized performance against lowered cost

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CUSTOMISED TWO STAGE SYSTEM

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CUSTOMISED TWO STAGE SYSTEM

SPECIFICATION OF UNIT

		UNIT 1	UNIT 2	TOTAL
CHILLER PART				
Cooling Capacity	[kW]	1030.1	1030.1	2060.2
Evaporative Temperature	[C]	0.0	0.0	
Inlet Water Temperature	[C]	10.0	10.0	
Outlet Water Temperature	[C]	1.5	1.5	
Intermediate Temperature	[C]	45.0	45.0	
HEAT PUMP PART				
Heating Capacity	[kW]	1452.6	1496.0	2948.6
Condensing Temperature	[C]	81.0	92.0	
Condenser				
Inlet Water Temperature	[C]	67.1	78.7	
Outlet Water Temperature	[C]	78.7	90.0	
Liquid Sub Cooler				
Inlet Water Temperature	[C]	65.0	65.7	
Outlet Water Temperature	[C]	65.7	67.1	
C.O.P cooling	[-]	4.22	4.22	4.22
C.O.P heating	[-]	7.49	5.99	6.64

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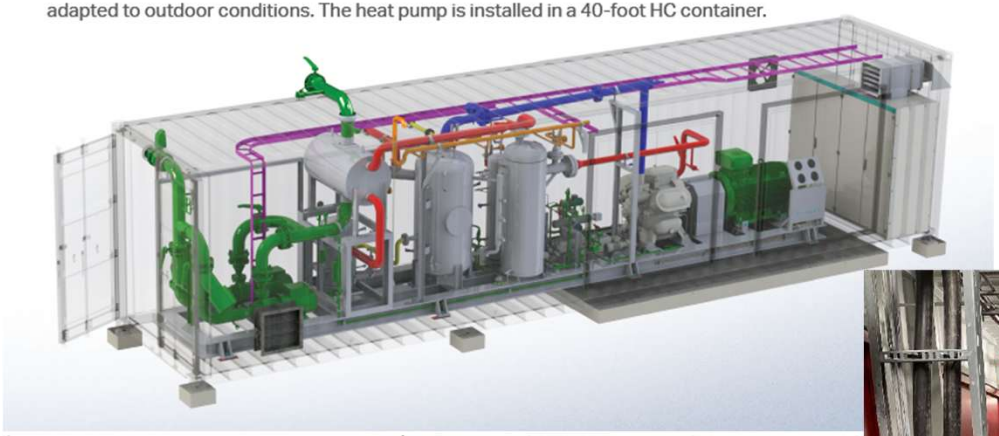
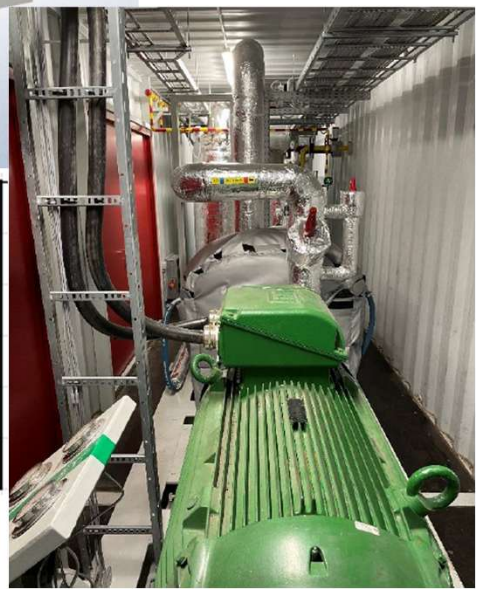
CONTAINERISED MODULAR HEAT PUMP

Options: containerised design

If there is no space in machine room, we suggest containerised design **GGHP**, adapted to outdoor conditions. The heat pump is installed in a 40-foot HC container.



MODEL :	N6HS III		TE/TC ° C
REFRIGERANT :	AMMONIA		+30/+70
CAPACITY :		[kW]	1285,8
HEATING CAPACITY :		[kW]	1500
ABSORBED POWER :		[kW]	240,3
COP-h			6,24



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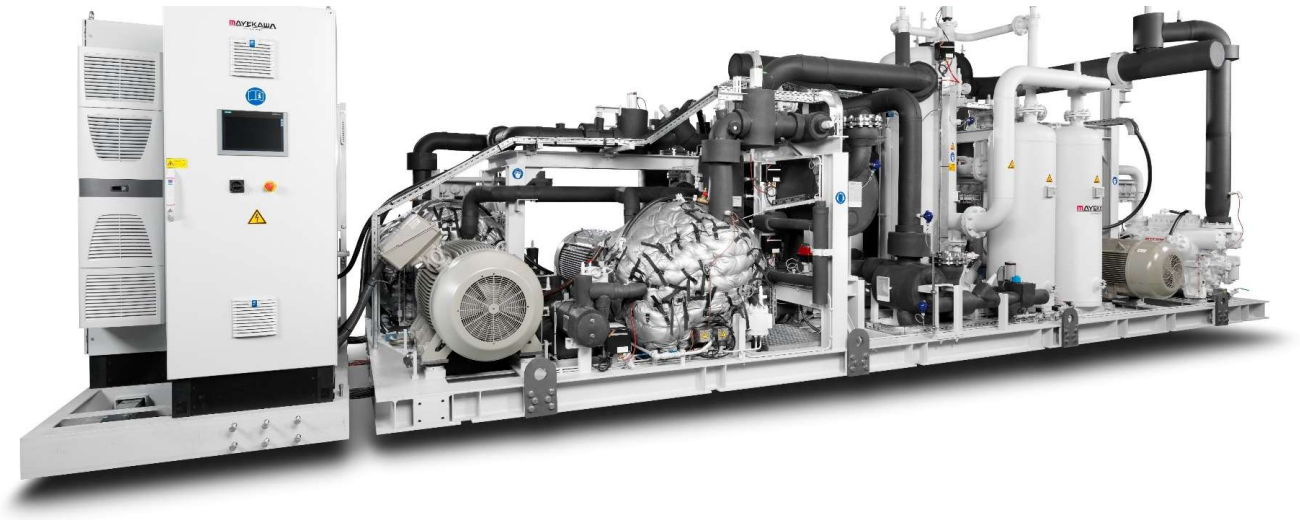
CUSTOMIZED TWO STAGE TWIN SYSTEM

- **District heating France** **(SO90.000)**
  - 5/85°C
  - 6x MII + HS twin-two stage heat pumps
  - **15**MW of water @ 80°C



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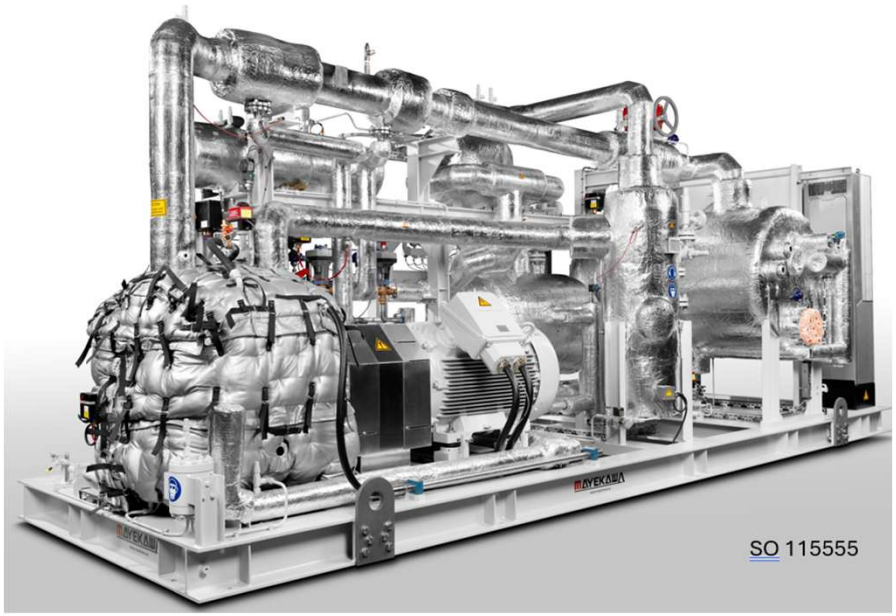
CUSTOMIZED MODULAR HEAT PUMP

- **District heating Finland** **(SO118880)**
  - 32/90°C
  - 8x HS high temp. heat pumps
  - **12**MW of water @ 90°C



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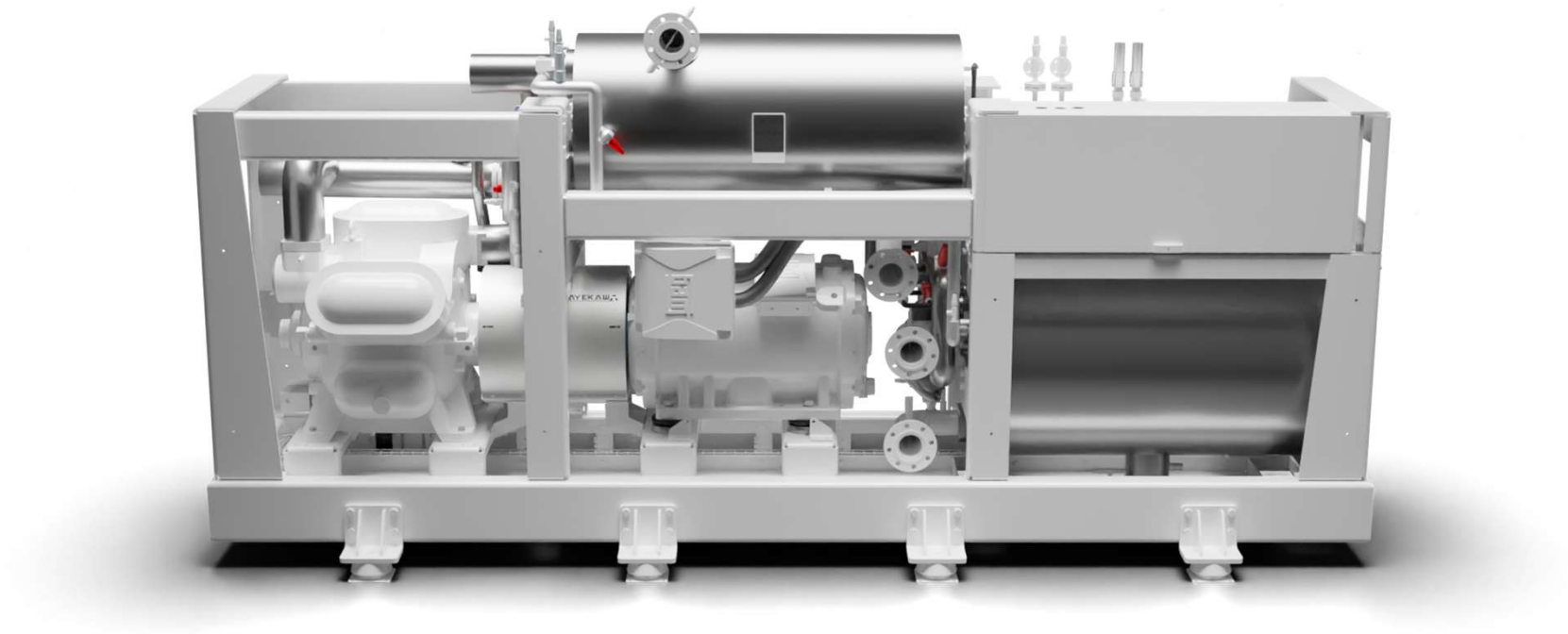
COMING SOON

- m-HEAT by Mayekawa Nordic



12.9.2024 85°C water heating:1400kW bkw(e):306kW COPh:4,6

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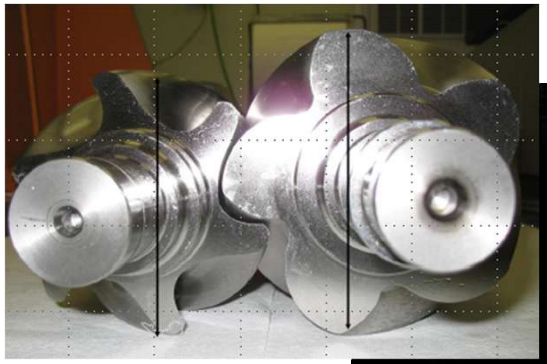
J-TYPE SCREW COMPRESSOR



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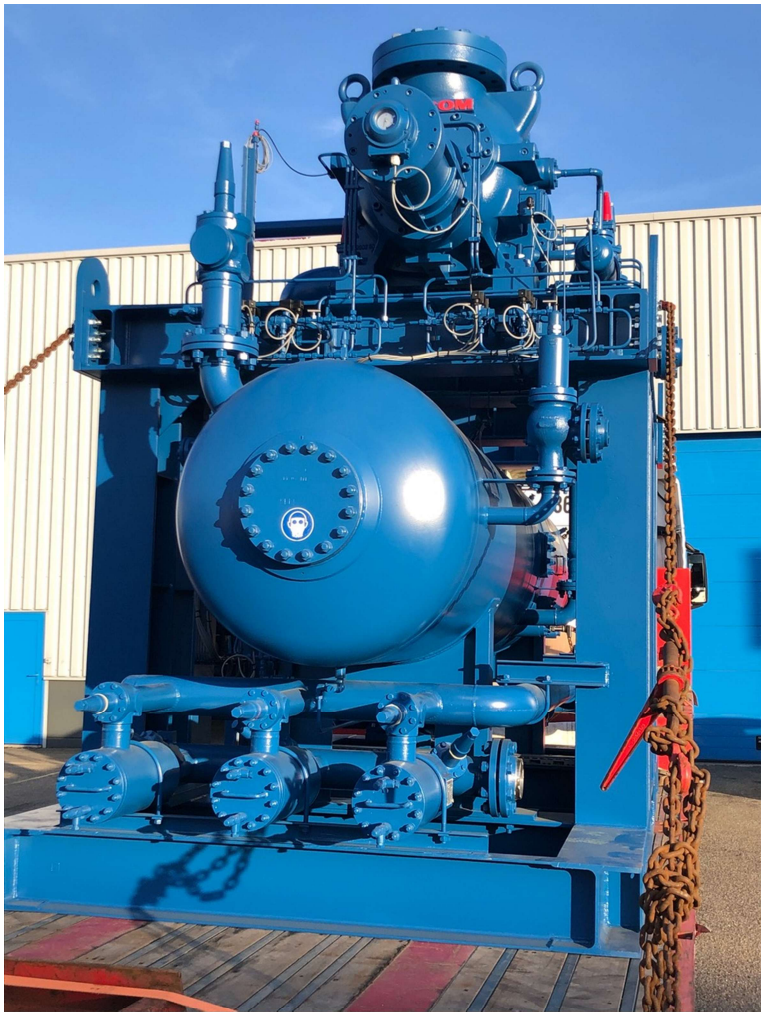
J-TYPE



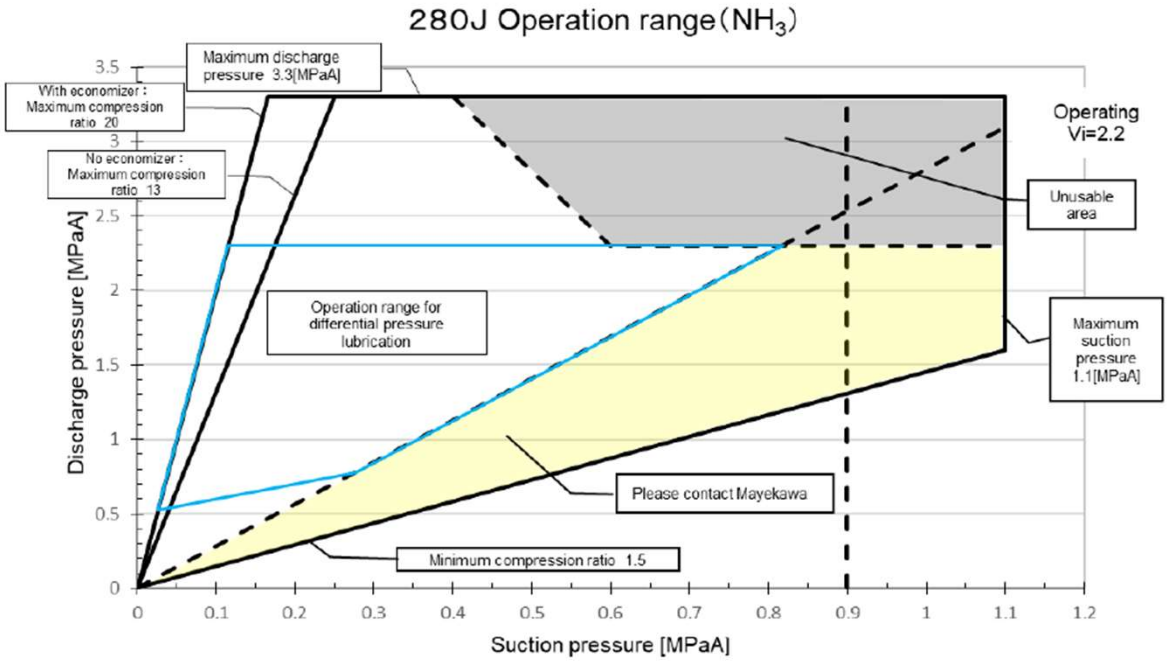


Figure 2-1 Operation Limits Chart

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DISTRICT HEATING DENMARK

DISTRICT HEATING DK

Heating range
N280J 3 to 4 mW each (65°C)
N6HS 2 to 3 mW each (75°C)

	SO	PLANT	N280J	N6HS
1	86927	BRANDE	2	
2	90700	STOEVRING	2	
	92700	STRANDBY	1	
3	93700	SKAGEN	3	
4	94700	FREDERIKSHAVN	4	
5	95200	EIBY MOELLE	4	
6	95300	FACEBOOK	3	2
7	95400	SVENDBORG	4	4
8	96900	FARUM	4	4
9	94600	RINGSTED	2	
			29	10

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COOLING & HEATING COMBINED

CHILLER-HEAT PUMP
HOT WATER 50 a 60 °C 1300kW
CHILLED WATER 9°C 1000kW

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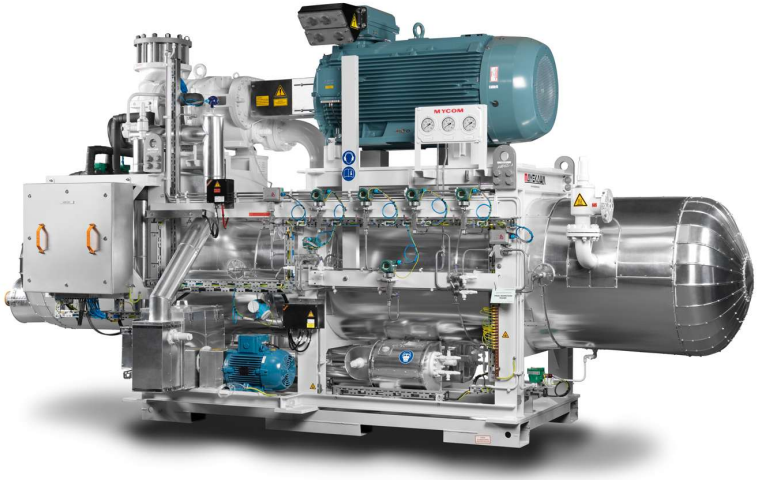
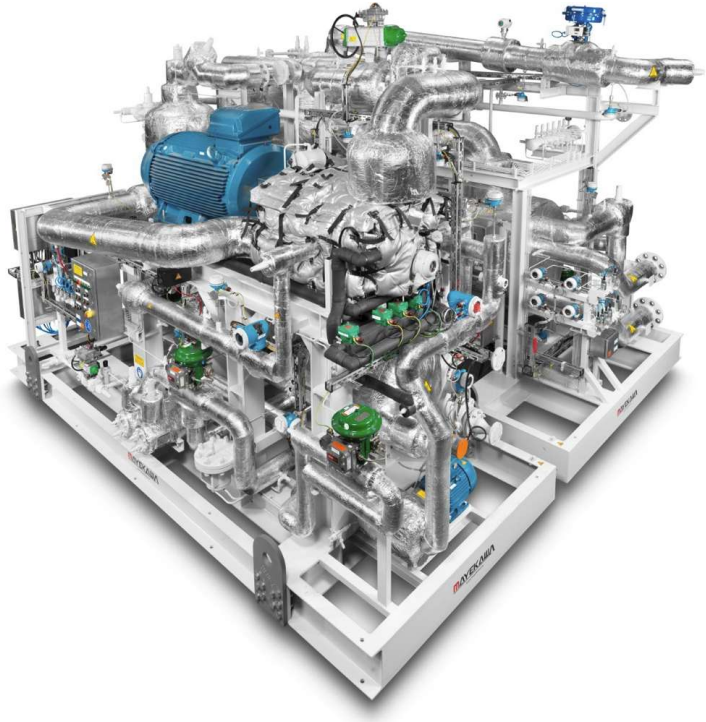
Hydrocarbon applications





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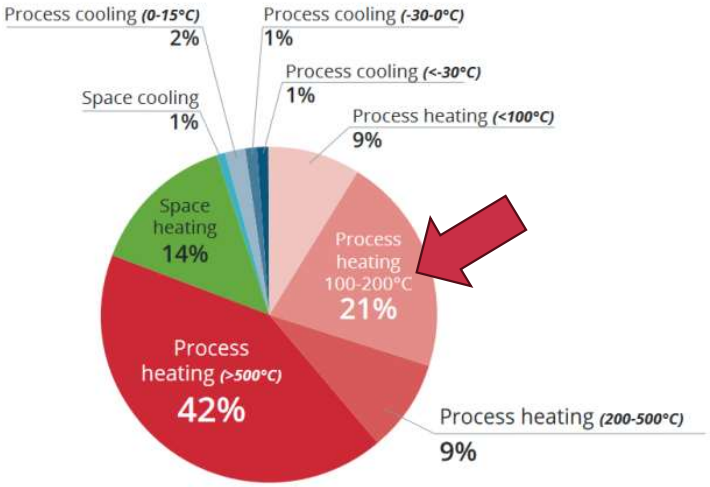
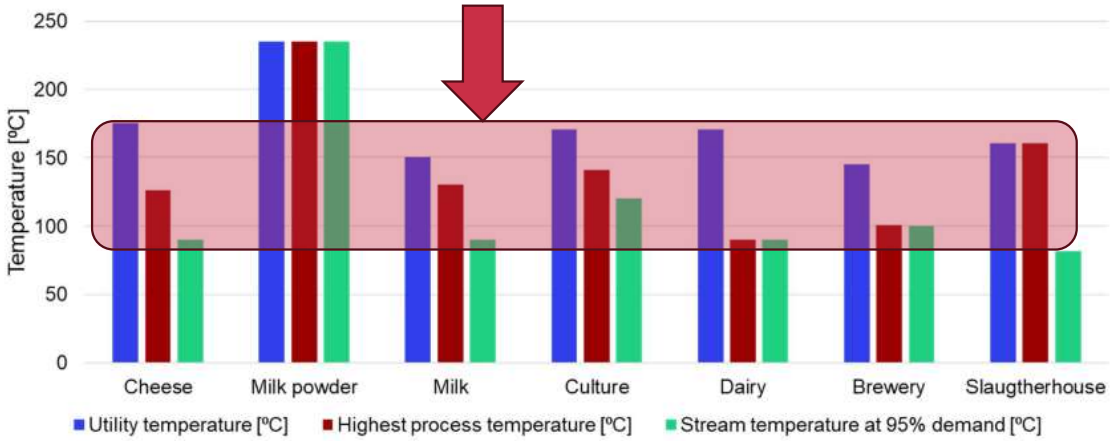
EUROPEAN MARKET & CLIMATE TARGETS

NetZero 2050 → zero CO2 emissions

High industrial heat demands for processes in Europe:



Industrial process heat requirements



Temperature requirements in food & beverage industry

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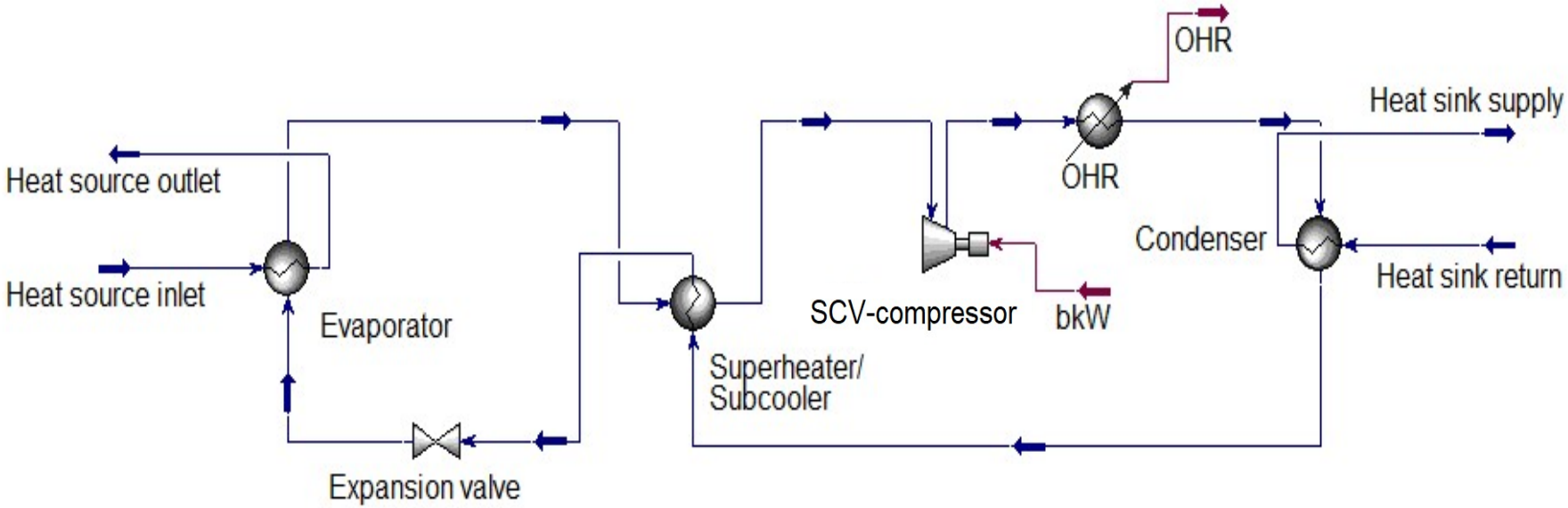
HYDROCARBON HEAT PUMP CONCEPT



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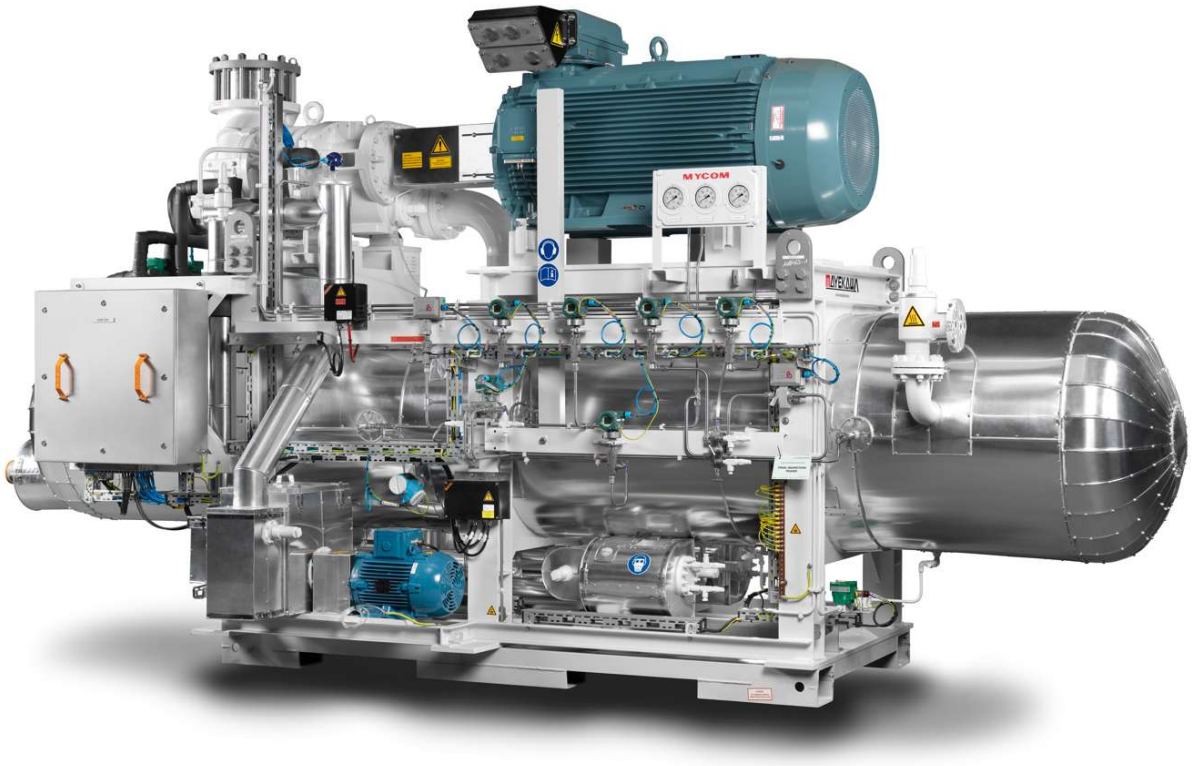
HYDROCARBON HEAT PUMP

(iso)Butane applications



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FC-SERIES HYDROCARBON HEAT PUMP

- For Te from 50-100°C
  (best above 75°C)
- Pentane
- For Tc from 115 – 160°C

V1.0 steam generating heat pump with PTN250SFC compressor, 80/145°C

https://heatpumpingtechnologies.org/annex58/task1/

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FC-SERIES HYDROCARBON HEAT PUMP

- Overview at operating condition 80/150 °C with R601, 3000 rpm

COMPRESSOR MODEL:		160SFC	160MFC	160LFC	200SFC	200MFC	200LFC
COOLING CAPACITY :	[kW]	136,3	170,7	205,6	408,9	336,9	408,9
ABSORBED POWER :	[kW]	87,1	104,9	124,6	243,4	205,2	243,4
HEATING CAPACITY :	[kW]	202,19	252,61	305,24	608,36	501,98	608,36
COP,heat :	[-]	2,32	2,41	2,45	2,5	2,45	2,5

Table 2: Compressor performance of smaller models

v1.0 *v2.0*

COMPRESSOR MODEL:		250SFC	250MFC	250LFC	320SFC	320MFC	320LFC
COOLING CAPACITY :	[kW]	533,0	673,5	808,1	1085,1	1352,4	1587,6
ABSORBED POWER :	[kW]	319,0	392,5	468,3	640,2	791,0	929,0
HEATING CAPACITY :	[kW]	791	999,85	1200,47	1597,88	2000,7	2359,8
COP,heat :	[-]	2,48	2,55	2,56	2,5	2,53	2,54

Table 3: Compressor performance of larger models

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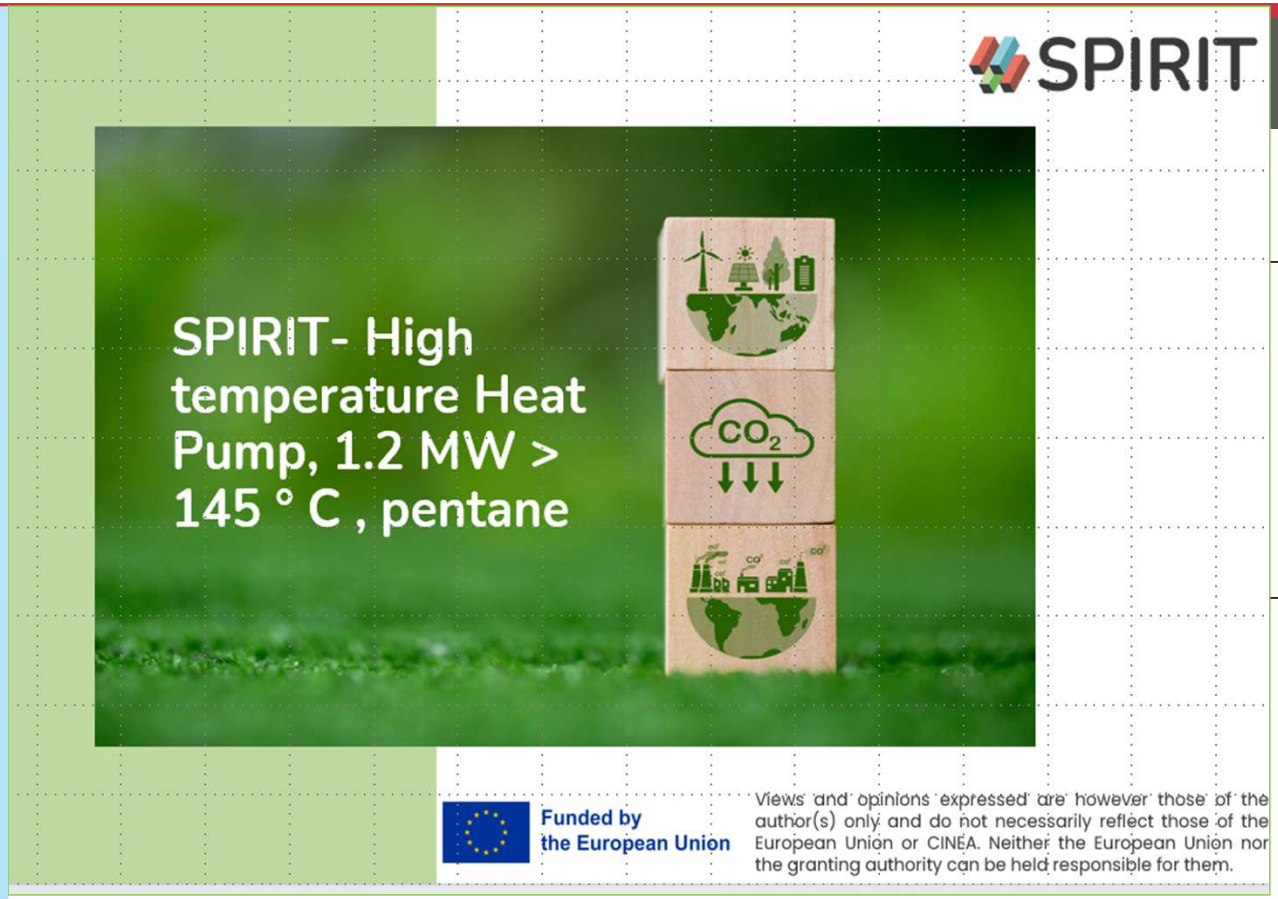

PROJECT

SHRIMP COOKING BY USING WASTE HEAT FROM SHRIMP FREEZING PLANT

Developed as part of the SPIRIT-Heat project, funded by the EU in collaboration with TNO and Mayekawa.
The Spirit-Heat project, funded by EC's Horizon Europe program, focusses on 'sustainable heat-upgrade technologies' for industry

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SPIRIT PROJECT 2023-2025

Project Partners

Knowledge Provider

TNO innovation for life

Technology Provider

MAYEKAWA

End-User

STELLA POLARIS

Funded by the European Union

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SPIRIT

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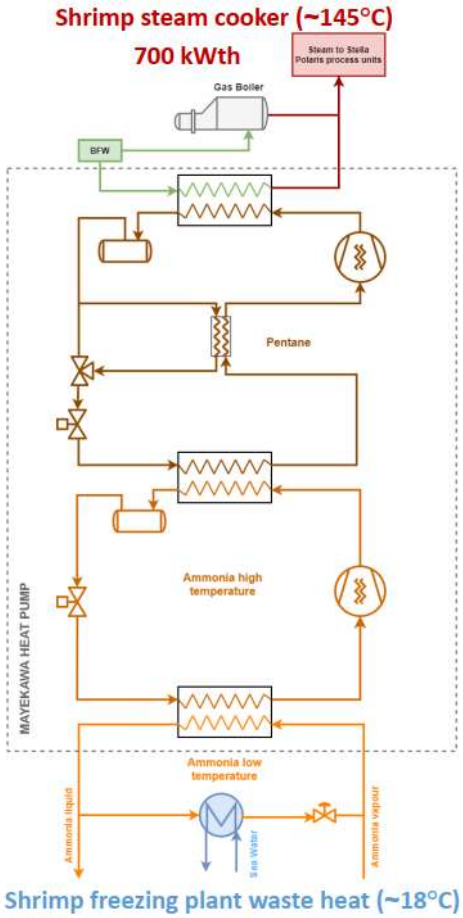
SPIRIT PROJECT 2023-2025

- Application
  - Recover the waste heat of the NH3 freezing plant condenser at 18°C
  - Upgrade with a cascade N4HSIII-heatpump to 85°C
  - Upgrade with a cascade PTN250FMC-heatpump to 145°C saturated steam
  - Testing:
    - Part load operations
    - Process fluctuation response
    - Make 2000 running hours
    - Achieve TRL 8: commercial readiness

	Overall cascade heat pump	Bottom cycle (ammonia heat pump)	Top cycle (pentane heat pump)
COP heating and cooling	2.53	6.04	3.92
COP heating	1.78	3.52	2.48
COP cooling	0.75	2.52	1.45



This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101069672 (SPIRIT).

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TRL STATUS

SPIRIT/H2020 – TRL 7 ongoing

TNO/FUSE – TRL 5/6 completed

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NH3 + PTN CASCADE SYSTEM

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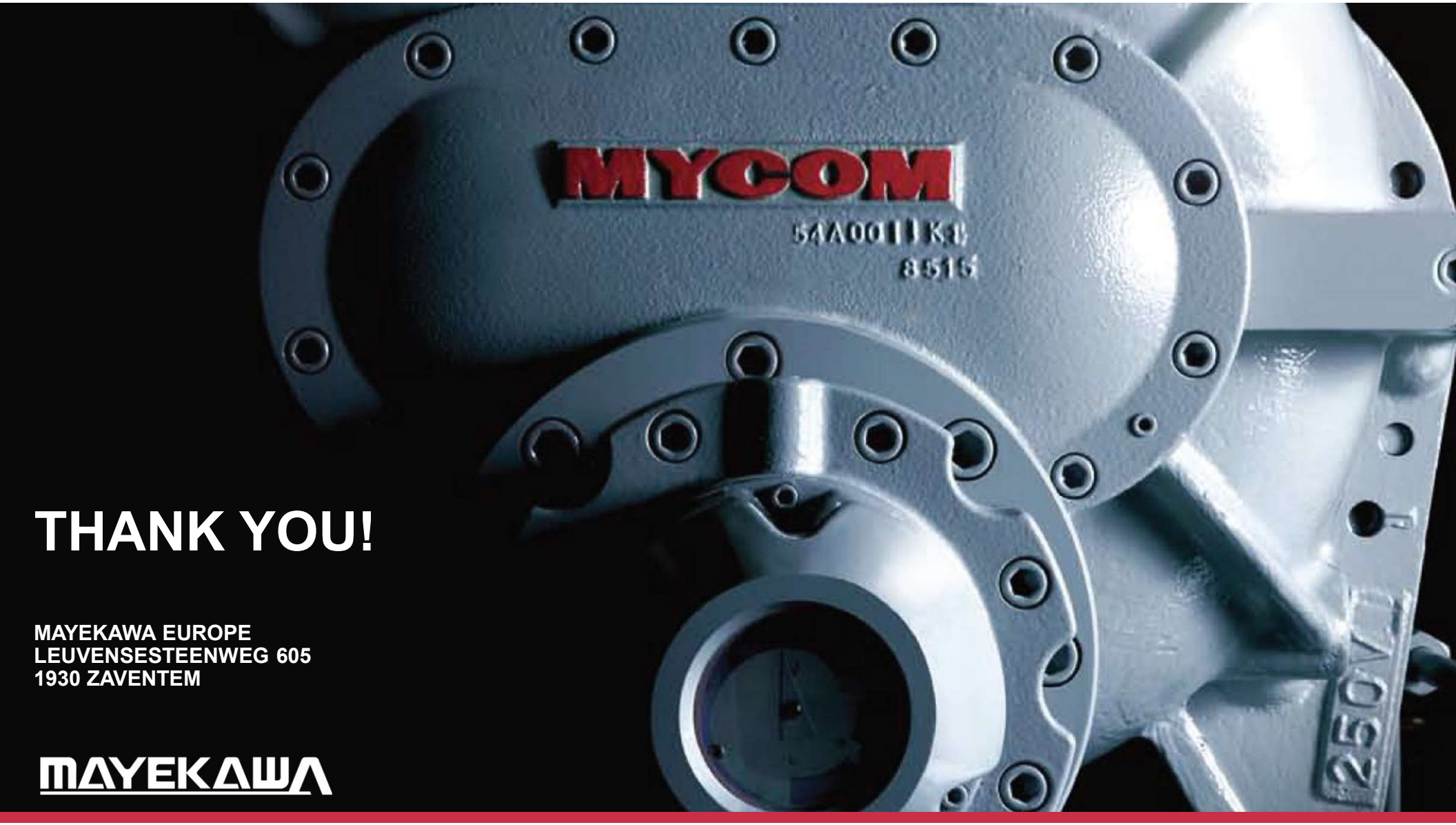

THANK YOU!

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