



PISTON-BASED HIGH-TEMPERATURE HEAT PUMP TECHNOLOGY FOR INDUSTRIAL DECARBONIZATION

Power with Passion

**HTHP Symposium
January 21st Copenhagen**

16 YEARS OF DEVELOPMENT



Concept Development

2011-2012

- › **Development of Single Cylinder ORC Heat Engines for up to 215°C**

2013-2015

- › Worldwide commercial deployment of demonstrators
- › Gaining operational experience with refrigerants and lubrication

Technology Development

2016 – 2017

- › Enhancement of technology

2018-2019

- › **Commercial installation of Heat pumps one-cylinder (now running for more than 50,000h each)**

2020

- › Acquisition of Viking IP, inventory and team by HEATEN

Product Development

2022-2023

- › Product specification for HBL4 and HBL16
- › Product development for HBL4

2024

- › **Acquisition of HEATEN by Advent & Strategic Partnership INNIO**

2024-2025

- › Testing on test bench and in field
- › Stabilization of HBL4
- › Concept study 2-stage conducted
- › Serialization of HBL4 incl. variants

Portfolio Development

2025

- › **Commercial role out**
- › **Product development for HBL16**
- › **Invest in test infrastructure Jenbach for HBL4 & HBL16**

2026-2027

- › HBL16 testing on test bench and in field
- › Launch of HBL4 2-stage
- › Launch of HC's products

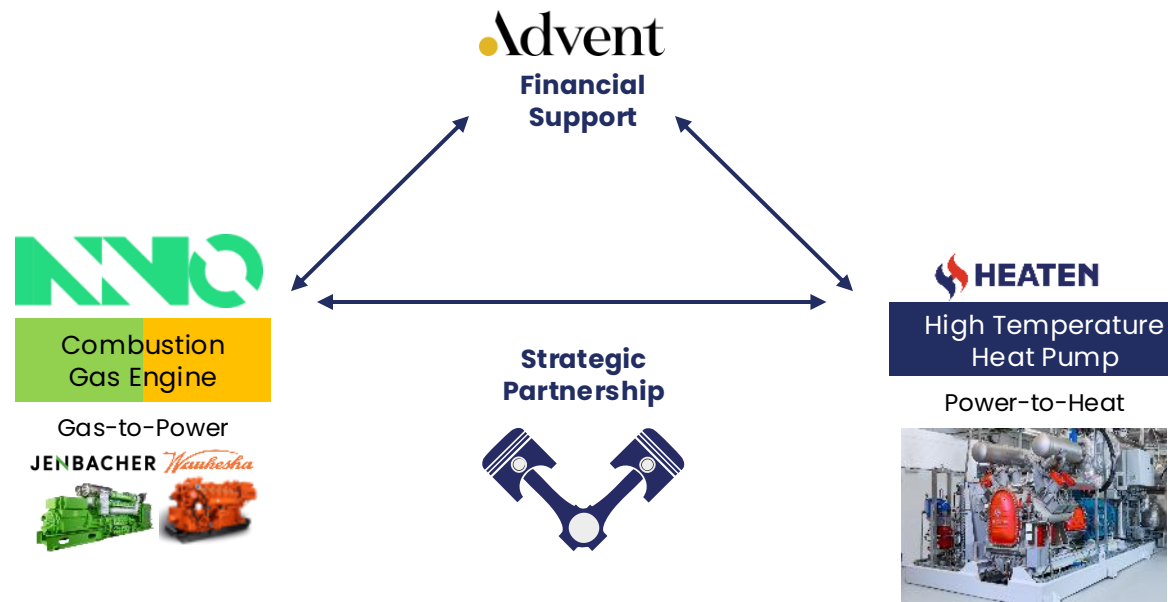
2028-2029

- › Launch of HBL16 2-stage
- › Standardization



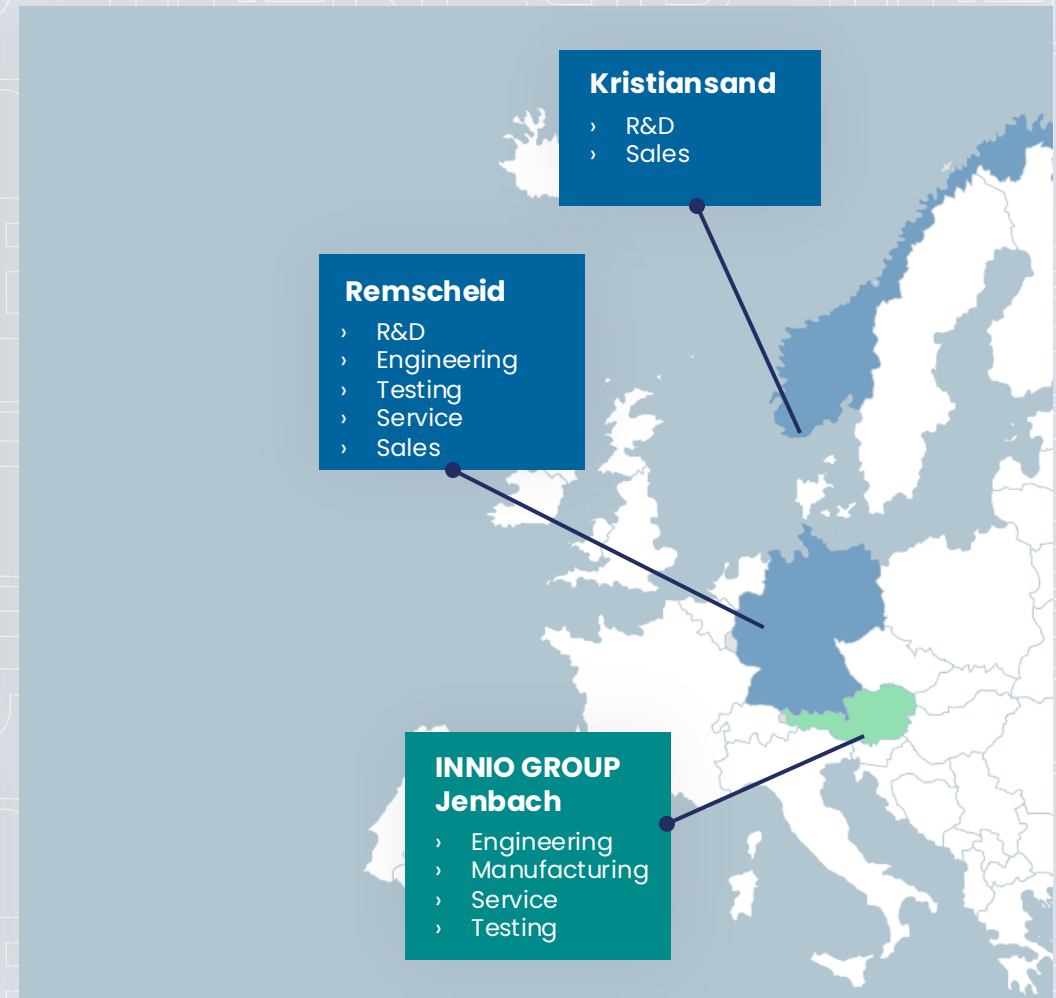
STRATEGIC PARTNERSHIP

between INNIO and HEATEN



INNIO has delivered more than 59,000 engines globally

- › Through a team of more than 4,500 experts
- › And a service network in more than 100 countries



HeatBooster TECHNOLOGY



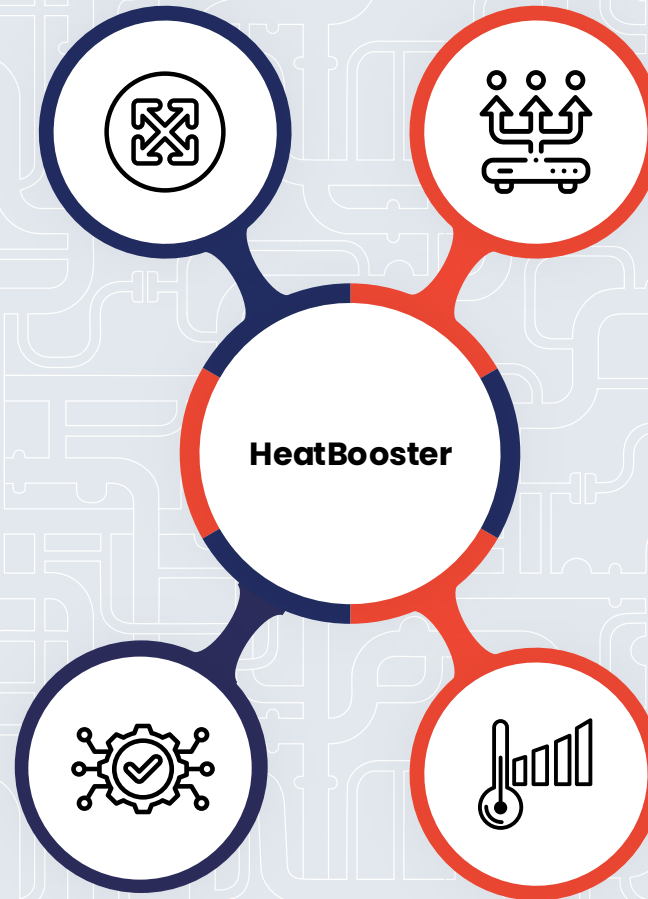
Unique Large Scale Piston Compressor – Bringing flexibility in the high MW_{th} range

Integration flexibility and modularization

- › System scalability from **1 to 50 MW_{th} +** through parallel or cascaded installation
- › Starting with a pilot and roll it out step by step
- › HeatBooster systems can always adapt to customer needs, especially in brownfield applications

Scalability

- › Standardization will be the key to reduce cost and speed-up the roll out
- › Production scalability is proven by our partner INNIO
- › We will leverage from service and maintenance network of INNIO



Operational flexibility (Load)

- › Flexible load handling & high part-load efficiency, **even at 20% load**
- › Super-fast load changes
- › **Grid-balancing capability incl. in the intraday market**

Operational flexibility (Temp. range)

- › The compressor is designed for 215°C
- › Variable compression ratio allows to use
 - › Different working fluids with the same Hardware
 - › Operation across different temperature levels with same working fluid

Continuous progress – Status update

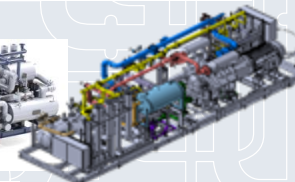
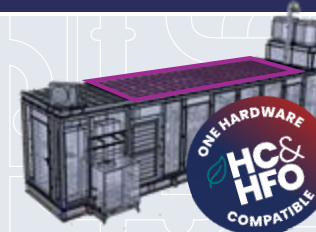
Commercial roll out started



	Testing Remscheid HBL4-W/W & Beneo	Testing Remscheid HBL4-S/S 130°C Steam	Südzucker 2x HBL4-S/S 130°C Steam	Südzucker 2x HBL4-S/S 100°C Steam	Testing Jenbach 1x HBL4-W/W 150°C Water	Plasterboard 2x HBL4-W/W Incl. Container	Dornoch HBL4-W/W 120°C	Felix Schoeller HBL4-W/S 120°C Steam
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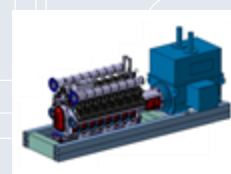
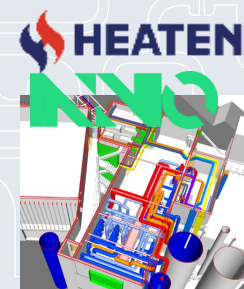
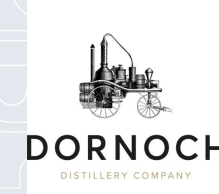
Rain



Offenau



Publish soon



V16 Design finalized

Testing Jenbach
HBL16

HBL16-W/W
130°C

2023

2024

2025

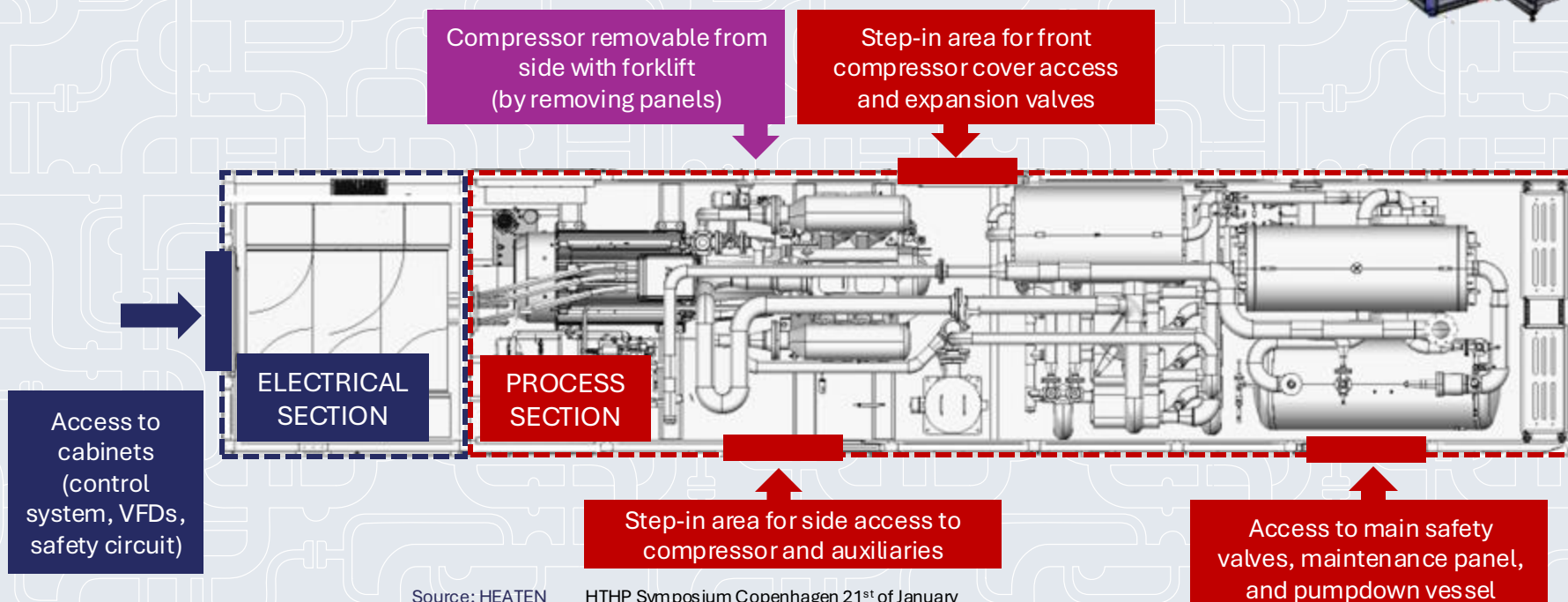
2026

2027

HBL4 with Enclosure

Fully containerized and standardized solution

- › Standardized solution incl. electrical section
- › Weather protected design for ambient temperatures up to 45°C
- › HC's ready solution
- › Modular system for up to 150°C and 2.5 MW_{th}
- › Deployment worldwide possible due to INNIO's service network

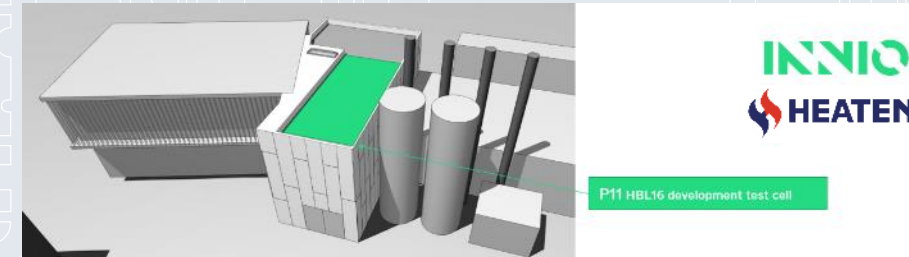


HBL16 Testbed Jenbach – Testing up to 10 MW_{th}



Joined forces between HEATEN and INNIO

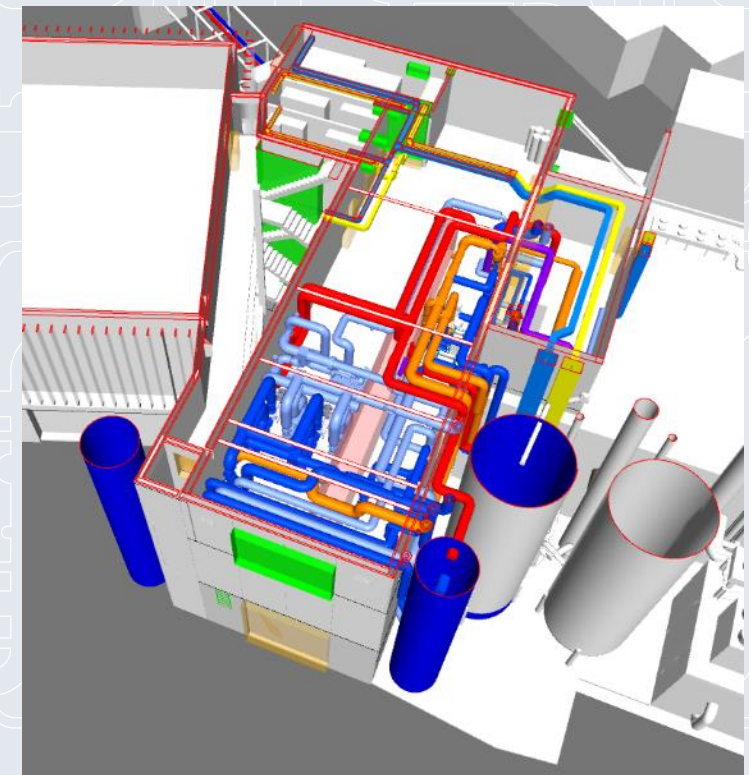
- › Testing of Water or Steam application of up to 10 MW_{th}
- › FAT and testing of various customer application will be possible



Source:

Source: HEATEN

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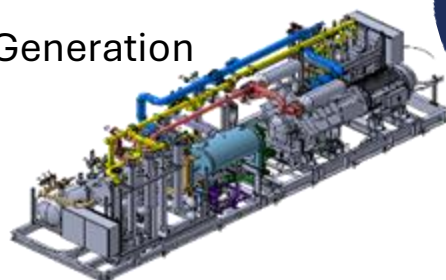


Current product portfolio

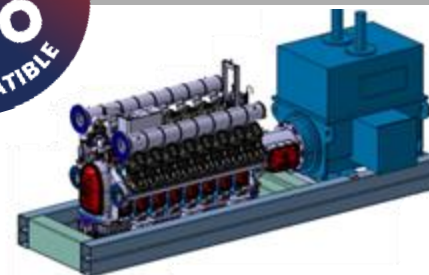
HBL4 & HBL16

HBL4 (V4 → 1500 m³/h)
(4-cylinders)

2nd Generation



HBL16 (V16 → 6000 m³/h)
(16-cylinders)



Operating range

Temperature heat source	10–150°C
Temperature heat sink	90–200°C (HC), 90–165°C (HFO)
Thermal power range	0.8–2.5 MW _{th}

Dimensions

Length	mm	9,000
Width	mm	2,400
Hight	mm	2,500



Datasheets

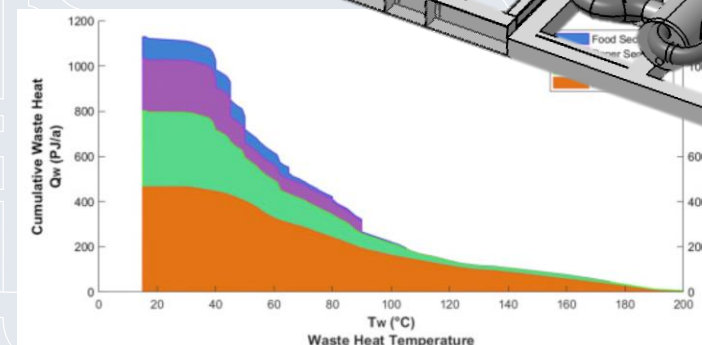
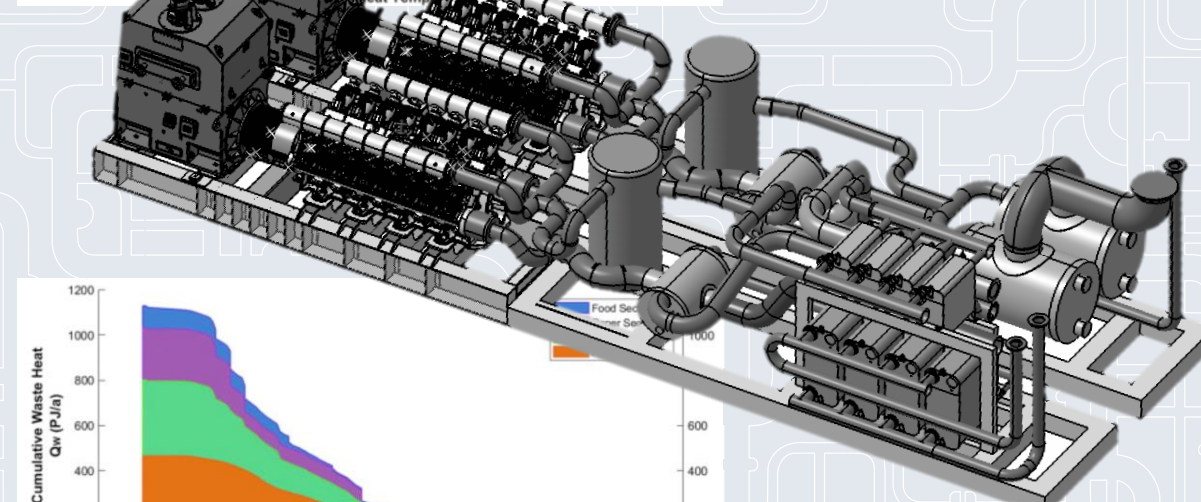
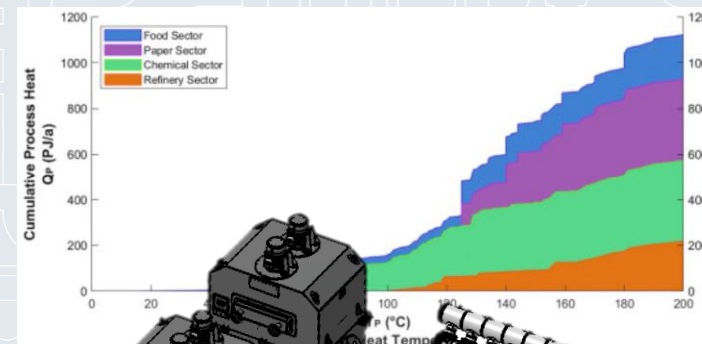
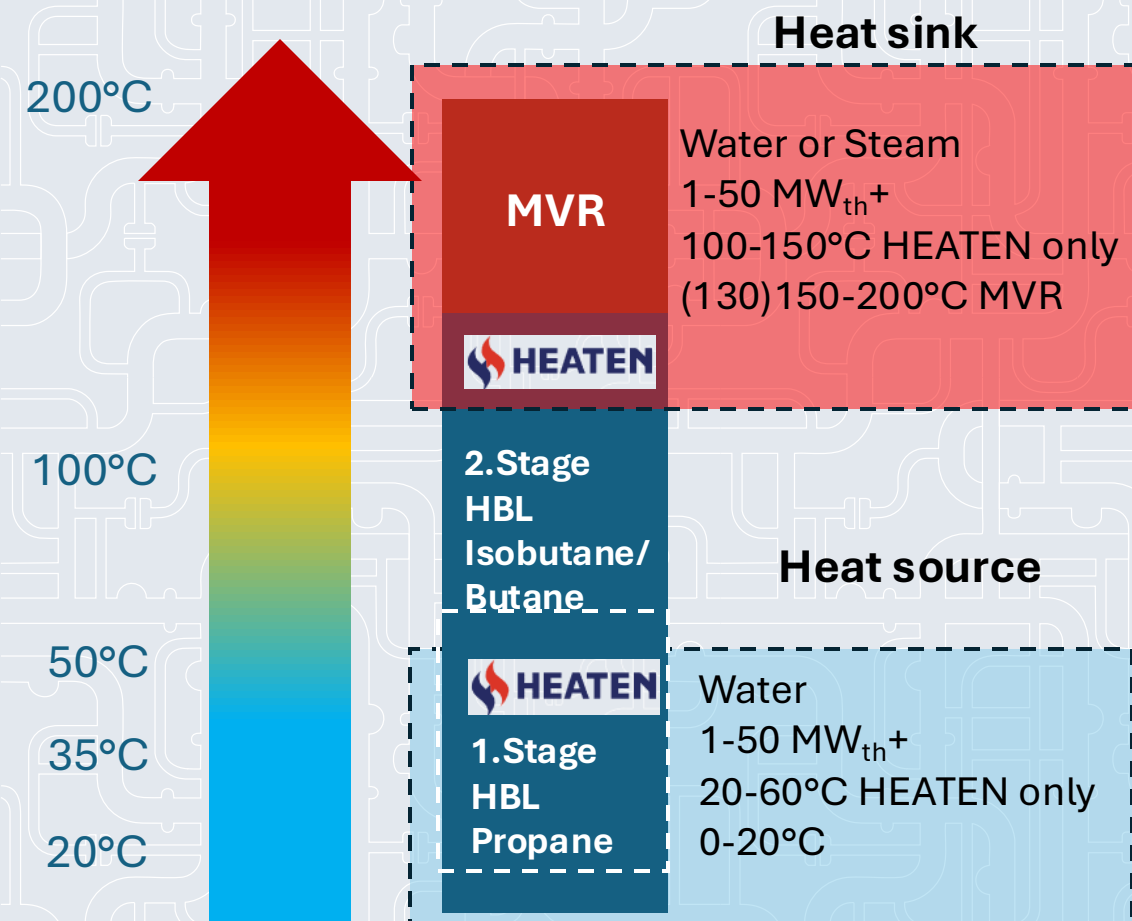
Operating range

Temperature heat source	10–150 °C
Temperature heat sink	90–200 °C
Thermal power	3.2–10 MW _{th}

Dimensions

Length	mm	11,000 (2 skids)
Width	mm	2,400
Hight	mm	2,500

2-Stage HeatBooster to cover most processes which require temperature lifts beyond 80 K



How to decarbonize industrial processes step by step



- Standardization and modularization will be the key in the future
- Several modules in the right sizing will enable redundancy and integration flexibility
- The overall efficiency will increase due to higher part load efficiency of the piston-based compressor technology
- At the same time we can balance the grid, almost as flexible as E-Boiler
- Typical large-scale applications 5-50+ MW_{th} such as in Chemicals, Pulp&Paper, Food&Beverage and District Heating



Source: HEATEN

Picture for illustrative purpose only

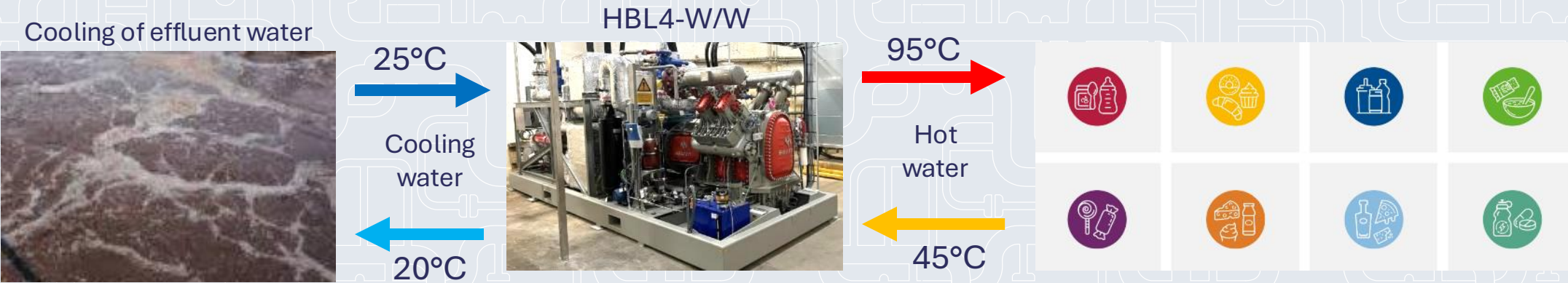
BENEO

Case Overview - Wijgmaal, Belgium

CASE HIGHLIGHTS	VALUES
COP	3.2
Thermal power Output	Up to 1 MW _{th}
Working fluid	R-515b
Cooling water savings	Up to 20,00 m ³ /a
CO ₂ savings	1900 t/a



- ▶ **BENEO:** Expertise in plant-based functional ingredients for food, feed, and pharma.
- ▶ **Nov 2024:** HEATEN delivered a HeatBooster to BENEO (Belgium).
- ▶ **Application:** Drying rice ingredients, delivering ~100°C heat, using wastewater at ~20°C as a heat source.



SÜDZUCKER

Case Overview - Offenau, Germany



CASE HIGHLIGHTS	VALUES
COP	3.8
Thermal power Output	2.8 MW _{th}
Working fluid	R-1234zeE
Steam supply	4.2 t/h
CO ₂ savings	1.358 t/a



- **Südzucker Group:** Leading food industry player & heat pump experts with vast experience in heat recovery
- **Application:** Steam supply for sugar processing – sugar house



62°C
Saturated steam
Hot water/
Condensate
59°C

2 x HBL4-S/S



100°C
Saturated steam
Hot water/
Condensate
98°C



SÜDZUCKER

Case Overview - Rain, Germany



CASE HIGHLIGHTS	VALUES
COP	6.0
Thermal power Output	4 MW _{th}
Working fluid	R-1233zdE
Steam supply	6.6 t/h
CO ₂ savings	2.660 t/a



- ▶ **Südzucker Group:** Leading food industry player & heat pump experts with vast experience in heat recovery
- ▶ **Application:** Steam supply for sugar processing – evaporation station



102°C
Saturated steam
Hot water/
Condensate
100°C

2 x HBL4-S/S



130°C
Saturated steam
Hot water/
Condensate
128°C



DORNOCH DISTILLERY

Case Overview

CASE HIGHLIGHTS	VALUES
COP	5,1-5,5
Thermal power output	Up to 1.2 MW _{th}
Thermal power input	Up to 850 kW _{th}
Working fluid	R-1233zdE
CO ₂ savings	Up to 2,000 t/year



HEATEN Public

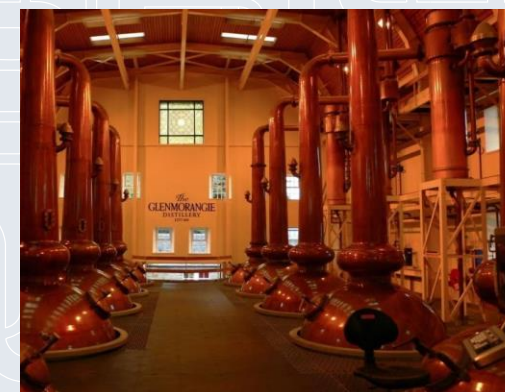
Source: HEATEN

82°C
Hot water
70°C



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120°C
Hot water
90°C



PLASTERBOARD DRYING

Case Overview

CASE HIGHLIGHTS	VALUES
COP	5-6,5
Thermal power output	Up to 2.3 MW _{th}
Thermal power input	Up to 2 MW _{th}
Working fluid	R-1234zeE
CO ₂ savings	Up to 4,000 t/year

► To be published soon



70-60°C
→

Hot
water

←
65-55°C



95-100°C
→

Hot
water

←
65-85°C



ARCELOR MITTAL

Case Overview - Ghent, Belgium



CASE HIGHLIGHTS	VALUES
COP	3.6
Thermal power Output	3.3 MW _{th}
Working fluid	R-1233zde
CO ₂ savings	6,274 t/year



- Industrial Waste Heat to District Heating



70°C
Hot water
55°C

1 x HBL16-W/W



125°C
Hot water
110°C

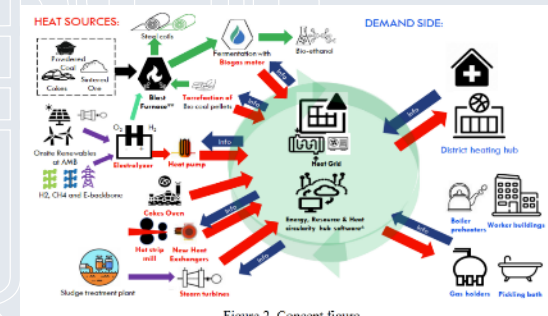
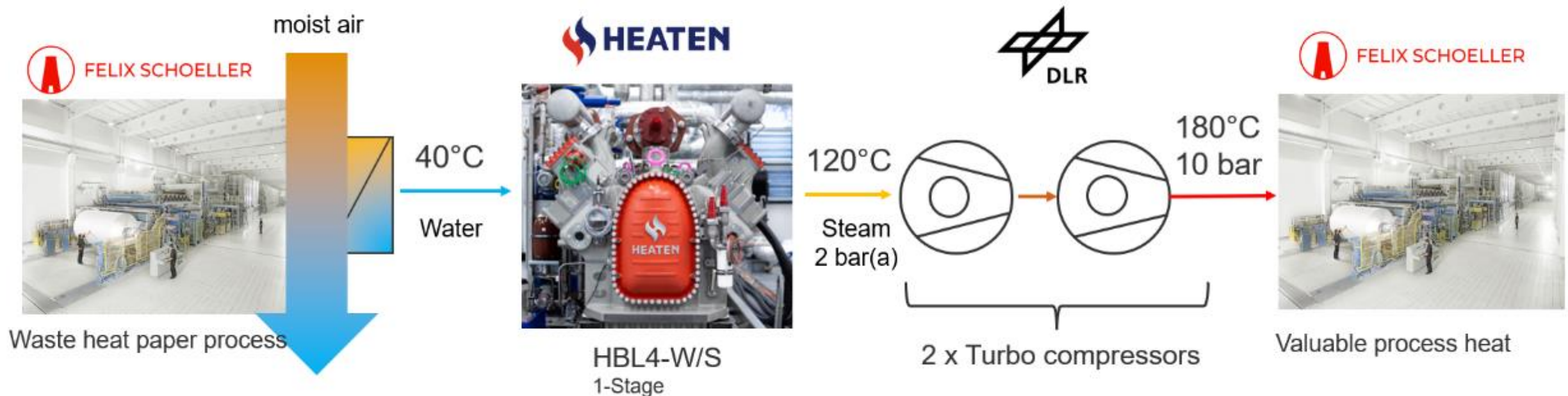


Figure 2: Concept figure

EEETHOS – Demo III HTHP for Pulp & Paper



Case Highlights	
Application	Pulp & Paper
Location	Felix Schoeller Osnabrück, Germany
Thermal power Output	$>1,000 \text{ kW}_{\text{th}}$, $>1,6 \text{ t/h}$
Steam output temperature	Up to 180°C
Working fluid	Isobutane
Application	Pulp & Paper



SteamPower Experience

HBL4-S/S up to 150°C Steam

**VISIT OUR TEST BED
IN REMSCHEID, GERMANY**

**Limited seats, registration
required**

29 January

25 February

24 March



Thank you for your attention!



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