Hall 4A

# **Chillventa Specialist Forums** 2024 **Chillventa Fachforen 2024** CTING S. CONNEC



## Shift your perspective

Industrial Heat Pump solutions to decarbonize the F&B Industry **Focus: High temperatures** 



#### **Ivan Rangelov**

Industrial Heat Pumps Manager

ENGINEERING TOMORROW



### Decarbonizing industry Where to start?

Currently available heat pump technologies coverage

Available prototypes of heat pumps with **very high TRL** 

		Heat Consumption (TWh/a)	EU-28	
		Space heating	297	16%
٦.		Hot water	25	1%
L		PH <60 °C	55	3%
		PH 60 to 80 °C	53	3%
	heat	PH 80 to 100 °C	89	<b>5%</b>
	SS	PH 100 to 150 °C	192	11%
		PH 150 to 200 °C	80	4%
		PH 200 to 500 °C	151	8%
		PH 500 to 1'000 °C	376	21%
		PH >1'000 °C	504	28%
		Total Heat Consumption (TWh/year)	1'821	100%
		Total Process Heat <60 °C to >1'000 °C (TWh/year)	1'499	
		Total Process Heat 90 °C to 160 °C (TWh/year)	237	16%

Process Heat Consumption (TWh/a)							
Industrial sector	PH 1	00 to 150 °C	PH 150 to	200 °C			
Iron and steel		19.8		7.3			
Chemical		19.3		15.4			
Non-ferrous metal		2.7		1.0			
Non-metallic minerals		36.5		0.0			
Food and tobacco		68.0		8.8			
Paper, pulp and print		10.0		39.4			
Machinery		<mark>6</mark> .9		2.9			
Wood and wood products		0.2		0.7			
Transport equipment		1.2		0.2			
Textile and leather		<mark>6</mark> .9		0.0			
Other		19.1		4.2			
Total		191		80			

 ڳ

In this presentation: outline **which** heat pump technologies are relevant for high temperatures (sinks > between 100°C and 150°C) as well as give some examples of combined cooling and heating for industrial applications

*Summary process heat demands split by temperature and segments EU-28 (Arpagaus, High Temperature Heat Pumps Update 2024)* 

	•00	●● <b>0</b>	•••
¥:	Mature and market	Very high technical	Food & beverage sector –
	available heat pump	readiness on prototypes	most heat processes are
	solutions for sinks < 100°C	for sinks 120-130°C	within reach!



## Example Food & Beverage site Brewery process diagram

⊿ E∛

•00

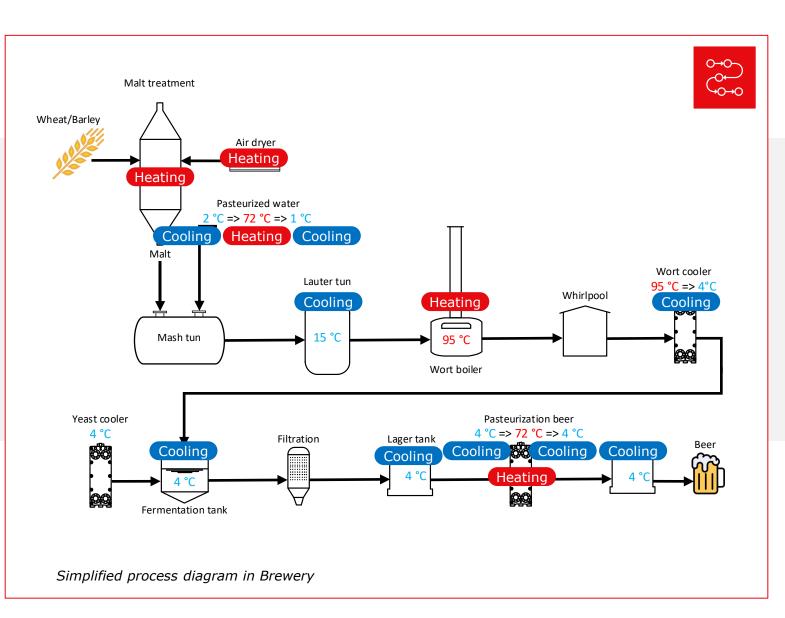
Multiple consecutive cooling and heating processes

 $\bullet \bullet \circ$ 

Traditionally: cooling & process heating disconnected. Fossils are burned for process heat

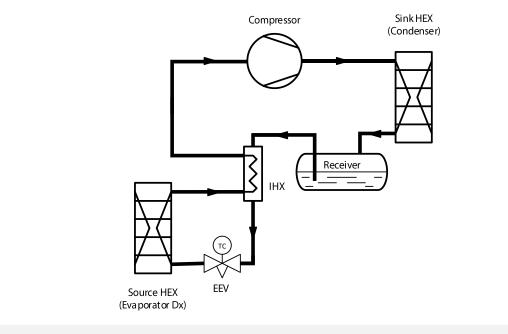
•••

Decarbonize: We can connect cooling and process heat, and disconnect from fossils!



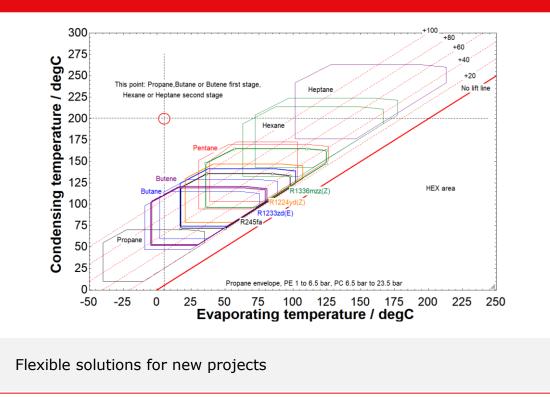
### Cooling & process heating in a brewery How to connect cooling and process heating systems?

#### **Generic one-stage system**



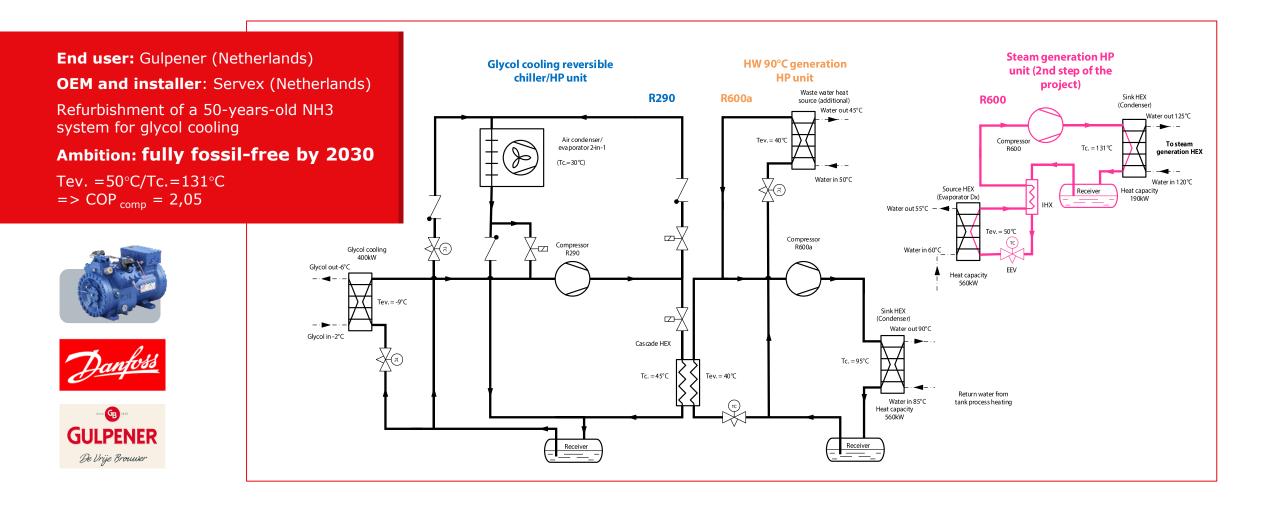
- Typical max lift 80-90 K
- Combinations are necessary to cover cooling and heating processes

How to combine cascades?



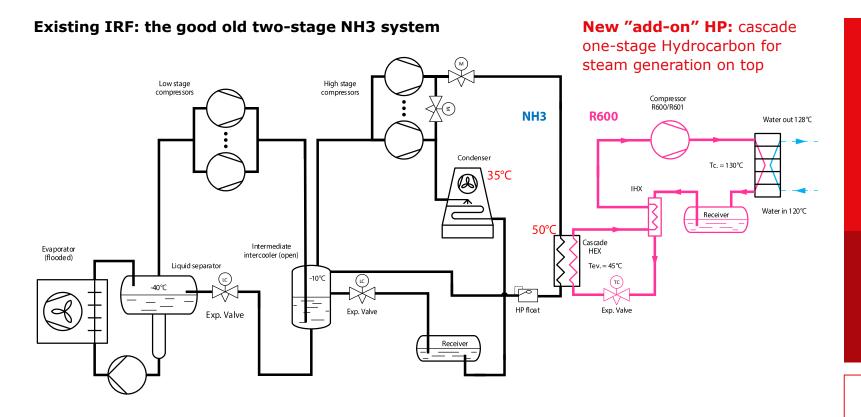


#### **Reference new project: Hydrocarbon system only** Brewery application – process cooling, heating and steam generation





### **Refurbishment example: Hydrocarbons on top of an existing Refrigeration system** Brewery application – process cooling, heating and steam generation



Typical two-stage NH3 IRF system in a F&B plant

≥ ≣

#### $\bullet \bullet \circ$

• • •

Add-on NH3 HP => max. water  $90-95^{\circ}C$ 

#### •••

Add on e.g. R600/R601 HP => hot water/steam out at 120°C/130°C

#### **Challenges:**

- Cascade HEX temperature
- Capacity mismatch in existing system and steam generating heat pump
- Control

#### **Good news:** Yes! R600 in cascade "on top" of the standard NH3 system can get us water out at 120°C

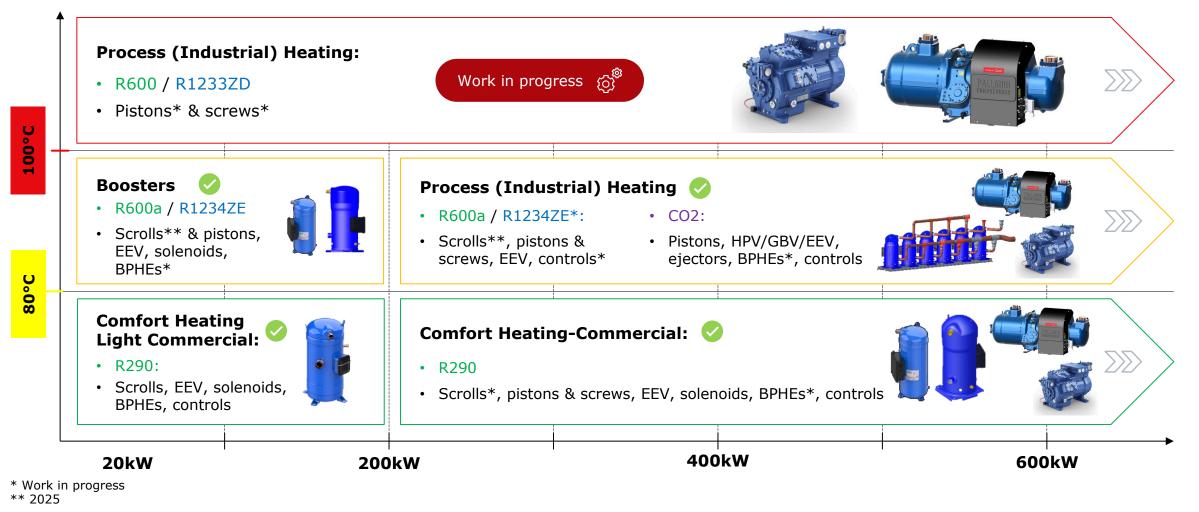


**Bad news:** We need to increase NH3 condensing temperature to 45-50°C for a reasonable COP



## Danfoss heat pump solutions

**Heat Supply** 





## ENGINEERING TOMORROW

Thank you for your attention! Let's meet at the Danfoss Booth Hall 7, booth 251 Hall 4A

# **Chillventa Specialist Forums** 2024 **Chillventa Fachforen 2024** CTING S. CONNEC



