



# INDUSTRIAL HIGH-TEMPERATURE HEAT PUMPS

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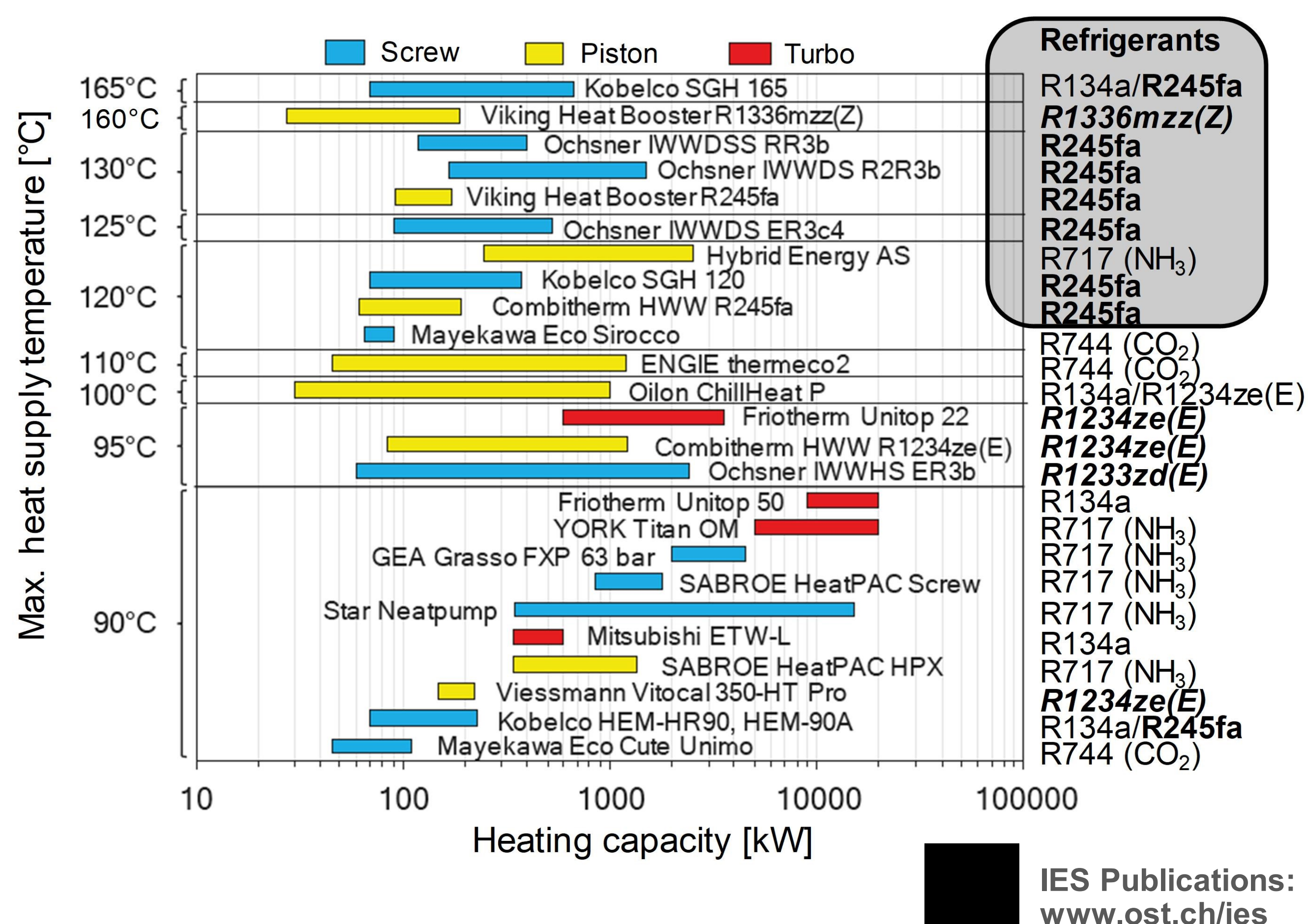
## MOTIVATION

The **electrification of process heat** in the industrial sector is a current topic of great interest. The potential of using **heat pumps** has a high potential in terms of **energy efficiency** and **reduction of CO<sub>2</sub> emissions**. A lot of research is performed in this area.

Of particular interest are **industrial high temperature heat pumps (HTHPs)**, which generally **supply heat above 100°C** and are mainly used in industrial processes, but also for district heating applications and large residential buildings.

## MARKET OVERVIEW

Industrial HTHPs are slowly entering the market. Various **product types** are already **commercially available** with heat supply temperatures **up to 165 °C**.

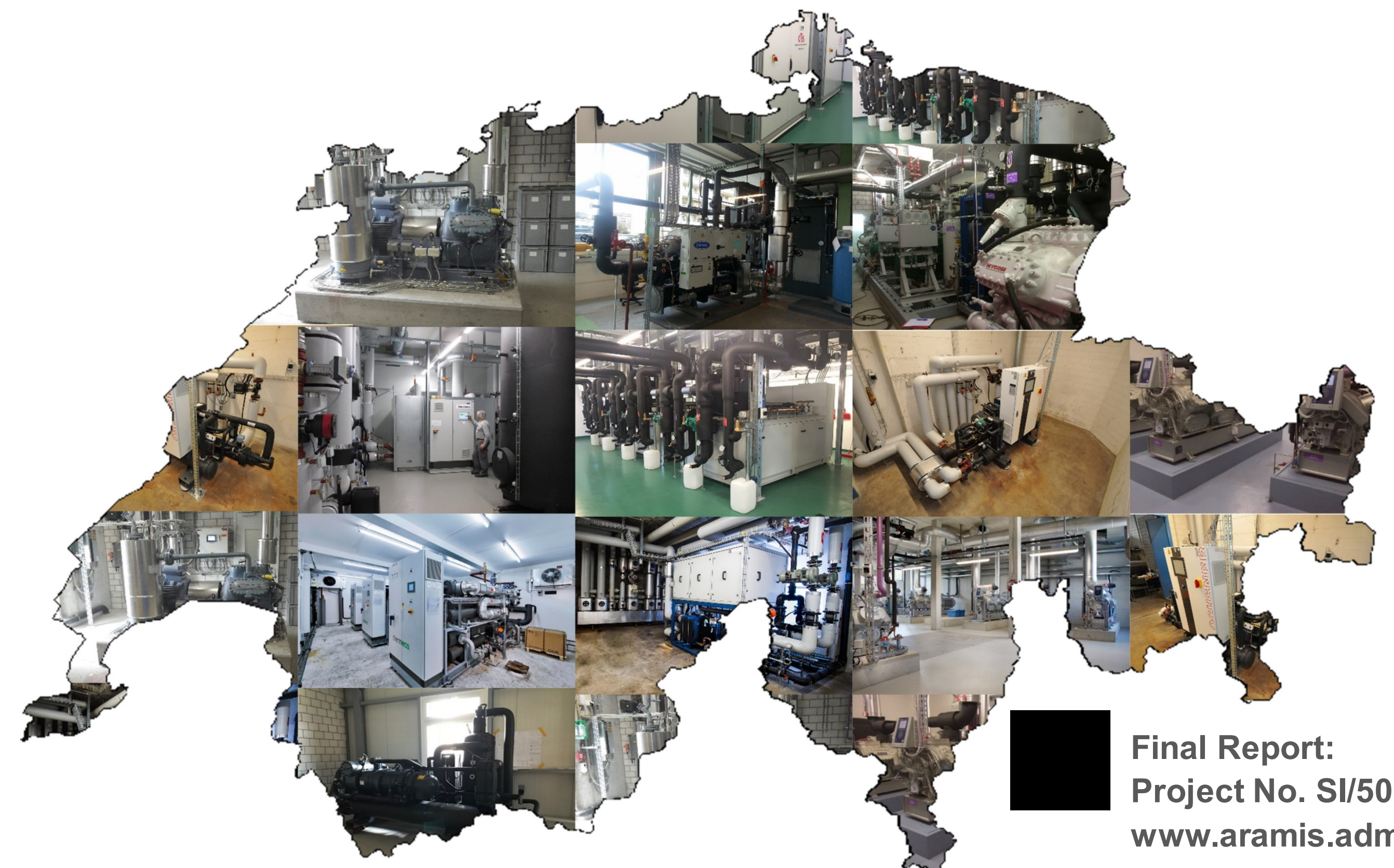


## KEY RESULTS

- By replacing gas and oil boilers with electrically driven industrial HTHPs, significant **energy savings (20% to 80%)** and a **reduction in CO<sub>2</sub> emissions (30% to 90%)** are achieved.
- Using industrial HTHPs to generate **low-pressure steam (133°C, 3 bar)** requires **less than half the energy** as direct **electrical heating** if waste heat is available as a heat source at 55°C.
- Potential applications for industrial HTHPs** have been identified in **various sectors**, mainly for the generation of **hot water, hot air, and steam**.

## CASE STUDIES SWITZERLAND

**25 application examples of industrial heat pumps** in Switzerland were analyzed on behalf of the SFOE and summarized in a report. Most applications are found in the **food sector for heating and cooling**. The **average COP was around 4.0 at 50 K temperature lift** (heat source inlet to sink outlet). The highest heat supply temperature was slightly **above 90°C**. **Multiplication potential** for similar heat pump systems was identified in other processes industries.



## POTENTIAL APPLICATIONS

- Food and beverages:** hot water and steam for sterilization, process heat for concentration and pasteurization
- Bottles and wine tanks:** hot water and steam for washing and sterilizing during bottling processes
- Slaughterhouses:** steam and hot water for cleaning
- Cheese factories:** process heat for pasteurization and hot water
- Brick drying:** Air preheating to 120°C with moist exhaust air (70°C, 50% r.h.)
- Starch drying:** Air preheating for steam generation 160°C
- Drying of animal fodder:** Low pressure steam for chamber dryer
- Milk powder production:** Air preheating to 120 to 150°C for spray drying
- Wood drying:** Air heating to 120°C to 150°C with moist exhaust air
- Paper drying:** Low-pressure steam 130°C using cooling water (60 °C) or humid exhaust air (76°C, 56 % r.h.) as heat source
- District heating networks:** Hot water production up to 120 °C
- Hospitals:** Steam 125 °C for autoclaves, sterilization and laundry drying
- PET bottle industry:** Process heat between 100°C and 150°C for injection molding of plastic preforms
- Sugar industry:** Process heat between 80 and 150°C for the processing of sugar beets, steam generation at 138°C for the production of 90°C feed water
- Breweries:** Process heat of around 100°C for the brewing process (e.g. mashing, lautering, wort boiling)
- Milk processing:** Milk pasteurization (HT 100°C to 120°C), sterilization (115°C to 135°C) and UHT (135°C to 150°C)
- Chemical industry:** Steam 120°C for alcohol distillation using the waste heat of the cooling tower or the condensation heat of the distillation column (65°C)
- Wellness sauna:** CO<sub>2</sub> heat pumps for different temperature levels up to 120°C



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