Industrial heat pumps can deliver

180°C and higher under development

More than half of all energy is used for producing heat. A big part of this can be provided efficiently by heat pump solutions in residential and commercial buildings, industry and district heating contributing to a carbon neutral Europe.

In industry, heat represents more than 60% of energy use. **Industrial heat pumps** can help decarbonise low temperature heat supply within industries by using **renewable energy and waste heat recovery**. With today's technology, **industrial heat pumps** can provide about **10% of total final energy demand of industry** (approx.. 2000 TWh) and hence are a significant contributor to **Europe's energy and climate targets.** This should be recognized in the **renewable energy directive and in energy statistics** and this potential for industrial applications and district heating needs to be developed faster.

What is an „industrial heat pump"

Industrial heat pumps can be characterised by

- having much **higher capacities**: starting around 200 kW, with many solutions in the one-digit MW range and maxing out at approx. 70 MW
- providing **higher temperatures**:
    a. Standard heat pumps for district heating systems provide around 90°C
    b. industrial heat pumps provide 120 – 160°C
    c. current prototypes are expected to deliver 180°C and beyond (see fig. 4)
- using **highly efficiency drive lines and motors** (efficiency of around 98% - IE4)
- using **naturally occurring refrigerants** (hydrocarbons, CO2, water, ammonia, and air) as well as HFOs and HFCs

Industrial heat pumps use **renewable energy** from air, water, sewage and ground, exhaust air from buildings (hospitals, hotels, offices) or **waste heat** from processes and infrastructure.

Typical applications:

- **drying** (paper and pulp, wood, fruits, vegetables, paint, food),
- humidity control,
- the **food industry** (dairy, brewing),
- cleaning,
- heating and cooling of products and processes,
- maintenance of **comfort** of production and office space (see fig. 1).

The brochure *Large scale heat pumps in Europe* gives an overview of concrete use cases of industrial heat pumps in the EU.

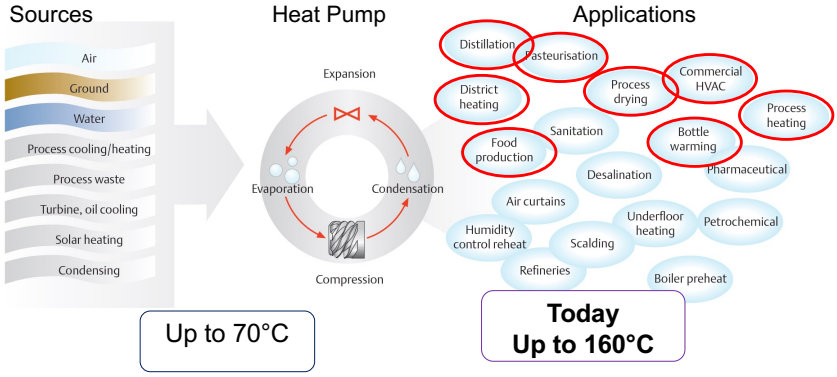

Figure 1: Sources and applications of industrial heat pumps. Source: EHPA.

The **industrial heat pump value chain** is characterised by bespoke solutions for each application field. It requires **highly skilled planning engineers** that fit heat pump technology to the respective process. **European manufacturers** for components and final products are often **world market leaders** and manufacturing sites for heat exchangers, compressors and controls are distributed through the continent, providing employment and perspective to its cities and regions.

Temperature levels :

Industrial heat pumps can provide energy at temperature levels of **up to 160°C**. Prototypes are operating at around 180°C and **industry experts expect temperatures of 200°C and beyond in this decade**. Figure 2 shows the typical temperature ranges of industrial heat demand. All processes with demands left of the 160°C line can be efficiently run with industrial heat pumps today. All processes listed in the table are estimated to be provided with the next generation of large heat pumps.

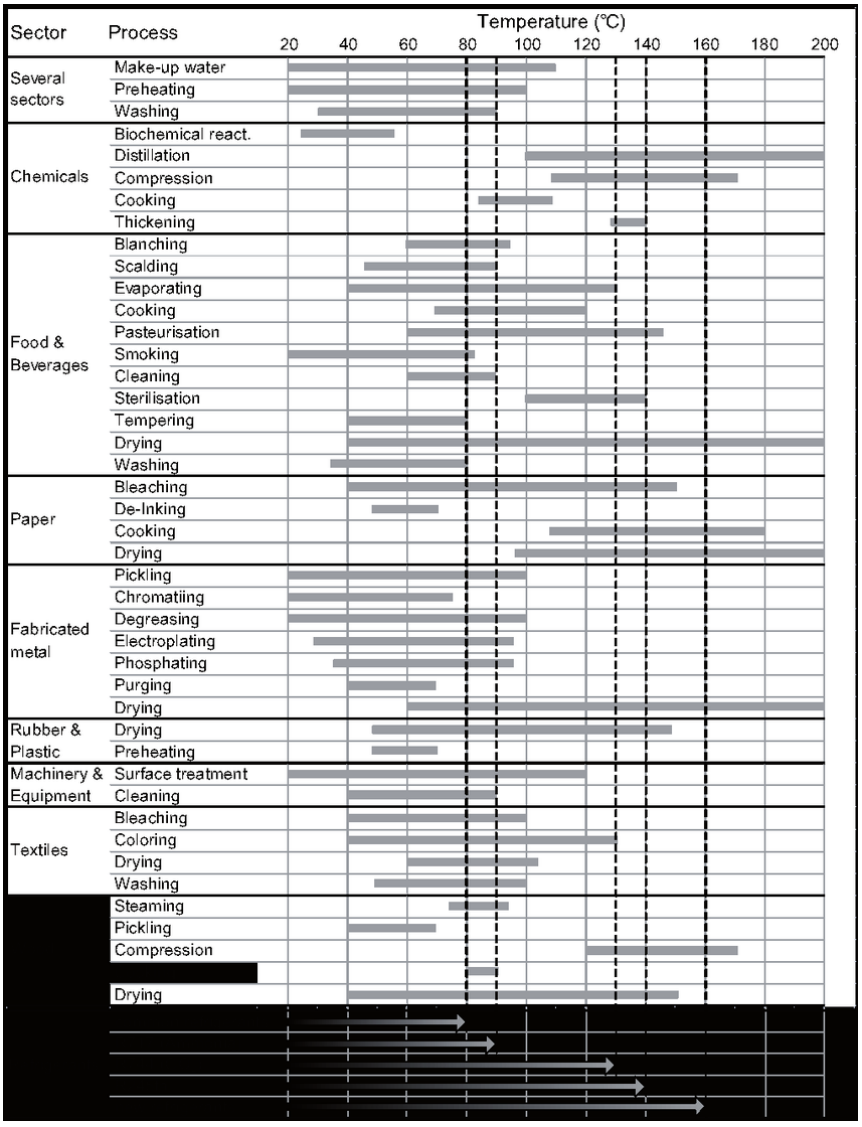

Figure 2: Typical temperature levels of common industrial processes. Source: Wolf, S. et al (2012) Industrial heat pumps in Germany: Potentials, technological development and market barriers.

The below figure shows the energy demands of different industry sectors. The shares coded in blue and yellow can be provided with heat pumps. With today's technology, they can provide about **10% of total final energy demand of industry (approx. 2000 TWh)** and hence are a **significant contributor to Europe's energy and climate targets** that should be recognized in the renewable energy directive and in energy statistics.

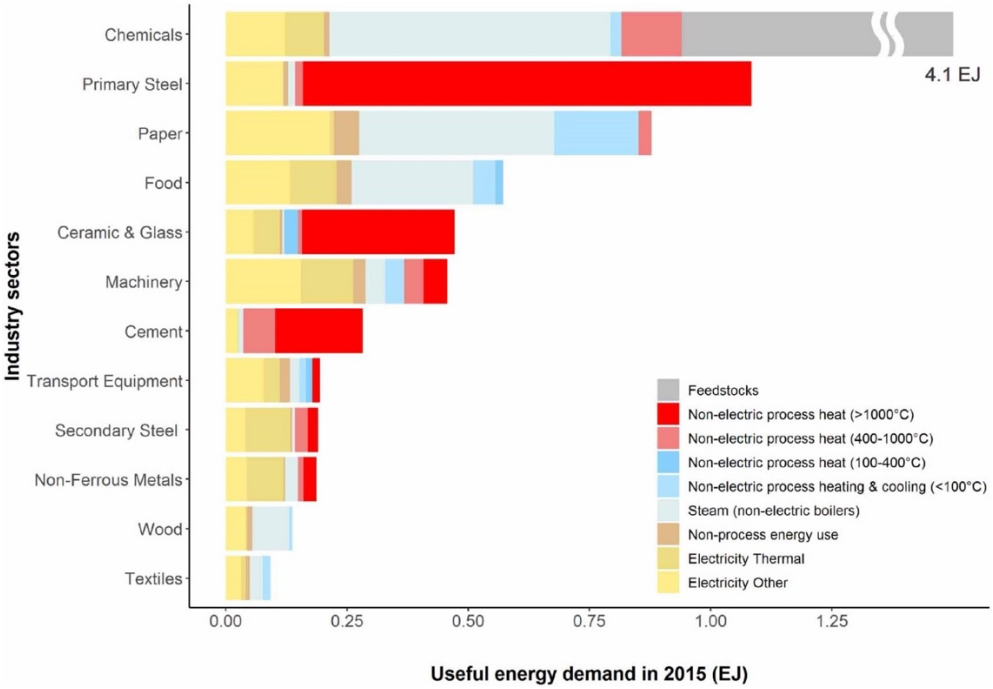

Figure 3: Useful energy by temperature level and industrial sector. Source: Maddedu, S. et al: (2020): The CO2 reduction potential for the European industry via direct electrification of heat supply (power-to-heat). Environ. Res. Lett. 15 124004

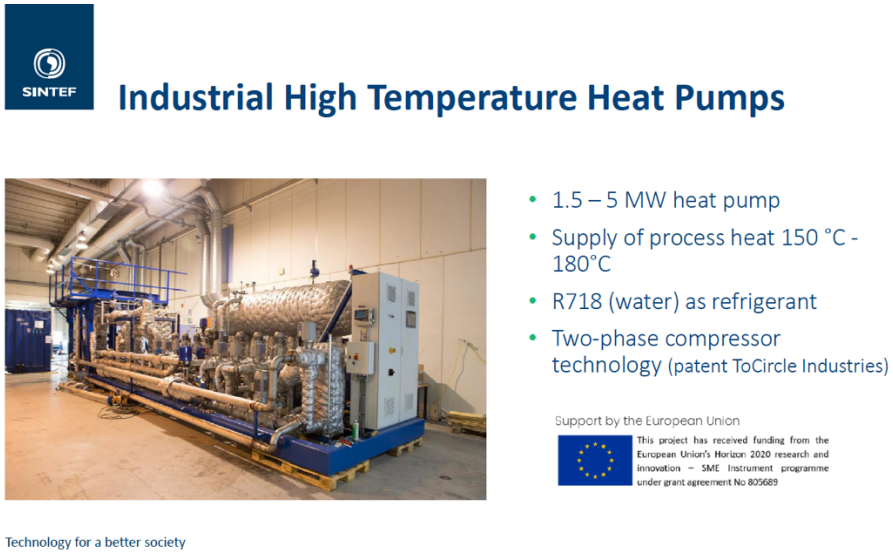

Figure 4: 180°C heat pump prototype using water (R718) as refrigerant. Source: Sintef

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