

High-temperature industrial heat pumps



Objective

The overall objective is to develop and implement cost effective industrial heat pump technology that produces steam in the temperature interval 120-200°C in a way that is economically feasible and using an abundant source of (waste) heat and (renewable) electricity.

Motivation

- Energy efficiency forms an important step in the transition to a more sustainable energy system. A large contribution is expected from industry;
- Energy use in the industrial sector is dominated by the use of heat from fossil fuels. A low carbon economy requires transition to more sustainable sources;
- This can be done by heat production from renewable sources or by recycling of waste heat. Both options need heat pumps as enabling technology.

Project scope

- End-user demands, specifications, and business cases;
- Compression heat pump technology at a 200 kW scale level;
- Alternative refrigerants (butane, pentane, DR2);
- Market potential studies.

Applicability

- Targeted markets are the refining, chemical, food, paper & pulp and steel sector;
- Temperature levels up to 200°C;



- New worldwide business opportunities for equipment manufacturers and technology providers;
- Estimated heat use below 200°C is about 180 PJ/year in NL industry.

Results

Experiments conducted with butane:

- Waste heat of 60°C to low-pressure steam and hot water;
- COP of 3 for 1.8 bara steam and 4.5 including hot water production;
- Heat pump was operated stable at higher steam pressures up to 3.4 bara (135°C);
- Measured performances match well with calculated performances.

Commissioning ongoing for setup with pentane:

- Two stage system;
- Waste heat at two temperatures;
- Heat delivery up to 150°C (4.7 bara).

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