

# Upgrading Waste Streams with Compression Resorption Heat Pumps



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**Project #:** UH – 20 - 10

## Objective

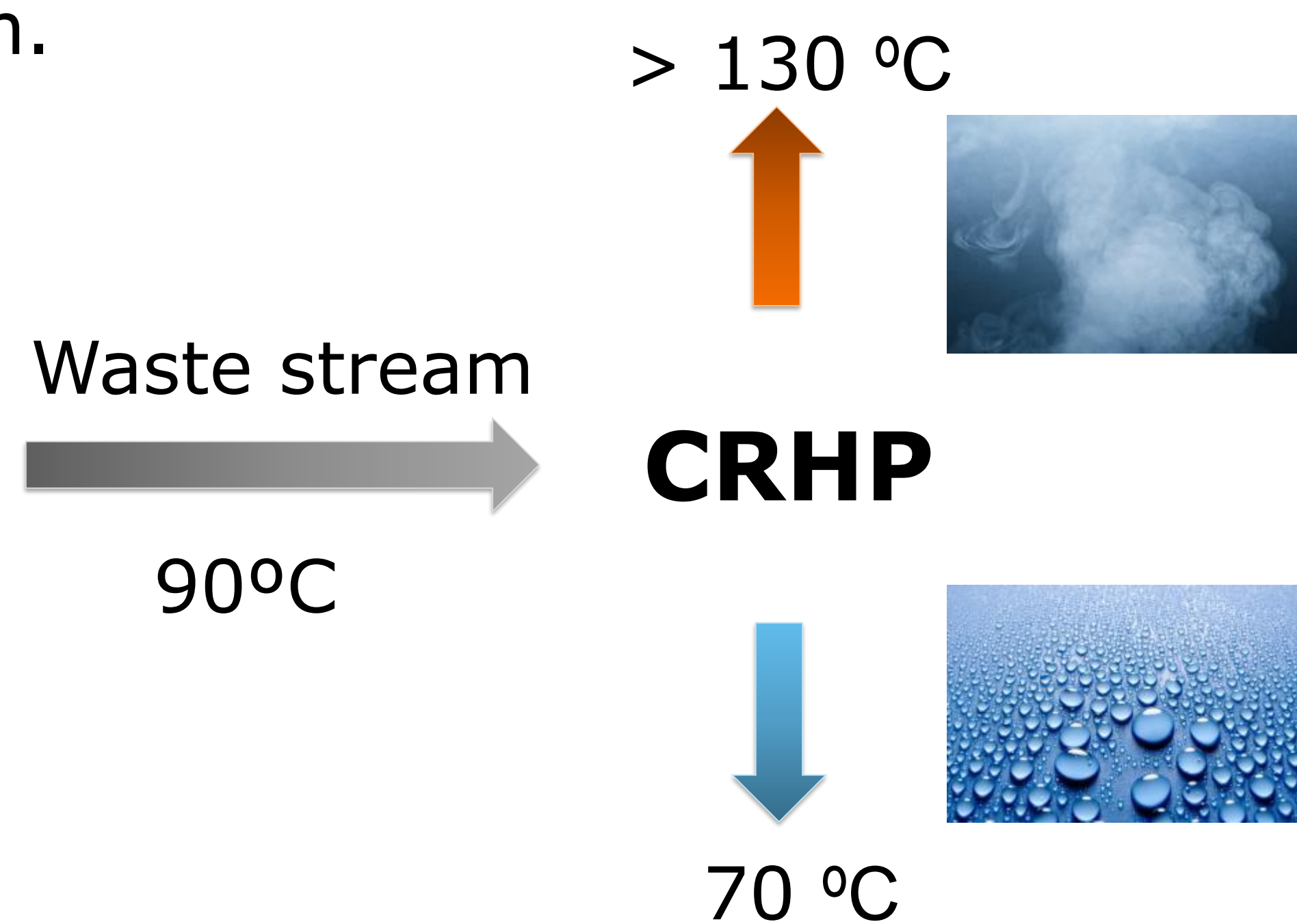
To develop a compressor prototype suitable for operation in compression-resorption cycles for heat recovery from process waste streams.



Fig 1. Twin screw compressor.

## Motivation

Waste heat recovery in the industry is still negligible. For many application compression-resorption heat pumps (CRHP) are an attractive option.



## Status

Homogeneous thermodynamic model including entropy production for each leakage path has been developed.<sup>1</sup>

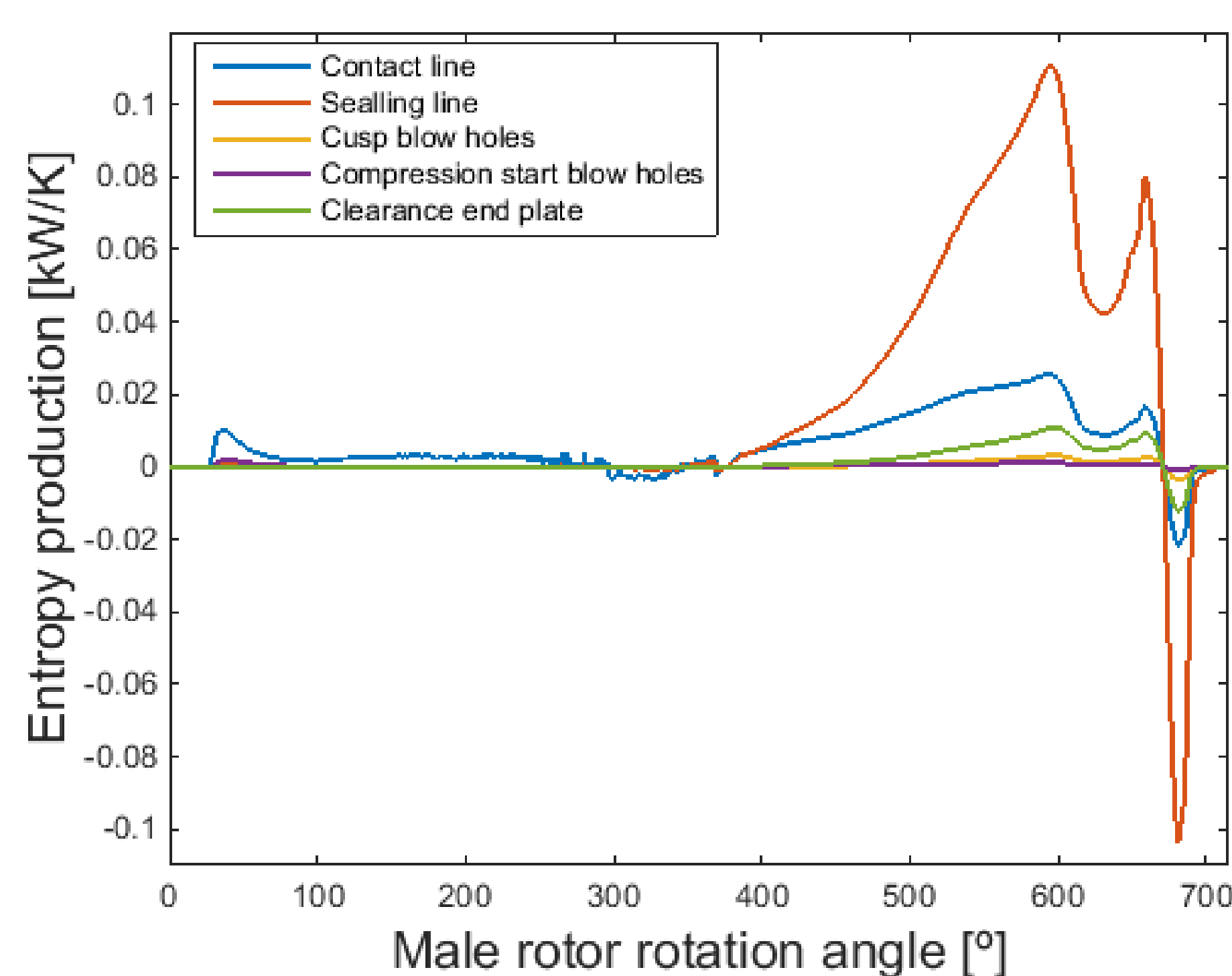


Fig 2. Example of entropy production of each leakage path in a twin screw compressor.

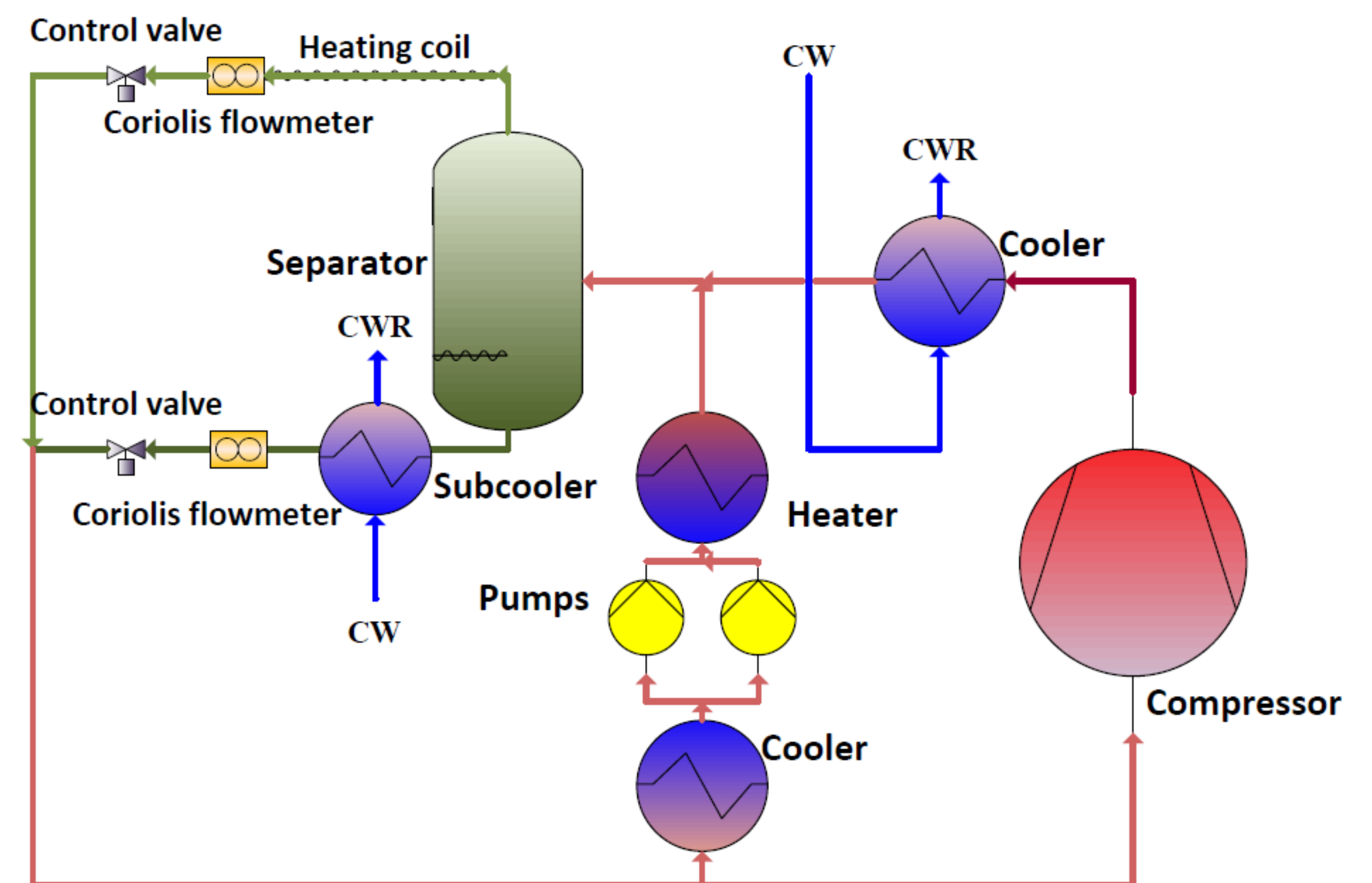


Fig 3. Simplified P&ID of the experimental set-up.

Initial testing of components and controls has been performed. The payback period when replacing a boiler with a CRHP has been estimated.

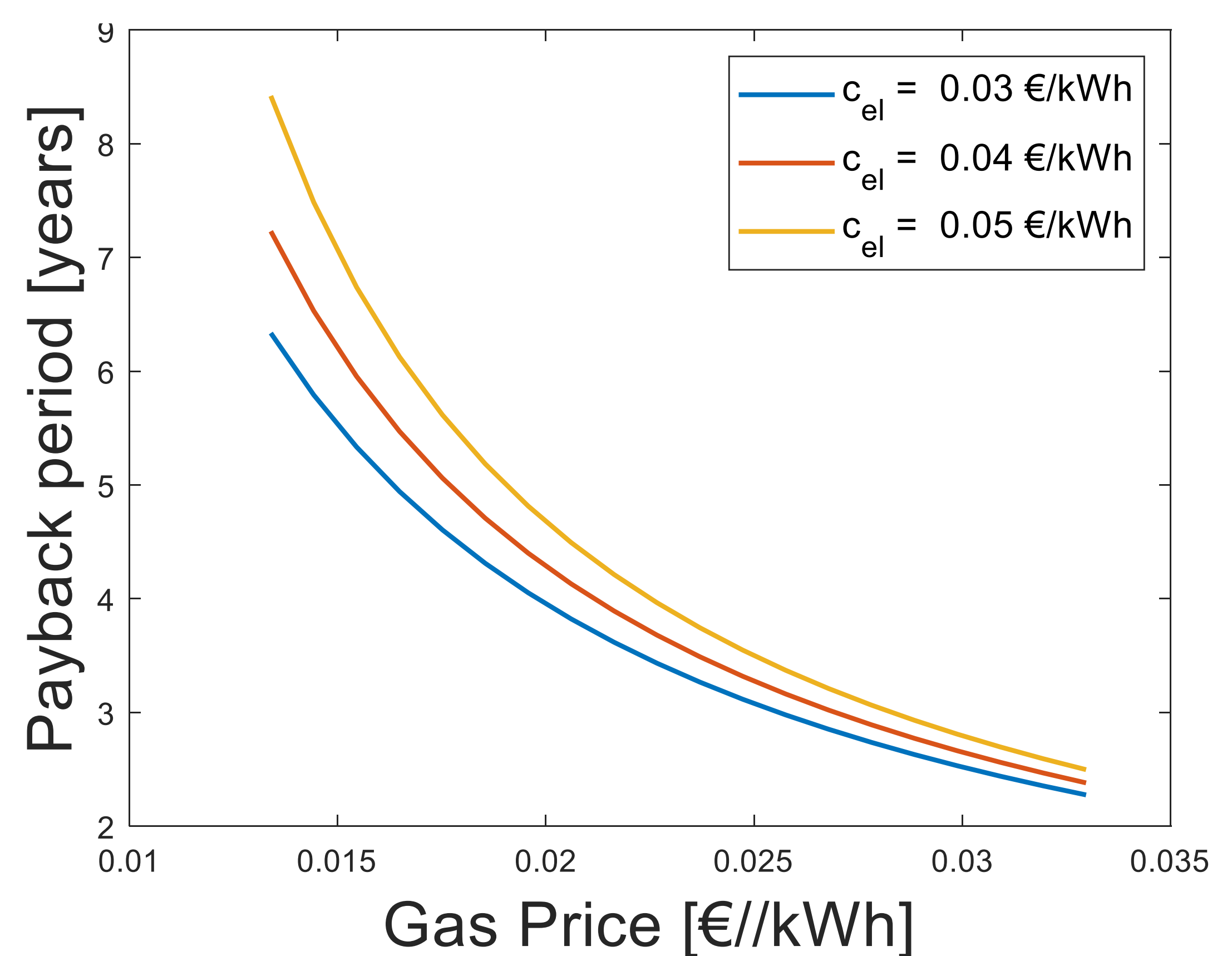


Fig 4. Payback period as a function of the gas and electricity price when upgrading 90 to 130 °C.

## Ongoing work

- Integrate all compression resorption heat pump components into an optimization model based on entropy production minimization.
- Perform experiments for evaluation of the compressor prototype performance. Additionally confirm the benefits of  $\text{NH}_3\text{-CO}_2\text{-H}_2\text{O}$  versus  $\text{NH}_3\text{-H}_2\text{O}$ .
- Compare the optimized design with reference system (boiler).

## References:

[1] Zaytsev, 2003, PhD thesis.