High temperature test results and application cases of a Rotation Heat Pump

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AGENDA

- **Introduction and Technology**
- **Test Results**
- **Summary and Outlook**

SUPPORTED BY

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This project is supported by InnoEnergy and Co-funded by the European Union.

THE PROBLEM

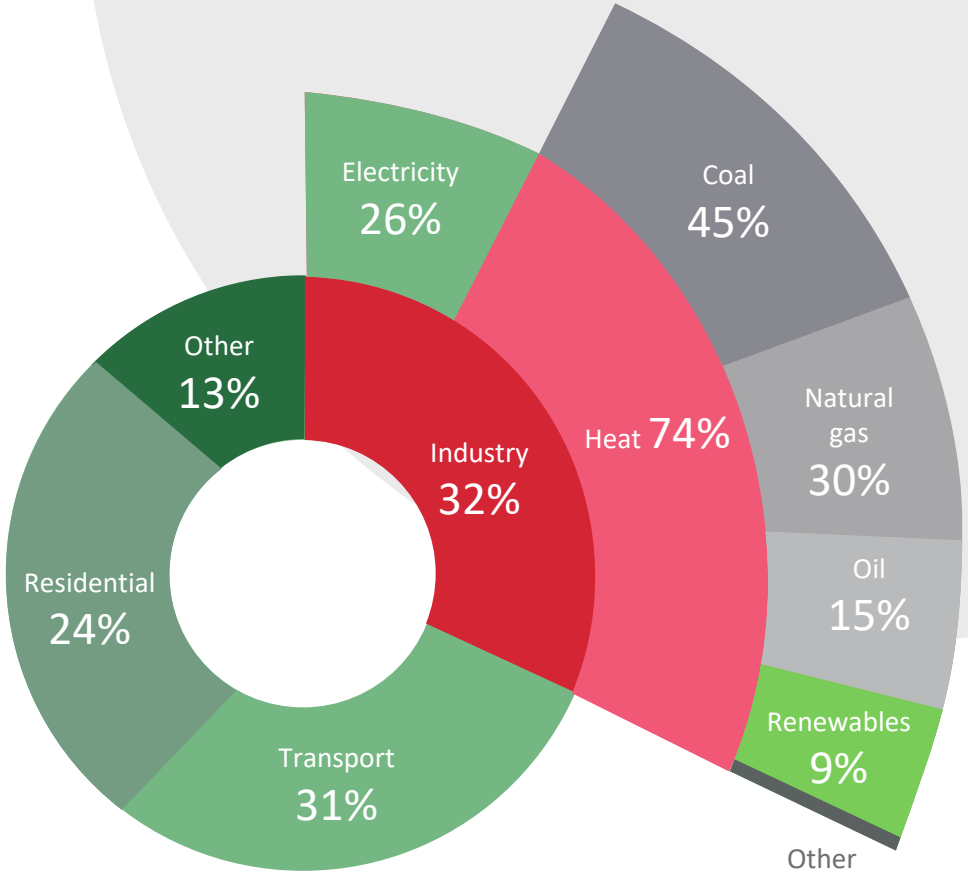
GLOBAL HEAT DEMAND IS CURRENTLY BASED ON FOSSIL FUELS

Heat energy employs 74% of total energy consumption in industry

90% of industrial heat generation is based on fossil fuels

An estimated 30-40% of the heat required in industry is between 100 and 200°C.

Industrial heat recovery is a key factor in order to achieve independence from fossil fuels (ie Russian gas) and to achieve the climate goals



Source: Global Heat Demand in Industry. Solar Payback. Based on IEA statistics and calculations from IRENA.

TEMPERATURE

ECOP IS CLOSING THE GAP FOR RENEWABLE INDUSTRIAL HEAT

Gas is the dominant source of heat in the industrial sector as one of the most expensive and non carbon neutral resources.

We are closing the gap for medium temperature applications in the industrial sector (e.g. for process steam, washing, cooking, distilling, pasteurising).

TECHNOLOGY

A HIGHLY EFFICIENT INDUSTRIAL HEAT PUMP WITH AN OPERATING RANGE OF UP TO 150°C (in future 200°C)

Core innovation is a novel circular compression process

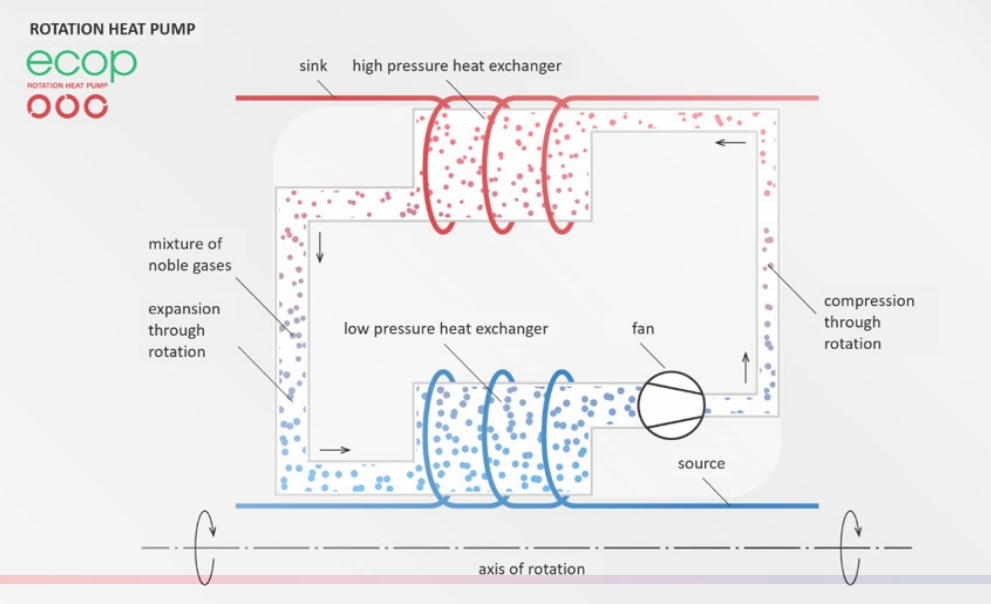
Use of a working gas without greenhouse effect

INNOVATION

Centrifugal force enables 99% efficiency in compression

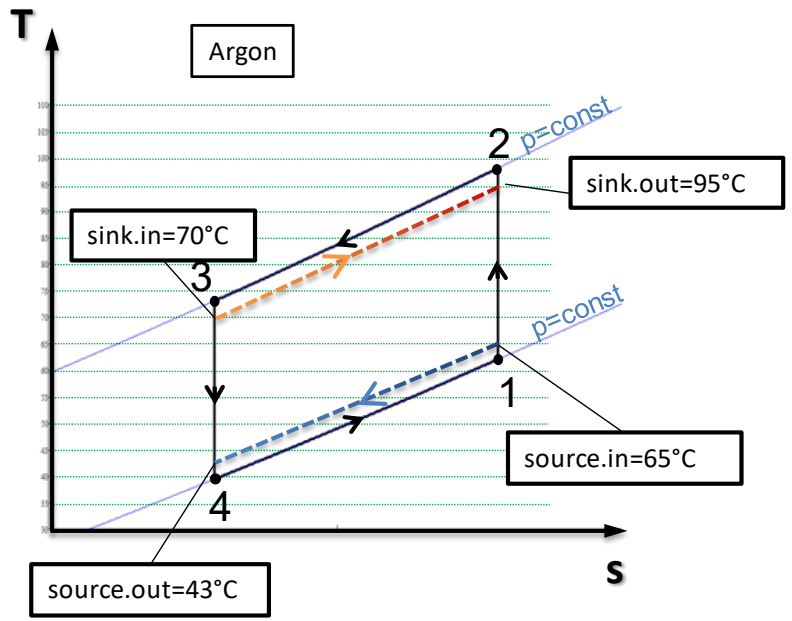
High temperatures, high temperature flexibility

700 kW(th)



AN EXISTING THERMODYNAMIC PROCESS REINVENTED

1-Phase Joule Process

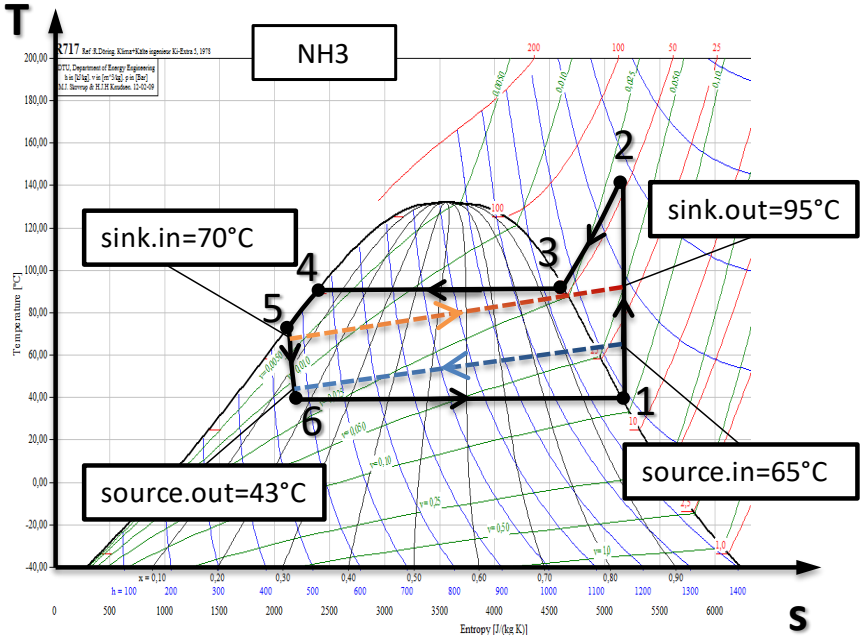


EXAMPLE

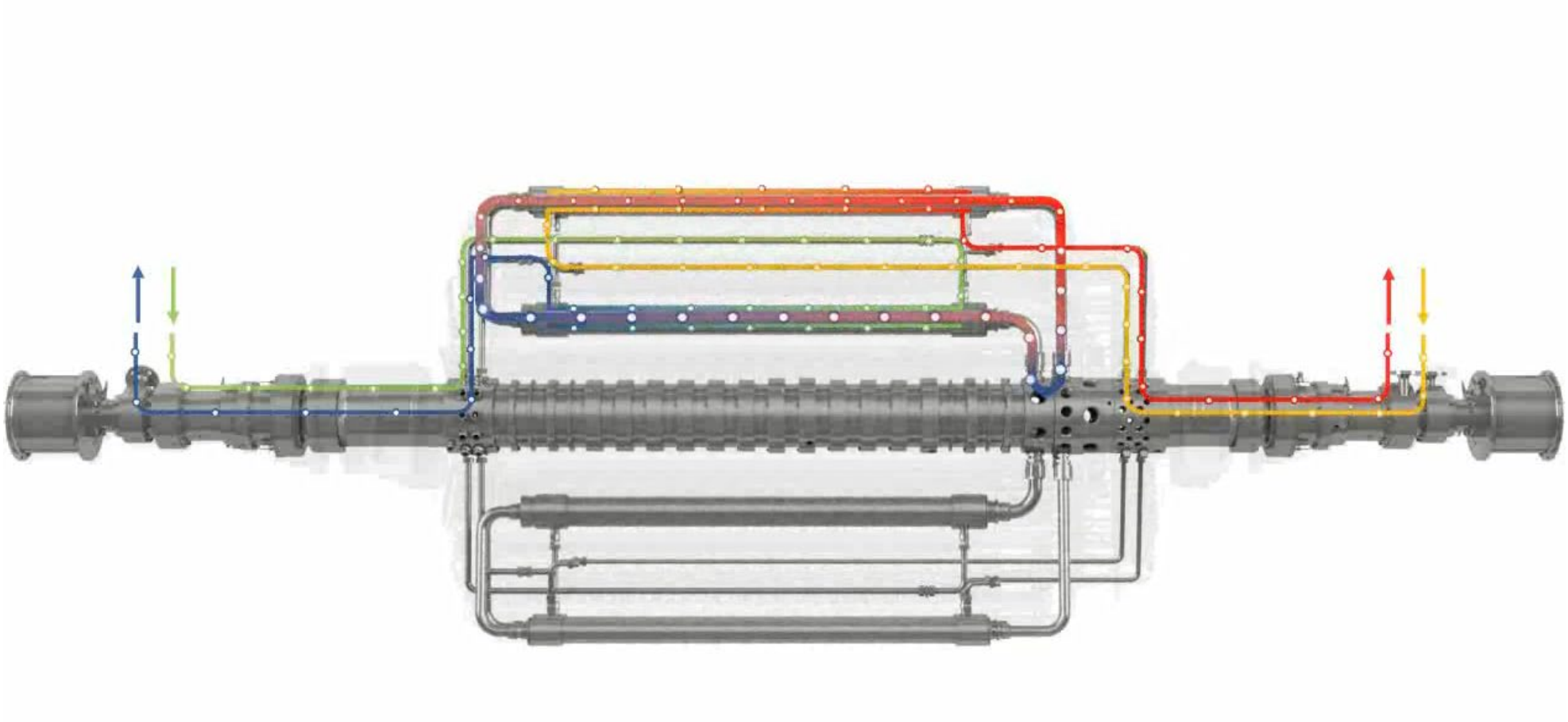
sink
70°C to
95°C

source
65° to
43°C

2-Phase Carnot process

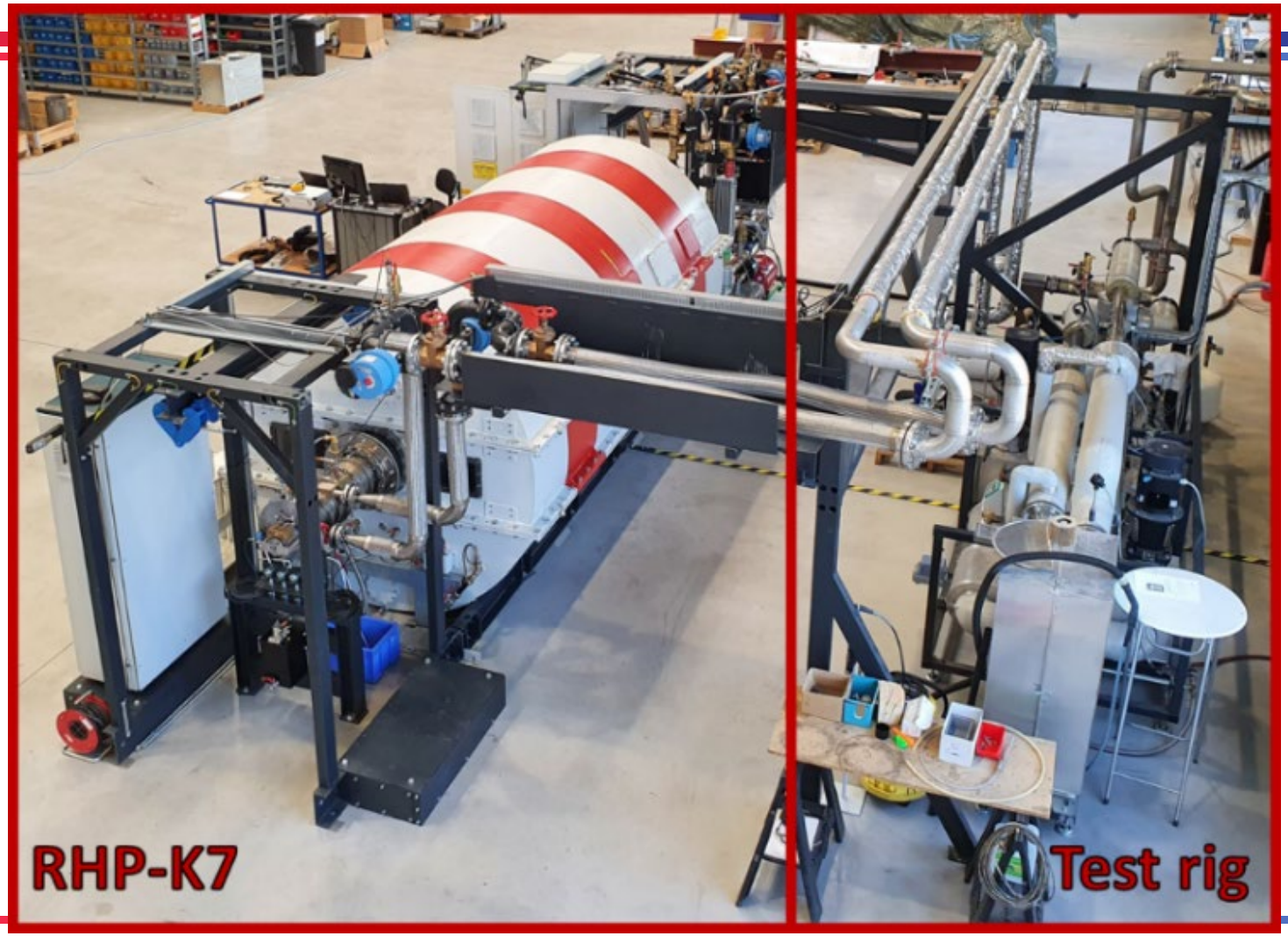


FUNCTION

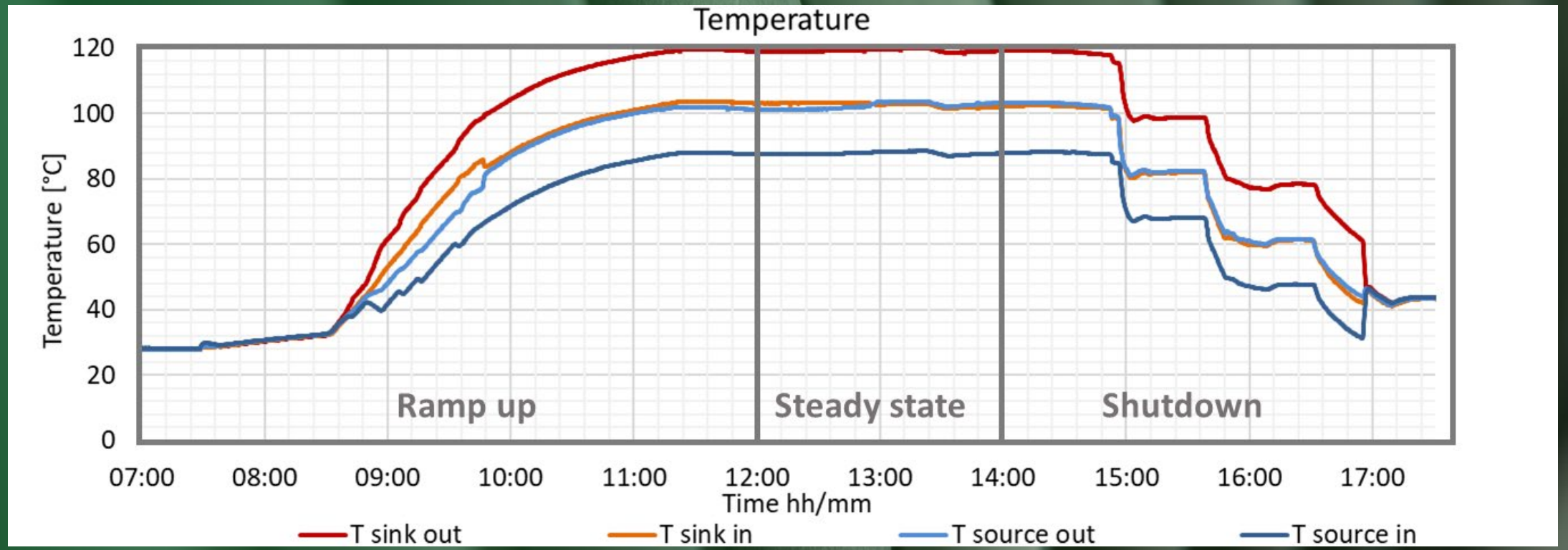


Rotation Heat Pump and Test rig

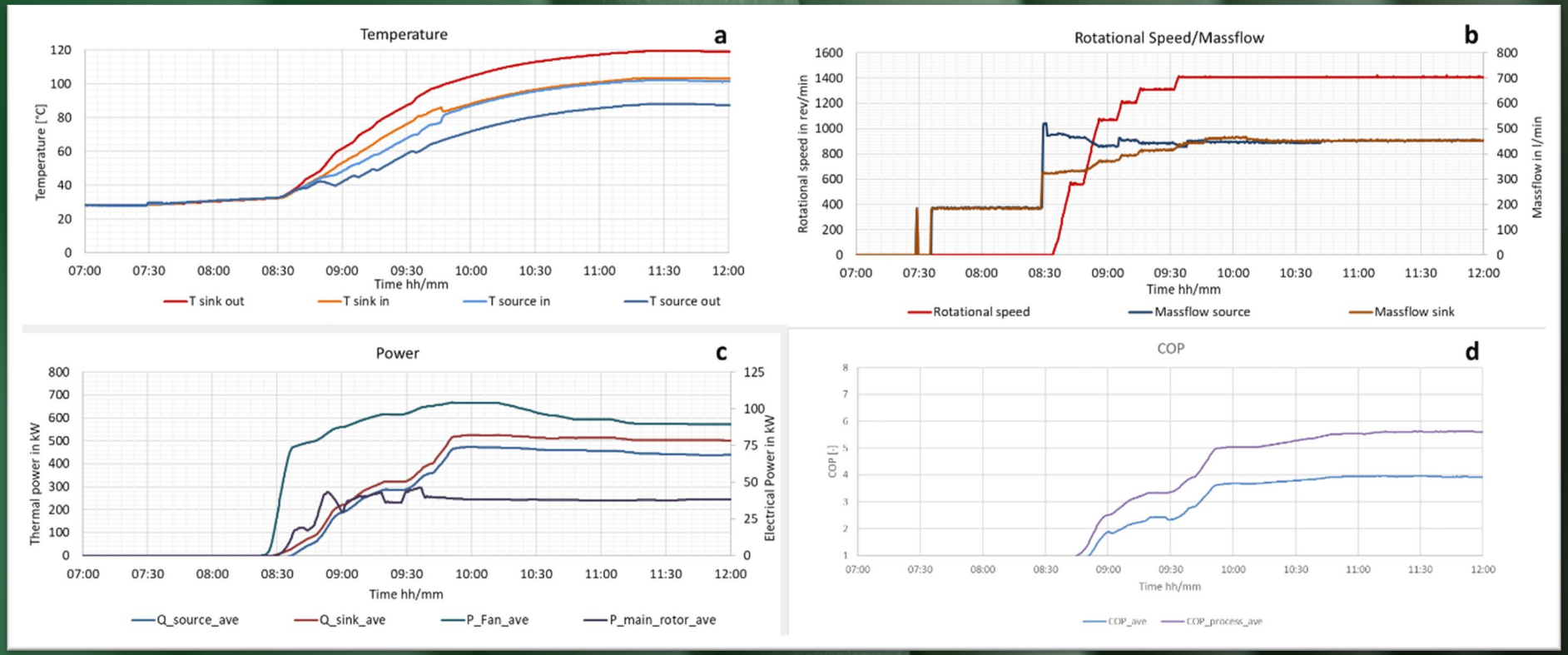
Test rig installation allows **flexible** varying of **temperature levels** and **thermal power** in a broad range



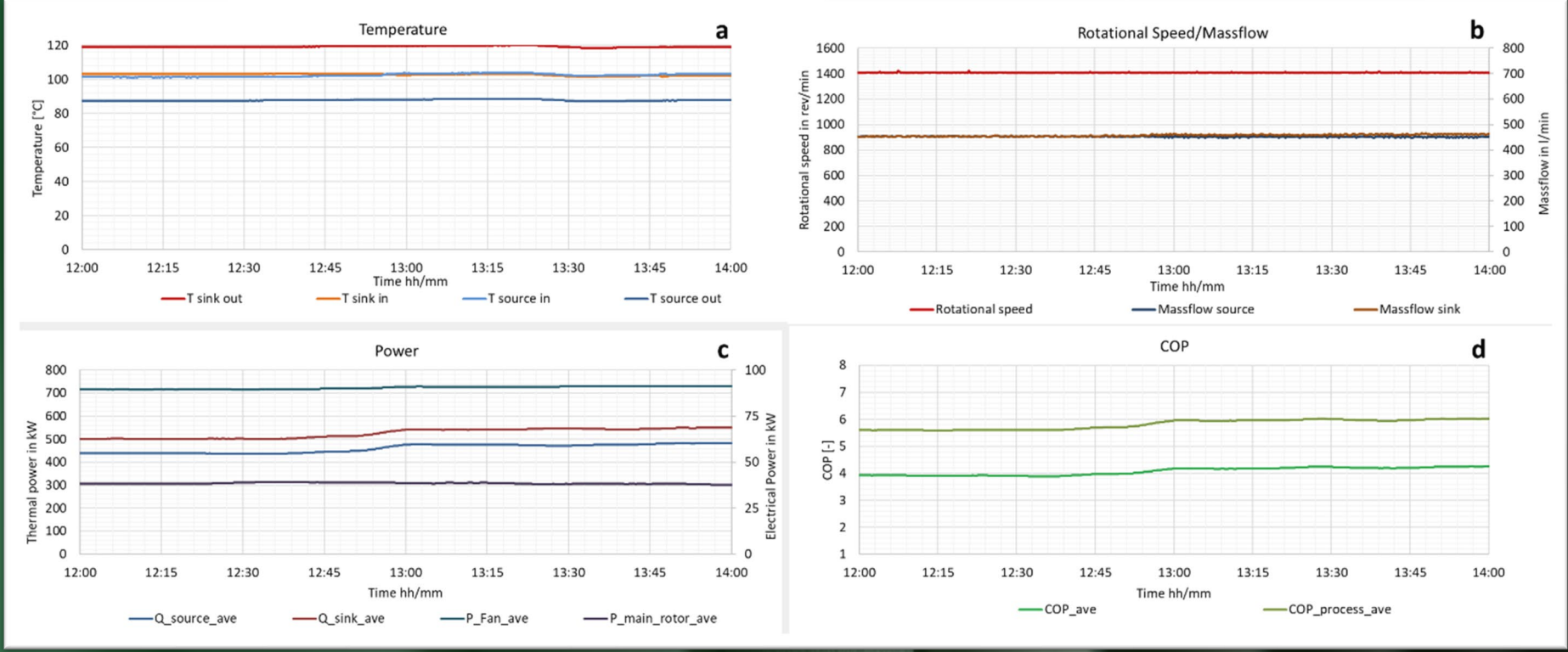
Test results - overview



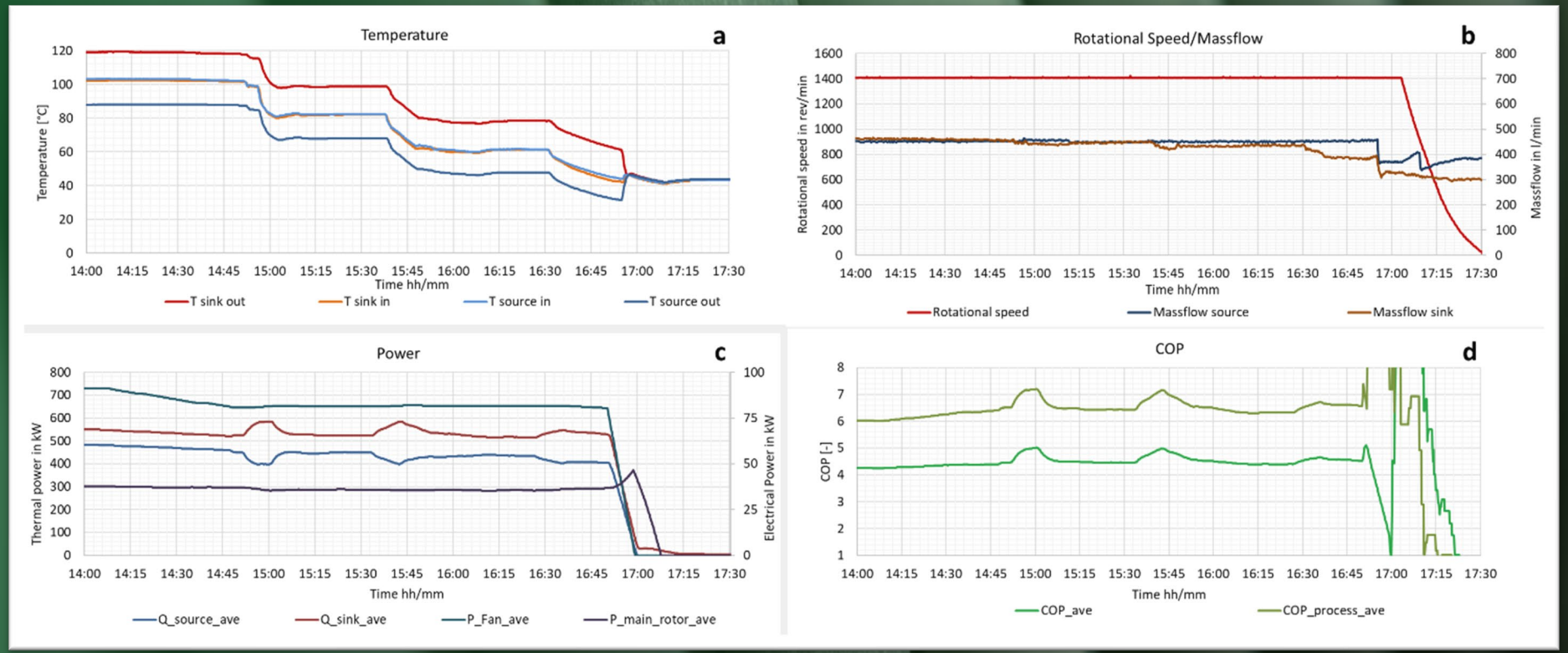
Test results – ramp up



Test results – steady state

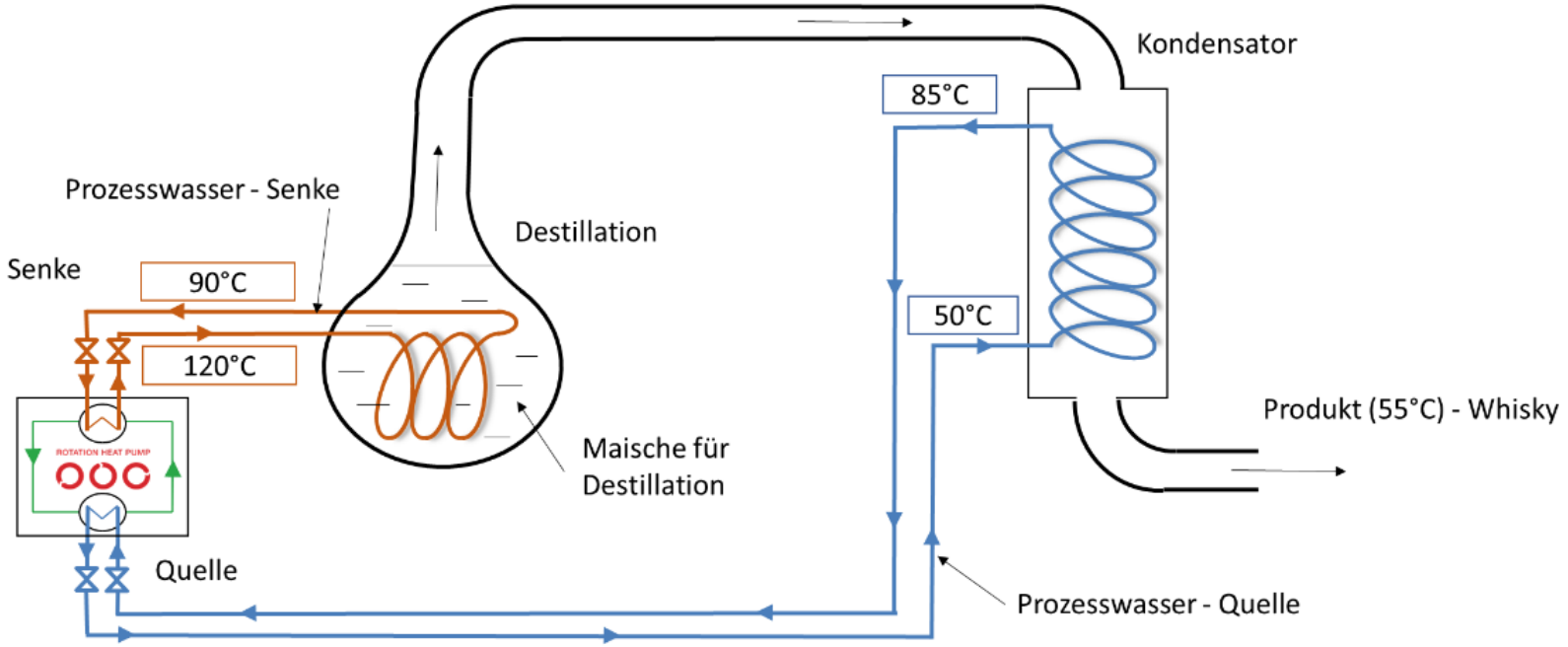


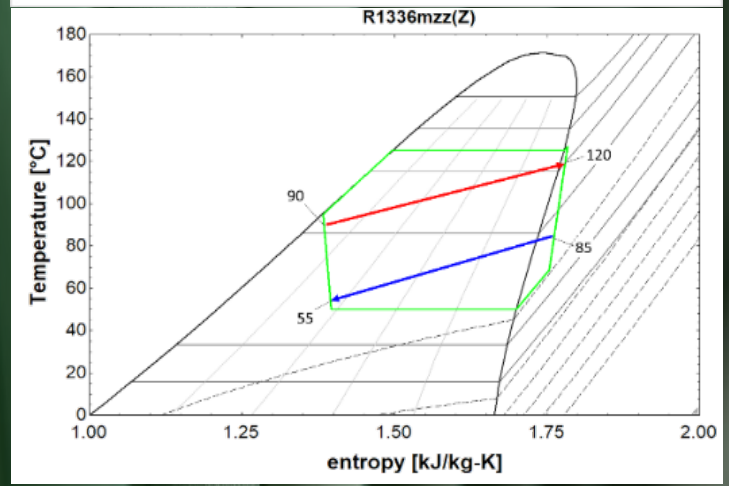
Test results – shut down



Application case & comparison

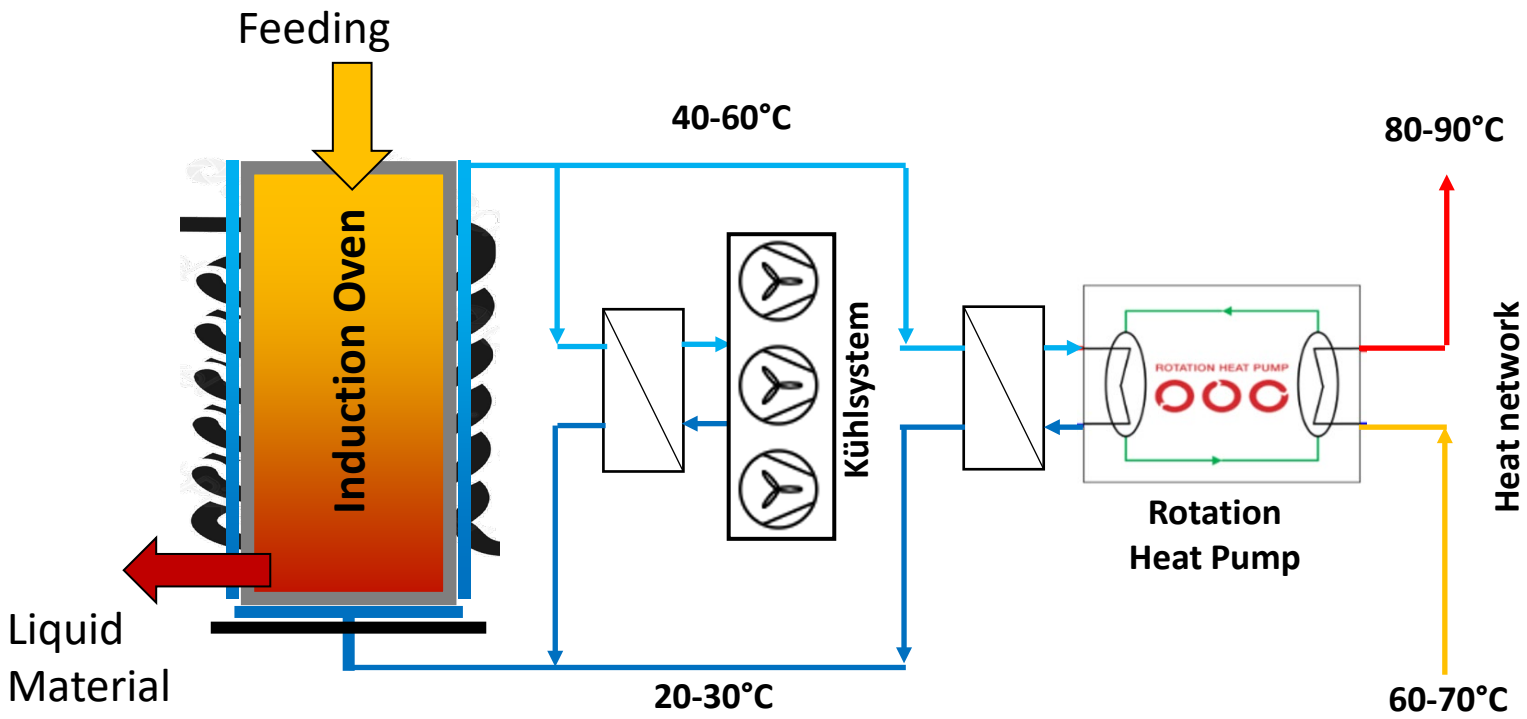
Distillation process at high temperatures and high spread at source and sink





Application case

Cooling & Heating Metal Industry



Benefits:

- High spread
- Cooling &
- Heating simultaneously

Source:

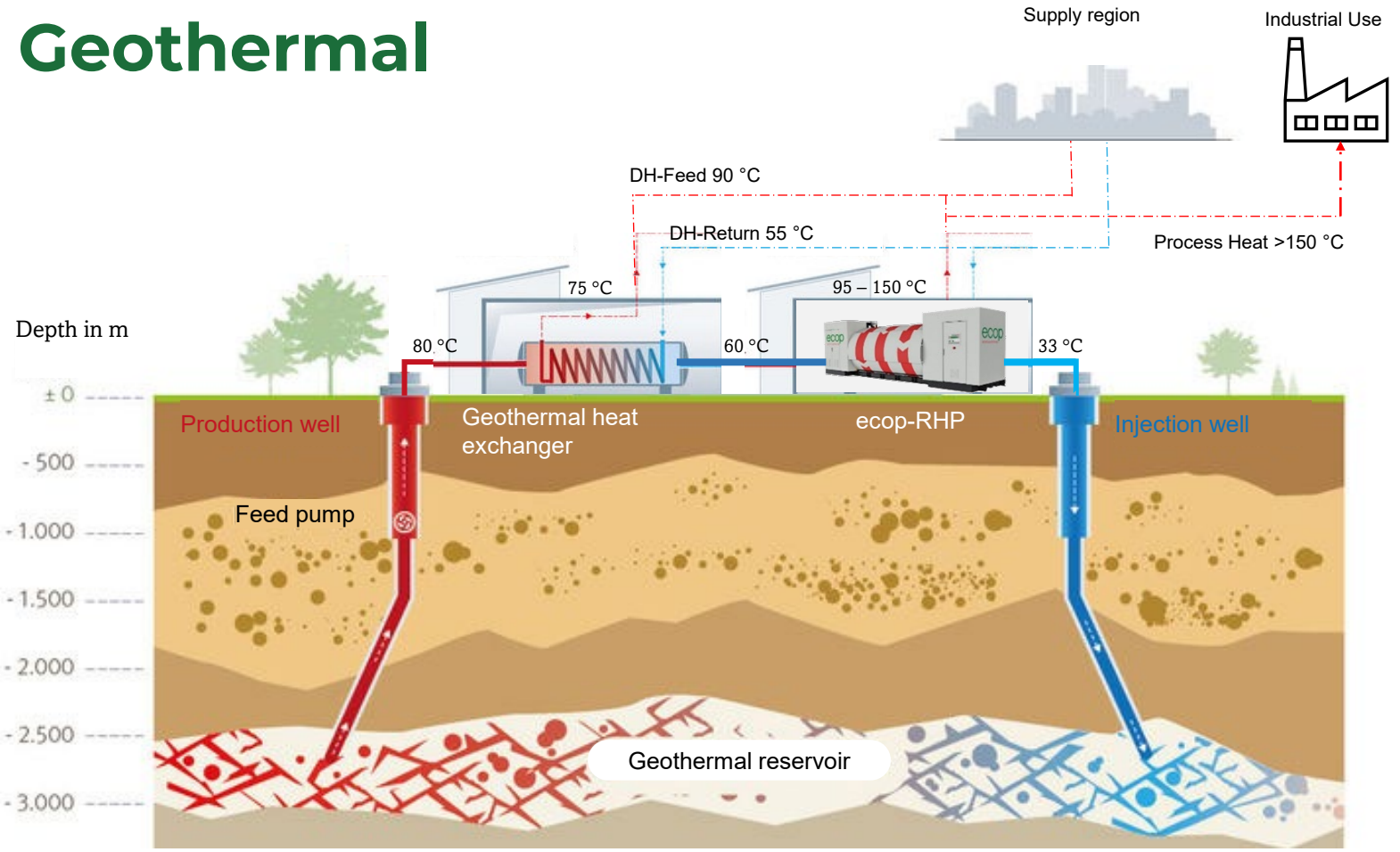
- Cooling water

Implementation:

- Melting furnace cooling
- And other metallurgical processes

Application case

Geothermal



Benefits:

- Flexible temperature level
- Geothermal Extension
- High temperature application

Source:

- Geothermal

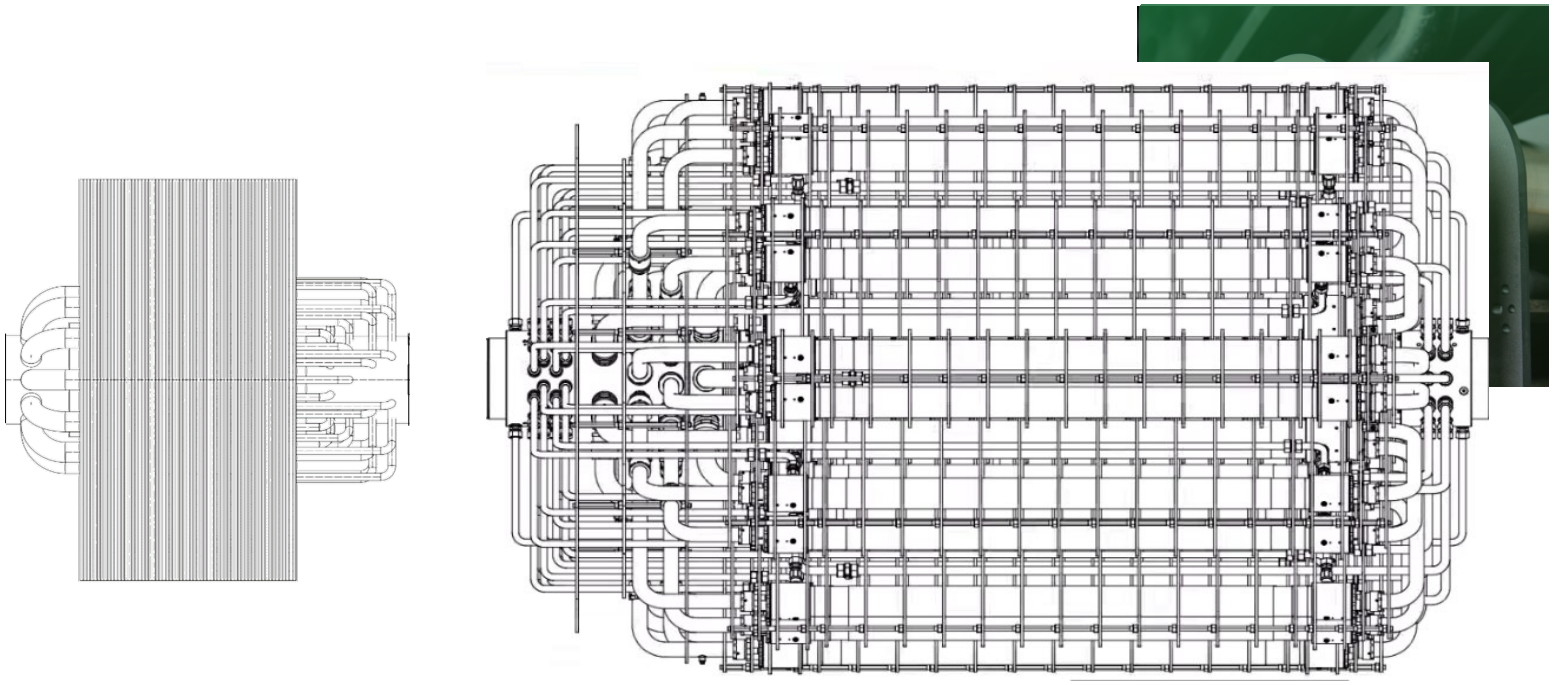
Implementation:

- Industrial processwater
- District/ local heating networks

New Rotor-Design

- same thermal power
- smaller size
- simplified design
- higher lift
- higher temperatures

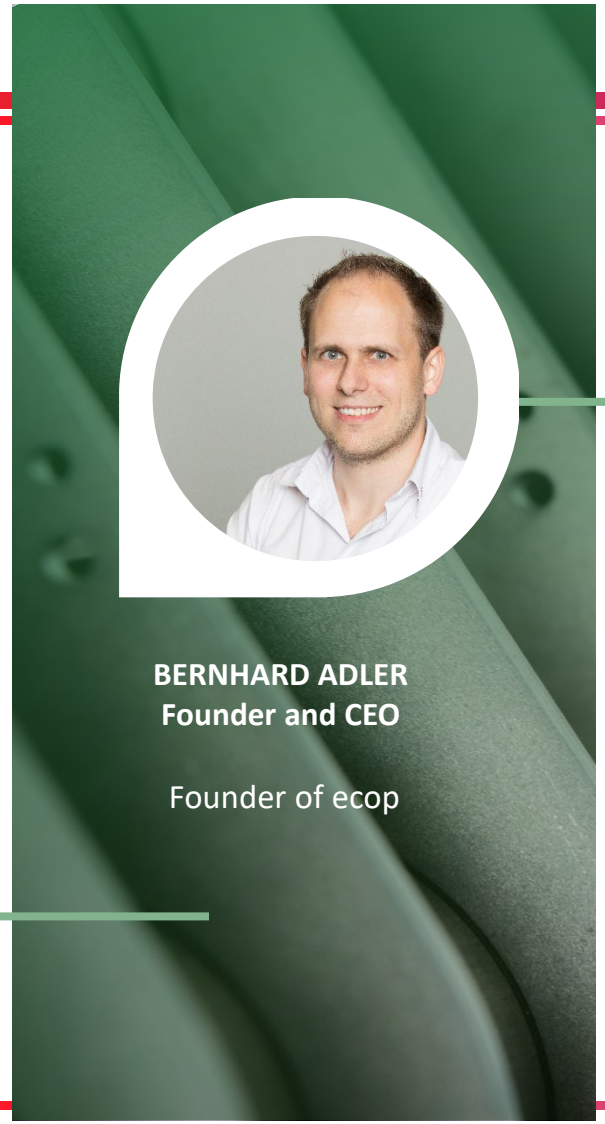
→ Micro channel diffusion bonded heat exchanger



Comparison of rotor designs (same scale for both); Left: Integrated-Rotor design based on diffusion bonding, Right: assembled rotor-design

CONTACT

WORKING ON THE GREEN TRANSFORMATION



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