ROTATION HEAT PUMP

ecop

Agenda

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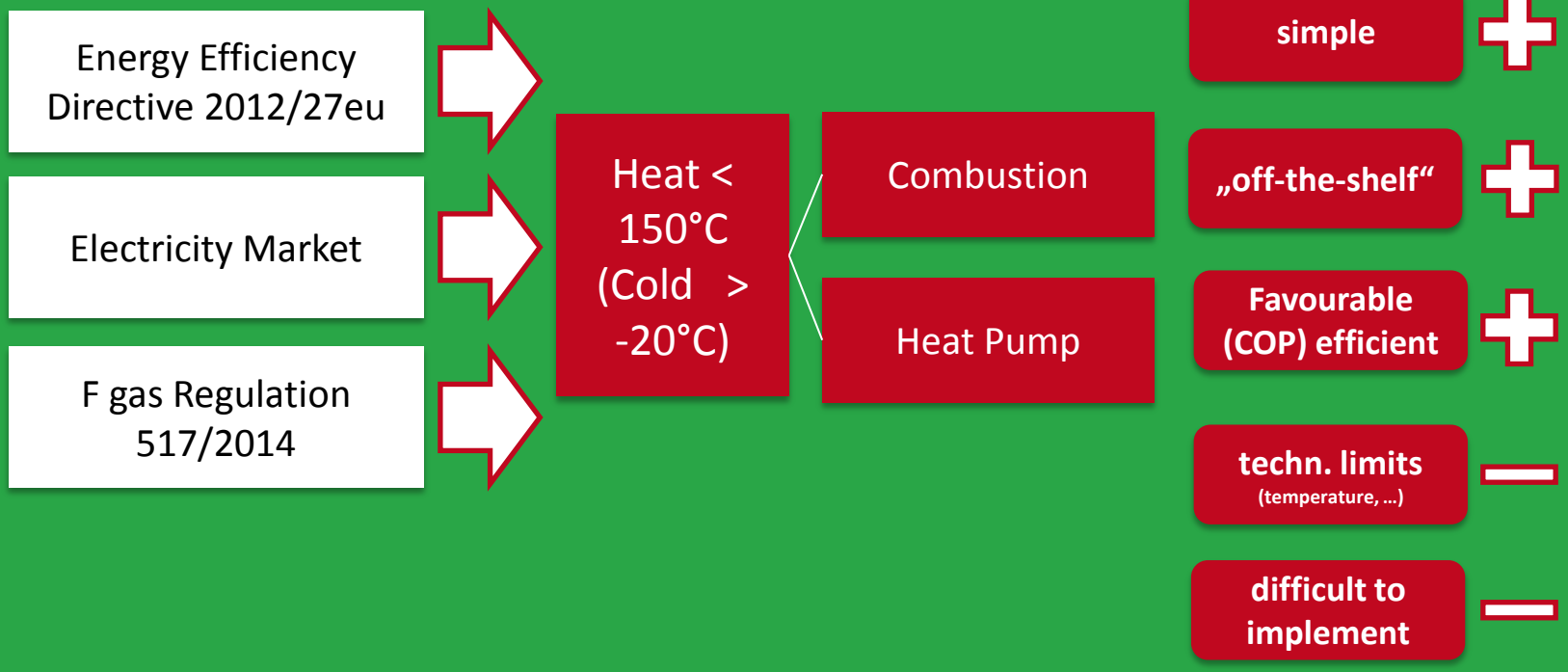
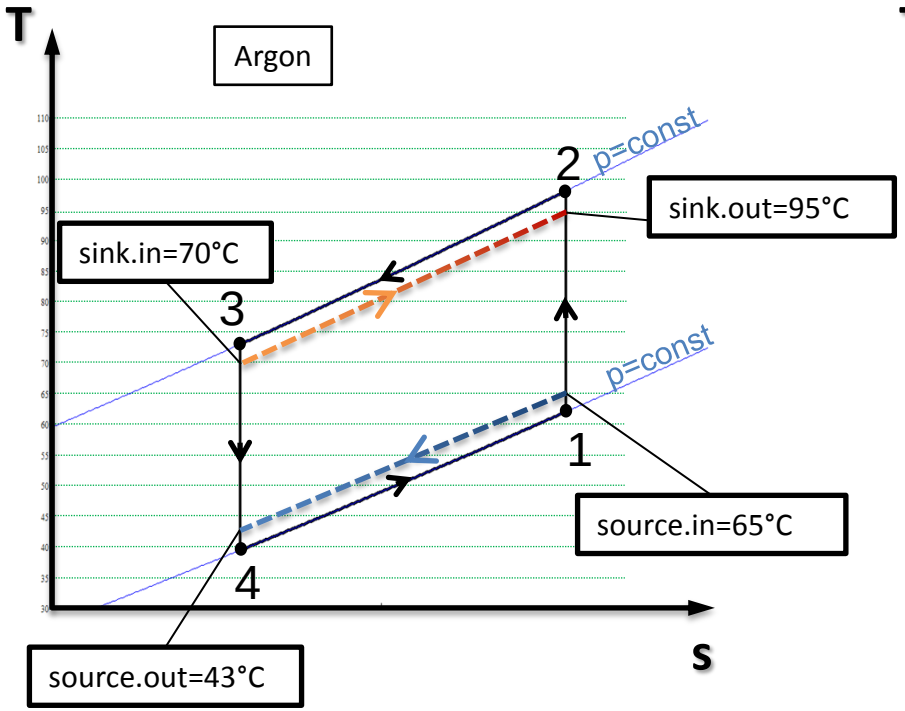
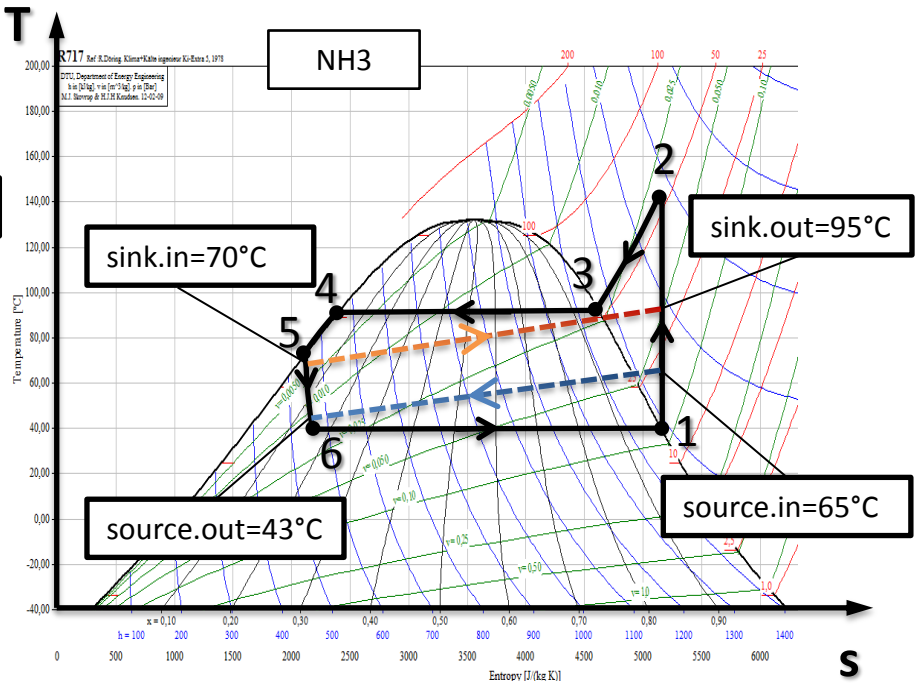
Introduction



1. Process Comparision





Schematic compare of a 1- und 2- phase process

$$COP = \frac{h2 - h3}{(h2 - h1) - (h3 - h4)} = 10.3$$

Example

- sink 70/95
- source 65/43

$$COP = \frac{h2 - h5}{(h2 - h1)} = 6.05$$

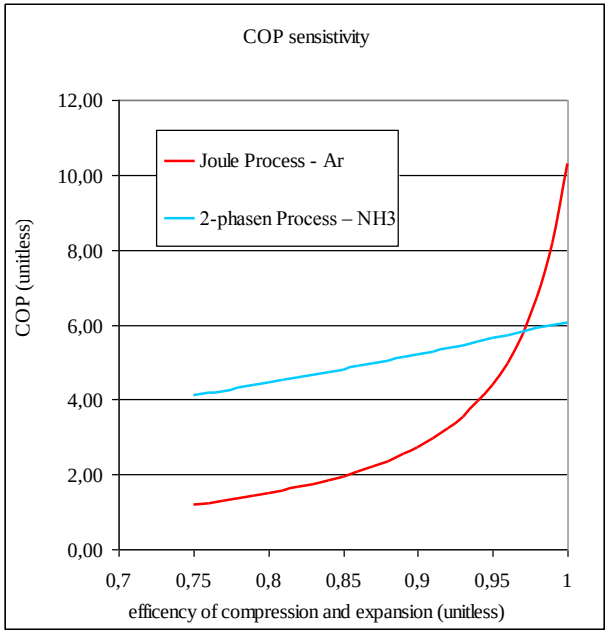
1. Process Comparision

COP potential of a Joule process compared with a 2 phase process with NH3

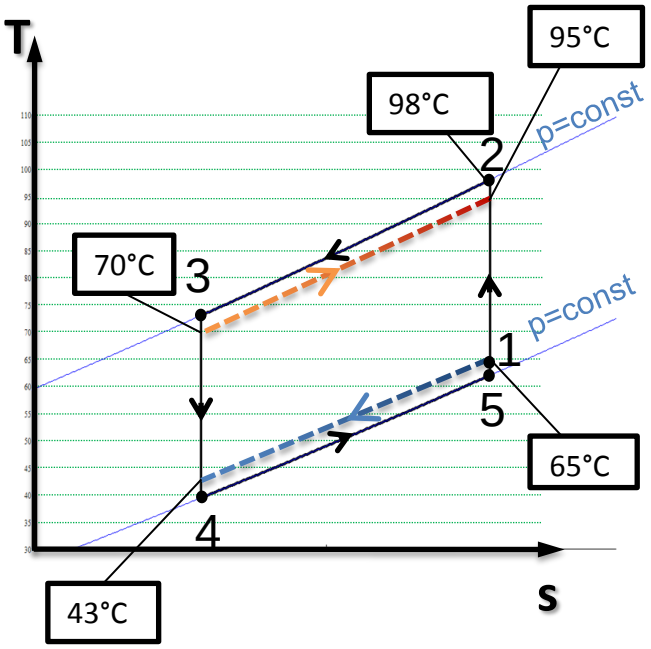
Compression with 100% efficiency @1MW heat emission	Joule process – Ar	2-phase process NH3
P.Compression in kW	1319	165
P.Expansion in kW	1222	-
Power Deviation	97	165
COP	10.3	6.1

Compression with 80% efficiency @1MW heat emission	Joule process – Ar	2-phase process NH3
P.Compression in kW	1649	207
P.Expansion in kW	1222	-
Power Deviation	427	207
COP	2.3	4.8

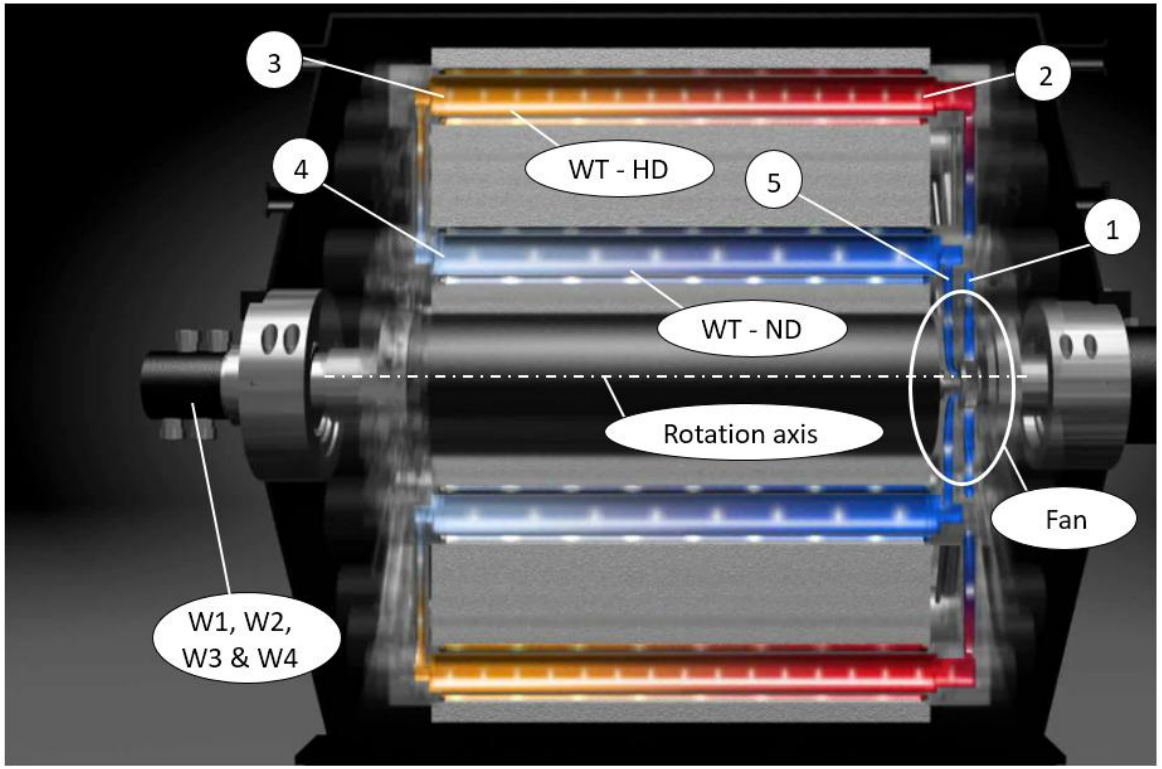
Influence of lower compressor and expansion efficiency to the COP



2. Technology



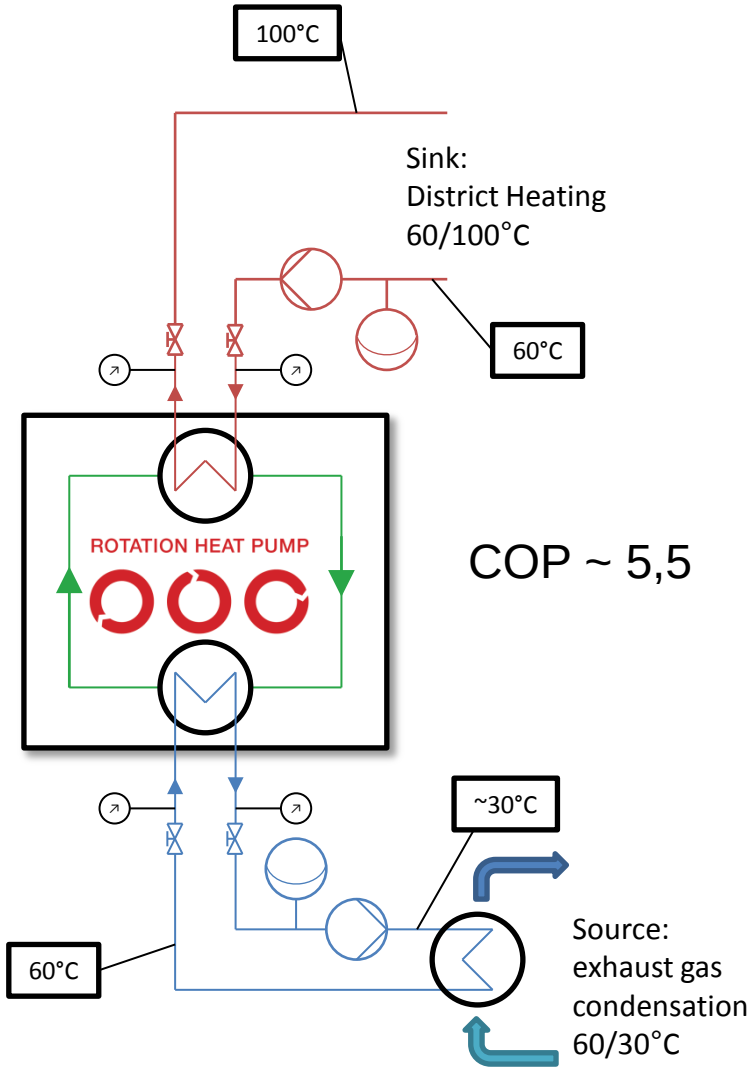
1 – 2 isentropic compression
2 – 3 isobaric heat dissipation (WT-HD)
3 – 4 isentropic relaxation
4 – 5 isobaric heat supply (WT-ND)
5 – 1 isentropic compression (fan)



Joule process within the rotation heat pump

Key factor : heat transfer by non continuous temperature

3. Product



ROTATION HEAT PUMP K7

- Nominal thermal output 700kW (400-800 kW)
- Max. DT source in to sink out 40°C
- Temperature range -20°C to 150°C
- Temperature spread up to 70°C
- Nominal heating water flow rate 21 m³/h / 0,5bar pressure drop

4. ECOP RHP K7

Technical Data

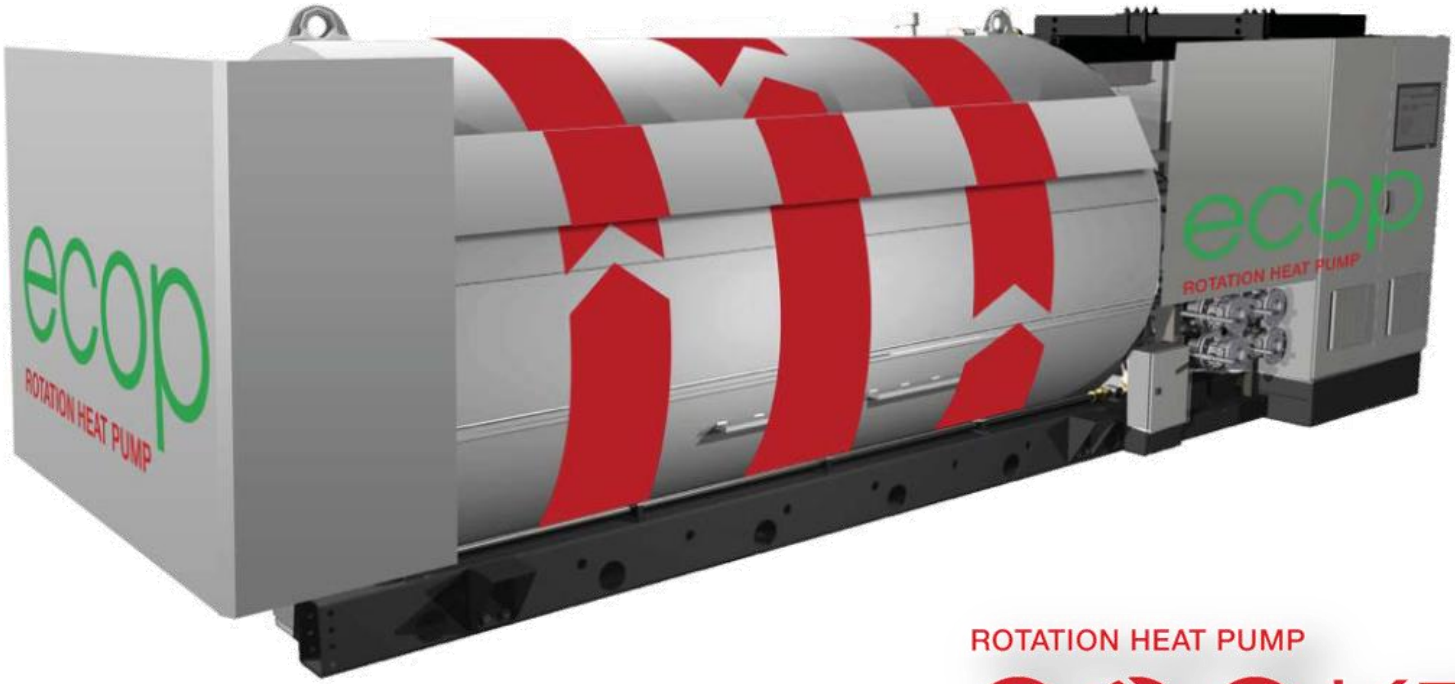
Technical data[1]	
Weight:	15t
Dimensions[1 2] (W x H x L):	2400 x 2500 x 7000mm
Connection heat source:	DN80 (3'')
Connection heat sink:	DN80 (3'')
Maximum flow temperature on heat sink:	150°C[6]
Maximum flow temperature on heat source:	110°C[6]
Maximum temperature spread between sink out and source in:	40 °C
Minimum flow temperature:	-20°C
Designed heat transfer medium:	H_2O
Heat output:	400-700 kW
Refrigerant	ECOP Fluid 1 (inert)
Nominal heating water flow rate[3] / pressure drop[4]:	21m³/h / 0,5bar
Fuse protection:	500A gL/gG
Main supply:	400V-3-N ~50Hz
Nominal power consumption:	70 - 280kW

5. USP

- High Temperatures (up to +150°C)
- Flexible temperature range with one machine (-20°C bis+150°C) only through control unit
- Summer- und Winter operation with one machine possible
- High efficiency by high temperature spreads (20 to 70°C)
- non-polluting (GWP = 0), not flammable and non toxic working gas (refrigerant)
- Low maintenance cost through rotation principle (no piston)
- High efficiency
- Higher COP
- High profitability (less additional expenses)

6. Outlook

- ECOP RHP M2 in development (2 MW thermal output)
- Ramp up of production plant in progress (capacity of 50 units per anno)



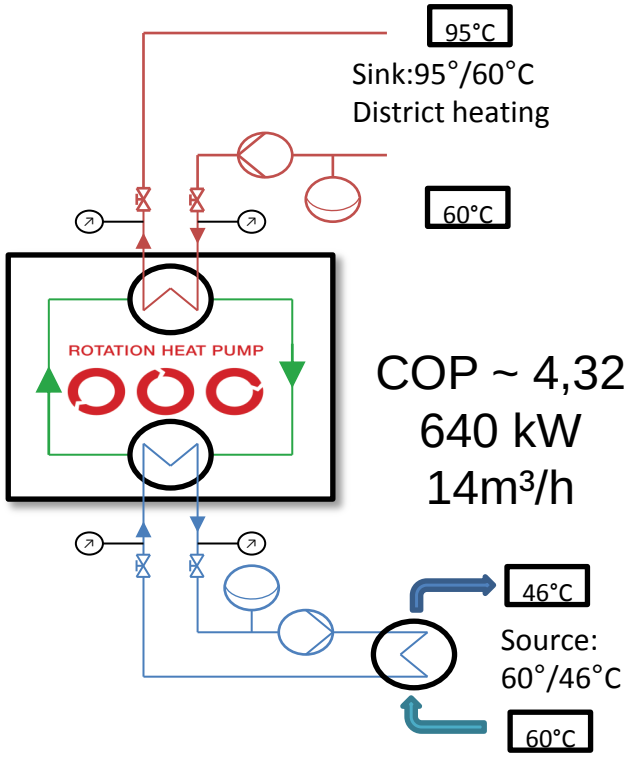
ROTATION HEAT PUMP
K7

7. Pilot Installation

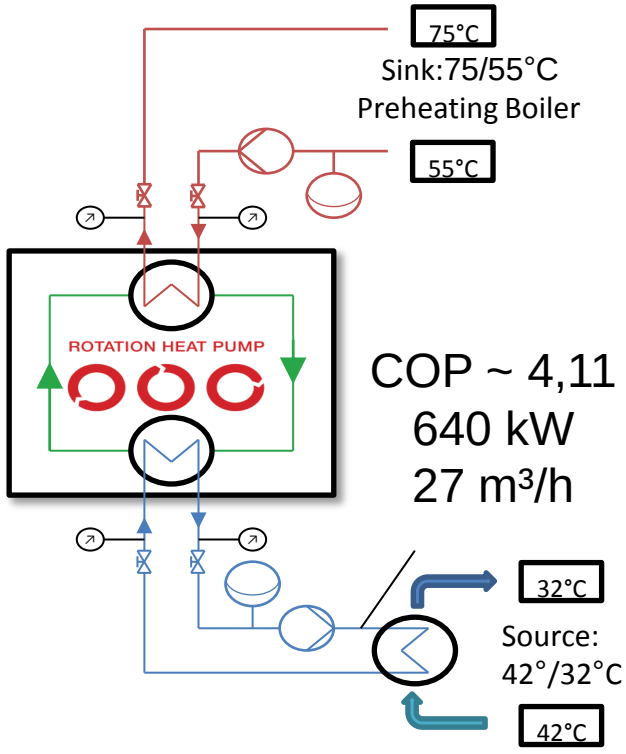
7. Pilot Installation

Different operations in Summer and Winter
Thermal output ~ **640 kW** by **COP > 4,11**

Sommer



Winter



8. Summary

ecop rotation heat pump provides solution for industrial application:

- High Temperatures (up to +150°C)
- Sensible heat transfers at source and sink
- High efficiency by high temperature spreads (20 to 70°C)
- non-polluting (GWP = 0), not flammable and non toxic working gas (refrigerant)
- Low maintenance cost through rotation principle (no piston)
- Higher COP
- High profitability (less additional expenses)

Thank you for your attention !

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