Hall 4A

CHILLVENTA

Chillventa Specialist Forums 2022
Chillventa Fachforen 2022

CONNECTING EXPERTS.

THERMODRAFT

SUSTAINABLE BOUNDLESS INNOVATION

Development of High-Temperature Heat Pumps for heat upgrade on industrial and marine applications

Presentation by:

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Managing Director

Presentation Outline

1. Company profile
2. Thermodraft’s portfolio
3. High Temperature Heat Pump/ Main benefits/ How a HTHP works
4. Available Thermodraft’s models
5. PBP analysis
6. Case study in a sardines’ factory for replacement of oil-boiler
7. Case study in a pulp & paper industry

About Us

Spin-off company

Piraeus, Greece

www.thermodraft.gr

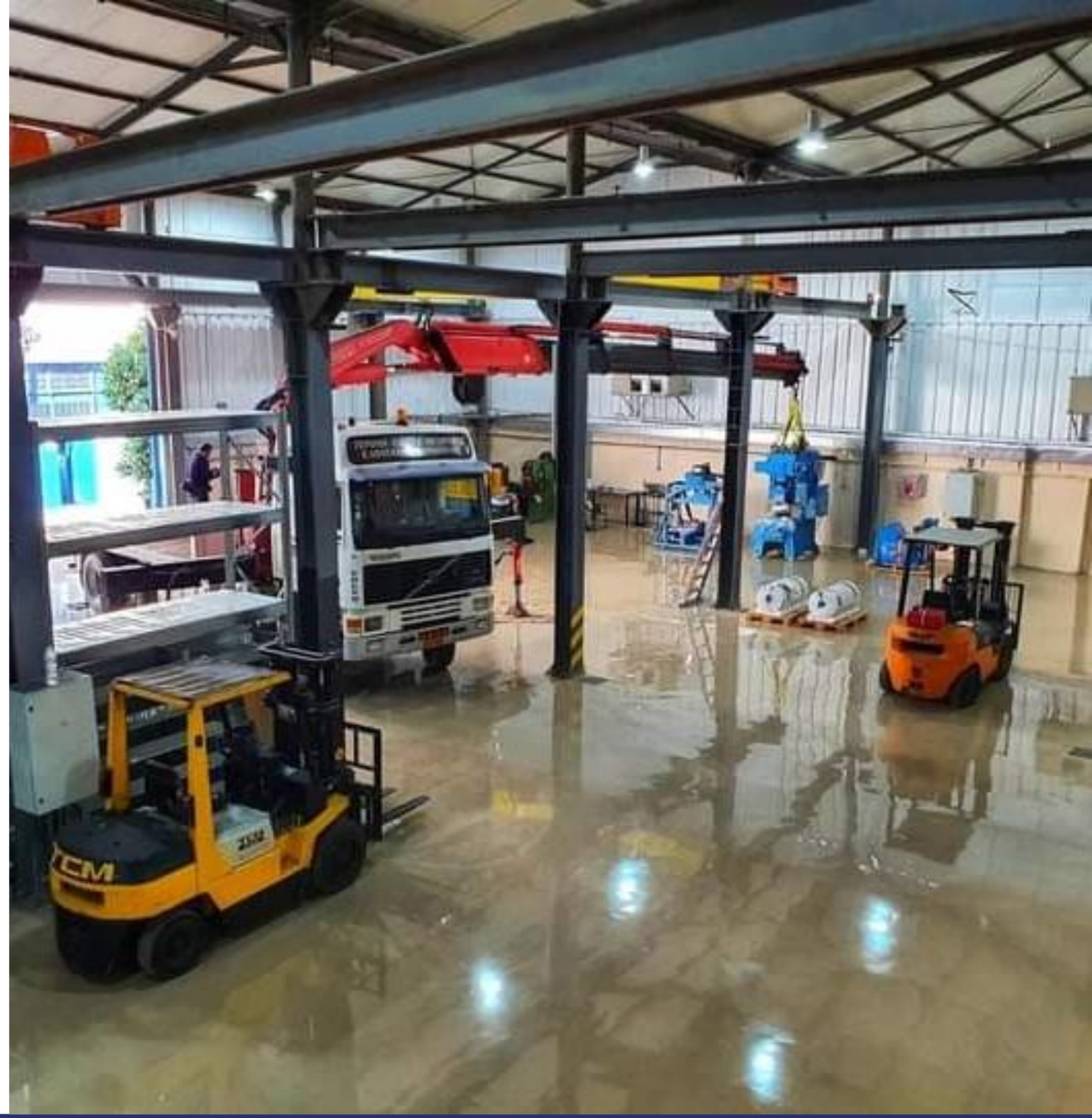
Our Vision: To produce pioneering & reliable solutions toward decarbonization and energy efficiency for the industrial and marine sectors.

We offer innovative and complete solutions in the sectors of:

POWER GENERATION ENGINES

HIGH TEMPERATURE HEAT PUMPS

INDUSTRIAL HEAT EXCHANGING,
RECOVERY AND UPGRADING SYSTEMS

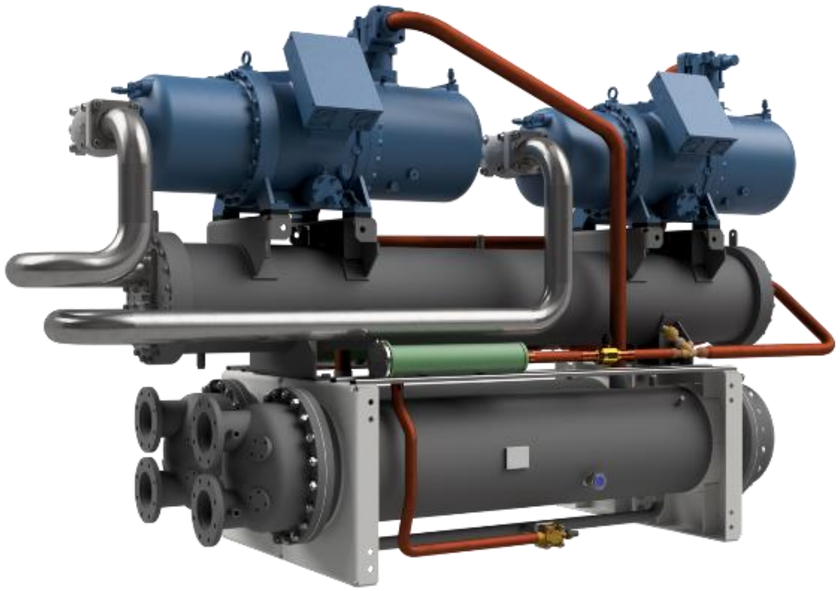


Air-cooled ORC

Heat to electricity applications with Organic Rankine Cycle (ORC) Air-Cooled Units

Water-cooled ORC

Heat to electricity applications with Organic Rankine Cycle (ORC) Water-Cooled Units



Water-cooled HTHP

High Temperature Heat Pump applications by exploiting low temperature waste heat

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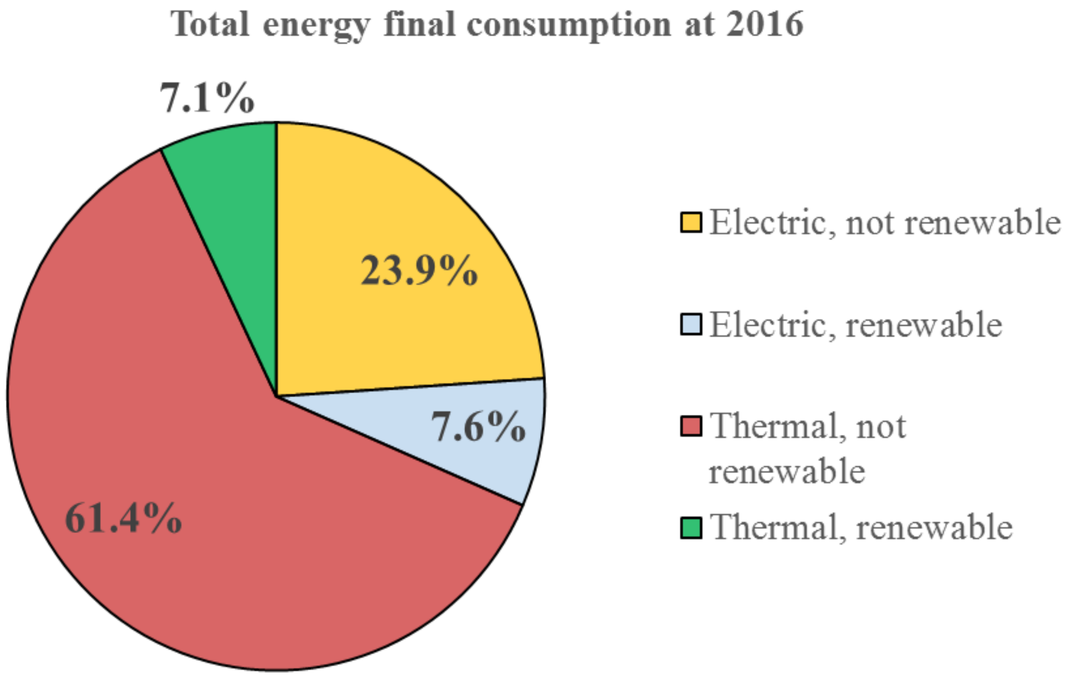
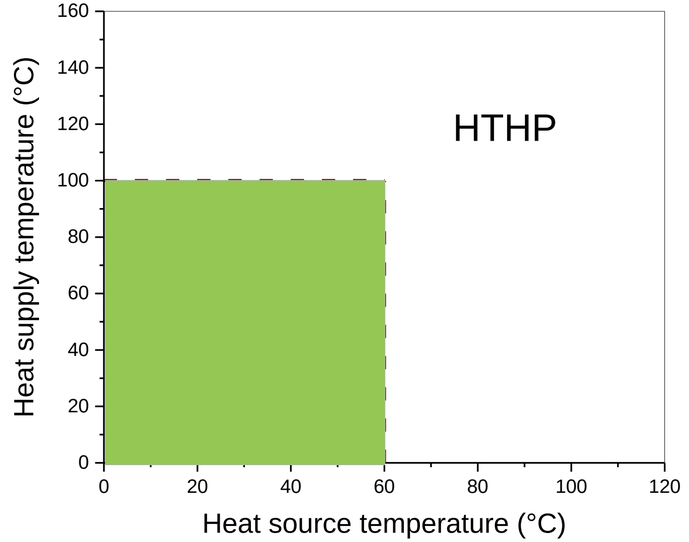
Main challenges of energy transition



- Waste heat rejected: ~300 TWh/year in the EU (2019)
- Need for decarbonization in industry and marine
- Cleaner, reliable & sustainable solutions for heating processes
- Lower operational cost for industrial thermal processes

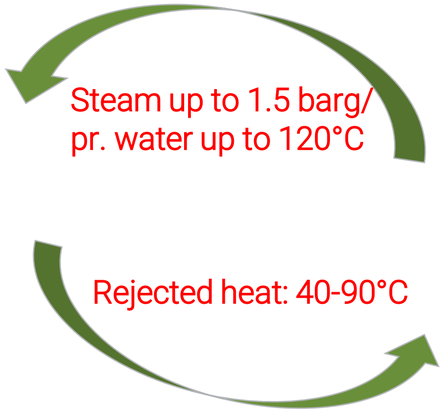
High temperature Heat Pumps: A modern way to save energy

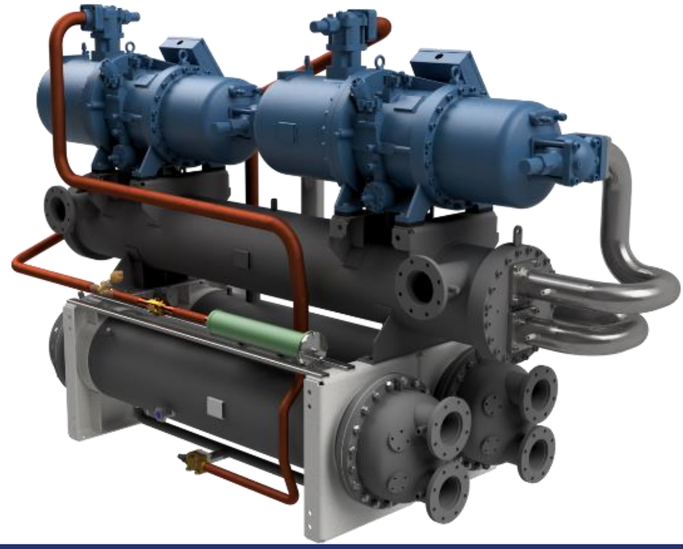
Heat recovery & upgrade, replacing the conventional fuels utilization



- Large amounts of process heat are rejected
- Recovery of low-temperature range: 40 – 90 °C
- Upgrade up to steam or pressurized water
- Covering heating needs or thermal processes
- Thermodrafts heating capacity: 100 kWth – 1.5 MWth

Possible applications





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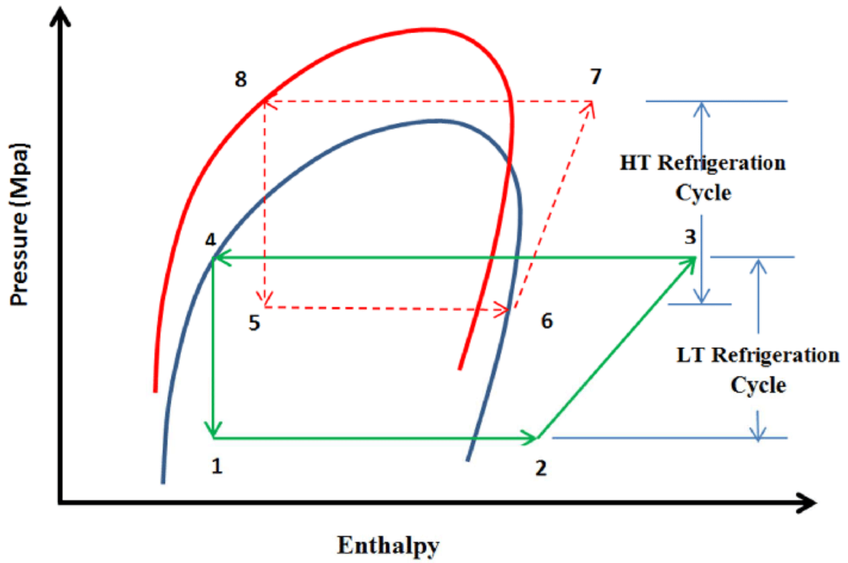
Main benefits of HTHP

- Reduction of fuel consumption
- Reduction of operating cost
- Reduced PBP of investment
- Possible waste heat usage
- No further on-site emissions
- Compliance with the environmental regulations
- RES & cutting-edge technology
- High-operational security
- Limited maintenance

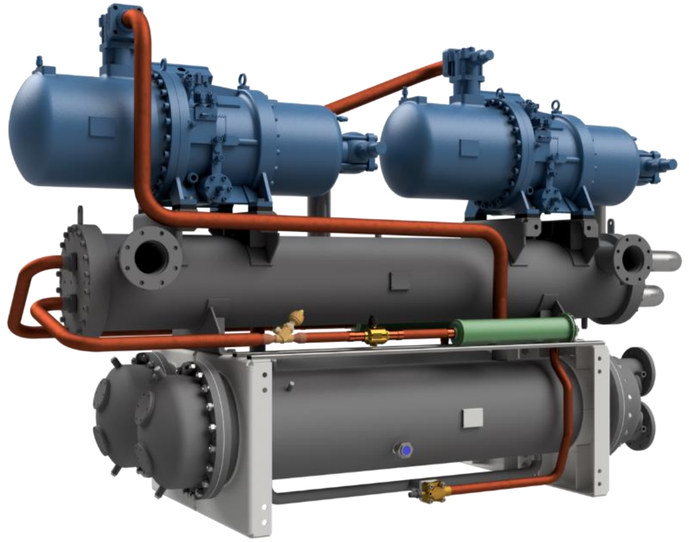
How does a HTHP work?

- Heat rejected from a process is used to evaporate a refrigerant.
- The refrigerant is compressed and then is cooled, releasing usable heat at 100-120°C, generating steam or pressurized hot water.
- Refrigerant suitable for the temperature range is selected.



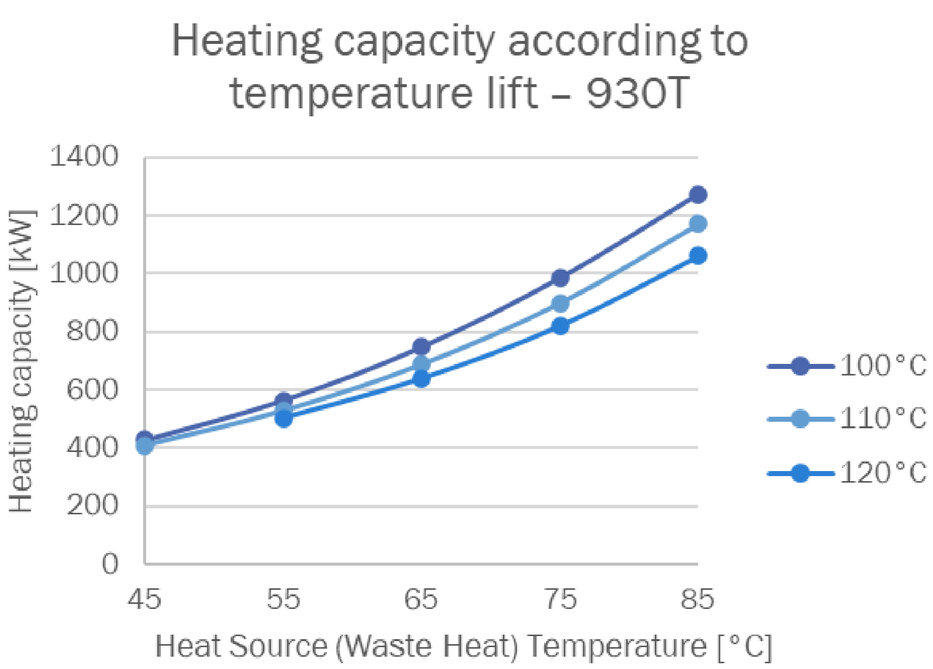
Main Components

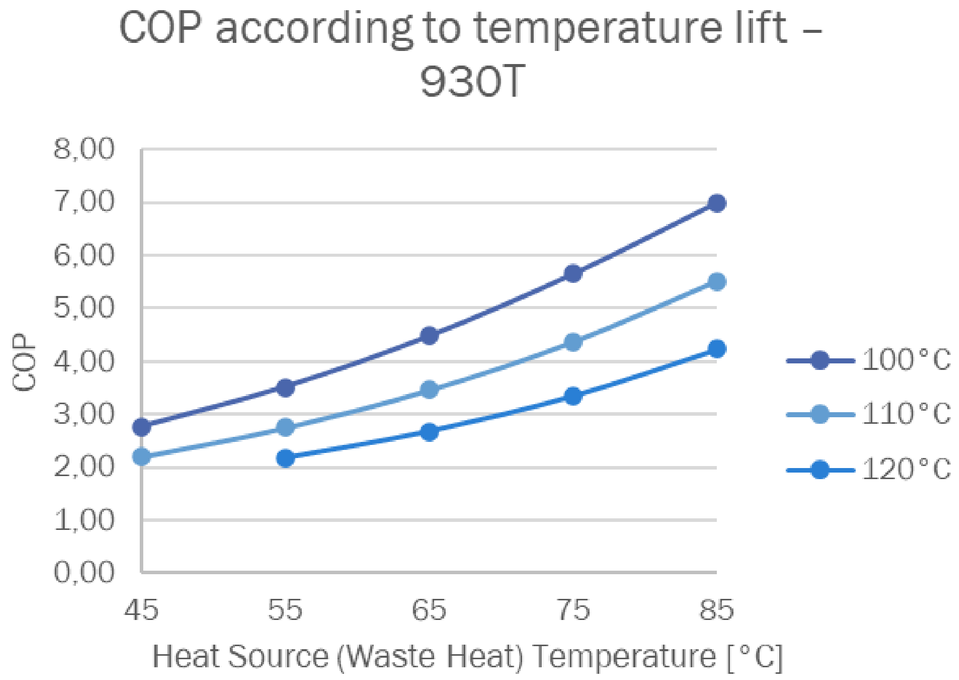
- High-Temperature **Screw Compressor**
- **Condenser**: Shell and Tube or PHE
- **Evaporator**: Shell and Tube or PHE
- Oil Separator – Oil cooler
- Specialized materials of heat exchangers for special applications
- 1 or 2 circuits depending on the application
- **Can be combined with an MVR for higher temperatures/pressures of steam.**



Available Models

High Temperature Heat Pump	1 compressor models								2 compressors models							
	200T	300T	410T	550T	620T	710T	830T	930T	2.200T	2.300T	2.410T	2.550T	2.620T	2.710T	2.830T	2.930T
Heating Capacity	114	177	249	335	379	440	521	582	227	353	498	671	758	879	1042	1165
Power Consumption	43	67	94	124	140	163	192	214	86	133	189	248	280	325	384	429
COP at nominal conditions	2,6	2,7	2,6	2,7	2,7	2,7	2,7	2,7	2,6	2,7	2,6	2,7	2,7	2,7	2,7	2,7
Maximum continuous current (A)	94	146	207	273	308	357	422	471	188	292	414	546	616	714	844	942
Subcooler load	8	13	18	25	28	33	39	43	17	26	36	50	56	65	77	87
Hot water flow m³/h	10	15	21	29	33	38	45	50	20	30	43	58	65	76	90	100
Condenser hot water connections	DN40	DN50	DN65	DN80	DN80	DN100	DN100	DN100	DN65	DN80	DN100	DN100	DN125	DN125	DN125	DN150
Cooling water flow m³/h	6	9	13	18	21	24	28	32	12	19	27	36	41	48	57	63
Evaporator cooling water connections	DN32	DN40	DN50	DN65	DN65	DN65	DN80	DN80	DN50	DN65	DN80	DN80	DN100	DN100	DN100	DN125
Refrigerant	R245fa / R1233zd(E)															
Power Supply	3 phase / 380V - 50Hz (60Hz data also available)															





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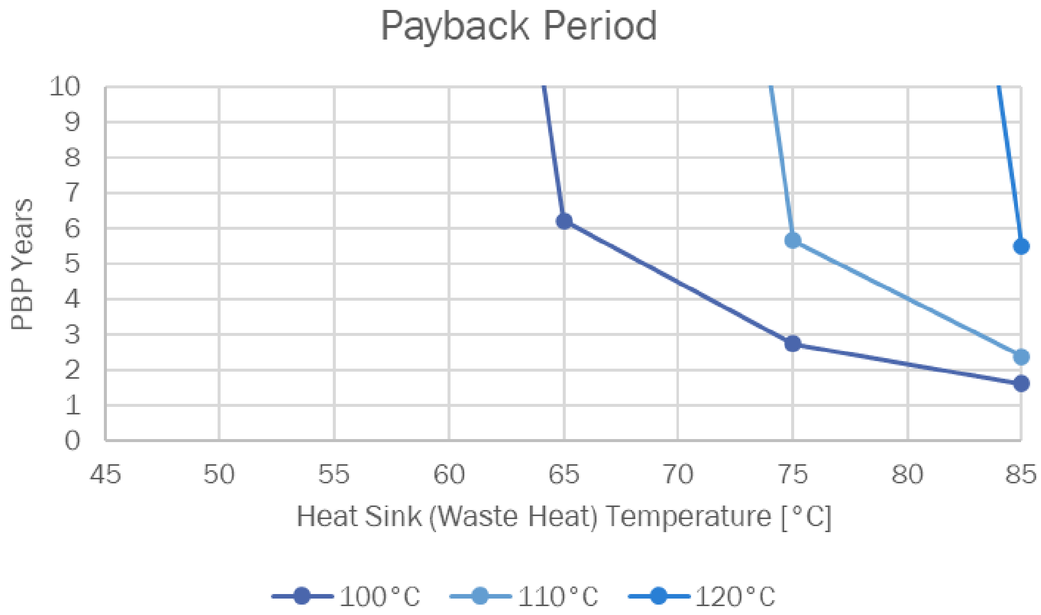
Payback period analysis – case 1

- PBP Scenarios to replace a natural gas boiler with HTHP for different temperature lifts
- Model 930T – 12 hours per day – 200 days per year
- Cost of electricity 0.25 €/kWh – Cost of natural gas 0.08 €/kWh (Euro area data: second half of 2021)



Attractive payback occurs only for low-temperature lifts!

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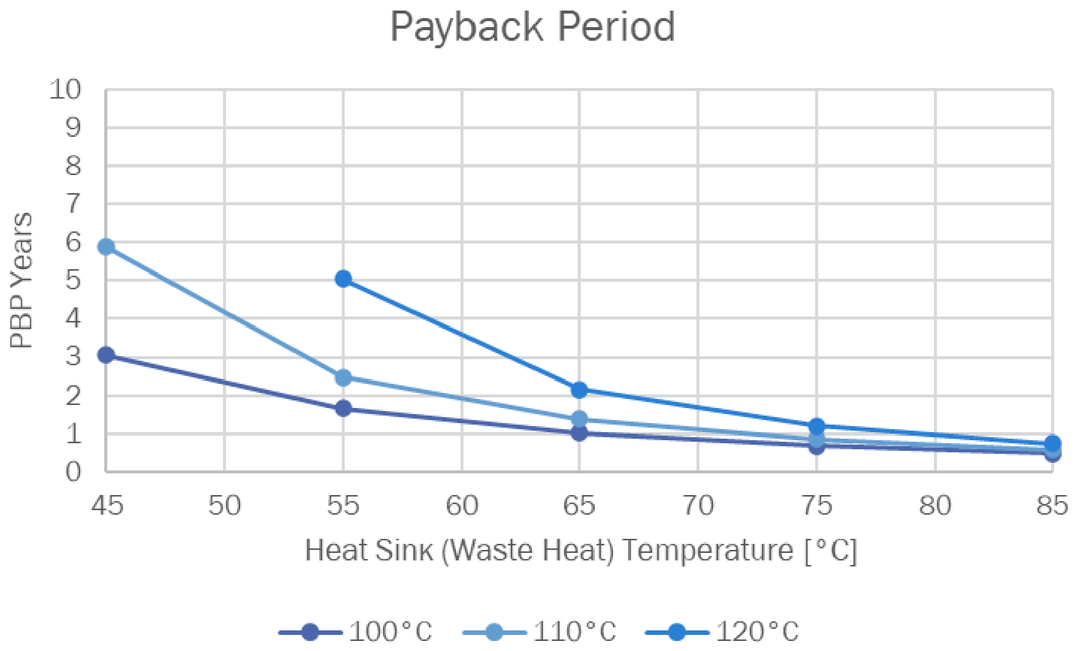
SUSTAINABLE BOUNDLESS INNOVATION

Payback period analysis – case 2

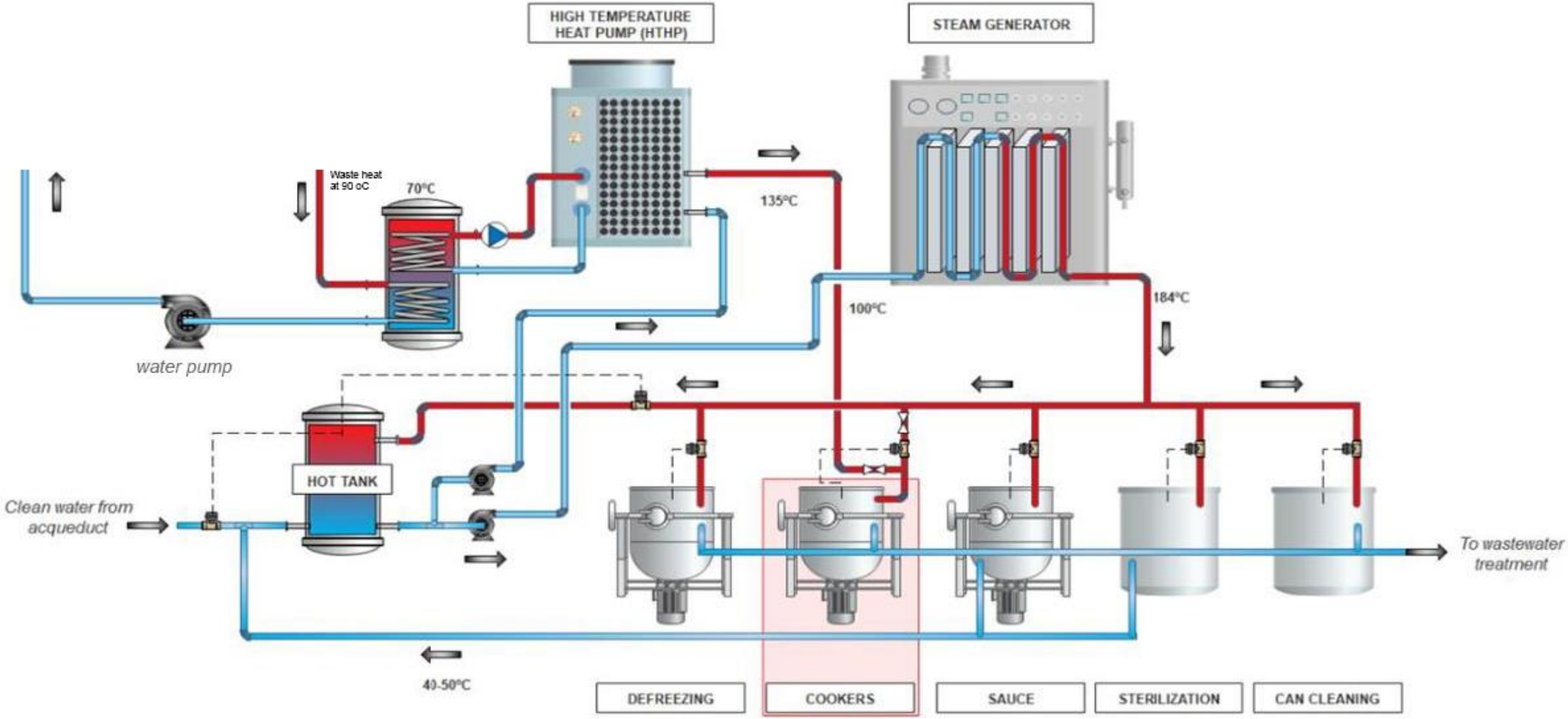
- PBP Scenarios to replace a natural gas boiler with HTHP for different temperature lifts
- Model 930T – 12 hours per day – 200 days per year
- Cost of electricity 0.4 €/kWh – Cost of natural gas 0.25 €/kWh



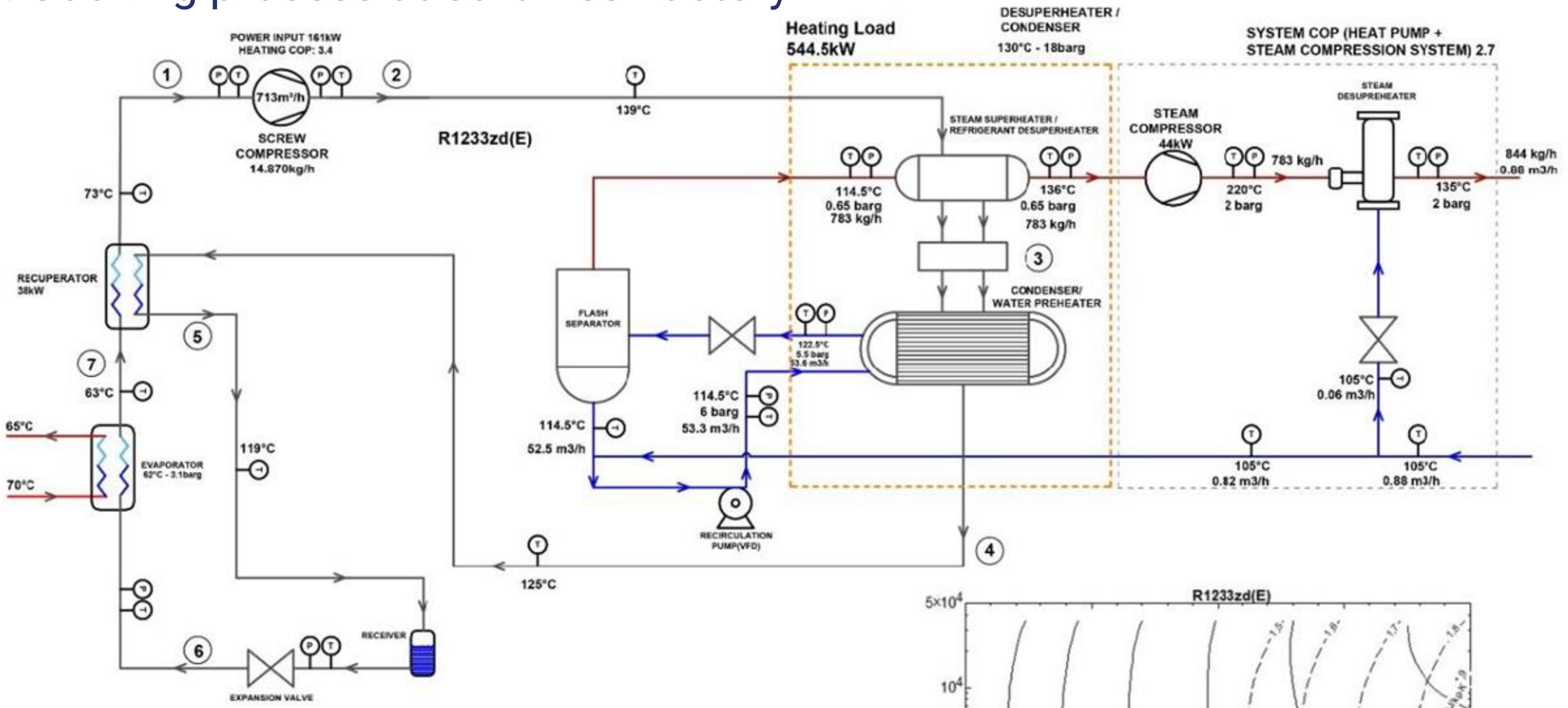
The payback period is from 6 years to even less than a year!

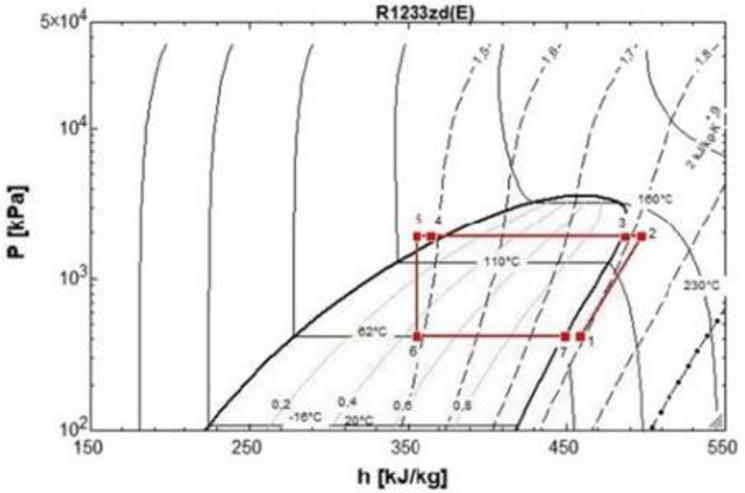
Case Study: Cooking process at Sardines Factory

- Cover part of oil boiler consumption (0.5 MW_{th})
- Supplying heat @ 135 °C, 2.2 barg



Case Study: Cooking process at Sardines Factory



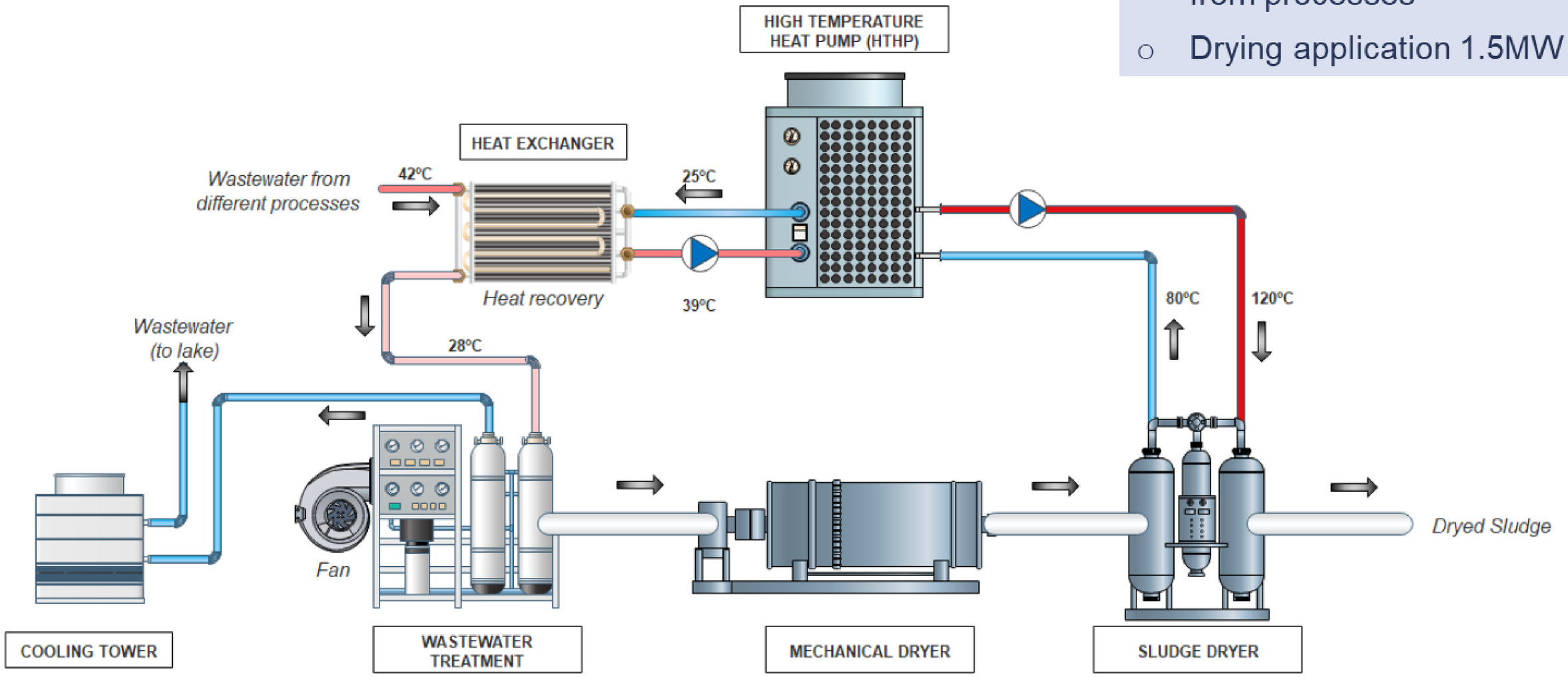


- HFO refrigerant with negligible GWP and ODP
- 1-stage HTHP with recuperator
- Heating capacity provided: ~0.5 MW @ 130 °C
- HTHP COP: 3.4 – SYSTEM COP: 2.7

Process Flow Diagram

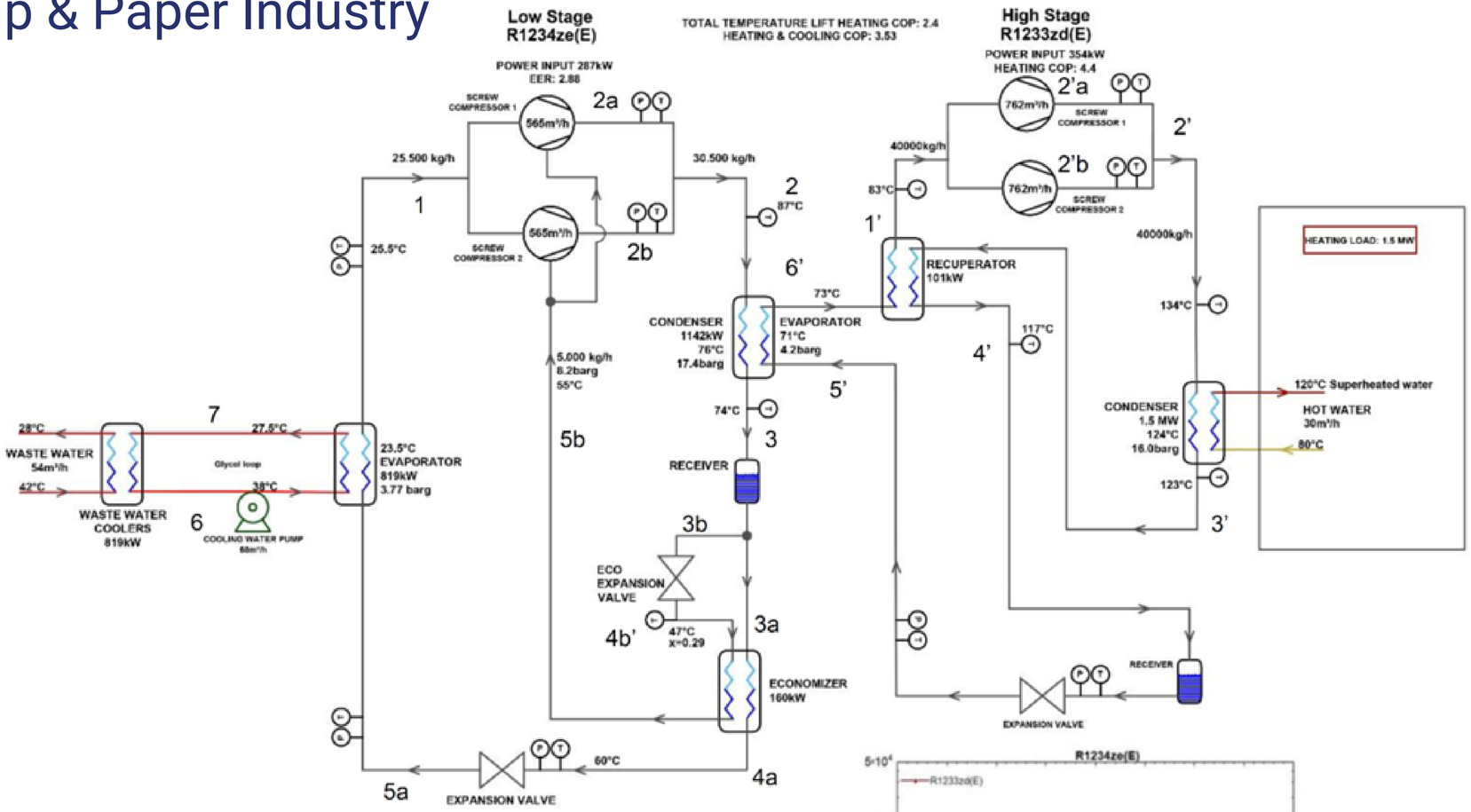
Case Study: Pulp & Paper Industry

- Recovery of wastewater from processes
- Drying application 1.5MW



Case Study: Pulp & Paper Industry

Process Flow Diagram



- Cascade HTHP for temperature lift of 78 °C
- HFO refrigerants with negligible GWP and ODP
- Heating capacity provided: 1.5 MW @ 120 °C
- Total COP: 2.4

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THANK YOU

Any Questions?

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