High Temperature Heat Pumps

A green perspective for process steam production in paper industries

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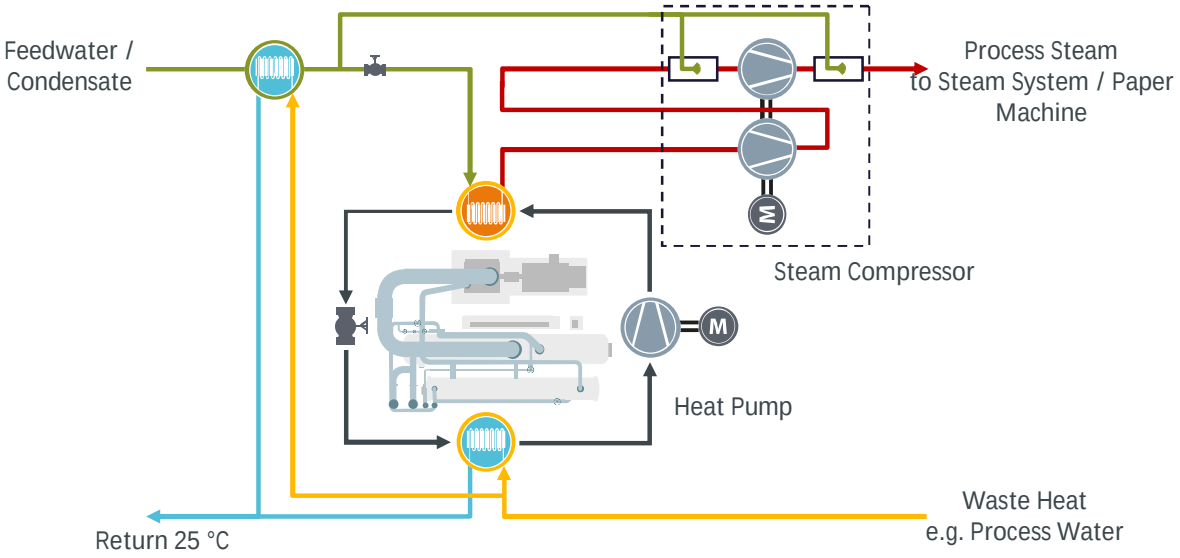
Siemens Energy heat pumps for process steam supply in fiber industries – example and key learnings

Example



BACKGROUND

- High temperature heat pump utilizes waste heat from hood exhausts to produce saturated steam from feedwater
- Low pressure saturated steam is fed to steam compressor (multi-stage intercooled)
- Final adjustment of steam parameters by attemperation

Key learnings

Integration in new paper mills leads to better economics

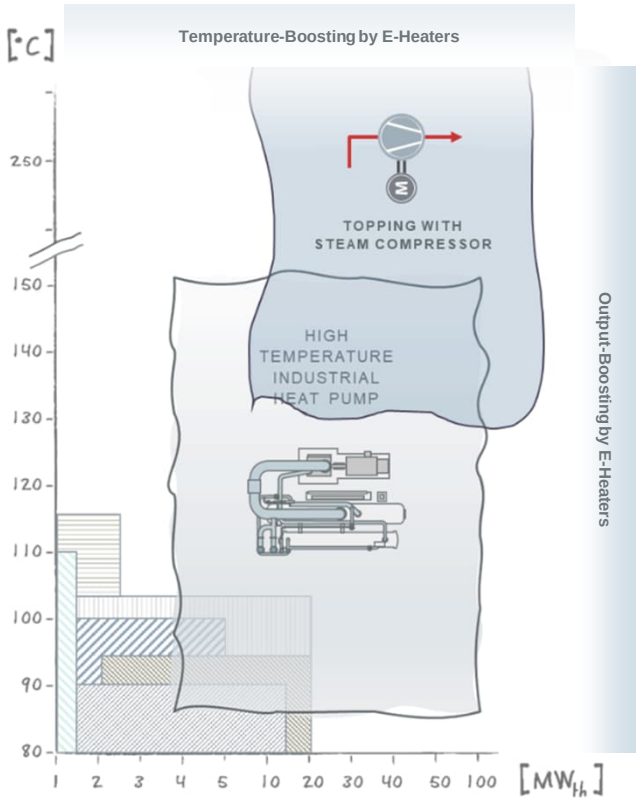
- Higher efficiency of heat integration
- HP+SC space requirement not to be neglected

Hood exhaust attractive heat source in paper mill.
Condensation of water leads to:

- Large heat source → “low” spec. CAPEX
- Rather “high” temperature → “high” COP
- Plume reduction
- Water reuse

Siemens Energy heat pumps open-up green perspectives for process steam supply in fiber industries

Siemens Energy heat pumps w/ or w/o steam compressor …



… serving the needs of our customers

Heat supply

~**12 – 70 MW_{th}** per unit

Temperatures

up to **150°C** directly from heat pump

Environment friendly work medium

low **GWP[1]** and **ODP[2]**

Various drive concepts

Electrical or **mechanical**

Combination with steam compression

-> **higher temperatures** and **pressures > 3.7 bara (**process steam production **up to 55 bara**, **270°C**)

Scope of supply

Component up to **turnkey supply**

[1] GWP = Global Warming Potential
[2] ODP = Ozone Depletion Potential

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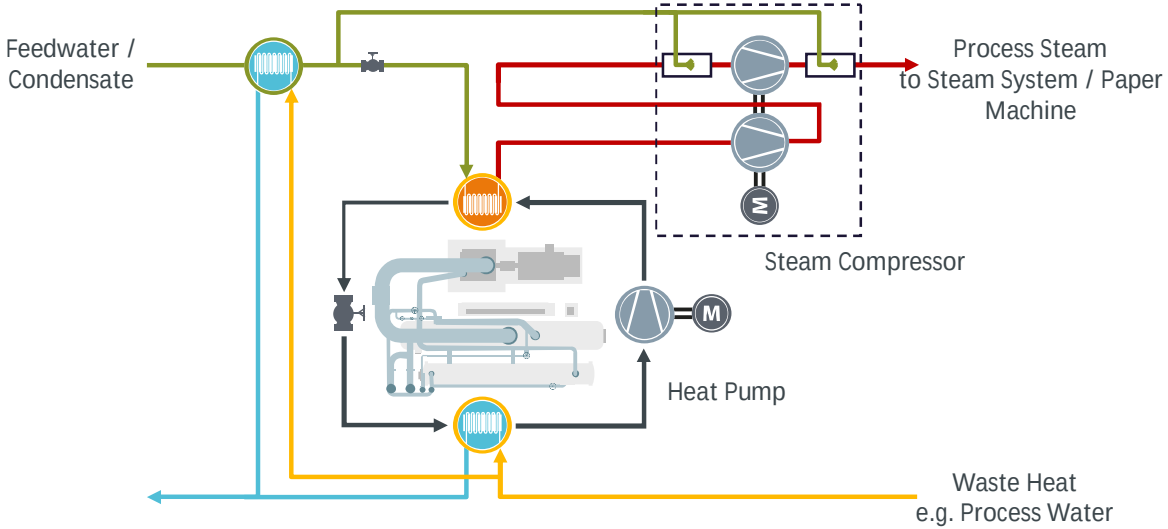
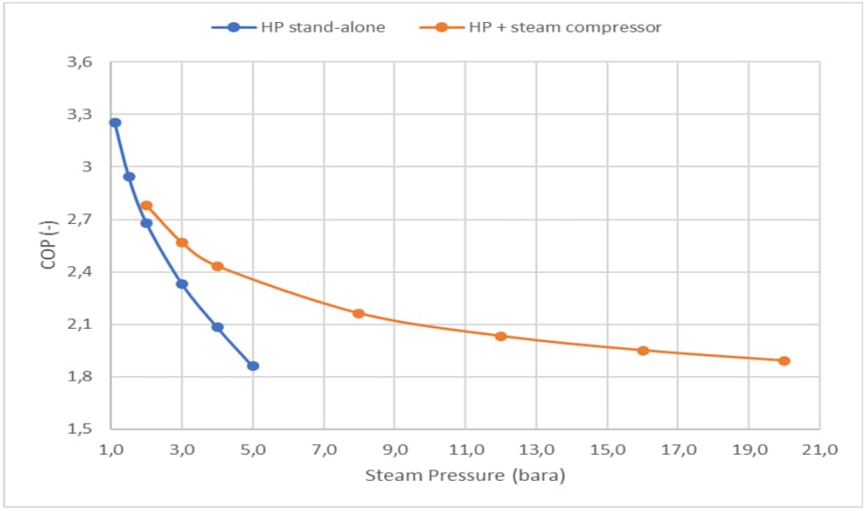
Siemens Energy heat pumps
Application Cases | Pulp and Paper

HEAT PUMP FOR STREAM PRODUCTION FOR DRYING PROCESS– UTILIZATION OF WASTE HEAT

Steam from Waste Heat



Example: Waste Heat @ 45 °C → 35 °C



BENEFITS

- Heat recovery increases overall energy efficiency of paper machine
- Lower production cost due to recovered heat
- Production of steam is highly flexible, produced steam can be utilized throughout the whole steam system

MAIN LEVERS ON COP

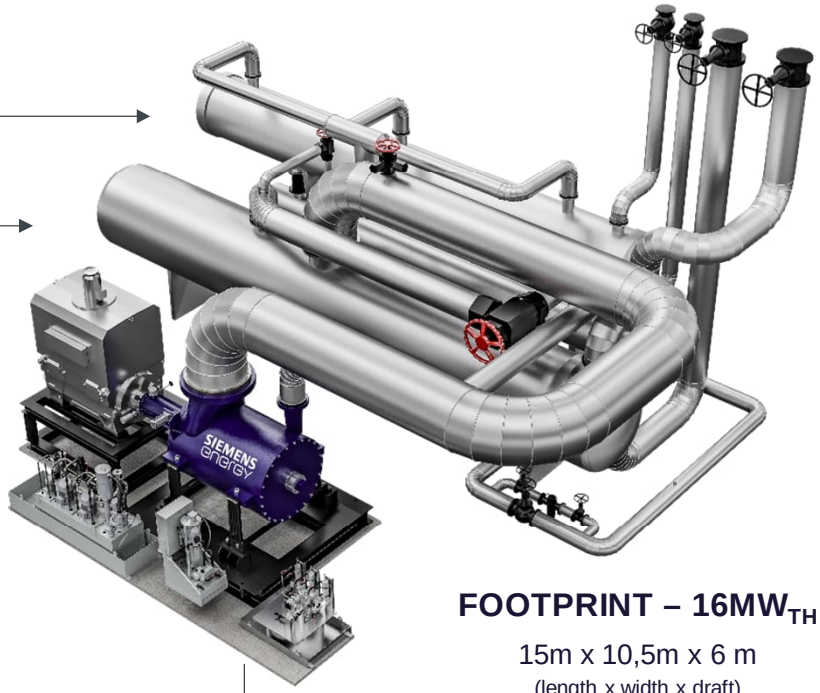
- **Required steam pressure: the higher the steam pressure the lower the COP → Every 0.5 bara counts**
- A higher temperature spread between the source and sink leads to a lower COP

Siemens Energy heat pumps
Major SE core components – 16 MW_{th} example

CONDENSER
+
SUBCOOLER

EVAPORATOR

SIEMENS MOTOR
4,16 KV, 3,5 MW, 1500 RPM

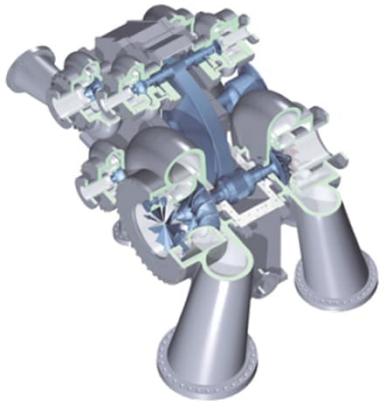


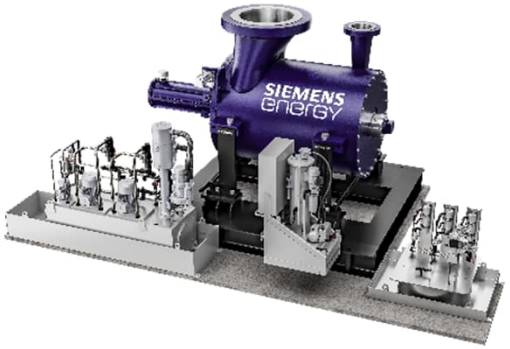
FOOTPRINT – 16MW_{TH}

15m x 10,5m x 6 m
(length x width x draft)

SIEMENS ENERGY SINGLE SHAFT CENTRIFUGAL
VERTICALLY SPLIT RADIAL COMPRESSOR (3 IMPELLERS)

Gear Type Compressor
as Steam Compressor





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