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**

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Feedwater / Condensate → Heat Pump → Process Steam to Steam System / Paper Machine → Steam Compressor → Waste Heat e.g. Process Water
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**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

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$^1$ GWP = Global Warming Potential

$^2$ ODP = Ozone Depletion Potential
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

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

Example: Waste Heat @ 45 °C → 35 °C

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<sub>th</sub> example

CONDENSER + SUBCOOLER

EVaporator

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

FOOTPRINT – 16MW<sub>th</sub>
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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