Vapour compression heat pump with turbo-compressors

Push2Heat
Heat upgrading technologies

Technology provided by enertime

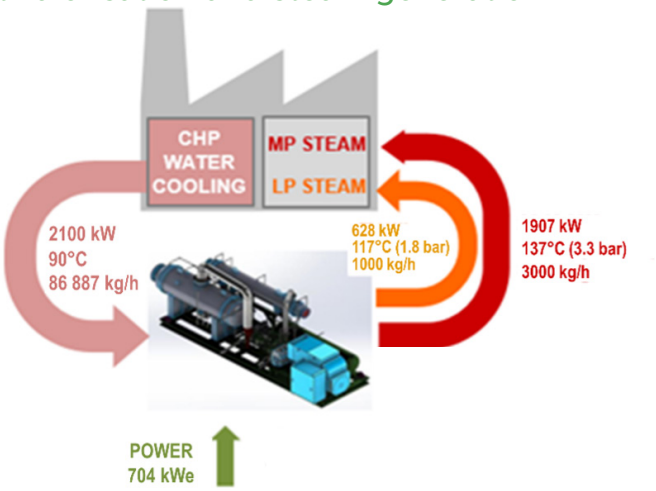
Technology overview

Enertime's **High Temperature (HTHP)** and **Steam Generating (SGHP)** Heat Pumps are essential for industrial processes, utilizing **waste heat** or renewables to produce valuable heat, especially for applications surpassing **3 MW**. Featuring a modular design, these pumps employ optimized centrifugal compressors for **steam, pressurized water, and hot air** production exceeding **100°C**. Adaptable to diverse heat sources, they ensure **high availability** through automated controls. Enertime prioritizes **sustainability** and **reliability**, using environmentally friendly synthetic fluids (ODP=0; GWP=1). This approach minimizes operational challenges, providing efficient industrial high-temperature heat generation, emphasizing **performance**, and contributing to **sustainable** and **efficient** resource utilization.

Objective

Within PUSH2Heat, **Enertime's high-temperature heat pump technology** aims to valorise **waste heat** from the cogeneration plant's **cooling water system**, recovering around **2.1 MW of heat** in the form of **water**. The upgraded heat will be available as steam at two pressure level (2.3 barg and 0.8 barg), serving specific applications such as supplying **steam for paper machines** and the deaerator of the plant.

Waste heat valorisation and steam generation



The **heat upgrade process** involves **extracting waste heat** from the cogeneration plant's cooling water system. This heat is **transferred to the evaporator** of a high-temperature heat pump within the upgrade system. **Cooling down the water stream** enables the **recovery of approximately 2.1 MW of heat**. The **upgraded heat** is then available as steam at **two pressure levels**. **High-pressure steam** is produced in the Heat Pump's condenser, and **low-pressure steam** is generated throughthe refrigerant cooling process in the **subcooler**. A **thermo-compressor** further raises the pressure of high-pressure steam to **5.5 barg**, allowing integration **into the medium pressure collector** for supplying steam to paper machines. Additionally, **low-pressure steam** at **0.8 barg** is intended to supply the plant's deaerator.

Expected Impact

- **Fossil fuel consumption reduction**
- **Carbon footprint reduction of 3500 tons CO^2 per year**
- **Energy efficiency improvement**
- **Avoidance of fuel combustion in cogeneration plant**

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Technical details

- **High-temperature heat pump:** 2-stage centrifugal compressor
- **Eco-friendly Refrigerant:** R1233zd(E)
- **Predicted COP:** ~3.64
- **Heat recovery:** Retrieves 2.1 MW from cooling water
- **Cooling water temperature:** 90°C (supply), 70°C (return)
- **Upgraded heat at 2 pressure levels:**
  - 3140 kg/h steam (2042 kW) at 2.3 barg
  - 1170 kg/h steam (734 kW) at 0.8 barg

PUSH2HEAT in a nutshell

PUSH2HEAT is an EU-Funded project that aims at addressing the technical, economic, and regulatory barriers that prevent heat upgrading technologies to be widely deployed. It is doing so by scaling up four different heat upgrading technologies to optimise their efficiency and economic performance. In addition, it is focusing on integrating them into the relevant industrial sectors such as the paper and chemical industries.

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Glossary

- **ODP (Ozone Deplition Potential):** Measures a substance's harm to the ozone layer. ODP = 0 is harmless to ozone layer.
- **GWP (Global Warming Potential):** Measures a substance's contribution to global warming relative to CO2. GWP= 1 means low impact in global warming.
- **COP (Coefficient of Performance):** A measure of the efficiency of a heat pump.
- **Evaporator:** The part of a heat pump where the refrigerant absorbs heat and evaporates.
- **Subcooler:** A heat exchanger using the residual thermal power from the condenser to vaporise water.
- **Deaerator:** Equipment that removes dissolved gases, such as oxygen, from liquids, like boiler feedwater.
- **Medium Pressure Collector:** A system collecting steam at intermediate pressure levels.
- **Thermo-compressor:** A device that raises the pressure of steam using high-pressure steam.