Using heat pumps to re-purpose industrial process waste energy

Case study

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Heating solutions in Europe, sourcing from nature

- **Water sourced:**
  - Sourcing from Geothermal / lake water
  - High heating temperatures
  - Up to 85°C

- **Cascade:**
  - Sourcing from ambient air
  - High heating temperatures
  - Up to 85°C

- **Air sourced:**
  - Sourcing from ambient air
  - Medium heating temperatures
  - Up to 55°C
HEAT Recovery, sourcing from waste

80kW Cooling and 100kW heating

100kW

20kW

Disconnected heating and cooling

80kW

Conventional approach

\[ \text{TER}^* = \frac{100+80}{100+20} = 1.5 \]

80kW Cooling and 100kW heating

“0” kW

100kW

20kW

100kW

Efficient cooling disconnected from heating

80kW

“Free Cooling” approach

\[ \text{TER}^* = \frac{100+80}{100} = 1.8 \]

80kW Cooling and 100kW heating

Connected Cooling and Heating

100kW

20kW

Efficient cooling

80kW

Heat Recovery approach

\[ \text{TER}^* = \frac{100+80}{20} = 9 \]

600% efficiency gain by connecting heating and cooling!
A Real Life example
Water-to-water Heat Pumps with Heat Recovery – Industrial application

Animal health products factory – France

• A global company focusing on R&D and manufacturing of animal health products
• Annual turnover of almost 1 billion dollars
• Several production sites spread across 10 countries
• Committed to **optimizing the resources they use** with continuous monitoring of energy consumption, water and materials used in their manufacturing processes.
The Challenge and current status

• One of their keys objectives is to reduce energy (smaller carbon footprint) and gas consumption (lower emissions)

• Traditionally, replacing old equipment with a more efficient equivalent unit was considered as the best option.

• The company partnered with Trane to identify innovative solutions, starting with a production site located in the south of France.

• Proposed solution: connecting the cooling and heating processes to recover the heat from the chiller plant and reuse it for heating in their production process.

Combining heating and cooling processes by re-purposing waste heat from cooling plant

System efficiency gain

Replacing a chiller with a more efficient chiller

Legacy chillers

EER

EER

TER

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Solution - Original design

Disconnection

Cooling Plant

Heating Plant

Air cooled Chiller

Boilers
Cooling requirements:
- Water Temperatures: 6/11°C
- Loads:
  - Manufacturing process
  - Storage ( Finished good + raw material)
  - Air conditioning for labs and office

Heating requirements:
- Water Temperature: 80/60°C
- Loads:
  - Manufacturing process
  - Space heating
Solution - new design

Connection

NEW Heat Pump Plant for Cooling and Heating

Existing heating plant kept as a back-up
Results – Estimated savings

Utility Plant Average Energy Efficiency Ratio increased from 1.18 to 2.15

Annual Gas Consumption decreased by ~ 80%

Avoidance of 225 Tons of CO₂ per year

* Electricity: 0.053 kgCO₂/kWh
  Gas: 0.2 kgCO₂/kWh

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