HEAT PUMPS FOR PRODUCTION PROCESSES
Reliable and Sustainable CO₂ Reduction

Online Presentation Berlin by Thomas Lergenmueller (GEA Refrigeration Germany), July 2nd 2020
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GEA – “engineering for a better world”

GEA is one of the largest suppliers of process technology to the food industry and to a wide range of other sectors.

The “Refrigeration“ division provides components and solutions for the industrial refrigeration and heating for nearly all applications which have respective demands.

GEA is one of the few “OEM's“ worldwide that offer complete ammonia heat pumps from our own production.

4.751 million order intake (EUR) *

17.863 employees (full time equivalents) *

* 2018
GEA Refrigeration Portfolio at a Glance

COMPONENTS
- High-quality screw and reciprocating compressors
- Controls
- Valves
- Service equipment

SKIDS
- Compressor packages
- Chillers
- Heat Pumps

Turnkey SOLUTIONS for complete refrigeration and heating systems

Building, MAINTAINING, optimizing and adapting for your continued success
Single-Stage Heat Pump Circuit

Coefficient of Performance (Heating)  
COP = Heating Rating / Power Rating
GEA’s History of Heat Pump Technology

2005
First screw compressor based heat pump installed for a food producer:
Hot water up to +70 °C for a gelatin production process.

2008
Market launch of high pressure screw and reciprocating compressors.

2010
First large heat pump installation for a district heating network:
Using waste heat from a paper production process to generate hot water
above +80 °C to supply the heating network in the Swedish town Sarpsborg.

2011
Continuous advancement of heat pump technologies and products.
Multiple installations across Europe.

2017
Market launch of the standard heat pump lines
GEA RedAstrum (screw based) and GEA RedGenium (piston based).

2018
Development of new high temperature compressors.

2020
Market launch standardized screw compressor heat pump packages.
Market launch standardized chiller-heat pump combinations.

GEA Heat Pumps For Production Processes
Over 75 installations across Europe in the last 10 years
INITIAL SITUATION

- Switzerland based company SWISS KRONO is a producer of wooden products. At the German location Heiligengrabe the group manufactures OSB plates (oriented structural board) using long tall wood chips called “strands”.
- During an energy-intensive production process the strands are dehumidified in a directly fired rotary dryer.
- SWISS KRONO also operates two biomass heating plants on the premises.

PLAN

- Modernization by installing an efficient heat pump that supports the drying process and ultimately saves cost and emissions by reducing fossil fuels.
"Kronoply“ Layout

Natural Gas CHP Plant

Biomass Heating Plant

GEA Heat Pumps

- *useful heat 2 MW supply +95 °C*
- *useful heat 9 MW return +60 °C*
- *useful heat 9 MW return +60 °C*
- *useful heat 9 MW supply +83 °C*

- *waste heat 7 MW*
  - +35 ... +40 °C

- *electrical power 2 MW*

- OSB-Dryer (11 MW)
“Kronoply“ Plant Data

Annual energy requirements
Electricity 250 GWh
Natural gas 440 GWh
Biomass 1.070 GWh

GEA heat pumps commissioned in Q4 2015

Primary energy savings 31 GWh annually
CO₂ savings 6.600 tons annually
“Kronoply“ GEA Heat Pump Data

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x heat pump units</td>
<td></td>
</tr>
<tr>
<td>9 MW total heating capacity</td>
<td></td>
</tr>
<tr>
<td>2 MW electrical power input</td>
<td></td>
</tr>
<tr>
<td>Coefficient of performance COP</td>
<td>4.5</td>
</tr>
<tr>
<td>Heat source water</td>
<td>+39 / +33 °C</td>
</tr>
<tr>
<td>Heat sink ethylen glycol</td>
<td>+60 / +73 … +83 °C</td>
</tr>
<tr>
<td>Dimensions per unit</td>
<td>Length x Width x Height = 7.7 x 3.9 x 3.9 m</td>
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</tbody>
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INITIAL SITUATION

- A British based, global food producer operates a plant in Bo'ness (Scotland) which provides fresh prepared foods, chilled ready meals, soups, salads, etc.
- The production process follows the so-called cook-quench-chill technique: Foods are cooked evenly, then transferred to and cooled down in a quench tank at ambient temperature level, and finally released to the chiller.
- The traditional plant uses a chiller and a boiler.

PLAN

- Modernization by installing an efficient, combined chiller – heat pump unit that provides both, cooling capacity for the chilling process and heating capacity for the cooker.
“Cook-Quench-Chill“ Layout Old

heating rating 760 kW
heating energy p.a. 5.320 MWh
hot water supply +67 °C

hot water return +52 °C

Gas 950 kW
(6.650 MWh p.a.)

P_el 175 kW
(1.225 MWh p.a.)

coolant return -1 °C

cooling rating 470 kW
coolant supply -6 °C
“Cook-Quench-Chill“ Layout New

- **GEA Heat Pump**
- **Heating**
  - Rating: 760 kW
  - Energy p.a.: 5.320 MWh
  - Hot water supply: +67 °C
  - Hot water return: +52 °C

- **Cooling**
  - Rating: 470 kW
  - Coolant supply: -6 °C
  - Coolant return: -1 °C

- **Electrical Power**
  - $P_{el}$: 280 kW
  - (1.960 MWh p.a.)
“Cook-Quench-Chill“ Plant Data

Annual energy consumption
Layout old: Gas 6.650 MWh, $P_{el}$ 1.225 MWh
Layout new: Gas 0.0 MWh, $P_{el}$ 1.960 MWh

Annual energy expenses and CO$_2$ emissions
Layout old: € 355,250.00 / 5,150 tons
Layout new: € 196,000.00 / 1,500 tons

GEA heat pumps commissioned in Q2 2017
Follow-up projects in 2018 and 2019
“Cook-Quench-Chill“ GEA Heat Pump Data

1 x heat pump unit
760 kW heating plus 460 cooling capacity

315 kW electrical power input
COP = 2.4 (combined COP = 3.9)

Heat source propylene glycol -1 / -6 °C
Heat sink water +52 / +67°C

Dimensions of the unit
Lengt x Width x Height = 6.3 x 1.6 x 2.3 m
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