

ENGINEERING
TOMORROW

Danfoss

Case story | VLT® HVAC Drive

Driving down
energy consumption
for central heating
– whilst preserving
full comfort

70%

less energy
consumption than
in 2007

drives.danfoss.com

VLT | **VACON**

A central heating system that uses 70% less energy now, than in 2007? Whilst maintaining full comfort and process performance? That is the impressive result achieved at Danfoss' industrial site in Nordborg, Denmark.

By taking a system optimization approach to energy efficiency, a diversity of improvements and retrofits have been implemented in the central heating system over the years. In total the energy consumption has been reduced by 59,000 MWh annually, which amounts to 70% less than the energy consumption level in 2007. Thanks to retrofits Danfoss has achieved these annual savings at its Nordborg factory, in just the last three years:

- 21.3% reduction in heat consumption without compromising on comfort and process performance
- 12% less electricity consumption

Harnessing excess heat

One of the most effective initiatives is in harnessing excess heat from the industrial park process water to contribute to the central heating system.

In January 2016 the natural-gas-driven generator producing electricity as well as heat was supplemented with a system of heat pumps recovering energy from process cooling water. Instead of being released to the atmosphere and effectively wasted, the heat is instead channeled into the central heating system which serves the entire industrial park.

The heat pump system is enhanced for optimal energy utilization by controlling fan and compressor motors with VLT® HVAC Drives. VLT® AQUA Drives control pumps on every pumping station to circulate the heated water.

The heat recovery solution in Nordborg production halls is made possible by the recent switch from 150 °C hot water to central heating temperature water at 84 °C).

Internal energy audits of the Nordborg factory identified the gas furnace

heating used in the production halls as a prime candidate for an energy-saving retrofit.

For the new heat recovery system, Danfoss chose four Sabroe HeatPac heat pumps, which are expertly modified with superior Danfoss components: motorized regulator valves, actuators, pressure transmitters and level sensors. In addition, Danfoss VLT® drives provide great energy savings by adapting compressor speed to actual capacity demand.

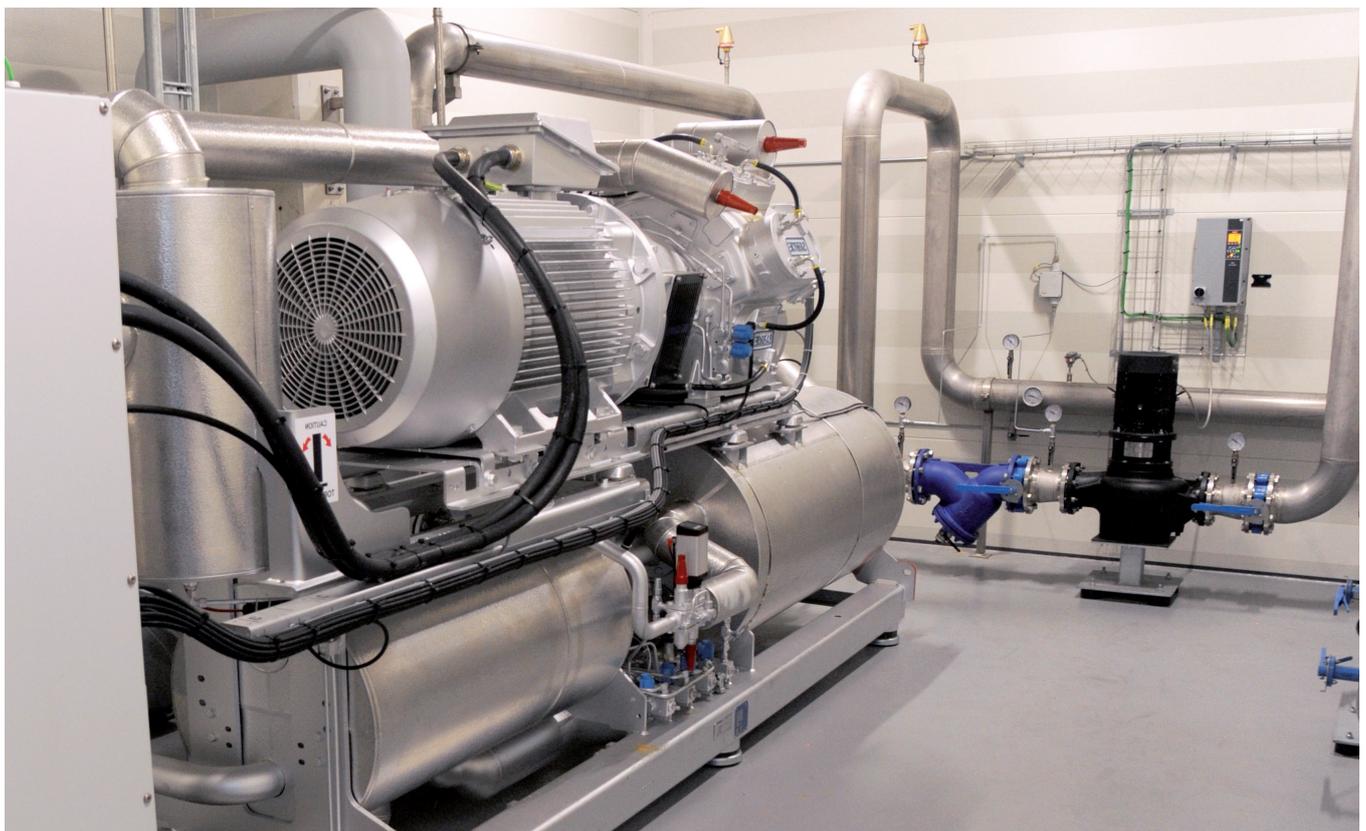
These four customized and ammonia-based heat pumps now ensure that as much heat energy as possible is transferred from process cooling to the central heating system.

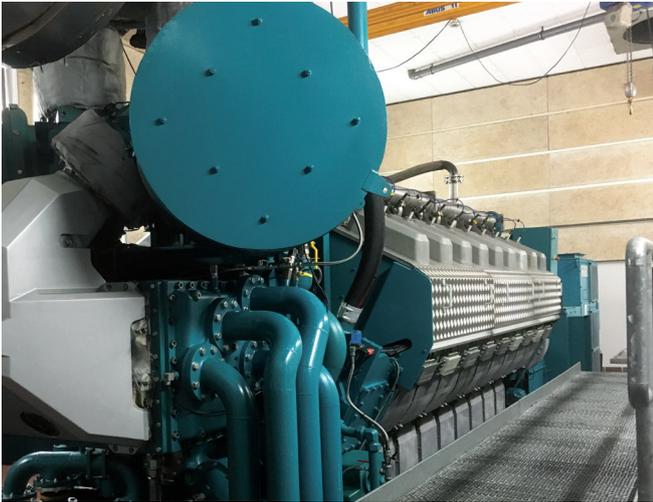
Fast payback

The four heat pumps installed at the Nordborg factory in 2016 have a projected return on investment (ROI) of only 2.8 years.

They are customized with superior Danfoss components:

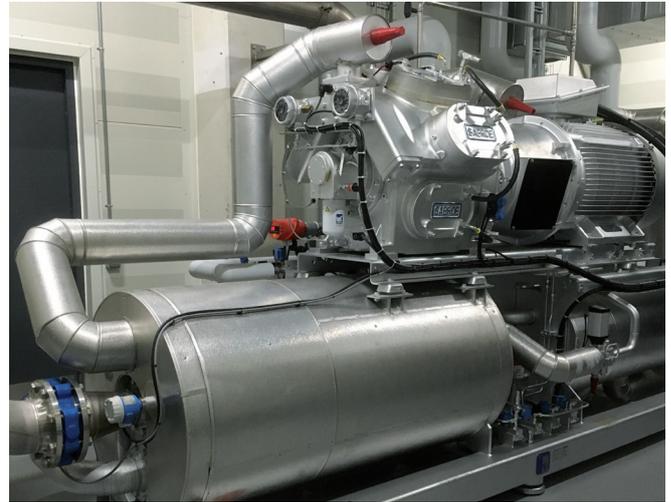
- VLT® HVAC Drive
- Motorized regulator valves and actuators
- Pressure transmitters and level sensors





Before:

The central heating system was previously powered by this gas generator. The excess heat in the process water temperature was removed via cooling towers which released the excess heat into the atmosphere.



After the upgrade:

Four 500 kW heat pumps reuse excess heat from process water. Each heat pump reduces the process water temperature from 26-30 °C down to 21 °C. Instead of going to waste, the excess heat now supplies the central heating system which serves the entire industrial site. A VLT® HVAC Drive controls the reciprocating compressor to ensure absolutely minimal energy consumption at all times. Each heat pump extracts excess heat from process water pumping at the rate of 250-350 m³/h. In the new system, the original gas generator is still available to supplement heating during high demands periods in the depths of winter. Operation of the gas generator has been dramatically reduced. Danfoss VLT® HVAC Drives and VLT® AQUA Drives ensure the optimum control of heat balance and liquid flow in order to obtain a seamless and smooth operation of the new system all year around.

System optimization

Every possible system optimization initiative is implemented in the central heating system.



A cabinet-mounted VLT® HVAC Drive controls each of the four powerful 500 kW heat pump compressors



VLT® AQUA Drive controls each pump for central heating water distribution, reducing energy consumption by up to 40% compared to direct-on-line operation. The process water pumps at a rate of 250-350 m³/h



The drive reduces the speed of the process water distribution pump, which in turn reduces heat loss. In addition the insulation reduces heat loss even further, resulting in a double energy saving.



VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202

By using VLT® HVAC Drive and VLT® AQUA Drive you can continuously match capacity from the compressor or pump to the exact consumption of the heating system, by high-precision control of the heat pump speed. By adapting compressor speed to actual capacity demand, you save up to 40% compared to direct-on-line (DOL) operation.

VLT® HVAC Drive and VLT® AQUA Drive can run many different motor types from induction motors to high efficiency permanent magnet (PM) and synchronous reluctance (SynRM) motors. This means that you can run the same control interface for all the drives in the plant, no matter which motor is connected, which reduces training time and stock of spare units. It also means you can retrofit to a new motor technology when this is the advantageous choice.

VLT® drives are available in a wide range of power sizes, catering for compressors or pumps of any scale.

Benefits for compressors in heat pumps and chillers:

- Energy savings
- Accurate temperature control, which minimizes heat losses and ensures reliable operation.
- Longer equipment life thanks to reduction of compressor wear by: reducing the number of starts and stops
 - ensuring sufficient lubrication
 - ensuring soft starts
 - adapting speed to capacity demand

Pumps are used in ground water pumping and air-conditioning circulation inside the building.

Benefits for pumps:

- Energy savings
- Reduces wear on pumps and piping system.
- Saves impeller maintenance
- Provides most efficient pump operation
- Prevents damage to the pump
- Avoids dry-running and pump overheat
- Extends life time of pump
- Substitutes flowmeter
- Reduces water loss

Discover more at Danfoss Drives website:

VLT® HVAC Drive: <http://drives.danfoss.com/products/vlt/low-voltage-drives/vlt-hvac-drive-fc-102/#/>

VLT® AQUA Drive: <http://drives.danfoss.com/products/vlt/low-voltage-drives/vlt-aqua-drive-fc-202/#/>

System optimization using drives: <http://drives.danfoss.com/knowledge-center/knowledge-articles/#/>