

Case story | VLT® Solutions

# VLT® AQUA Drive optimising district heating pumps – **climate-friendly waste incineration** plant saves power

New, energy efficient VLT® drives strengthen CO<sub>2</sub>-neutral heat supply from waste incineration plant in Aarhus, Denmark and saving 50,000 kWhrs per year.

by Jesper With

Aarhus Municipality's goal of achieving a CO<sub>2</sub>-neutral heat supply is one step closer to becoming a reality. Two new energy efficient frequency converters from Danfoss have significantly increased the efficiency of the two district heating pumps located in the nearby town of Skejby, which send heat from the waste incineration plant in the town of Lisbjerg to the district heating net in Aarhus. As a result, Aarhus is getting closer to

reaching its ambitious goal of becoming a CO<sub>2</sub>-neutral municipality.

The new frequency converters also run the plant's existing motors at a much higher efficiency than previously and at the same time create greater stability, as the new converters work better with the motors than the old ones. The savings amount to 50,000 kWhrs per year. Danfoss has delivered a comprehensive solution which, in

addition to the frequency converters, includes an extra cabinet for the connection of existing cables and a filter device that protects the motors.

## **Pumping climate-friendly heat**

Ever since the Skejby pumping station was built in 1993, it has pumped cheap and climate-friendly heat from the Lisbjerg Incineration Plant to the district heating net for consumers in the Aarhus area. Residual heat is



**50,000**

**KWhrs saved  
per year**

by optimising the two 500  
kW primary pumps with  
VLT® AQUA Drives





*The two 500 kW primary pumps are equipped with two new Danfoss VLT® AQUA Drive FC 202 frequency converters.*



*The back channel cooling system of the VLT® AQUA Drives is directly connected to the control room ventilation system.*

created as a result of the high temperature incineration of residential and commercial waste, which would otherwise be disposed of in a less sustainable fashion. Instead of allowing this heat to simply escape into the air, it is used to heat private residences, although the pumping station was in need of an overhaul. It had become too expensive to maintain the 15-year-old control system and the old frequency converters needed to be replaced. The two large 500 kW primary pumps had previously

been speed-regulated by using the old less efficient frequency converters, which have now been replaced by two high-efficiency Danfoss VLT® frequency converters. The motor flux control mechanism of the new VLT® drives also runs the existing motors at higher efficiency than before, giving a two-fold benefit.

One pump is in constant operation while the other remains in stand-by so that in the event of interruption, it is up and running in just a few seconds. "Both district heating pumps

are in good condition due to regular maintenance work. It would not make energy-saving sense to replace them. On the other hand, we've cut back significantly on energy consumption by optimising them", says operating assistant Martin Jensen, who is responsible for AffaldVarmes Århus' motor control systems and the Skejby Pumpestation.

### **Great benefits from EnergyBox2**

The heat exchangers for the transmission net have also been removed in the optimisation process, so the pipe system from the incineration plant is now connected directly to the city's district heating net. This results in additional energy savings and has increased the output transfer by 8 MW. A new PLC control with process image display and the installation of improved control regulation programmes have also contributed to the energy optimisation of the incineration plant. The SRO plant is connected to a Profibus network and all operating data is remotely monitored 24 hours a day.

Drive electronics have been greatly improved over the last 15 years. The new frequency converters have a



*Martin Jensen, Operations assistant at AffaldVarme Aarhus, with the new VLT® AQUA Drives.*



98% efficiency rate and provide significantly lower motor heat loss than the original converters. This helps lower operating costs. "With the new frequency converters and using the operating performance history which is automatically saved in the frequency converter, we have used Danfoss' EnergyBox2 calculation programme to calculate savings of approximately 50,000 kWh per year", Martin Jensen explains. The new converters were delivered with motor filters and features that allowed them to be installed on the existing base and also allowed all existing cables to be reused.

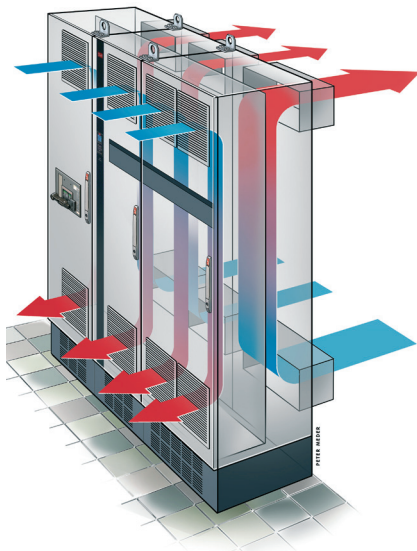
### Back channel cooling

The converters are cooled using direct exhaust of cooling air from a separate back channel cooling system, which ensures that no impurities

are sucked into the electronics. "The optimisation is a clear improvement of the plant and makes it easier for us to ensure a stable district heating supply for our customers", comments Martin Jensen.



Transmission pipes, district heating in the Aarhus area. source: [www.affaldvarme.dk](http://www.affaldvarme.dk)



Back channel cooling minimises heat loss increasing energy efficiency, a significant benefit at high powers. 85% of the heat losses in the drive are deviated by the cooling channel fan of the drive directly into the control room ventilation system. The remaining 15% of heat generated by the drive is removed via the temperature controlled fans in the front doors of the drive.

### Facts

The Lisbjerg Incineration Plant provides up to 76 MW of heat to the supply net in Aarhus and together with a smaller plant, Reno Syd, reaches a capacity of just under 100 MW. This represents a very significant portion of the total heating consumption of Denmark's second-largest city.

The two 500 kW primary pumps are equipped with two new Danfoss VLT® AQUA Drive FC 202 frequency converters.

AffaldVarme delivers heat to Aarhus and the surrounding areas, from the towns of Hornslet to Odder and Skanderborg. Production is provided via CO<sub>2</sub>-friendly heat from waste incinerators, straw heating plants, wood chip heating plants, biogas heating plants and residual industrial heat. The heat

provided from these sources is supplemented when required by heat from the Studstrup plant, the region's largest supplier.

Significant fuel savings are created by utilising residual heat from waste incineration for district heating and from the Studstrup Combined Heat and Power Plant. During normal electricity production only around 40% of the fuel is used, whereas approximately 85% can be used in combined electricity and district heating production. At combined heating and electricity plants and incineration plants, the flue gas is treated to remove most of the NO<sub>x</sub> content and almost all of the sulphur. 25% of the heat production is based on CO<sub>2</sub>-neutral fuels such as straw and waste.

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front picture source: [www.affaldvarme.dk](http://www.affaldvarme.dk)

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