

Green Directives lower operational costs

Free cooling at Danone factory

In a factory for dairy products in the greater Moscow area, Danone-Unimilk has been producing yoghurt and curd products since the year 2000. The plant was enlarged in 2011 and a new refrigerating concept with free cooling and perfectly harmonized energy-efficient control was introduced. Danone-Unimilk opted for this solution, focussing on its strategic target of sustainably reducing energy consumption and carbon footprint.



Transportation by crane without cross beams due to movable crane lugs

Line of Business:	Industrial Refrigeration
Application:	Dairy products
Country / City:	Russia / Moscow
Fluid:	Propylene glycol (40 %)
Product:	Drycooler GFD, Güntner Motor Management GMM sincon

Since the start of production in the year 2000, the production was continually enlarged. In the last year, the refrigerating plant was refurbished, as the existing system was no longer able to fulfil the requirements. In 2011 it was decided to invest in more efficient cooling equipment that can supply chilled water required for the production processes in the factory during winter time. For this purpose four Güntner GFD drycoolers with a total capacity of 6 MW were selected for free cooling. Of course, the system as such was required to run as energy-efficient and steady as possible.

Maximum capacity, minimum footprint

The greatest challenge faced during the planning phase was the limited space for the installation area of the drycoolers. In order to ensure a sufficient air supply also in the winter when there are large amounts of snow, the units were placed on a steel substructure on the roof of a production hall at 8 m total height.

Different operating modes in summer and winter

During the summer, the refrigerating capacity needed is so high that the water is being chilled with an ammonia refrigerating plant with three chillers. The total power consumption of the refrigerating plant is approximately 1550 kW. During maximum operation, the plant offers an efficiency factor of $5500 \text{ kW} : 1550 \text{ kW} = 3.55$.

In order to maintain an operating mode that is as energy-efficient as possible, it was decided to use a drycooler system with propylene glycol (40 %) during the winter, as especially during the four coldest months, the ambient temperature is so low that the system can be op-

erated in free cooling mode. In the case of free cooling mode, the overall power consumption is at 360 kW, here 800 m³ fluid are circulated in the drycoolers. This means that with a total capacity of 6 MW, the efficiency factor is at 6000 kW : 360 kW = 16.6.

So, the lower the ambient temperature, the less energy is needed for the production of chilled water. With an ambient temperature of -3 °C, the refrigeration system for the chilled water production is in a kind of transitional phase; the free cooling system is reinforced with a chiller of the ammonia plant. In this case, one of the chillers of the ammonia plant that also can be used for chilled water production via plate heat exchangers, is added to complement the capacity of the drycoolers. When the ambient temperature sinks even lower, the power consumption can again be lowered considerably by controlling the pump capacity and by using a PID control (Proportional-Integral-Differential control; forms part of the Guntner Motor Management GMM sincon) that controls the fan speed in a stepless mode. At temperatures below -30 °C, the fans stop completely. In this free cooling mode, the operation of the system is the most efficient with an efficiency factor of 5500 kW : 150 kW = 36.7.



The four GFD drycoolers were placed on a steel substructure at 8 m total height.

Precise control by Guntner

However, guaranteeing the large volume of chilled water while keeping energy consumption as low as possible was only part of the challenge. Of course, the chilled water had to be cooled down to the required temperature of 2 °C as precisely as possible. In order to achieve this, precision temperature sensors by

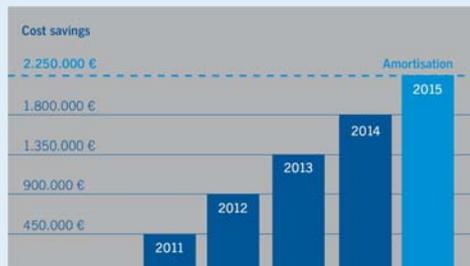
Siemens were used; the AC fans of the GFD drycoolers are controlled in stepless mode with the newest version of the GMM sincon. With the profibus integrated in the GMM sincon, external data logging and signalling is equally possible without any problem. In order to harmonise the adjustment of these components as much as possible, the commissioning of the control panels was realized by a member of staff of Guntner Controls on site together with the local Danone Controls expert. Even the tiniest details were closely looked at to guarantee smooth operation. This also included the communication to the superordinated control system in which the communicated data are analysed.



The Guntner Motor Management GMM sincon ensures perfectly controlled operation.

Free cooling – big energy savings

The free cooling concept has proven itself to be very efficient in this project. Of course, the efficiency of the system mainly depends on the ambient temperature. Even after a very short operating time, the numbers are very promising: Preliminary figures show that during the winter season 2011/2012, the energy savings were between 500,000 and 1,000,000 kW/h. This means for the month of January alone cost savings of about 1.5 million Roubles (approx. 40,000 Euros). With this level of savings, the new system will amortise itself within five years.



The free cooling system will amortise itself within five years.

This project was the first one in Russia using the system of free cooling for the production of chilled water used in production processes of a dairy plant. With the experiences gained in this project, it may be concluded that this kind of system is especially proper for dairy plants in northern regions in which the average monthly temperature is at least -7°C or lower during four months in winter.



The plant in the greater Moscow area now has a new refrigerating concept for the production of chilled water.

