Environmental protection thanks to efficient technology

In recent years the Caritas-Krankenhaus Bad Mergentheim hospital has been gradually upgrading its HVAC technology with the latest focus on its cooling system. An important element of all projects was the hydraulic system with high-efficiency pumps by Grundfos.

Hospitals are large-scale, resource-intensive energy consumers and can play an important role in climate protection. This is evident from initiatives such as the 'KLIK green' project funded by the German Environment Ministry, where 250 hospitals and rehabilitation clinics across Germany have cumulatively saved 100,000 tonnes of CO_2 as of April 2022. Yet modernising energy systems in hospitals is in practice a long-term undertaking involving replacing parts of the building technology in phased projects. This is no different for the Caritas-Krankenhaus Bad Mergentheim hospital, which upgraded its cooling system in 2021.

BACKGROUND

As the biggest acute care hospital in the region, it employs 1450 staff in ten specialist departments, two institutes and ten certified medical centres and provides care to around 22,000 in-patients and over 45,000 out-patients each year. Since 2006 the hospital has been part of the BBT Group, a major Christian provider of hospitals and social facilities.

In the 1990s, the Caritas hospital was rebuilt, while its technical facilities were subsequently due to be upgraded. Thus, the hospital has been gradually carrying out major modernisation work since 2014, which has so far seen the power supply centre, heat distribution system, ventilation and air-conditioning technology and the cooling system replaced or upgraded. These measures have focused on energy optimisation for greater climate protection and more efficient operation.

New cooling system

The most recent project was the replacement of the cooling system, which was completed in autumn 2021. 'The existing installation from the 1990s was no longer able to meet the cooling requirements in summer and did not offer sufficient redundancy for a potential failure of a refrigeration unit,' explains Detlef Janßen, Head of Technology of the BBT Group for the Tauberfranken-Hohenlohe region. 'Furthermore, the two open cooling tower installations were no longer fit for purpose and needed to be replaced to counteract hygiene problems.'

THE SOLUTION

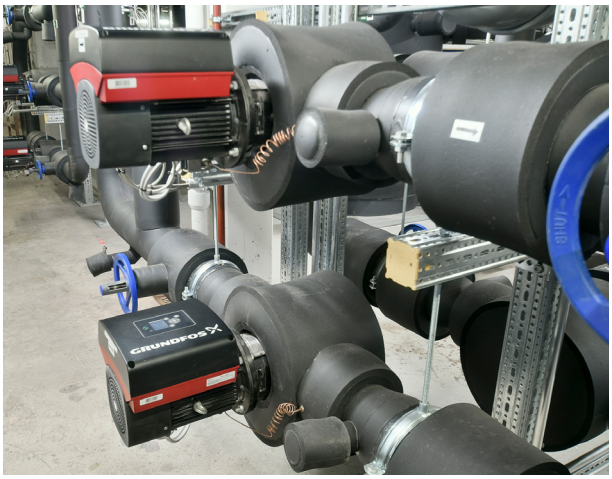
The new cooling system was designed on the basis of sufficient redundancy, replacement of the two wet cooling towers and continuing operation of the existing absorption cooling plant. To this end, two new refrigeration units were installed in the hospital's power supply centre. Each has a refrigeration capacity of approx. 550 kW, while one has 400 kW of free cooling. Distribution is via a new Zortström distribution centre (max. 2 MW), to which the existing buffer storage tank and the absorption refrigerator with 450 kW refrigeration capacity are also connected.

There is a second distribution centre (max. 1.5 MW) connected to the main distribution centre via pump lines in the former central cooling plant. In addition, a new water chiller of approx. 600 kW output and another Zortström distribution centre (approx. 1.0 MW) were installed in the former cooling tower centre. In summer the ventilation and air-conditioning systems are independently supplied with cold water from this third distribution centre. In winter, the cold obtained from free cooling can be fed to the ventilation and air-conditioning systems. With 150 kW output per plant, the cold extraction meets all the year-round needs.

Like previous modernisation measures in the Caritas hospital, the new cooling system was designed by the engineering firm Neckermann (Gerlingen) and realised by plant manufacturer RGT Rhönland Gesundheitstechnik (Bad Neustadt an der Saale). The plant went into operation in Autumn 2021, and the project has now reached completion following the final handover.

For Caritas-Krankenhaus Bad Mergentheim, the latest modernisation phase is another important step towards making its technical equipment environmentally and economically fit. 'The new cooling system offers huge flexibility between generating plants, free cooling and buffer storage tanks and can therefore provide refrigeration efficiently and securely,' explains Detlef Janßen.

New cold power supply centre with one of three Zortström distributors and cold pumps



Regulated electronic cold pumps by Grundfos

Focus on high-efficiency pumps

Pump technology by Grundfos also plays its part in the energy and economic efficiency of the new cooling system at the Caritas hospital. Several dozen models of the high-efficiency MAGNA3 circulator pump series as well as the TPE inline series with high-efficiency motors were installed. The clinic has consistently relied on Grundfos pumps since the first major phase of modernisation in 2014. Back then, the outdated power supply centre with three steam boilers, which were oversized due to energy-saving measures, was replaced with a new CHP system, two steam boilers to generate process steam and two boilers, each with a 1,500 kW output. Grundfos' high-efficiency MAGNA3 and TPE pumps were used for the first time in the hydraulic system.

'After the renovation of the power supply centre in Bad Mergentheim, colleagues were chatting at an event and we wondered if it might be possible to optimise the pump settings

High-efficiency inline pump from the TPE series

even further,' recalls Detlef Janßen. 'So we made an appointment with Grundfos Service, who adjusted our pumps to the optimal setting and came out to give our colleagues in-depth training. What impressed us most was the fact that the Grundfos pumps provide more information for optimisation than other models.'

These positive experiences formed the basis for long-term cooperation. 'What we value in particular is the straightforward personal advice,' says Janßen. 'Whenever a question arises, we don't have to click our way through endless computer help screens, we just pick up the phone and get the answer we need quickly. This saves time and builds trust.'

The decision for the pump technology goes beyond the Bad Mergentheim site. The Caritas hospital is connected to the neighbouring Tauberbischofsheim hospital through the BBT Group, and the head of technology also looks after the modernisation projects there. After the positive experiences at Bad Mergentheim in 2016-17, the power supply centre in Tauberbischofsheim was upgraded too. The old boiler system was replaced with two boilers and a CHP system, and the hydraulic system was updated with a larger number of Grundfos MAGNA3 and TPE high-efficiency pumps. An absorption refrigerator was also installed for a new-build with concrete core cooling to allow the power plant to run in summer.

Pump system for pumping the cooling water to the dry cooling tower

Energy savings by replacing the pumps

The modernisation projects in Bad Mergentheim and Tauberbischofsheim have prompted those in charge to once again turn their attention to the energy optimisation potential in the hydraulic system. 'We still had a large number of old pumps in the facilities and gradually began to replace them,' explains Detlef Janßen. 'The growing demands of environmental protection added further impetus to this process, especially as we were able to access government funding.'

This means that around 130 existing pumps have been replaced in the buildings' heat distribution systems with high-efficiency pumps at the Caritas hospital since 2018. For the most part, models from the MAGNA3 series were used, which, with its 45 types and over 220 models, covered a wide range of sizes. The Tauberbischofsheim hospital decided to have an Energy Check carried out by Grundfos before the replacement. 'We wanted to play it safe with the sizing and the choice of replacement pumps and to be able to plan the project with valid figures,' says Detlef Janßen.

And so in October 2019 Grundfos undertook an Energy Check on the 57 existing pumps at Tauberbischofsheim.

The outcome: all 57 pumps offered the potential for savings, in some cases significant ones. All in all, the check resulted in energy savings of almost 71,000 kWh a year, equivalent to a reduction in emissions of almost 31 tonnes of CO_2. In monetary terms, the savings amount to a reduction in running costs of almost €13,000 a year. The calculated payback period for all pumps was under eight years in 2019, but with subsequent soaring energy costs, the project will pay for itself much sooner. Many of the oversized pumps were replaced over several months in winter 2019-20, again with mostly MAGNA3 models and the smaller ALPHA2 series.

Cold water pumps for pumping the cold medium to the Zortström distributor

Group of fittings from the high-efficiency SEW heat recovery system

Successful contribution to environmental protection

In Bad Mergentheim the high-efficiency pumps play an important role in achieving the 'KLIK green' objectives of the Caritas hospital. In line with the motto 'Hospitals help climate protection', the one-year 'KLIK green' project funded by the German Environment Ministry aims to help 250 participating hospitals and rehab clinics across Germany safe 100,000 tonnes of CO_2 by April 2022. 'We are confident that we'll be able to achieve the 400 tonnes reduction that we've set for the Caritas hospital,' says Detlef Janßen. 'Thanks to our involvement in the 'KLIK green' project, we can this year complete the energy upgrade of our ventilation and air-conditioning systems, which was originally set to take place more gradually.'In 2019-20 the clinic upgraded the first ventilation and air-conditioning system with multifunctional counterflow layer heat exchangers. In 2022 another five systems of the same design are set to follow. Grundfos high-efficiency pumps will be used in these systems too.

Practical experience for health managers of the future

Efficient building technology isn't just an important issue for Detlef Janßen in his main job as Head of Technology at the BBT Group. Janßen is also a health management lecturer at Baden-Wuerttemberg Cooperative State University (DHBW). 'Commercial involvement in facility management and energy procurement in the healthcare sectors requires a basic understanding of the technical equipment,' says Janßen. 'That's why I try to make students aware of technical relationships too. Many of them don't realise how much energy is used in hospitals and the effect that energy optimisation can have. The practical experiences at Bad Mergentheim and Tauberbischofsheim are excellent ways of conveying this.'

Refrigeration unit and one of the three Zortström distributors installed

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