New Aalborg University Hospital, Denmark

NAU that's an impressive district cooling system

About

Country	Denmark
Customer	Aalborg Forsyning
Location	Aalborg, North Denmark Region
Industry	District heating and cooling

OPTIMIZING COST

80%

electricity savings

PERFORMANCE AND RELIABILITY

11MW

cooling capacity

DRIVING SUSTAINABILITY

80–90%

CO_2 savings (500,000 to 700,000 tonnes) per year

The vast New Aalborg University Hospital's (NAU) highly effective and sustainable cooling system draws cool water from a chalk lake.

Challenge

NAU, New Aalborg University Hospital is a vast 330,000m² new hospital complex serving the entire region of northern Jutland, Denmark. Besides the University's Faculty of Health Sciences it is also home to the Aalborg Psychiatric Hospital, an oncology house, patient hotel, outpatient house, service village and chapel.
Besides the need for equipment cooling and air conditioning, patients need the air to be carefully filtered and conditioned to provide a comfortable temperature and humidity especially in summer. To meet the project's cooling needs, a district cooling solution was provided by Aalborg Forsyning.

Aalborg Forsyning is a group of utility companies owned by Aalborg Municipality that provide district heating, cooling, gas and water, as well as wastewater, waste collection and energy advice. Although the NAU project is their first large scale district cooling project, it has already earned international attention as Denmark's most effective and most sustainable district cooling systems.

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Johnson Controls

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"The project is expected to be one of the most energy efficient refrigeration plants in the world, with an all year efficiency of up to 23, where conventional plants are 2 to 5. So we expect to have a reliable system that is up to 8 times as efficient as efficient as conventional cooling."

Michael Sandager
Project Engineer, Aalborg Forsyning

Solution

The cold source is a deep cold artificial lake that was formed by Aalborg Portland's chalk mining activities. The lake water temperature is 5-13°C providing a source of free cooling that would cover 80% of NAUs cooling needs.

As in most district cooling systems, there are strong seasonal fluctuations in both the peak and average cooling requirements. Thus, from December to June, the free cooling provided by the lake water would be sufficient. However, from July to November, additional cooling would be required to meet the peak demand.

It would have been possible to simply install a chiller to cover the peak demand during the afore-mentioned months, but Aalborg Forsyning opted to install a combined chiller and heat pump solution for greater flexibility. This means they have the freedom to use a lower percentage of the available free cooling capacity and make the chiller do more work – i.e. working longer and harder to provide the required cooling. Meanwhile the diverted cold water can be used to drive the heat pump to produce hot water for other customers.

Benefits

Aalborg Forsyning's district cooling system exploits the low temperature found at the bottom of the lake to deliver cooling for air-conditioning, machines, servers, scanners and the like. It replaces the conventional electrically-powered cooling facilities.

The energy plant comprises a heat exchanger and pump facility with three Sabroe ChillPAC chillers and two Sabroe HeatPAC heat pumps and other auxiliary equipment.

The district cooling provided by the project is up to eight times more efficient than conventional cooling solutions. This means that the new hospital can look forward to saving 80% on electricity compared to past systems used in the old hospital. Furthermore, the facility occupies much less space and eliminates noise and vibration.

Finally, as surplus heat is considered 100% renewable energy, the project also delivers annual CO_2 savings of approx. 500 to 700 tonnes.