SMART BUILDING COOLING: WATERNET

Amsterdam, Netherlands

PROJECT DESCRIPTION

Waternet-section of the heat and cold storage installation at Sanquin Blood Bank

Waternet is a government owned utility that is responsible for delivering drinking water and providing wastewater treatment for over 1 million people in the Amsterdam metropolitan area. Its nearly 2,000 employees are also responsible for managing groundwater, surface water, wastewater and flood protection. Waternet's largest sources of greenhouse gas (GHG) emissions are the wastewater treatment plants and agricultural land where groundwater levels are being controlled. Due to these GHGs, Waternet is not climate neutral, but is actively working towards reducing its emissions.

About 7-8 years ago, Waternet was looking for customers that could benefit from the thermal potential of drinking water mains to save energy and reduce GHG emissions. Depending on the drinking water temperature in a distribution network and the temperature outside, drinking water can be used for both heating and cooling purposes. Through this targeted outreach, Sanquin Blood Bank was identified as a potential partner. The blood bank needed more compression cooling machines but was unable to get permits due to space and noise constraints. To solve this issue, heat exchangers were connected to the drinking water mains and an aquifer by boring two wells to create an underground thermal storage system. In the winter months, this system harnesses cooling from the drinking water main and stores it underground. In summer, the heat exchange between drinking water and groundwater is shut off and the stored cooling from groundwater is utilized for cooling the blood bank.

The system works in wintertime by pumping aquifer groundwater from one borehole to the other via the heat exchanger. At the same time, drinking water is pumped through the heat exchanger in the opposite direction. The entire process results in the ground water being cooled by the cold drinking water and then stored back underground in preparation for the hotter summer months. The cooling power of the system ranges from 2 megawatts (MWs) to 4 MWs, depending on the allowed warming of the drinking water in the mains (when the drinking water is used to cool down the groundwater, the temperature of the drinking water that is returned to the system rises). Due to the good microbiological quality of the drinking water after the heat exchange, the maximum temperature of the drinking water after heat exchange has been raised from 15 degrees Celsius (°C) to 17 °C (59 ° Fahrenheit to 62.6° Fahrenheit). This project has reduced GHG emissions by roughly 1.1 Kilotons of Carbon Dioxide equivalent per year (KT CO_2e / yr).

MAKING THE PROJECT HAPPEN

The primary driver for this project was GHG emission reductions. When the project began, it was primarily a technical project and not very political, which ultimately contributed to its success. The project also benefitted from having a strong personal involvement from the technical manager of blood bank and his technical adviser, who were both very driven to make the project work. As more stakeholders have since become involved, the project may play a more significant role in reducing GHGs in Amsterdam.

WUCA
Water Utility Climate Alliance

SMART BUILDING COOLING PROJECT

Waternet

IMPLEMENTATION

No special permits were required for this project, but strict monitoring programs for both drinking water temperature and quality were required to be installed by the local ministry to ensure no contamination to drinking water or groundwater. Since the drinking water is not chlorinated and high temperatures could create unwanted bacteria, additional protections were also implemented that primarily focus on temperature. Additionally, Waternet worked closely with the blood bank partners to understand the complexities of the blood bank operations to ensure the cooling system would meet the needs of the blood bank.

FINANCES

In total, this project cost US $2.1M to install the pump and heat exchanger. To assist with the installation costs, Waternet was able to obtain a European subsidy for GHG reductions. The municipality provided most of the funding for this project. Additionally, the blood bank pays Waternet a yearly fixed fee as well as a variable fee per unit of cooling.

CHALLENGES

This project required lots of perseverance, as it took 5-6 years to go from concept to bringing it online. Additionally, corrosion of the heat exchanger became a challenge once the equipment was installed. Particles from the drinking water mains, which were made of cast iron, became trapped in the stainless-steel heat exchanger, which caused the corrosion and some minor leakage. While switching to titanium heat exchangers is feasible, it is very expensive. Instead, there is now regular monitoring in place to avoid further problems.

ADVICE AND LESSONS LEARNED

Water systems present a significant opportunity to harness thermal energy (for both heating and cooling). It is important that water utilities intentionally search for and pursue these opportunities, otherwise the potential will remain untapped. For example, it is estimated that thermal energy from water systems (heat and cold from surface water, wastewater, and drinking water) could supply 60% of Amsterdam's heating needs. As a drinking water utility, energy transitions should be considered in a holistic way and incorporated into the way projects are considered.

LEARN MORE

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