Borders College - Scotland

Figure 1: Sewage heat recovery system [3]

Context

Borders College is a small college in Scotland (Galashiels) with approximately 5500 students. In 2010, they developed a Carbon Management Plan to reduce CO_2 by 25%. In June 2015, SHARC Energy Systems secured a £4million investment from Equitix and the UK Green Investment Bank plc (GIB) to finance the installation of the SHARC sewage heat recovery system. From this and to achieve its goal, Borders College have installed the UK's first heat from sewage scheme which intercepts heat from a waste water sewer close to the local treatment works. The local treatment works are operated by Scottish Water with SHARC Energy Systems as the main partner in the project, specialising in sewage heat recovery technology.

The system uses heat pumps to amplify the natural heat of the waste water and the heat is then sold to Borders Campus in Galashiels,

UK's first heat from sewage scheme which provides 95% heat needed by the Galashiels Campus and doesn't impact on local waste water network

under a 20-year purchase agreement. Providing around 95% of the heat needed by the campus, the scheme does not impact on the normal operation of the local waste water network (they set up a range of measuring equipment for establishing that the downstream temperature and ultimately the biological process of the wastewater treatment plant was not affected) but delivers long term renewable heat to the campus. This innovative technology aims to deliver a substantial reduction in CO_2 emissions. There are plans to deliver similar systems across Scotland.

How does the scheme work?

The average sewage water temperature coming out of the homes in UK is 15°C as an average on the yearly basis, though this temperature varies between 20-25°C in summer and 10-15°C in winter. This sewage heat can be recovered saving a large amount of energy required for heating the water and air by the use of heat exchangers and heat pumps. The Borders College system is composed of two sewage heat pump units (both have a heat capacity of 400kW) parallel to the old existing natural gas boiler and an added valve on the water supply line to the boiler that diverts the heated water so that it passes through the heat pumps instead of the boiler for most of the time. The heated water is thereby distributed between the two heat sources according to the heat demand. The operation is simple, as everything is automatically regulated and only remote supervision is required

Results

The estimated reduction of CO_2 emissions are around 170 tonnes per year. Furthermore, this scheme is also economically feasible, the monetary savings by the college per year sums up to around £10,000 per year on their bills for heating in comparison to use of gas boilers for heating of the buildings.

Key facts

Building type: College (5500 students)

Heat source: two heat pumps to recover heat from wastewater

Heat capacity: 800kW (2* 400kW)

Annual heat production: 1.9 GWh (95%)

Carbon savings: 170 tonnes of CO_2 per year

Temperature in: 7-8°C (Winter) and 13-16°C (Summer)

Temperature out: 50-60°C

Heat pump type: SHARC energy system with R134a Refrigerant

COP: 4.8

Time frame: In operation since 2015

References

[1] "Heat Networks Investment Project: case study brochure", BEIS, 2018

[2] "Heat recovery from untreated wastewater: A case study of heat recovery from sewer line to district heating network", Ola Vestberg, KTH Industrial Engineering and Management, 2017

[3] "Flushed with success", Borders College and SHARC, 22 February 2017

[4] "Recovery of thermal energy from large sewers", Ashish Narula, University of Glasgow

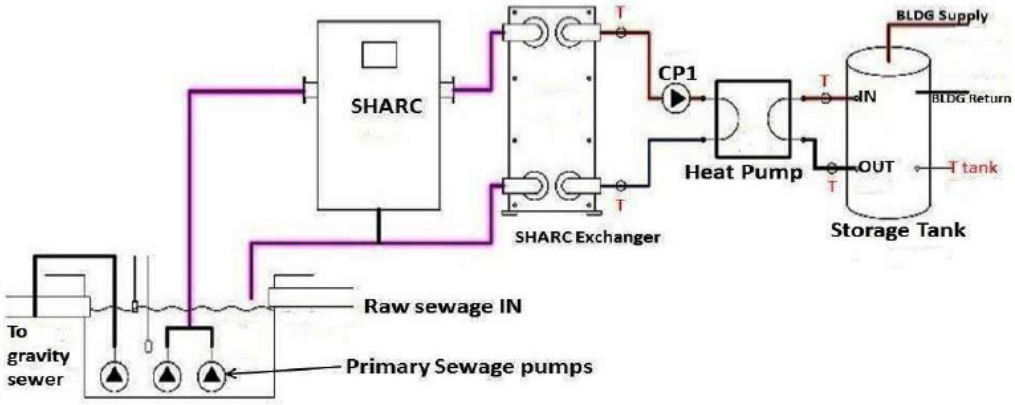

Figure 2: SHARC Unit functioning process [4]