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Low temperature heating project in Tartu

Introduction

Fortum Tartu is a DHC company, delivering heating and cooling for citizens of Tartu. Today there are more than 1700 buildings connected to DH network and ca 75 000 end users in the city are using district heating, of which more than 70% is produced by cogeneration of heat and power by using renewable biomass.

Fortum Tartu is investigating new possibilities and solutions for developing the low temperature concept in Tarkon, a selected part of the existing DH network. The main idea is to investigate whether it is possible to lower the DH supply temperatures in the existing DH system, what its benefits are and where the limits are.

The using of waste heat from industry as an energy source for DH is also a part of the project. Several cases are studied within the project.

Figure 1. TARKON demo area in Tartu

This Project has recieved funding from the European Union's Horizon 2020 research and innovation programme under gran agreement Nº 768567.

Description of LT project

The temperature range of the DH system is 105/55 and it depends on outdoor temperatures. Actually the temperature is about 75 degrees if the outdoor temperature is above zero and it is higher if it is colder outside.

The demo site is a little part of the whole network, comprising 54 consumers in TARKON area with the total capacity of 4.3 MW and with a network length of 4.6 km. The main idea of the concept is to reduce supply temperatures down to 65 °C during mild winter conditions and to 60°C during summer. If it is very cold outside, the supply temperatures are higher to secure the energy demand.

The technical concept of the demo area consists on the temperature intervention on the primary and secondary sides of heat substations, but also on the temperature intervention on DHW at the secondary side of the heat substation. All readings are measured on hourly basis. During the first heating season (winter 2018/2019), the reference measurements were collected. Those measurements are like base case readings – “as it is now”.

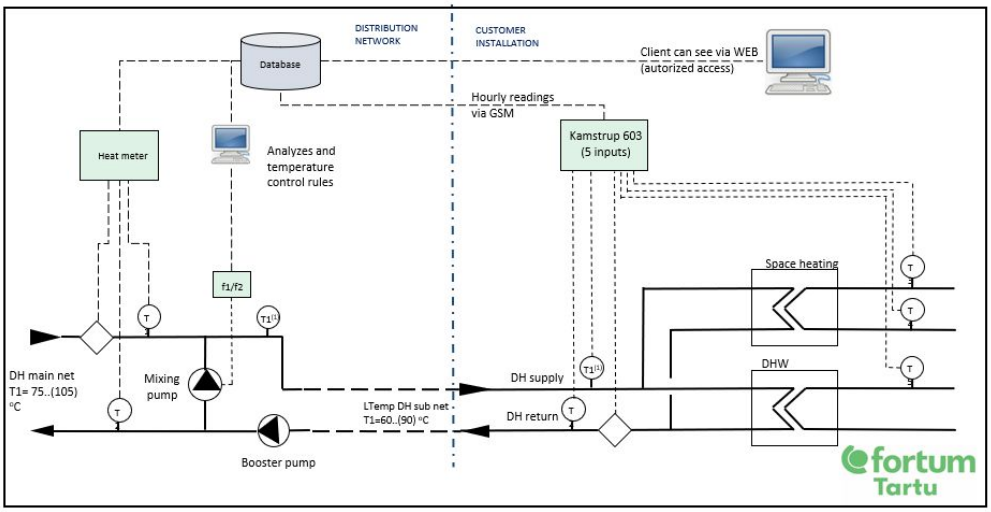

Figure 2. Technical concept of measuring and mixing system of demo area

From December 2019, the supply temperatures have been lowered by 10-15 degrees to simulate the LT concept. The lowering of temperatures is carried through by a mixing pump, which is installed inside the DH net chamber. The test will run until May 2021, after which the results will be analyzed. A report on temperature reduction limits and the achieved energy savings will be available after the test period in 2021. If the results are positive and beneficial, the temperature lowering concept will be applied also to other parts of DH network.

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Heat recovery projects

The collection of industrial waste heat from one or several industrial companies is a part of the project. At this point, several options have been studied by Fortum Tartu.

- Food factory case. 800kW surplus heat from autoclaves with average temperature of 28°C goes to sewage and is available as a heat source. By using a heat pump, heat recovery with an annual amount of 2GWh is available. About half of it could be used for factory space heating and the rest could be used as energy for DH network.
- Printing house case. After the drying prosses, hot gases go into the chimney. By using heat recovery, it is possible to capture 340kW of heat. Heat could be used for own space heating and about 1 GWh/y could be used for DH system.
- CHP case. Warm condensate water from flue gas condensation with the temperature of 48°C goes to sewage. By using a heat pump, the heat recovery with a capacity of 740kW is possible. The annual heat amount of 2.6 GWh is available for DH.
- Ice arena case. Surplus heat from ice machines will be utilized. Ice machines will be connected with district cooling, which delivers the surplus heat to the heat pump situated in the cooling plant. The surplus heat will be used for DH.

Fortum Tartu has the plan to implement all these cases, except the food factory case, by the end of 2020.

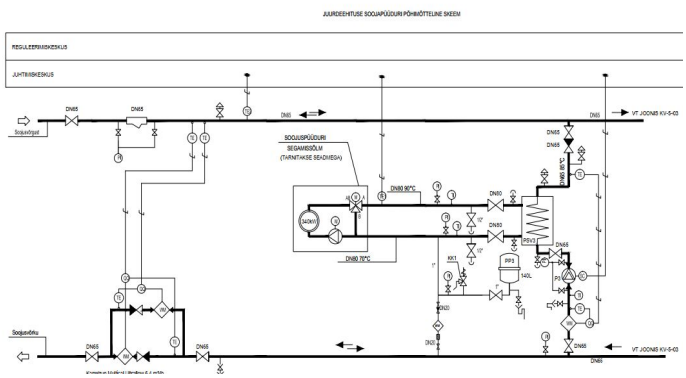

Figure 3. *Heat recovery of printing house scheme*

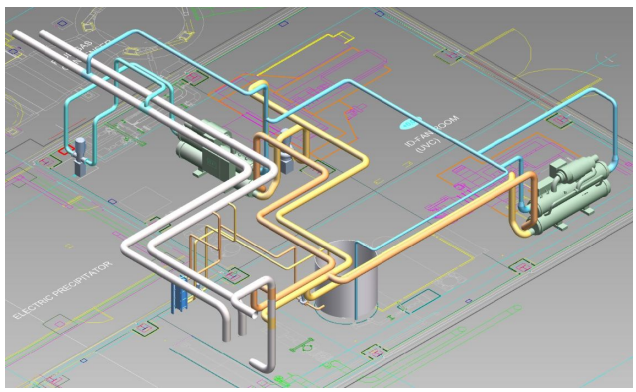

Figure 4. *Heat recovery of CHP layout*

Conclusions

Initially, it seems that the lowering of the temperature in the supply network is possible and it can bring positive and beneficial impacts. In general, the customer heat substations are bigger than the actual need and only a few installations needed improvements.

Many industrial companies have waste heat available and this could be used as a heat source for DH. Usually, the waste heat has low temperature, which shall be boosted by using a heat pump. Lower DH temperatures enables the waste heat to be used in a more efficient way.

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