FLEXeble District Heating for Prosumers

DH is facing challenges, due to improving energy efficiency of electricity using heating systems, mainly different combinations of heat pumps. Also, increasing distributed solar power production adds to this development.

There is a strong demand for development in DH systems, both at the consumer (or prosumer) end and at the production end, including the transmission grid in between.

Smart customer: District Heating vs. Ground Heat, case LUT GC

During the FLEXe program, a smart customer calculation model was developed by LUT, in order to assess the best available alternatives to purchase heat energy. LUT Green Campus was selected as a case to demonstrate the assessment method. In the study, DH and ground heat pump heating system were under comparison, in order to find out the most feasible way to acquire heating energy for LUT GC. The preliminary findings from the study are presented in figure 1.

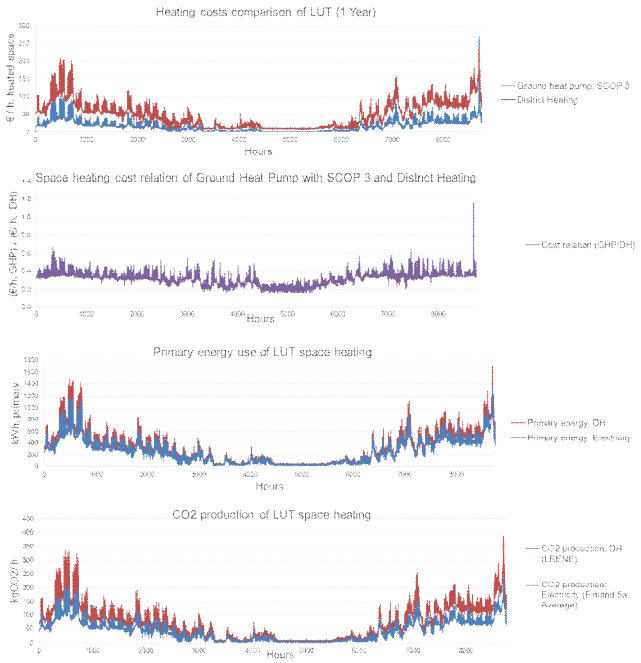


Figure 1. Cost and emission comparison of LUT GC, 2014.

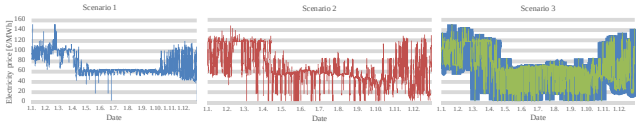
Preliminary results:

- Annual heating cost savings: 64 %,
- Annual CO_2 reduction: 39 %,
- Annual primary energy reduction: 20 %.

No further conclusions should be made according these preliminary results, since they are presented as a basis for comparing the impacts of different energy options in customer's energy planning process.

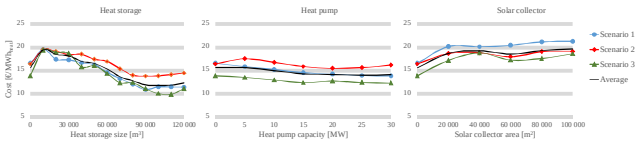
Smart DH grid, case Järvenpää-Tuusula

DH system of Järvenpää and Tuusula was analysed by Aalto, in order to assess the role of heat storages, heat pumps and solar collectors in a future DH system. In this case study, three future electricity price scenarios (Fig. 2) with different shares of wind power and PV (40% and 60%) in 2050 were investigated.



Fig, 2. The studied electricity price scenarios.

The analysis was performed using energyPRO software which solves the optimal operation strategy by minimizing the total variable costs so that the assumed hourly heat demand is met. The average annual costs for heat production in each electricity price scenario are illustrated in Fig. 3.



Fig, 3. The average annual cost for heat production in different price scenarios.

Results:

- A rather large heat storage (100,000 – 110,000 m³) is optimal as the costs are then lowest.
- The most economical capacity for a heat pump seems to be approximately 20 - 25 MW.
- Yet, the most profitable solution was to include both a heat storage and a heat pump in the DH system.
- There is some difference between the costs of different scenarios and the costs are typically lowest in scenario 3 even though the average electricity prices were highest in scenario 1.

It should, however, be noted that the assumptions probably have significant impact on these costs.

Future steps – Beyond FLEXe

- Further development of the smart customer calculation by adding heat storage and in-site solar power production calculations in the model.
- Further development of DH grid analysis methods and tools.

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