Flexible district heat systems enabling future success

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District heat system scenarios

We studied, how city-level district heat (DH) systems could best operate as part of the future energy system.

Typical Finnish city level DH systems have both combined heat and power (CHP) plant and heat-only boilers. The overall efficiency is exceptionally high in international comparison.

We studied the expected future changes by using the VTT Wilmar electricity market scenarios as input in our modelling.

Three scenarios for the Northern European market area for 2050:

1. Shares of wind and PV 28% and 12%
2. Shares of wind and PV 42% and 18%
3. Shares of wind and PV 30% and 30% of all electricity production.

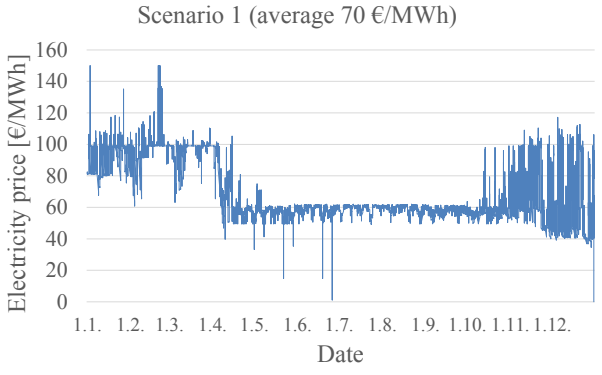
Case Järvenpää

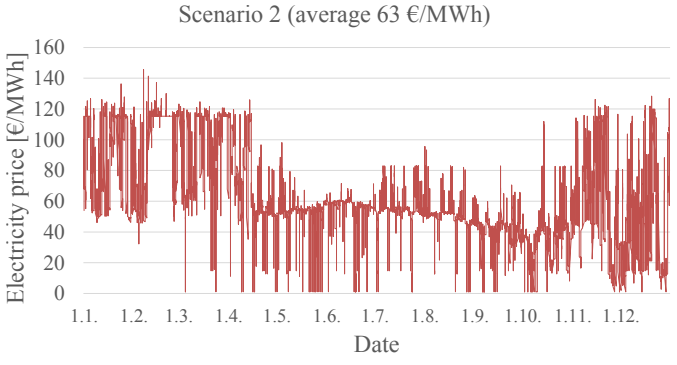
Study case was Järvenpää DH network operated by Fortum Ltd:

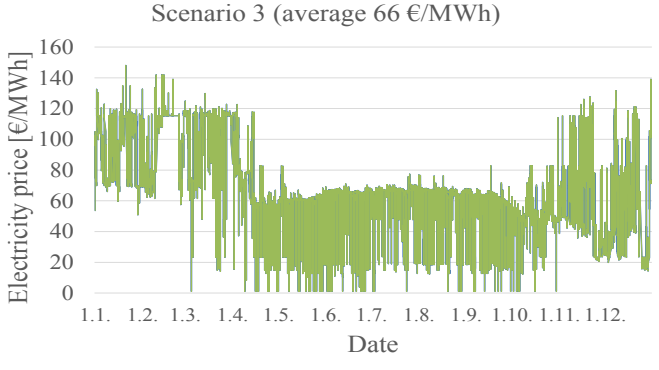
- Modern biofuel CHP plant
- We assumed a minimum operation time of one week for CHP when started
- 7 heat-only boilers (natural gas, fuel oil) + possibility for trade with Kerava and Vantaa

Simulation and system optimisation (system cost minimisation) in different scenarios was done with EnergyPRO model developed by Aalborg university, Denmark.

Electricity price scenarios

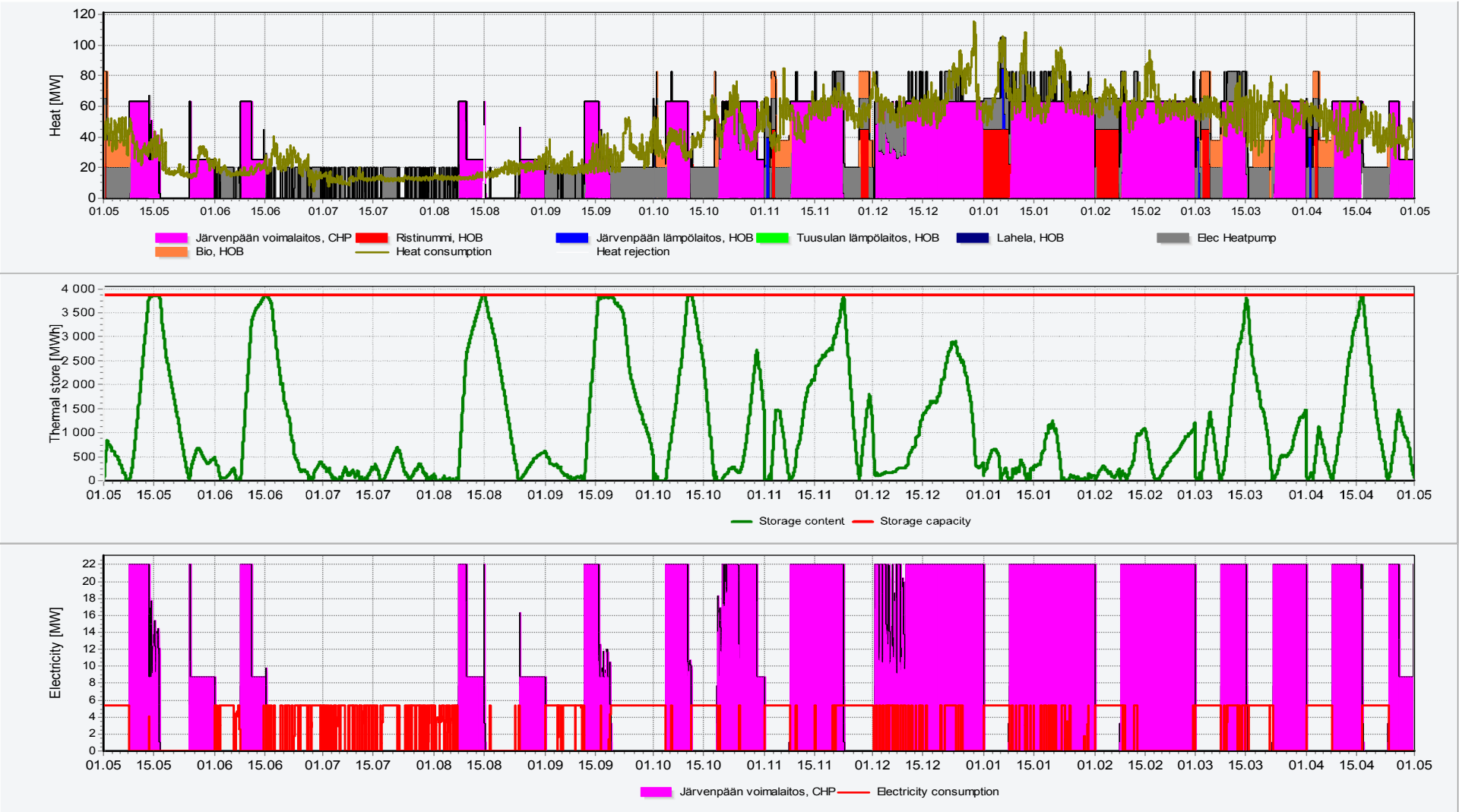






Hourly prices as input to EnergyPRO modeling.

Heat storage (110,000 m^3) and heat pump (20 MW) included (scenario 2)



Conclusions

Both heat storages and heat pumps are important elements in future DH systems:

- They provide flexibility to operate in very different electricity market situations.
- The average heat production cost decreases even with very large heat storages (up to 110 000 m^3).
- Heat storages proved profitable investments also in the Helsinki urban case study conducted by Aalto School of Science.

Soft-linking of different models was successful and provided good insight into the issue. We recommend this for future analyses.

Please see posters:

District heating network simulation and optimization
by VTT, Aalto ENG and Finnish Meteorological Institute
FLEXeble District Heating for Prosumers by LUT, Fortum and Aalto ENG
Urban networks with high share of variable generation by Aalto SCI

for more information!