Transformation of an existing into a Fourth Generation Heating Network*

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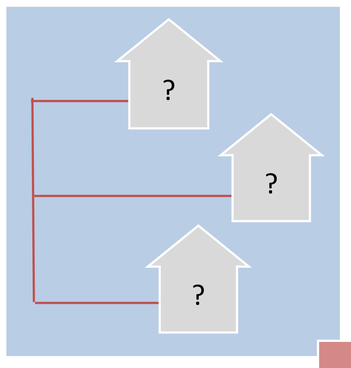
MOTIVATION

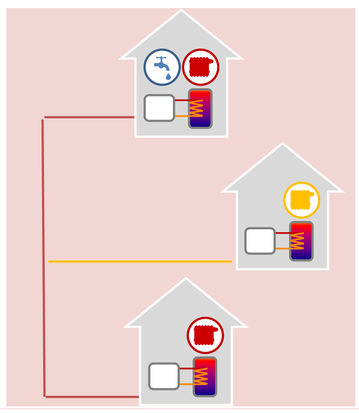
Different measures to supply an area consisting of two consumer units (police station and university) efficiently and based on renewable energy sources are investigated. For this temperature levels of supply and generation are crucial, as most renewables supply lower temperatures more efficiently or vary in supply temperature.

DECREASE IN SUPPLY TEMPERATURES



Reference case

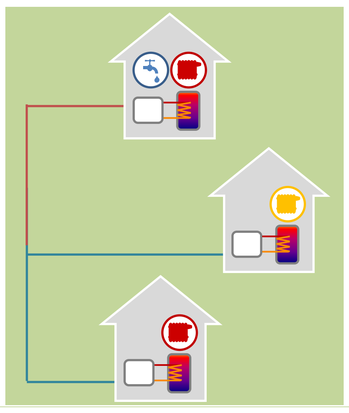
Normally, a heat network is supplied by the maximum required temperature without any analysis of consumers per network line.



Winter

Decrease in supply temperatures in suitable lines leads to decrease in total supply losses.

- Decrease in thermal supply losses of up to 36 %

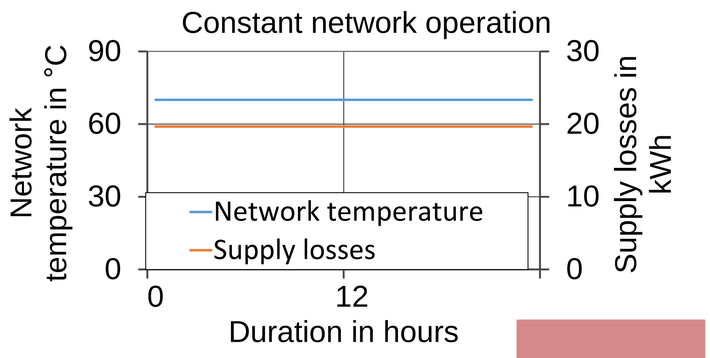


Summer

Lines with no domestic hot water demand can be disconnected from the network. In lines with low domestic hot water demand a change towards decentral electric heating can be economically viable.

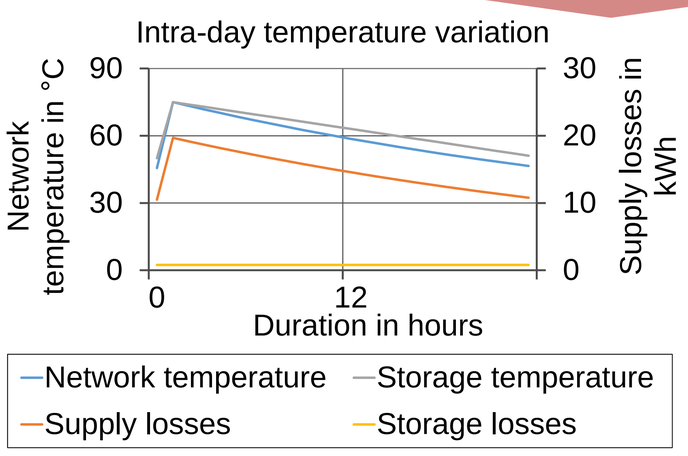
- Reached decrease in losses up to 100 %
- Economic benefit up to 2.300 €/year

INTRA-DAY TEMPERATURE VARIATION



Reference case

In Summer the network is operated at constant temperatures with constant losses.



Case study at high supply temperate

Smaller storages required but overall distribution losses increase.

Case study at low supply temperate

Storage losses overcompensate the decrease in distribution losses.

CONCLUSION ON EFFICIENCY INCREASE

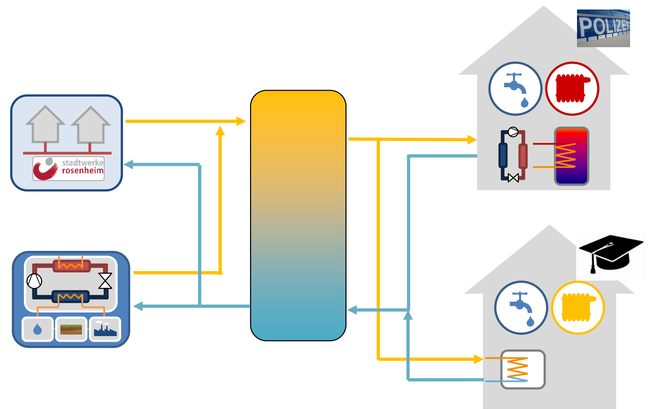
The analysis of thermal energy demands by supply line allows suitable adaptations of supply temperatures and therefore a reduction in thermal losses.

Intra-day variation of supply temperatures is only suitable for long network lines and low domestic hot water demand. Otherwise storage losses, and in some cases increasing short term supply losses for heat distribution, can exceed the constant thermal losses.

Further information see: www.ffegmbh.de/waermenetze

INNOVATIVE HEAT SUPPLY CONCEPTS

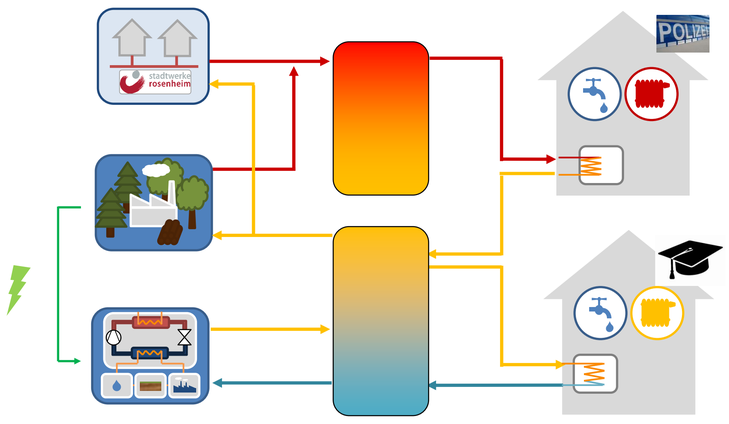
Low-temperature network with decentral heat pumps



Heat for a low-temperature network is generated by a central heat pump supplied by environmental heat from a waste water stream. The close-by primary network return serves as back-up.

In a high energy standard building the thermal energy of the low-temperature network is directly used. In contrast to this, in another close-by low energy standard building the temperature level is required to be further increased by decentral heat pumps.

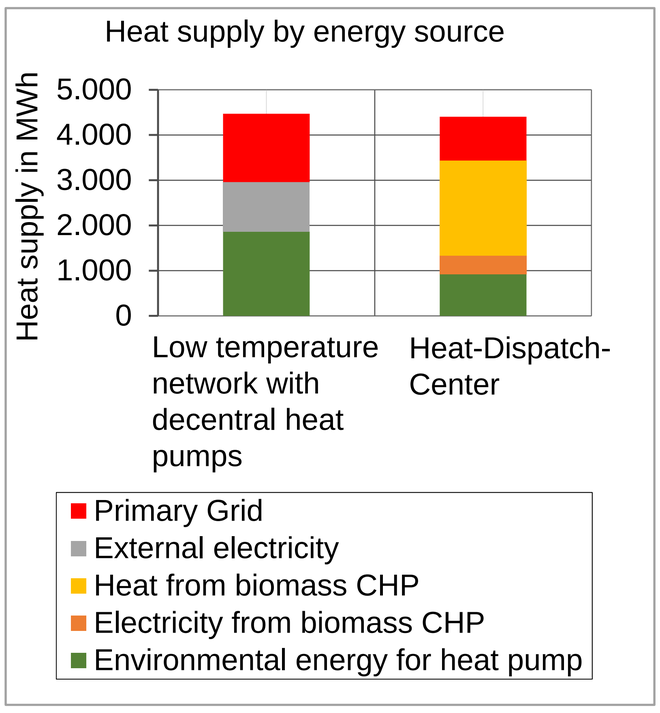
Heat-Dispatch-Center

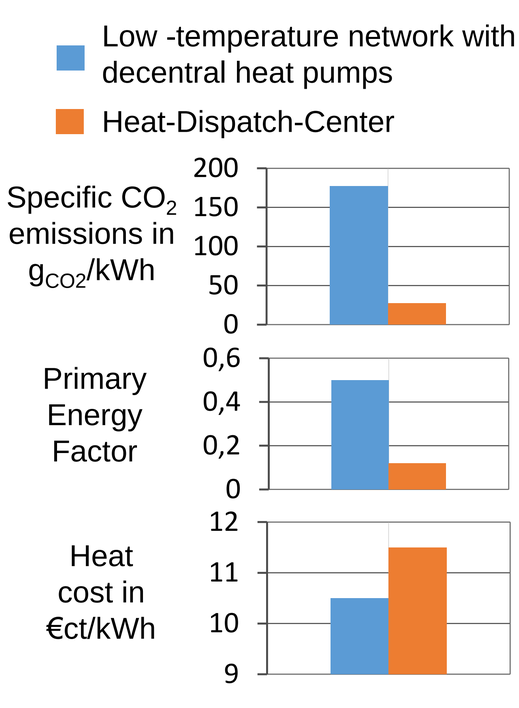


Heat for a high-temperature network is generated by a series connection of a central heat pump (first increase in temperature) with the two high temperature heat generation units combined heat and power and the primary network. The return of the high temperature network serves as flow for the low temperature network close by.

The Heat-Dispatch-Center could also serve as flexible electricity generation and consumption unit. In this way, additional economic benefits could be realized.

RESULTING ENERGY SUPPLY CHARACTERISTICS





CONCLUSION ON SUPPLY CONCEPTS & OUTLOOK

In order to really decrease emissions, the low-temperature heat network must be connected to renewable electricity generation units. Heat generation cost is nearly completely dependent on electricity prices.

The costs for different generation units in the Heat-Dispatch-Center make initial investments high. Still, CO_2-emissions and overall Primary Energy Factor are very low. With the aim of achieve higher flexibility of the Heat-Dispatch-Center and to enable trading at electricity markets, further analysis of adaptations in target temperatures by each technology is required.

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