ELECTRICITY MARKET PARTICIPATION OF RURAL DISTRICT HEATING NETWORKS IN AUSTRIA: ANALYSES FOR DIFFERENT MARKETS

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Motivation and research questions

Tapping the flexibility of small- to large-scale district heating networks to participate on electricity markets [1] is seen as a crucial step on the way to smart energy systems [2]. This might enable new revenues and business models for network operators and, thus, contribute to the economic feasibility of more than 2.400 district heating networks in Austria. Apart from heterogenous generation portfolios and thermal storage tanks, flexible buildings, where the thermal mass of the building is used as storage, offer a high flexibility potential, which can be used to react to changing electricity market prices [3]. This article analysis the use and profitability of tapping this flexibility potential for electricity market participation conducted within the project Flexi-Sync.

Methodical approach

The potential of district heating network participation on electricity markets is assessed using a mathematical programming approach. The model represents

- generation technologies present in the network, e.g., heat only boilers or heat pumps,
- flexibility options, i.e., thermal storages or thermal mass of buildings used as storage, and
- different electricity markets, i.e., spot markets (day-ahead & intraday) and balancing reserve.

The model is used to analyse the operation of a rural district heating network of Maria Laach in Lower Austria in detail. The network is mainly supplied by biomass using heat only boilers and, in the future, a combined heat and power plant, i.e., a situation quite representative for many rural networks in Austria. Measured historical heat demand data together with input data for electricity markets are used.

Different scenarios, e.g., with or without buildings-as-storage, a heat pump or a larger central storage tank, are being considered. A rolling horizon approach allows to assess the operation of the network for these different scenarios for a full year using a 15-minute resolution. This is necessary to account for fluctuating electricity prices as well as to enable detailed models for generators, flexibility options and electricity markets. Tapping the flexibility of buildings-as-storage is currently being implemented in the studied network as part the project Flexi-Sync.

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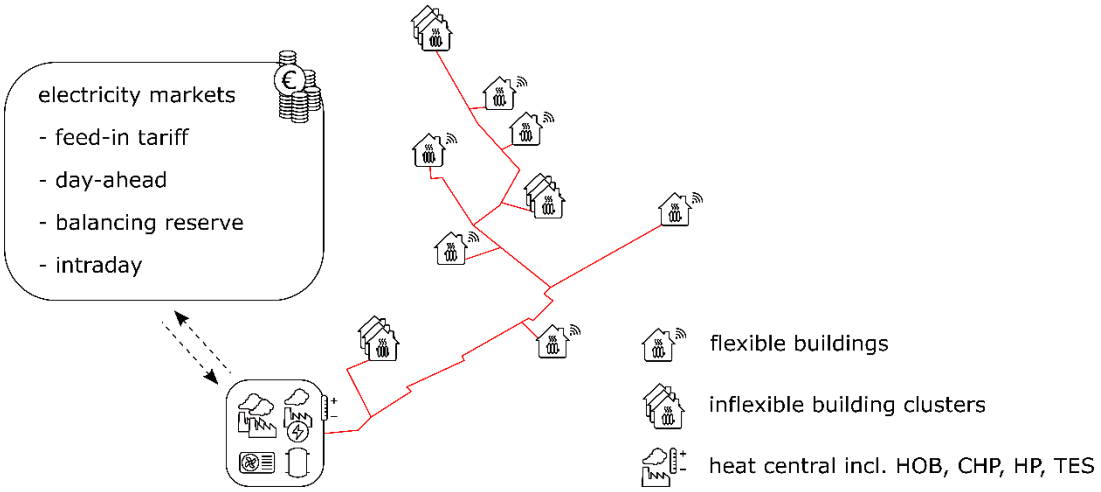

Figure 1: Schematic of the district heating network under consideration.

Results and conclusions

This contribution provides a detailed comparison of the profitability of electricity market participation of rural district heating networks in Austria. The results are compared to the status-quo of quasi fixed feed-in tariffs, market premium and electricity prices. Moreover, sensitivity analyses are done for different levels of biomass prices and feed-in tariffs as well as for spot market prices, using predictions from a dedicated model for the year 2030.

In summary, electricity market participation might be a profitable opportunity for district heating networks in the future, especially, in the case of a fade-out of subsidies like feed-in tariffs or market premium.

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