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The case of Hamburg

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Development of an Open Heating Platform – the Case of Hamburg

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The district heating grid of Hamburg is the second largest in Germany, following Berlin. 1200 km heating network supplies appr. 500,000 consumers (equally divided between private households and commercial customers).
Today, the district heating network of Hamburg consists of 25-30 different grids, of which the largest one, covering appr. 80% of consumption, is owned and operated by Vattenfall. District heating covers only 20% of the overall heat supply, but induces 30% of the CO_2 emissions of the heating sector. The primary form of heat supply in Hamburg is individual heating based on natural gas.
In contrast to the German electricity supply, there is almost no renewable energy in the heating sector.
Because heat production is coal-based, the CO_2 emissions from district heating in Hamburg are higher than those of individual gas-based heating.
There is a large public and political resistance towards coal based district heating, and therefore a push towards increasing the share of renewable energy sources in the heating sector, and the need of developing an ”open heating platform” is part of the discourse.
As a result of a referendum held in 2013, the district heating system will be ’re-municipalized’ in 2019 and hence be sold from Vattenfall and EON to the City of Hamburg (FHH, Freie und Hansestadt Hamburg). After the referendum, Hamburg does virtually not have any heat planning, since until now, this was the responsibility of the private actors.
With an open heating platform, there is potential for integrating new heat suppliers, e.g.:

- Heat from the river Elbe via large heat pumps
- Wastewater heat via large heat pumps
- Integration of wind energy from Schleswig-Holstein (Power2Heat): According to the
- Think Tank ’Agora Energiewende’, the potential for wind used in the heating sector is 2.3 TWh/year by 2023, due to low electricity prices. Today, taxes and duties prevent such a use of wind in the heating sector.

Falling electricity prices constitute a risk element for district heating based on co-production of electricity and heat, especially after the coal powered power plant Moorburg started operating in February 2015. This reinforces the price dampening

effect on electricity prices from increased wind production in northern Germany. Basing district heating on heat sources not based on co-production with electricity therefore becomes increasingly important.

Sara Fritz joined the Energy Economics Group at Vienna University of Technology, Austria in 2013 and holds a degree in Mathematics in Economics at the Vienna University of Technology. She works as a research associate and is a PhD Fellow in an interdisciplinary Doctorate Course in the field of smart cities. Her main research interests cover the evaluation of the interaction between the long-term heating related investment decisions in buildings, the resulting development of the buildings heat demand and the future potential for existing district heating networks under various scenario assumptions.

The Impact of Policies in the Building Sector Influence the Economic Feasibility of District Heating

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An urban district heating network represents an energy efficient way to supply the cities heat demand. The extension of district heating and the increase of its share in heat supply allows replacing ecological inefficient heating technologies. The economic feasibility of the extension and expansion and the operation of a local district heating network is a major issue. Hence the investment decision of a local district heating company is influenced by the current and future installed capacity for heat generation, the trend of energy prices, as well as the development of the regional heat density. Therefore, apart from production and distribution, it's also necessary to convince the society to make use of the network and the development of the buildings' heat demand should be considered explicitly.

The approach is divided in two steps: First, the decision behavior of the building owners is simulated with the existing bottom-up model Invert/EE-Lab[1,2)]. A multinomial logit approach with policies, subsidies and directives as scenario-framework and a time horizon up to 2050 simulates their investments in thermal refurbishments and new heating systems and the resulting energy demand. Based on the decision makers' willingness to connect to the existing district heating system and the correspondent heat demand, an investment optimization for the extension and expansion of district heating is conducted in a second step. This optimization model considers the development of the buildings' heat demand explicitly for the considered time horizon, for both, the already connected buildings as well as for the buildings, which consider a change to district heating. The models objective is to maximize the profit taking account of the European targets and the impacts on the whole heat market. Besides different energy price scenarios for heat generation, also different installed capacities up to 2050 are considered and the impacts on the economic feasibility are analysed.

The results of the integrated approach allow the analysis of the impacts of international and national policies in the building sector on the future design of an urban district