



CITIES

Centre for IT Intelligent Energy Systems

Dynamic prices for heat delivered to district heating systems

This *Demo project* could include the CITIES partners Fjernvarme Fyn, AffaldVarme Aarhus (AVA), HOFOR, DTU, and Ea Energy Analyses. More partners may be included (e.g. more district heating companies, universities, international partners).

Already today, district heating systems have an important role in collecting heat from various sources (including CHP and waste plants as well as industrial sites) and in distributing it to the end-users. In the future, this role may be strengthened with more heat suppliers, including new elements like industrial surplus heat, heat pumps based on sewage water, groundwater, seawater or district cooling (which can consume or deliver heat dependent on system design), geothermal energy, solar heating or even privately-owned heat pumps and other resources.

The task in this demo project is to study the dynamic value of heat supplied to the district heating system. An identical challenge exists on the demand side. However, this activity will focus on supply. Many of the methods used and the obtained results could also be used in a study on the demand side.

The idea is to approach the challenge from a theoretical and a practical perspective including:

- Model-based analyses to compute the value of heat based on location (node in grid) and time (hour).

- Proposals of practical contracts with heat suppliers, which can vary from very simple tariffs (e.g. Time-Of-Use, with price differentiation between summer and winter or between day and night) to more advanced (e.g., time-varying day-ahead prices resulting from a dispatch procedure). Tariffs may or may not include the locational element.

Phase I: Initial analyses

WP1: Review of existing experiences with dynamic prices for heat supplied to district heating systems. Experiences from Aarhus, Odense, Copenhagen and Gothenburg as well as other relevant cases will be included. Also, a literature review will be reported. Aarhus already has dynamic prices with hourly day-ahead heat prices and realised hourly prices. The system is operated by Varmeplan Aarhus, and prices can be observed in real-time on www.varmeplanaarhus.dk.

WP2: Computation of hourly values per node for Aarhus district heating system. Projections will be made for the years 2015, 2025 and 2035. Ea Energy Analyses has a functioning model for the Aarhus district heating system, which will be developed further in cooperation with AVA to represent grid bottlenecks, nodes and more detailed information on the supply and the demand side. The Balmorel model computes the optimal dispatch of all units and the marginal value of heat in each node of the transmission grid. This value is influenced by transmission constraints in the district heating grid as well as by the electricity price (which is coupled to the heat price via the CHP plants). As part of WP2, the model will be extended to include parts of the distribution grid with the possibility of delivering heat at lower temperatures. Seasonal variations of district heating temperature and its influence on heat production technologies and transmission constraints could also be considered.

WP3: Development of a set of practical contracts for heat supply. The contracts may vary in complexity. For large units more complex contracts may be relevant. The contracts will be developed for Aarhus based on the model study. For Copenhagen and Odense the contracts will be developed based on the existing insights in these systems. An overview of relevant tools to support dynamic tariffs will be developed. This may include prediction of prices, communication with end-users and prediction of (price dependent) demand.

As part of WP3, suggestions for dispatching the heat in a system with a high number of producers will be given, e.g. market, central dispatcher, dispatch based on contracts. Advantages and barriers for the different dispatch options will be analysed.

WP4: Summary of results and development of Phase II.

Phase II: In-depth study and practical implementation

In the second phase, practical tests may be developed in cooperation with relevant heat suppliers. Model-based studies may be expanded to some of the other cities if relevant. Tools may be developed and tested.

Project plan

27th May 2015: Presentation of demo project idea at CITIES workshop

June 2015 – July 2015: Development of project plan

August 2015 – July 2016: Phase I

August 2016 – July 2018: Phase II

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