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Editorial – Smart District Heating and Energy System Analyses

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ABSTRACT

This editorial introduces the 13th volume of the International Journal of Sustainable Energy Planning and Management, which addresses thermal storage systems in district heating systems, simulation of scheduling of energy units as well as the structure of pricing systems for district heating in Sweden. Beyond the area of district heating, the volume probes into the effects of energy price reductions on energy demand in Hungary as well as the geographical distribution of electricity demand and production in Germany.

Keywords:

Energy system simulation;
Thermal storage;
Pricing of energy;
Grid layout;

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1. Introduction

This editorial introduces the 13th volume of the International Journal of Sustainable Energy Planning and Management. This volume is the second special issue on Smart district heating and electrification from the *2nd International Conference on Smart Energy Systems and 4th Generation District Heating*, held in Aalborg, Denmark in September 2016.

The first special issue[1],reported primarily on low-temperature district heating [2, 3]. In this second special issue, three of the included articles[4–6] were presented at this annual conference, addressing district heating from technical and economic perspectives. In addition, two ordinary submissions [7, 8] addressing power system structure in Germany and the effects of energy prices on energy usage in Hungary are included.

More work from the *2nd International Conference on Smart Energy Systems and 4th Generation District Heating* is published concurrently in Energy [9–24]. Additionally, special issues were established for the 1st *International Conference on Smart Energy Systems and 4th Generation District Heating* in both Energy [25–40] and this journal [41–44].

The conference series *International Conference on Smart Energy Systems and 4th Generation District Heating* is organized as an annual joint effort between the 4DH Strategic Research Centre in collaboration with Aalborg University, Denmark, with venues alternating between Aalborg and Copenhagen.

2. District heating and smart energy systems

Flores et al.[4] investigate and compare different thermal energy storage types in 4th generation district heating systems; more specifically latent heat vs sensible heat storages. Latent heat storages – using phase change materials – are 1.5 to 4 times more expensive than a sensible heat storage using water. Latent heat storages are often of a passive type where the phase change material is used in building materials, however for district heating applications, active latent heat storages are required to engage with the water-borne heating system. Latent heat storages are more expensive due to the circumstance that phase-change materials with phase change at relevant temperature levels are significantly more expensive than the alternative from sensible heat storages – water. However, volumetric energy contents is also significantly larger

Leeuwen et al.[5] establish a model for both simulating the scheduling of local energy systems and for optimising the composition of the energy system. Taking a starting point in a Dutch case, they seek alternatives to the present natural gas-based heating system, electric cooling and

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conventional power generation. Alternatives include biomass a) heat/PV/wind, b) heat pump/PV/wind, and c) biogas CHP/heat pump/PV/Wind. Findings include that alternative b) is the most attractive from a financial perspective, whereas the others perform better in terms of CO_2-emissions.

Sernhed et al. [6] address the situation that pricing schemes for district heating in Sweden is moving towards an increasingly larger share of the costs being included in the fixed share of the district heating costs of customers. This on the other hand has a negative impact on incentives for energy savings as a smaller fraction of the district heating bill may be saved. Another thing the authors identify is that customers need to be able to predict costs – both for budgeting and for assessing potential savings.

3. Price impacts on energy demand

Szép[7] applies a Logarithmic Mean Divisia Index (LMDI) method to analyse the effects of Hungarian energy prices on energy consumption finding that energy demands increase with falling energy unit costs. On an aggregated level this is partly counter-balanced by population and other effects, however for the individual consumer it still creates a disincentive for energy savings and thus functions as a barrier for meeting national energy targets.

4. Geographical distribution of electricity demand and production

Changes in the energy system also generate changes in the geography of the energy system. This is one of the starting point in the *open_eGo* project. In their analyses, Hülk et al.[8] investigate the geographical distribution of power demand and production based on catchment areas surrounding grid nodes in Germany. One of the ambitions of the project is to establish an open-source grid planning tool.

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