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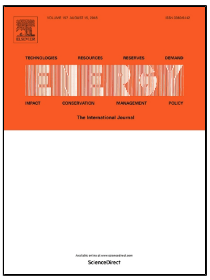

Demand Modelling in District Heating Systems within the Conceptual Design of a Waste-to-Energy Plant

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Demand Modelling in District Heating Systems within the Conceptual Design of a Waste-to-Energy Plant

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The paper deals with the issue of fluctuations in heat demand and how they are dealt with when planning investments in the field of energy recovery of waste. The lifetime of Waste to Energy plants (WtEP) is typically 20-30 years. Their construction is also a time and investment-intensive business and requires a robust design with low sensitivity to future changes in key parameters.
The paper analyses the effect of fluctuations in heat demand on the accuracy of techno-economic models and their outputs. The aim is to determine the sensitivity of optimisation models to the applied time step. The sensitivity of two different models is compared – a simple model of a WtEP cooperating with a gas boiler and a complex model of a WtEP integrated with a combined heat and power plant.
Optimisation models, commonly used to design these facilities, perform calculations in certain time steps, typically on an annual or monthly basis. The simplification from hour to month time step may cause inaccuracies. The paper offers alternative solutions to modelling methods of WtEP, using so-called correction coefficients. They help to increase the accuracy of the models while maintaining acceptable calculation time.

Highlights

- Tracking short-term changes to important parameters for the WtE plant economy.
- Modelling the operation of an existing and newly considered thermal facility.
- Creating and applying correction coefficients for fluctuation parameters.

Keywords: Waste; Waste-to-Energy Plant; Cogeneration; Heat demand; Operation planning

Abbreviations

C	WtEP capacity [kt/y]
c	amount of waste entering the boiler in the WtEP [t/h]
D,D^s,D^w	total heat demand, demand for heat in form of steam, hot water [TJ]
d,d^s,d^w	average total heat demand, demand for heat in form of steam, hot water [GJ/h]
$P_{max,\,min}$	maximum, minimum heat output of the WtEP [TJ]
$q_{WtEP,\,GB,CHPP}$	heat energy supplied from the WtEP, gas boiler [GJ/h]
$Q_{WtEP,\,GB,CHPP}$	heat energy supplied from the WtEP, gas boiler [TJ]
R	ratio of average monthly heat demand and maximum heat output of the plant [-]
r	dissipated heat [GJ/h]