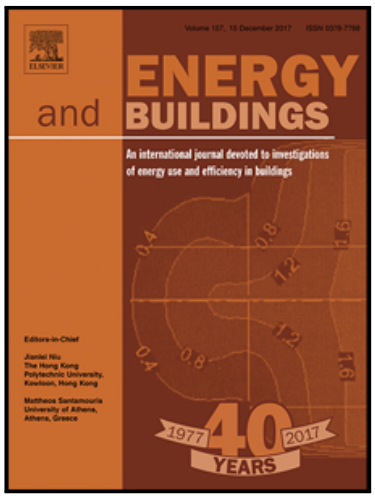

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PII: S0378-7788(17)32874-8
DOI: 10.1016/j.enbuild.2018.05.010
Reference: ENB 8551

To appear in: *Energy & Buildings*

Received date: 24 August 2017
Revised date: 12 April 2018
Accepted date: 7 May 2018

Please cite this article as: Piotr Hirsch , Michał Grochowski , Kazimierz Duzinkiewicz , Decision Support System for Design of Long Distance Heat Transportation System, *Energy & Buildings* (2018), doi: 10.1016/j.enbuild.2018.05.010

Decision Support System for Design of Long Distance Heat Transportation System

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Abstract. District Heating (DH) systems are commonly supplied using local heat sources. Nowadays, modern insulation materials allow for effective and economically viable heat transportation over long distances (over 20 km). The paper proposes a Decision Support System (DSS) for optimized selection of design and operating parameters of a long distance Heat Transportation System (HTS). The method allows for evaluation of feasibility and effectiveness of heat transportation from the considered heat sources to the given DH area. The optimized selection is formulated as the multicriteria decision-making problem. The constraints for this problem include a static HTS model, allowing considerations of the system life cycle, as well as time variability and spatial topology. Thereby, the variation of heat demand and ground temperature within the DH area, the insulation and pipe aging, as well as the terrain elevation profile are taken into account in the decision-making process. The HTS construction costs, the operating costs (pumping power), and the heat loss are considered as objective functions, while such parameters as: inner pipeline diameter, insulation thickness, temperature and pressure profiles, as well as pumping station locations are optimized during the decision-making process. Moreover, variants of pipe laying e.g. one pipeline with a larger diameter, or two parallel pipelines with smaller diameters might be considered during the optimization. The analyzed optimization problem is multicriteria, hybrid and nonlinear. The genetic solver has been proposed to solve it.

1. Introduction

Space heating is a major component of overall heat consumption in Europe. At the same time, heating uses up to 80% of total energy consumed in residential houses [1]. The district Heating (DH) is an attractive solution for space heating, especially when it is supplied by a Combined Heat and Power (CHP) plant [2–4]. Recovering the heat from any kind of a thermal power plant increases the plant energy efficiency and is an effective method for cutting carbon emissions. Several studies have shown that conventional CHP plants are

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