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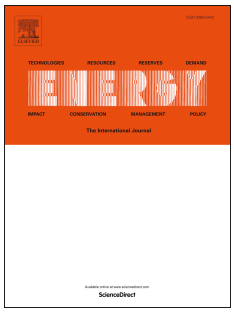

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Technical Assessment of Electric Heat Boosters in Low-Temperature District Heating based on Combined Heat and Power Analysis

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Abstract

This paper provides a technical assessment of electric heat boosters (EHBs) in low-energy districts. The analysis is based on a hypothetical district with 23 terraced single-family houses supplied by both a low-temperature district heating (LTDH) network and a low-voltage network (LVN). Two case studies are provided to show the active role of EHBs in a smart energy system (SES). The first case compares annual heat and power flow analyses for LTDH at five supply temperature levels, focusing on their impacts. The results show that district heating network (DHN) losses can be reduced by 35% if the supply temperature is reduced from 70 °C to 50 °C, but the LVN peak power will have to be increased by up to 2% using heat boosting. The second case further aggregates EHBs to provide a fuel shift (FS) service for the DHN. The results show that while LVN peak power was increased by up to 4.3%, the basic power production and peak boiler usage for DHN could be reduced by as much as 15% and 48%, respectively. In summary, lower supply temperatures and intelligent components can improve system efficiency and turn the DHN into an integrated part of a SES.

Keywords: Smart energy systems; 4GDH; Low-temperature district heating; Electric heat boosters; Fuel shift; Combined heat and power.

1. Introduction

Denmark is aiming at a 100% renewable-based electricity and heating sector by 2035 and a complete transition to a renewable-based energy system by 2050 [1]. Such ambitious targets demand considerable effort involving integration of intermittent renewable sources and energy conservation. In recent years, a large number of renewable energy sources, such as wind power plants, have been connected to the Danish energy system. Meanwhile, energy

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