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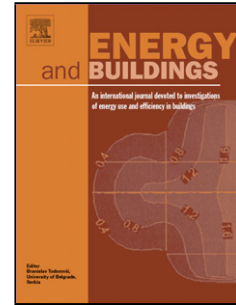
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Improving Energy Efficiency via Smart Building Energy Management Systems: A Comparison with Policy Measures

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Abstract

To foster the transition to more sustainable energy systems, policymakers have been approving measures to improve energy efficiency as well as promoting smart grids. In this setting, building managers are encouraged to adapt their energy operations to real-time market and weather conditions. Yet, most fail to do so as they rely on conventional building energy management systems (BEMS) that have static temperature set points for heating and cooling equipment. In this paper, we investigate how effective policy measures are at improving building-level energy efficiency compared to a smart BEMS with dynamic temperature set points. To this end, we present an integrated optimisation model mimicking the smart BEMS that combines decisions on heating and cooling systems operations with decisions on energy sourcing. Using data from an Austrian and a Spanish building, we find that the smart BEMS results in greater reduction in energy consumption than a conventional BEMS with policy measures.

Keywords: Smart building energy management, Dynamic energy consumption, Energy-efficiency policy measures, Non-linear optimisation.

1. Introduction

Concerns about climate change stemming from increased anthropogenic emissions of greenhouse gases such as CO₂ have catalysed a transition to a more sustainable energy system. In many industrialised countries, such ambitions have been formalised by targets set by policymakers, e.g., the EU's 20-20-20 by 2020 directive, which stipulates a 20% reduction in energy consumption by 2020 relative to 1990 levels along with a 20% reduction in CO₂ emissions and 20% of all energy produced by renewable technologies [1]. Typically, supporting the attainment of these targets are policy measures such as feed-in tariffs (FIT) or renewable portfolio standards, which effectively subsidise renewable energy technologies [2, 3]. Yet, while such measures are prominently discussed in terms of stimulating the adoption of renewable energy technologies, the demand side's role in facilitating this desired transition to sustainability has been often overlooked.

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