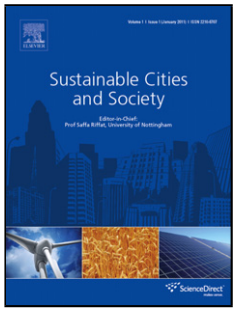

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Assessing Demand Response with Heat Pumps for Efficient Grid Operation in Smart Grids

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Abstract

Renewable power generation will increase and more heat pumps (HP) will be installed in the UK causing challenges regarding balancing electricity supply and demand. Demand Response (DR) can help overcoming this issue. This paper investigates how DR with HP can be used for efficient grid operation and which potential exists in the UK. A model has been developed. It allows estimating the impact of introducing HP on the half-hourly load profile on both single dwelling and UK grid level. In the base case scenario it has been shown that grid peak loads would increase by about 6 GW in the winter. On household level, peak loads would approximately triple. DR has the potential to avoid the new peak loads on grid level. On household level, new peak loads can only be reduced. In an ideal case in the winter peak loads would increase by 2 GW on grid level. In single dwellings peak loads would increase by one quarter. In both cases DR can avoid the new peak loads. The findings confirm results of previous studies regarding future challenges for grid operators. DR can be one of several solutions that help overcoming these obstacles and it should thus be promoted.

Keywords: heat pump, model, demand response, smart grid, demand side management

1 Introduction

In the UK, the aim is reducing greenhouse gas emissions by 80 % from 1990 levels by 2050 [1]. One element that helps achieving these climate targets is producing power from renewable energy carriers. However, this causes challenges regarding the matching of electricity supply and demand leading to an increased need for flexibility [2].