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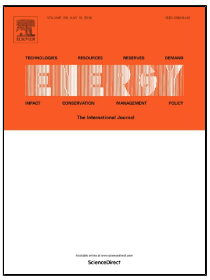

A novel approach for estimating residential space heating demand

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A novel approach for estimating residential space heating demand

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Keywords: energy system modeling; demand curve; heating degree days; mapping; residential demand; space heating;

Abstract

Energy system models on country level usually contain multiple energy carriers at different granularity. While data is comparably rich in terms of temporal and spatial resolution for the electricity part, much less is known for heat. Especially the true demand for heat as a function of usage and time is difficult to obtain. In many cases, energy consumption data (fuel oil, natural gas, district heating etc.) is taken as approximation for the final energy end-use of heat. Different heat distribution technologies bring their own bias on temperature levels and heating hours, like with ground floor heating vs. radiator. Therefore, historic consumption data is not an appropriate base for modelling of energy systems with long prospect. The present research work proposes a novel top-down methodology for generating aggregated load curves on heat demand, with a focus on residential space heating. Maps of population density distribution combined with norm temperature profiles and the definition of heating degree days provides a tempo-spatial map of heating demand. The knowledge of total residential space heating demand is used to identify the aggregated demand curve, suitable for energy system modelling.

Introduction

Space heating in buildings takes a significant share in global energy end use. According to IEA data, 171.5 EJ (or 31%) out of 549 EJ total primary energy supply is attributed to the total final energy use for heat, compared to 65.1 EJ (or 12%) for end use of electricity [1]. From this heat, 78.8 EJ are used in industry, 83.7 EJ in buildings and 9 EJ in other sectors [ibid.]. Depending on each countries' specific energy mix, climate-depended basic heating demand, building insulation level and space use, heat and electricity use in buildings causes 19% of energy-related global greenhouse gas emissions (GHG)