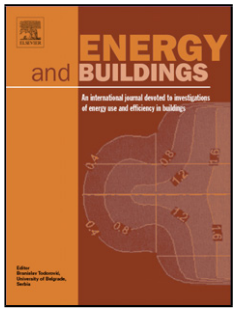


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# Global sensitivity analysis as a support for the generation of simplified building stock energy models

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**Abstract**

Buildings are responsible for 40% of total final energy consumptions in Europe. Numerous bottom-up models were recently developed to support local authorities in assessing the energy consumption of large building stocks and reduction potentials. However, current models rarely consider uncertainty associated to building usage and characteristics within the stock, resulting in potentially biased results.

This study presents a generic model simplification approach using uncertainty propagation and stochastic sensitivity analysis to derive fast simplified (surrogate) models to estimate the current building stock energy use for improved urban planning. The methodology includes an engineering-based energy model as input to global sensitivity analysis (GSA) using the elementary effects (EE) screening and Sobol' method for key parameter identification and regression analysis to derive simplified models for entire building stocks.

The application to the housing stock of Esch-sur-Alzette (Luxembourg) showed that the parameters explaining most of the variability in final energy use for heating and domestic hot water are floor area, set-point temperature, external walls U-values, windows and heating system type. Results of the simplified models were validated against measured data and confirmed the validity of the approach for a simple yet robust assessment of the building stock energy use considering uncertainty and variability.

**Abbreviations**

$A_f$: Building footprint area ($m^2$);

$A_n$: Floor surface area ($m^2$);

CC: Construction class (light, medium, heavy);

DH: detached house;

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