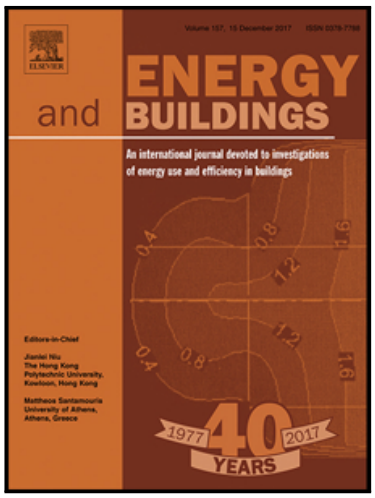

Synthetic Building Stocks as a Way to Assess the Energy Demand and Greenhouse Gas Emissions of National Building Stocks

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PII: S0378-7788(17)33642-3
DOI: 10.1016/j.enbuild.2018.05.055
Reference: ENB 8596

To appear in: *Energy & Buildings*

Received date: 23 November 2017
Revised date: 22 May 2018
Accepted date: 30 May 2018

Please cite this article as: Claudio Nägeli , Clara Camarasa , Martin Jakob , Giacomo Catenazzi , York Ostermeyer , Synthetic Building Stocks as a Way to Assess the Energy Demand and Greenhouse Gas Emissions of National Building Stocks, *Energy & Buildings* (2018), doi: 10.1016/j.enbuild.2018.05.055

Synthetic Building Stocks as a Way to Assess the Energy Demand and Greenhouse Gas Emissions of National Building Stocks

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Keywords: Building Stock Modeling, Bottom-up Model, Synthetic Building Stock, Synthetic Population, Building Archetypes, Building Energy Modeling, GHG Emissions

Abstract

In Europe, the final energy demand and greenhouse gas (GHG) emissions of residential and commercial building stocks account for approximately 40% of energy and emissions. A building stock model (BSM) is a method of assessing the energy demand and GHG emissions of building stocks and developing pathways for energy and GHG emission reduction. The most common approach to building stock modeling is to construct archetypes that are taken to representing large segments of the stock. This paper introduces a new method of building stock modeling based on the generation of synthetic building stocks. By drawing on relevant research, the developed methodology uses aggregate national data and combines it with various data sources to generate a disaggregated synthetic building stock. The methodology is implemented and validated for the residential building stock of Switzerland. The results demonstrate that the energy demand and GHG emissions can vary greatly across the stock. These and other indicators vary significantly within common building stock segments that consider only few attributes such as building type and construction period. Furthermore, the results indicate a separation of the stock in terms of GHG emissions between old fossil fuel-heated buildings and new and refurbished buildings that are heated by renewable energy. Generating a disaggregated synthetic building stock allows for a discrete representation of various building states. This enables a more realistic representation of past building stock alterations, such as refurbishment, compared with commonly used archetypes, and not relying on more extensive data sources and being able to accommodate a wide variation of data types. The developed methodology can be extended in numerous manners and lays groundwork for future studies.