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Quantifying Uncertainties in an Archetype-Based Building Stock Energy Model by Use of Individual Building Models

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Abstract : Focus on reducing energy consumption in existing buildings at large scale, e.g. in cities or countries, has been increasing in recent years. In order to reduce energy consumption in existing buildings, political incentive schemes are put in place and large scale investments are made by utility companies. Prioritising these investments requires a comprehensive overview of the energy consumption in the existing building stock, as well as potential energy-savings. However, a building stock comprises thousands of buildings with different characteristics making it difficult to model energy consumption accurately. Moreover, the complexity of the building stock makes it difficult to convey model results to policymakers and other stakeholders. In order to manage the complexity of the building stock, building archetypes are often employed in building stock energy models (BSEMs). Building archetypes are formed by segmenting the building stock according to specific characteristics. Segmenting the building stock according to building type and building age is common, among other things because this information is often easily available. This segmentation makes it easy to convey results to non-experts. However, using a single archetypical building to represent all buildings in a segment of the building stock is associated with loss of detail. Thermal characteristics are aggregated while other characteristics, which could affect the energy efficiency of a building, are disregarded. Thus, using a simplified representation of the building stock could come at the expense of the accuracy of the model. The present study evaluates the accuracy of a conventional archetype-based BSEM that segments the building stock according to building type- and age. The accuracy is evaluated in terms of the archetypes’ ability to accurately emulate the average energy demands of the corresponding buildings they were meant to represent. This is done for the buildings’ energy demands as a whole as well as for relevant sub-demands. Both are evaluated in relation to the type- and the age of the building. This should provide researchers, who use archetypes in BSEMs, with an indication of the expected accuracy of the conventional archetype model, as well as the accuracy lost in specific parts of the calculation, due to use of the archetype method.

Keywords : building stock energy modelling, energy-savings, archetype
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