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Development of a dynamic European residential building stock typology for energy system analysis

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In recent years, different approaches have been developed with the aim of defining representative buildings that can be used as a basis for residential building energy system analyses. Due to the coupling of different sectors at the household level, the analysis of future residential energy systems is becoming increasingly complex. On the European level a large amount of data has been published over the last years. This study combines multiple different data sets relevant for energy system analysis at the building level and presents a dynamic methodology for the derivation of representative building/household combinations, which can be used as a basis for residential energy system analyses on a European level. The approach enables representative buildings to be generated dynamically taking into account the parameters relevant to the respective research question. In a first step, various data sets are combined to describe local building properties, weather conditions, economic and ecological framework conditions as well as socio-demographic parameters on NUTS3 level. Based on the developed database, a two-step procedure for the derivation of building household combinations is presented. In the first step, a synthetic European population is generated by using iterative proportional fitting. In the second step different cluster approaches are compared for the derivation of case specific archetype buildings. Finally, the developed methodology is used in an exemplary way for the analysis of the potential of energy self-sufficient single-family buildings in the future European building stock by using a mixed integer linear programming optimization model for the optimal energy system design and dispatch of residential buildings, taking into account relevant framework conditions such as weather conditions, regulatory framework conditions and site-specific building properties.