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Identification of parameters affecting the variability of energy use in residential buildings

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INTRODUCTION

Variations in energy use of buildings are considered a significant issue towards their integration in the overall energy grid. Especially in the framework of Energy Hubs (1) where integrated district energy systems are dominant, the accurate prediction of the operational energy use of a building or clusters of buildings is crucial. According to the findings of IEA EBC Annex 53 (2), these variations are mainly attributed to the following areas: building envelope and equipment, operation and maintenance, occupant behavior and indoor environmental conditions, as well as climate. Starting from this classification, this study will treat these areas as a) the passive parameters mainly representing the building envelope and possibly the equipment and b) the active components standing for users and climate.

Uncertainty characterizes both categories of parameters, especially occupancy. Uncertainty analysis has proven to be the main approach to determine the effect of uncertainty on building energy performance. Moreover, sensitivity analysis is conducted to analyze variations in building parameters and their effect on energy use. Previous studies have extensively used sensitivity analysis in building energy analysis such as (3), (4). Generally, the methodologies found in literature are classified into local and global sensitivity analysis (i.e. regression, variance-based, screening-based and meta-model based method). The latter is the most commonly used for building energy analysis, mainly because it considers the interactions among the input parameters.

METHODS

The present study aims first at identifying the stochastic and non-stochastic parameters that are responsible for the variations in energy performance investigating simple building models. Secondly, through the implementation of a sensitivity analysis, it will determine the key variables that affect energy use in residential buildings and propose a new methodology for parameter optimization.

RESULTS AND DISCUSSION

The derived results will be evaluated based on a reference scenario. Probabilistic profiles will be created accounting for stochasticity. It is discussed whether the levels of detail of each building parameter is necessary to accomplish accuracy.

CONCLUSION

The results of this study lead to a methodology for realistically estimating the magnitude of key variables on building performance. The next step will be to apply this methodology to

housing stock models in future studies considering any sources of uncertainty, such as heterogeneity and parameter uncertainty.

REFERENCES

1. M. Geidl and G. Andersson, 'Optimal Power Flow of Multiple Energy Carriers', IEEE Transactions on Power Systems, 2007, 22: 145 – 155.
2. IEA EBC Annex 53, Final Report, 'Total energy use in buildings', November 2013.
3. A. Ashouri, F. Petrini, R. Bornatico, M. J. Benz, 'Sensitivity analysis for robust design of building energy systems', Energy, 2014, 76: 264-275.
4. P. Heiselberg, H. Brohus , A. Hesselholt, H. Rasmussen, E. Seinre, S. Thomas, 'Application of sensitivity analysis in design of sustainable buildings', Renewable Energy, 2009, 34:2030–6.