Master Thesis

Development of socioeconomically-differentiated heat and electricity profiles for private households

Introduction

The large number of "prosumers" in the future energy system will mean that standard load profiles for heat and electricity are no longer appropriate. In some cases this is already the case, yet outdated standardized load profiles are sometimes employed in many energy system analysis studies. The merging of conventional supply and demand sides, and their associated increase in flexibility, partly achieved through decentralized heat and electricity storage, will lead to very different load profiles than have been previously encountered. This will also beg the question of what is understood by a load profile; in the case that a prosumer is able to meet its own demand and shift this in time quite easily, it might be more sensible to relate a load profile to a specific perspective.

In addition there is a lot of evidence that the energy use by private households is strongly influenced by socioeconomic factors. This means that variables such as the socioeconomic status, household structure, tenure, presence of children, age, etc. all have an effect on the ownership (or not) of specific appliances and their frequency of use. Up until now most studies focussing on energy use in the residential sector have either focussed on technical or these socioeconomic factors, but rarely both.

Thesis contents

Previous work at the Chair for Energy Economics has involved developing a detailed electricity and heat demand model for residential buildings. Based on inputs related to the number of persons, type, age and thermal characteristics of the building, this model generates detailed load profiles for heat and electricity demand. It is the objective of this Master's Thesis to extend this existing model to differentiate between some of the socioeconomic characteristics mentioned above. The modified model would then produce demand profiles that are tailored to a specific household type.

The data with which to carry out this extension is available, and includes a survey of about 2600 households as well as measured smart meter data for a subset of about 100 households (EFUS, 2011). This data should be used to develop statistically significant functions/models which relate, for example, the ownership and frequency of use of certain appliances with the above socioeconomic characteristics. These functions should then serve as input to the load profile model, in order to produce differentiated load profiles for each household (type). The smart meter data should be used in a final step to calibrate/validate the extended model and ensure that the profiles it produces are realistic.

Eligibility and application

The Thesis is available immediately and should preferably be written in English. Skills in working with Visual Basic for Applications or other programming languages would be highly advantageous. For further information and to make and application please contact: Dr. Russell McKenna, Email: mckenna@kit.edu

References

BRE (2013): Energy Follow-Up Survey 2011, Report by BRE on behalf of DECC.

DECC. (2011). Energy Follow Up Survey, 2011 (survey data). London: Department of Energy and Climate Change and Building Research Establishment. http://doi.org/10.5255/UKDA-SN-7471-2