Modelling of electricity savings in the Danish households sector: from the energy system to
the end-user - DTU Orbit (10/08/2017)

In this paper, we examine the value of investing in energy-efficient household appliances from both an energy system and
end-user perspectives. We consider a set of appliance categories constituting the majority of the electricity consumption in
the private household sector, and focus on the stock of products
which need to be replaced. First, we look at the energy system and investigate whether investing in improved energy
efficiency can compete with the cost of electricity supply from existing or new power plants. To assess the analysis,
Balmorel, a linear optimization model for the heat and power sectors, has been extended in order to endogenously
determine the best possible investments in more efficient home appliances. Second, we propose a method to relate the
optimal energy system solution to the end-user choices by incorporating consumer behaviour and electricity price addition
due to taxes. The model is nonexclusively tested on the Danish energy system under different scenarios. Computational
experiments show that several energy efficiency measures in the household sector should be regarded as valuable
investments (e.g. an efficient lighting system) while others would require some form of support to become profitable. The
analysis quantifies energy and economic savings from the consumer side and reveals the impacts on the Danish power
system and surrounding countries. Compared to a business-as-usual energy scenario, the
end-user attains net economic savings in the range of 30–40 EUR per year, and the system can benefit of an annual
electricity demand reduction of 140–150 GWh. The paper enriches the existing literature about energy efficiency modelling
in households, contributing with novel models, methods, and findings related to the Danish case.

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