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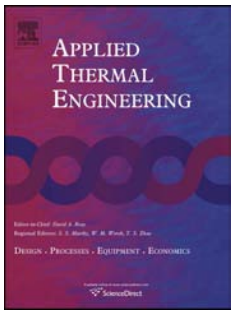

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ESTIMATION OF THE ECONOMIC ADDRESSABLE MARKET OF MICRO-CHP AND HEAT PUMPS BASED ON THE STATUS OF THE RESIDENTIAL BUILDING SECTOR IN GERMANY

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ABSTRACT

In order to reduce the impact of the anthropogenic climate effect, the transition to a highly efficient and sustainable energy system is needed. In particular, the heating sector shows a large potential for efficiency measures. Besides increasing requirements for the thermal insulation of buildings, in order to reduce the residential thermal energy demand, more efficient technologies such as micro combined heat and power generation units as well as heat pumps become increasingly important in the German households sector.

Accordingly, this is a very dynamic market with uncertainties about the diffusion of these technologies for residential applications. Furthermore, forecasts of the development just focus on historical market trends. In order to forecast the possible market diffusion of the considered technologies until the year 2020 a new approach is developed based on the status of the residential building sector in Germany. Thereby, the possible market diffusion is based on the amount of units that are economically viable for the users, the so called economic addressable market.

The analysis shows that the new construction of single family houses has the highest addressable market for heat pumps. The improvement of existing heating systems by heat pumps is only cost efficient, if an existing oil-based heating system is replaced. The use of micro-CHP units has the highest potential in multifamily houses. This applies for existing buildings as well as for the case of new construction. Nevertheless, the results just can indicate a tendency, how the market will develop in future.

Keywords: heat pumps, micro-CHP, market development, German building stock.

1. INTRODUCTION

The energy consumption in houses, offices, shops and other buildings makes up in sum nearly 40 % of the final energy consumption in the European Union. Two thirds of this energy consumption is caused by the thermal energy demand of space heating for residential buildings [1]. For example, the heat demand of residential buildings reached 1,926 PJ in 2010 in Germany. This is about 74 % of the overall energy consumption of the households. The carbon dioxide (CO_2) emission of the private household sector amounted to 112 million tons in the year 2012, which is 13.5 % of the overall CO_2 emissions in Germany [2]. Hence, efficiency measures in the private household sector can lead to a significant reduction of CO_2 emissions in Germany.

The European Union has set itself a target of saving 20 % of its primary energy consumption by 2020 [1]. To reach this challenging target, the European Union has defined various measures. Increasing the requirements for the thermal insulation of residential buildings is one of the main measures to reduce the energy demand of the buildings. The Energy Performance of Building Directive (EPBD) defines the target, that all new buildings shall be nearly zero-energy buildings by 31 December 2020 [3].

One other measure is to increase the efficiency of the generation of heat and electricity. The use of condensing boilers and heat pumps (HP) leads to an increasing efficiency in the residential sector [4]. Furthermore, the cogeneration of heat and electricity can make an important contribution to increase the energy efficiency [1]. Especially, in the residential sector small combined heat and power generation (micro-CHP) units are often discussed.

The market for these technologies is a very new and dynamic market with uncertainties about the diffusion in residential applications. The potential for the use of these technologies in Germany until the year 2020 or further was estimated in various studies [5-9]. The studies either describe the development potential in an overall future energy demand for the technologies or give an aggregated number of applicable units. However, the studies do not provide information for which type of residential building the units can be applied to in detail.