

House owners' perceptions and factors influencing their choice of specific heating systems in Germany

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HIGHLIGHTS

- Current regulations support renewable heating systems insufficiently in Germany.
- We developed a model to characterize the purchasers of different heating systems.
- Ecological attitudes differentiate the purchasers of the different heating systems.
- Economic reasons are mainly important for owners of gas and oil heating systems.

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ABSTRACT

Against the background of global climate changes and several legal obligations, the target of this paper is to analyze the buying behavior of house owners in Germany with respect to heating systems and the main factors influencing choice when purchasing a specific heating system (e.g., oil heating or wood pellet heating). To investigate these issues, a Germany-wide written survey was conducted and the completed questionnaires of 775 respondents analyzed using multinomial logistic regression. Of 29 different variables influencing the purchase of a heating system, 12 statistically significant variables have been identified which characterize the owners of oil heating, a heat pump, gas heating and wood pellet heating. The membership of different ecological clusters primarily segregates the owners of a specific heating system, but the assessment of the different combustibles also plays a major role in this context. Suppliers of heating systems can use the results of this study to fine-tune their marketing strategies. With respect to policy issues only limited room for additional economic incentives can be identified to promote replacement of fossil-fuel based heating systems in favor of renewable ones.

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1. Introduction

Against the background of global climate change, predominantly caused by human activities, limited non-renewable resources, the environmental damage caused by the production, transport and use of fossil fuels, the heating (system) used in private and public buildings are of particular interest in many highly industrialized countries such as Germany. This is due to the fact that nearly 75% of the energy used in residential houses is used for heating (BMU, 2014).

Both, the installation and running of heating systems are significant markets in Germany. Altogether, there were approximately 20.5 million heating systems installed in the private sector in 2012, of which 13.1 million were gas heating, 6 million were oil

heating, 0.6 million were heat pumps, 0.6 million were biomass-related heating systems (e.g. firewood or wood chips), and 0.18 million were pellet heating systems (Statistika, 2013).

However, the market for heating systems sold in Germany has changed in recent years, indicating a trend towards natural gas heating systems (see Fig. 1).

The German government has undertaken several political initiatives to promote use of heating systems which run on renewable combustibles, including direct subsidies or low interest loans (Bundesamt für Wirtschaft und Ausfuhrkontrolle, 2012). In this context, subsidies granted for purchasing a pellet heating system can be up to €3000 (Bundesamt für Wirtschaft und Ausfuhrkontrolle, 2012).

There are additional regulations in Germany which influence the purchase of a heating system. Firstly, there is a legal requirement to reduce energy consumption in both new and existing buildings (Energieeinsparungsgesetz EnEG). Furthermore, heating systems older than 30 years must be replaced if they do not use

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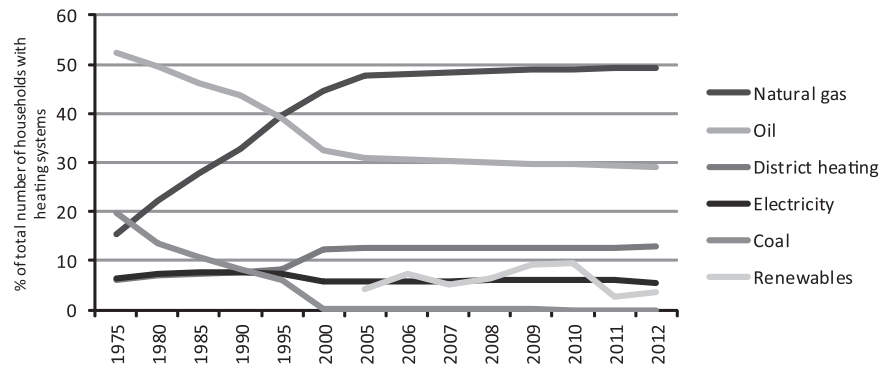


Fig. 1. Development of heating systems in private households in Germany. Source: (Statistika, 2014b).

low temperature boiler technology (Deutscher Bundestag, 2013). Besides that, Germany has introduced the so-called “Renewable Heating Act” which aims to decrease the usage of fossil resources, to reduce energy imports, to develop sustainable electrical power supplies and to further develop technologies which can produce heat out of renewable resources (Deutscher Bundestag, 2014b). This law requires that minimum 15% of the needed energy for heat (and cooling) has to be produced by renewable resources in case of building a new house. In order to meet these high requirements for a new house or an energetic refurbishment, only environmental friendly heating systems can fulfill the standards (Kreditanstalt für Wiederaufbau, 2014a, 2014b). Additionally, the “Chimney-Sweeper Act” has an indirect influence on the choice of heating systems, as the owners of residential buildings must have the heating system and the chimney cleaned professionally at least once a year (Deutscher Bundestag, 2012).

A heating system is a very special product as it is used for approximately 20 years (Hartmann et al., 2007). Further, purchasing a heating system is rather expensive. Depending on the type of system, investment costs range between €9000 for oil heating and €17,000 for a heat pump (Schramek et al., 2010). In addition, variable costs, for example for fuel chimney sweeping or electricity, are also significant and cannot be foreseen by the owner at the time of choosing a specific heating system (Schramek et al., 2010).

However, there are not only economic aspects that play a role when purchasing a new heating system. In recent years, several studies (Nyrud et al., 2008; Mahapatra and Gustavsson, 2008; Kasanen and Lakshmanan, 1989) have analyzed this issue and investigated the different aspects which influence the choice of house owners (people who own the house in which they live) of a heating system. Several studies have emphasized the considerable relevance of economic issues in this context, for example investment costs, (development of) combustible costs, and level of fuel consumption (Mahapatra and Gustavsson, 2008; Kasanen and Lakshmanan, 1989; Korehnke Kommunikation, 2009; Scarpa and Willis, 2010; Nyrud et al., 2008; Skaggs et al., 1996; Michelsen and Madlener, 2012; Rouvinen and Matero, 2013). Additionally, the following aspects may also be considered by house owners in their choice of a heating system: comfort aspects (Mahapatra and Gustavsson, 2008; Kasanen and Lakshmanan, 1989; Korehnke Kommunikation, 2009; Nyrud et al., 2008; Michelsen and Madlener, 2013b; Skaggs et al., 1996; Michelsen and Madlener, 2012), ecological issues (Mahapatra and Gustavsson, 2008; Nyrud et al., 2008; Korehnke Kommunikation, 2009; Michelsen and Madlener, 2013b, 2012), technical issues of the heating system (Mahapatra and Gustavsson, 2008; Korehnke Kommunikation, 2009; Skaggs et al., 1996; Sopha et al., 2010; Braun, 2010), socio-demographic characteristics of the purchaser (Mahapatra and Gustavsson, 2008; Kasanen and Lakshmanan, 1989; Braun 2010; Sopha et al., 2010;

Michelsen and Madlener, 2012), and information aspects (Korehnke Kommunikation, 2009; Sopha et al., 2010).

Comparison of the relevant studies is hindered primarily by the differing methodological approaches, the different target groups investigated as well as the differing thematic focus points of these studies. Whereas some studies concentrated on a specific heating system (e.g. Vinterbäck, 2000; Nyrud et al., 2008; Skaggs et al., 1996), other studies took a more general view of this topic (e.g. Mahapatra and Gustavsson, 2008; Kasanen and Lakshmanan, 1989; Korehnke Kommunikation, 2009). The target groups of these investigations differed in so far as some studies surveyed people who already owned a certain heating system (Mahapatra and Gustavsson, 2008), while the “man on the street” was surveyed in other studies (Korehnke Kommunikation, 2009). Despite these difficulties, it can be concluded that purchasing a specific heating system is a complex and difficult decision for house owners. This is mainly due to the fact that this decision is not often taken in the house owner’s lifetime and most of the variable costs are unknown at the time of researching different options for a heating system.

Against the background that the mixture of the heating systems sold in Germany has changed in recent, the main objective of our study was to gain some insight into the buying motives of purchasers of different heating systems. In this context, we investigated the following issues: which factors influence the choice of a specific heating system (focus on wood pellet heating systems) of house owners? How relevant are product-related factors, the motives and the characteristics of the buyers, and situational factors in this context? Are there significant differences in the factors influencing the choice related to the purchase of heating systems based on renewable combustibles compared to those using fossil fuel.

Within our study, we analyzed four different types of heating systems: gas heating, oil heating, wood pellet heating and heat pumps. These four systems were selected as they represent nearly 90% of all heating systems used in Germany (Agentur für Erneuerbare Energien, 2013). In addition, the choice of one of these systems implies the use of different types of combustibles. Whereas gas and oil heating run on fossil-based combustibles, the use of wood pellets is renewable. Heat pumps play a special role as they need no specific combustible but use electric power, which can be generated to different extents from either fossil or renewable sources. The combination of different heating systems (e.g. the combination of solar thermal panels with wood pellets or gas heating) was not taken into account in this study as the buying decisions of house owners related to such combinations are essentially oriented towards the main component of the combination.

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