

STRUCTURE / OUTLINE ABRIDGED REPORT

Title

Auxiliary heating systems – the use of additional heating systems in the buildings sector. Effects on the energy and climate balance of buildings.

Reason/ Initial situation

Up until now, the influence of secondary heating systems on the energy balance of buildings has been little-researched, even though additional heating systems are widely popular (ca. 11 Mio in Germany). Above all, both the energy consumption of such heating systems and the total energy consumption of buildings with auxiliary heating systems have not yet been substantiated by numbers. Moreover, no findings have been made as of yet in regards to the question of whether the total additional end-use energy consumption of buildings is the same with and without auxiliary heating system.

Subject of the research proposal

In this project, auxiliary heating systems are defined as secondary heating systems implemented by small, solid-fuelled single-room combustion plants.

Aim: Based on data analyses, propositions are to be made about the following aspects of single-family and two-family homes:

- The amount of energy consumption of the auxiliary heating system
- The substitution effect (gradual replacement of the primary heating system by auxiliary heating systems)
- The additional energy consumption of buildings with auxiliary heating system in contrast to those without
- The reduction of primary energy consumption due to the use of auxiliary heating systems

Method: The data of 23,078 users of the co2online online tool “HeizCheck”¹ were collected (owner or occupier of a single-family or two-family home), 3,845 of who had an additional heating; 1,833 of the latter (8 %) provided information on the energy consumption of their auxiliary heating system. This consumption data was processed to energy consumption parameters adjusted for climatic fluctuations (calculation based on the Energy Saving Ordinance (EnEV)) and displayed in kWh per m² usable floor space and year. Moreover, both a consumer survey (1,559 participants) and an expert survey of chimney sweepers (19 participants) complemented the project.

Results:

- Auxiliary heating systems use an average of 39 kWh/(m²*a). This makes a proportion of 33 % of the total end-use energy consumption. In 23 % of the buildings, the energy consumption of the secondary heating is higher than the energy consumption of the primary heating. When extrapolated to the Germany-wide stock of single-family and two-family homes, the consumption amounts to 119 PJ/a.
- The substitution effect of the use of auxiliary heating systems leads to end-use energy savings of the primary heating system of about 28 % in comparison to buildings without additional heating system (extrapolation parameter: 85 PJ/a).
- When investigating the total end-use energy consumption, buildings with auxiliary heating systems (127 kWh/(m²*a)) show an additional energy consumption of 18 % compared to buildings without auxiliary heating systems (109 kWh/m²*a).
- Flat size has a particular influence on the additional energy consumption. Often, only one auxiliary heating system is installed, so that there is a significant effect on the building balance in case of small usable floor space; in case of greater usable floor space (>300 m²) on the other hand, the effect is small. In newer buildings, the differences are smaller due to the generally lower total energy consumption. In buildings completed between 2001 and 2010, the additional energy consumption is estimated at 10 kWh/(m²*a) (extrapolation parameter: 59 PJ/a).
- In regards to primary energy consumption (only taking into account the non-renewable proportion according to EnEV), buildings with auxiliary heating system only use 102 kWh/(m²*a), i.e. 16 % less than buildings without auxiliary heating system (extrapolation parameter: 59 PJ/a).

Discussion: One of the significant results of the project was the realisation that buildings with an auxiliary heating system use 16 % more end-use energy than buildings without one. The reasons for this were established as follows. In essence, the additional end-energy use is contingent upon user behaviour. For users, the most important thing is the motivation to achieve a high level of comfort and a “warm” room temperature. As a consequence, rooms equipped with an auxiliary heating system are overheated. The second most important thing in regards to users’ motivation is the heating energy savings that can be achieved with auxiliary

¹ <https://www.co2online.de/service/energiesparchecks/heizcheck/>

heating systems. In this context, the additional use of firewood only has a minor effect on the costs, as many users of auxiliary heating systems obtain fuel either from their own forests respectively gardens or from an otherwise cost-effective source. Due to their low level of automatisisation, auxiliary heating systems require a high degree of experience in order to achieve a needs-based usage (and in order to avoid over-heating), since the user effectively exercises a regulatory role. On the other side, auxiliary heating systems are often oversized and comparatively inefficient. In the context of legal requirements, the following aspects, amongst others, stand out.

- In the energy performance certificate, auxiliary heating systems are estimated at 10 % + losses all-in. This figure significantly deviates from the results of the field test (33 %).
- The specification of primary energy consumption according to EnEV does not reflect a high proportion of auxiliary heating systems.
- The investigation of the energy consumption of auxiliary heating systems is especially aggravated when logs are used. Declaring the energy consumption of an auxiliary heating system in the energy performance certificate is not really in users' interest because it downgrades the efficiency class of a building.

Conclusion

Both the presumed additional energy consumption of buildings with auxiliary heating system and the impact of auxiliary heating systems on the energy balance of buildings have been proven. There are various options for actions in order to counteract the respective additional energy use. Users could, for example, be better provided with information and be sensitised to the topic of "using wood for heating"; the nominal capacity of common ovens could be adjusted, and further technical optimisation measures could be conducted. Moreover, it is feasible to assume an executional deficit in regards to the declaration of the energy consumption of auxiliary heating systems in energy performance certificates, which should be reviewed by the EnEV registration office (Deutsches Institut für Bautechnik).

Key data

Abridged title: Auxiliary heating systems – the use of additional heating systems in the buildings sector

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PICTURES/ IMAGES:

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