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Summary of the main results of the study

Energy savings potential of water-saving showers and faucets

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"Energy savings potential of water-saving showers and faucets"

This fact sheet was compiled on behalf of Hansgrohe and is based on the "Short study on the potential energy savings of using water-saving and efficiency technologies in showers and tap fittings in residential buildings" by ITG Dresden.

Table of contents

1 Water-saving approaches

To improve the energy efficiency of buildings, the focus tends to be on the heating technology and the energy performance of the building envelope. However, one aspect is frequently overlooked: the hot water heating. Hot water heating accounts for 16 % of final energy consumption in residential buildings, and space heating accounts for around 66 %. The two areas of application hot water and space heating combined amount to 535 TWh. After space heating, hot water heating represents the second highest share of final energy consumption in residential buildings. There is therefore still potential for making energy savings in this case.

Approaches to saving hot water

There are different approaches to saving energy when heating hot water, ranging from efficient hot water heaters to the insulation of pipes. One approach which tends to be overlooked in the building industry is simply to use less hot water. A considerable amount of hot water can be saved by using water- and energy-saving showers or faucets. For example, the flow rate of a conventional shower of 15 to 18 l/min is considerably higher than the 6–8 l/min of a water-saving shower; corresponding to a reduction of hot water consumption of around 60 %. A study conducted by ITG Dresden determined the precise effects and calculated the potential energy savings for the entire building.

The results show that water-saving faucets and showers achieve savings of 2 to 6 % of the overallprimary energy demand or total greenhouse gas emissions of buildings. Savings of up to 12 % are possible in combination with decentralised hot water heating. Particularly notable was the fact that when the heating demand of a building is low, the energy savings that can be achieved as an overall percentage when using water-saving showers and faucets is even higher.

The principle of limiting the flow rate

With water-saving showers and faucets, the aim is not just to reduce the flow rate with a flow limiter, but to also ensure the water jet quality with lower water volumes. A special flow limiter therefore reduces water consumption via hand showers and faucets on sinks. Special jets open or close, depending on the water pressure. This ensures that the resulting flow rate is not too low, even when the water pressure is lower. Air can also be added to the water. This does not impair washing comfort when showering or hand-washing at sinks and water is saved while retaining the same level of comfort.

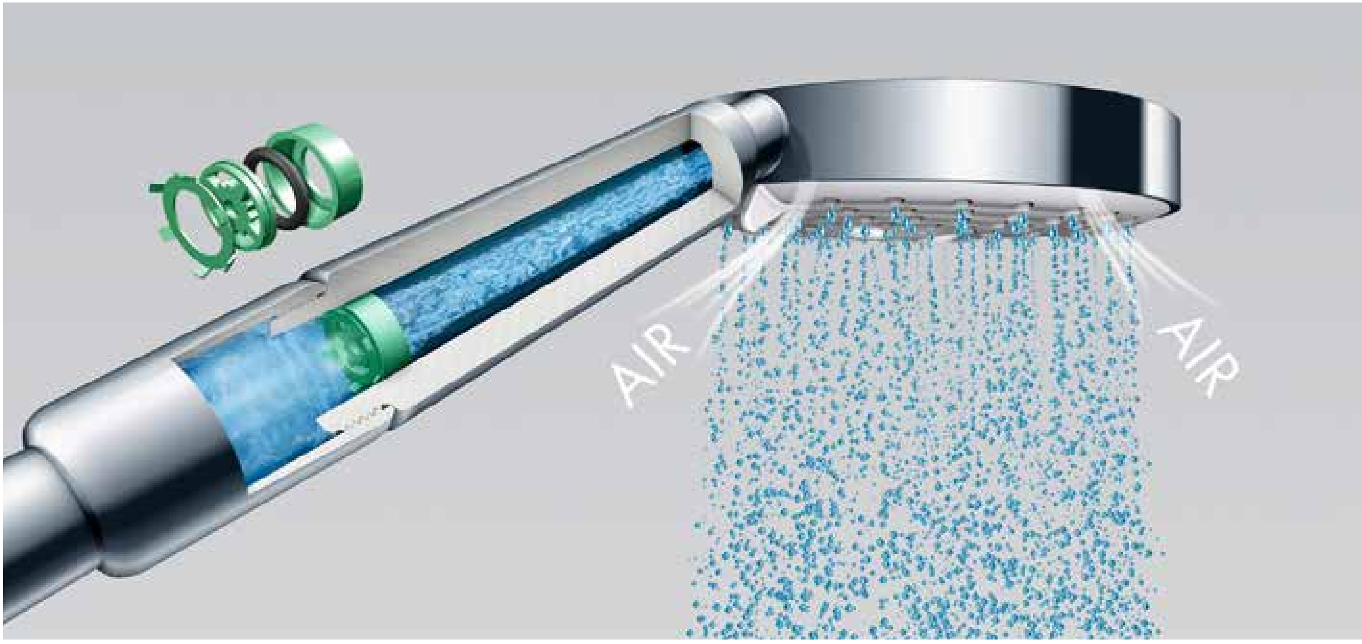

Fig. 1: A flexible elastomer sealing ring reduces the flow aperture when the water pressure is high and increases when the water pressure is low.

2 Conducting the study

In the *short study of the potential energy savings of using water-saving and efficiency technologies in showers and tap fittings in residential buildings,* the current consideration of water-saving faucets based on the calculation standard DIN V 18599 is used. This standard is referenced in the German building energy act (GEG), the federal funding programme for energy efficient buildings (BEG) and the climate-friendly new build funding programme (KfN). The assumptions made in the study, including for example that for roughly 75 % of showers or showering time, the maximum available hot water flow rate is used according to DIN V 18599, were also made in this case.

To make this clear, the energy demand of a detached house with roughly 150 m^2 of living area, a basement, two upper storeys and cold roof space is calculated. Example calculations were carried out for an 'Efficiency House 40' with air/water heat pump, for a refurbished existing building with district heating supply and for an older/partially-refurbished existing building (1990s) with natural gas condensing boiler. In the three variants described, savings in the annual energy demand are achieved.

To calculate the potential savings, different usage scenarios were defined:

- In the first scenario, no water-saving products were used,
- In the second, water-saving products were used and there was a high proportion of baths,
- In the third, water-saving products were used and there was a higher proportion of showering.

The reduction in net energy demand for domestic water heating of 30 or 40 % resulting from the above-cited scenarios two and three was used as the basis. The difference between the scenario with a high percentage of bathing and scenario with a high percentage of showering arises from the fact that hot water usage should either correspond to a specific quantity (bathing, cooking) or specific duration (showering, washing hands, etc.). Where hot water usage is dominated by draw-off time, limiting the volumetric flow rate has an impact on energy performance.

3 Results of the study

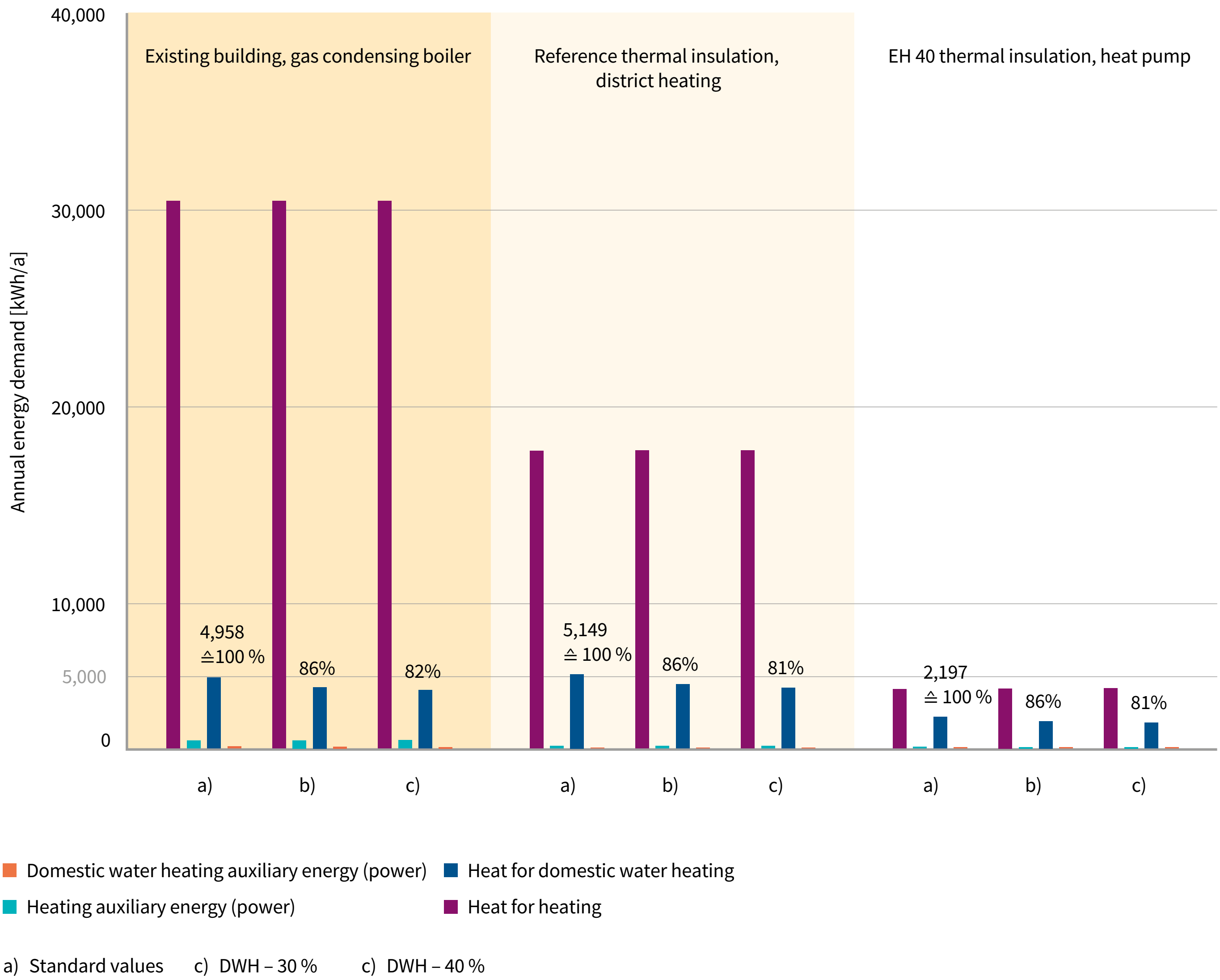

Fig. 2: Annual energy demand (based on calorific value)

Results of the study
In the example calculation, the reduction in net energy demand for hot water of 30 or 40 % by limiting the volumetric flow rate results in a saving of 14 to 19 % in the final energy required to heat the hot water.

This difference between the calculated end energy savings and reduction in net energy demand on which this is based, can be traced back to the significant fixed losses for storage and distribution with circulation that occur in the central systems under consideration. If the system had no hot water cylinder and/or a minimal network of distribution pipes with circulation, the percentage of end energy savings would be closer to the percentage of net energy savings.

4 Primary energy and greenhouse gas emissions

In the overall context, the primary energy demand and the greenhouse gas emissions play the most important role. The percentages for heating and domestic water heating include heat and auxiliary energy respectively. To show how the measures considered here on the hot water side affect the respective overall value, both values are also stated relative to one another with reference to the respective initial/comparison state.

The savings indicated for primary energy and greenhouse gas emissions are roughly the same (see figure 3). If the saving is referenced to the total value (heating + domestic water heating), the percentage change will naturally be smaller. In the two gradings net energy for domestic waterheating DWH - 30 % or DWH - 40 % resulting from the scenarios, total savings of 2 % for the existing building right through to 4 to 6 % for 'Efficiency House 40' are obtained.

Consequently, as the heating energy demand falls (e.g. by increasing the thermal insulation), the more obvious the potential savings in hot water heating will become in terms of the overall picture.

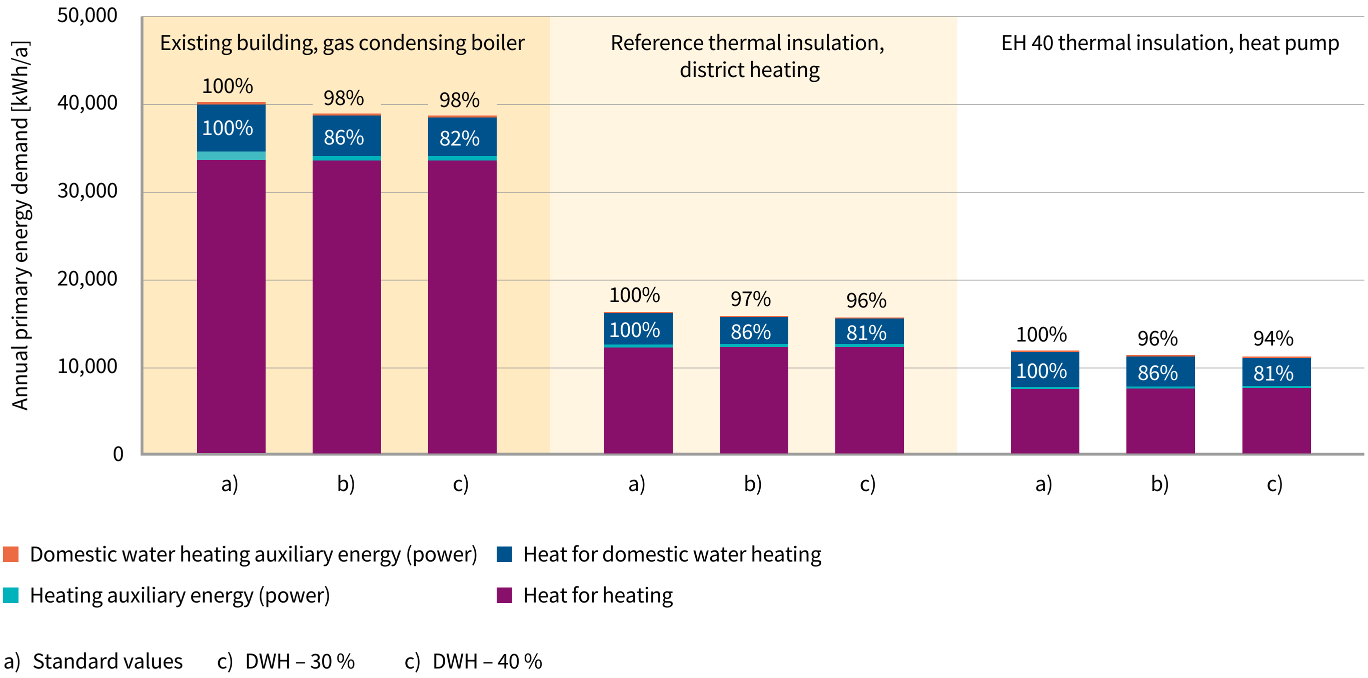

Fig. 3: Annual primary energy demand (based on calorific value)

5 Decentralised continuous flow heater

If a system is now used in the EH 40 to heat the hot water locally, the significant and extensively fixed losses for storage and distribution with circulation no longer exist. Values close to the net energy savings in the selected scenarios are then also obtained for the primary energy. The resulting savings are between 8 and 12 % in relation to the total energy demand of the building.

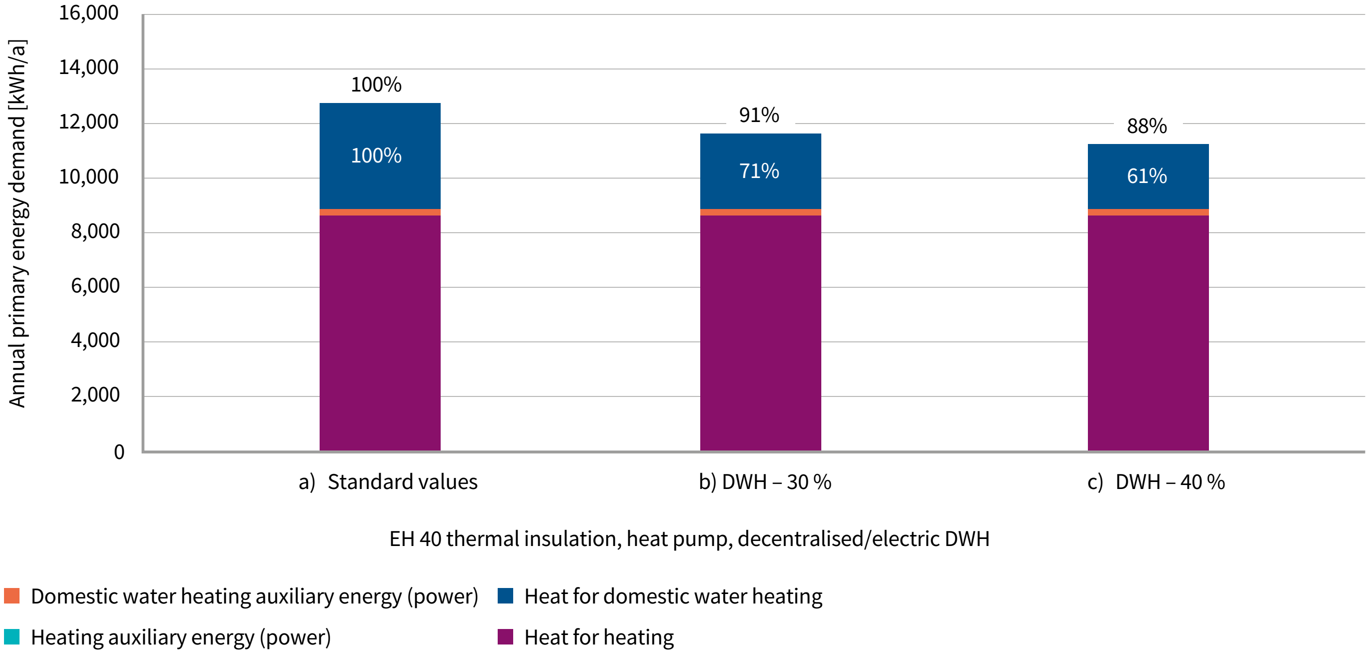

Fig. 4: Annual primary energy demand (based on calorific value)

6 Opportunities for further development

The results of the study highlight the potential energy savings of water-saving faucets and showers in buildings.

It is important to consider these savings in relation to other measures taken in the heating system.

Energy saving measures for heating

Comprehensive/predominant use of water/energy-saving taps	
Central domestic water heating	2 to 6 %
Decentralised electric domestic water heating	up to 12 %
Flow temperature reduction/heating curve optimisation of heat pumps	
Low	4%
High	12%
Flow temperature reduction/heating curve optimisation	1 to 4 %
Night setback/shutdown	3 to 10 %
Summer shutdown	0 to 4 %

Future studies could also contribute towards quantifying the potential energy savings for other building types while factoring in the costs. In particular, the costs incurred must be placed in the context of upkeep of the building fabric.

Summary

The results of the study show that water-saving showers and faucets make a difference to the energy efficiency of a building. If the possible savings that could be achieved by using energy-saving showers and faucets with central domestic hot water heating of 2 to 6 % in detached houses are related to the energy demand of all residential buildings for hot water and heating of 535 TWh, this saving would amount to around 11 to 32 TWh.

7 Energy balancing options

To increase awareness of the potential savings that could be achieved by using energy- and water-saving showers and faucets, it is also important to factor in the energy required to heat the hot water consumed when calculating the energy performance certificate. To do this, when defining the calculation criteria, it is necessary to dispense with the rule of thumb approach for hot water consumption. In contrast to the previous EnEV, the GEG does not explicitly refer to the standard values as stated in DIN V 18599-10:2018-09, which are based on the size of the apartment. However, it is unclear whether other values can be used. The standard already makes it possible to use an individual parameter for the net energy required to heat the domestic water by adopting external calculations. With energy consultation in practice, however, this option rarely presents itself because free input is rarely possible in the 18599 software. To carry out a more detailed calculation, the actual flow through the showers and faucets installed in the building must be taken into account.

Although section 6.4.9 of DIN V 18599-8:2018-09 describes the option of factoring in a flow rate limitation based on the type of sanitary fitting used, the net energy demand for hot water can only be modified as part of an independent energy consultation. This option is also not included or not recognisable in most programmes. When preparing official/legal evidence, i.e. an energy certificate, it is not permitted to modify the net energy demand for hot water. The results of this study show that this approach is also feasible for providing evidence. If it was integrated into the energy performance certificate in Germany and throughout Europe, there would not only be a greater awareness of the potential energy savings of water-saving showers and faucets, but the incentive to use these kinds of products would also be much greater. Consequently, buildings would achieve better performance ratings and also save energy, water and CO_2.

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