Reaching net zero by 2050: The limit of personal responsibility

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As there is increased awareness of the climate crisis, there has been increased interest into reducing a person's own carbon footprint. Within short report, the impact of personal changes in reducing carbon emissions will be discussed and clear limitations will be established.

The majority of homes within the UK in 2050 will consist of already existing homes today. There must be a concrete plan to retrofit these homes such that they can accommodate a carbon free means of power and heat. However, it must be acknowledged that there is significant limit on personal responsibility, as well as financial setbacks. With the national grids current reliability on fossil fuels, the carbon content in 2021 is still non-zero. However, there is a downward trend with a 65.8% decrease from 2013-2020[1]. The limit on personal changes to reduce carbon emission in this area is strikingly low and limited to energy saving tactics, buying more efficient appliances and the installation of solar panels. Solar panels installed on an ideally angled, south facing roof could save approximately 0.973 tons of CO_2 a year [2]. If the ideal orientation is not met, the payback time could be longer than the lifetime of the solar panels at (25-30 years) making them a financial liability[3].

The most common form of heating within the UK is using a natural gas boiler[4]. Hydrogen boilers are expected to be available 2026 at the earliest[5] and there has been promise that they will cost no more than the gas alternative to buy and install[6]. If the technology is to be familiar and easy, hydrogen boilers are the best long term option. Hydrogen boilers share very similar components to the gas boiler making them an easy alternative and, for existing homes, it makes more sense to switch the fuel than to retrofit every home. The other option is to switch every home to electric heating but this is costly and all of the pipework and radiators would have to be switched, meaning that a lot of houses will no longer be compatible with hydrogen boilers when they are available. Also, with the demand for electricity predicted to rise, switching to electric heating will largely impact energy bills.

Until then, hybrid air source heat pumps could be considered. A hybrid heat pump system uses a combination of renewable energy and fossil fuels to heat the property[7]. Hybrid heat pumps allow a lot of flexibility; they work with the existing gas boiler. With heat pumps as the sole provider for heating demands, the size of the radiators may need to be changed to provide adequate heat, but using the combination means that the gas boiler could kick in to fill the gap. This will save new, bigger radiators from being fitted, and reduce the upfront cost as shown in Fig. 1.

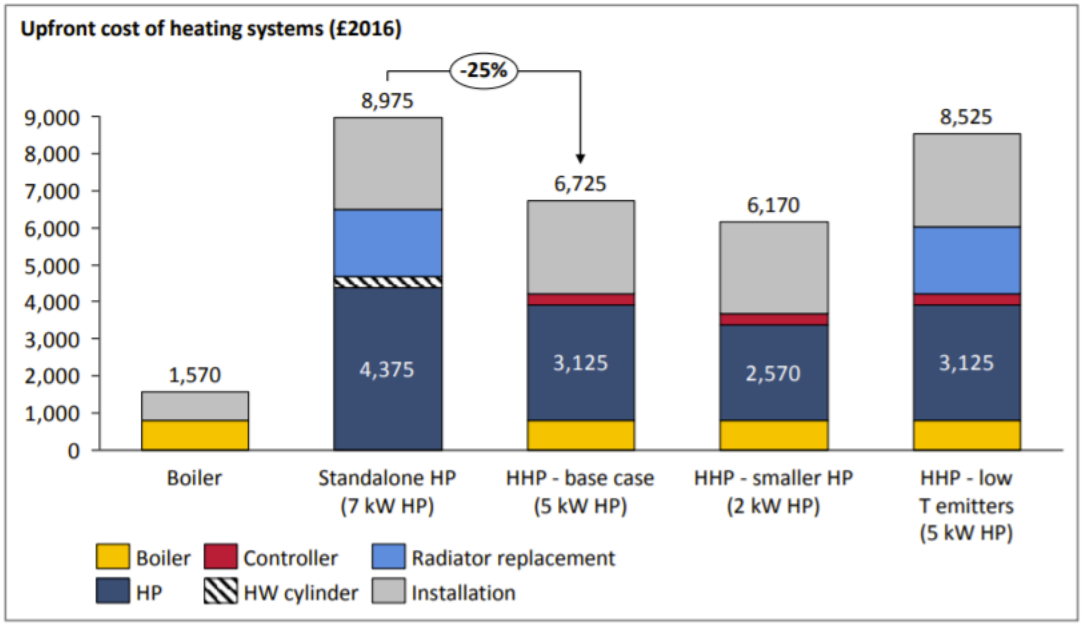

Figure 1: The comparative upfront cost of boilers, standalone heat pumps (HP) and hybrid heat pumps (HHP). With HHP, there is no need to replace radiators [8]

Furthermore, as shown in Fig. 2, the carbon savings are comparable to stand alone heat pumps and the carbon intensity is much smaller than the traditional gas boiler. Unfamiliarity of heat pumps, disruptions to life and high upfront cost make heat pumps unfavourable. Insulation must also be maximal to increase the heat pumps efficiency, which also increases costs. Hybrid heat pumps installed now could lead to greater public awareness on heat pumps and, with the smaller up-front cost, are more probable than stand alone heat pumps. The reduced upfront costs are expensive, so government schemes could expedite installation.

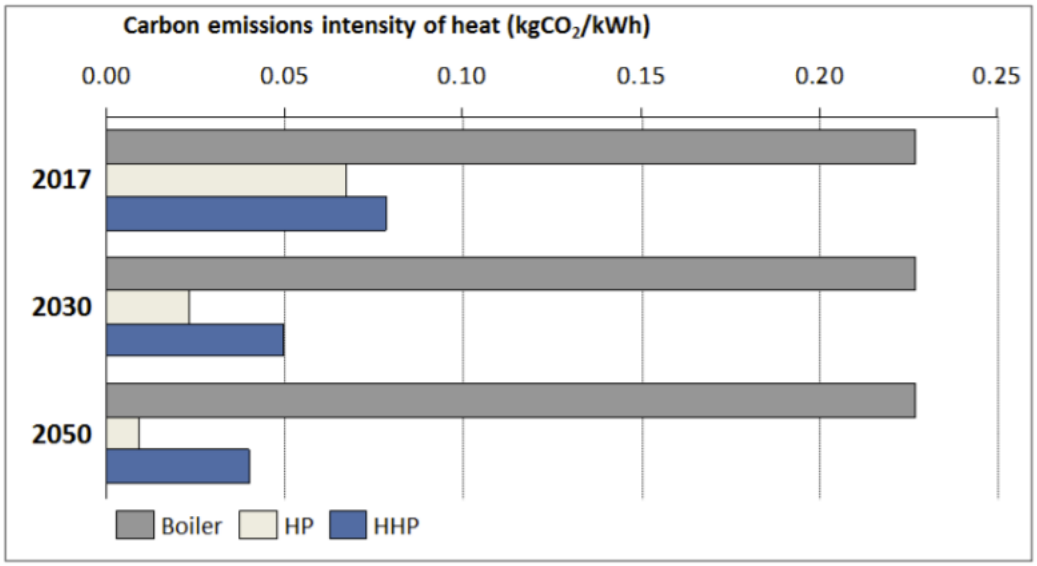

Figure 2: Carbon emissions of boiler, HP and HPP for 2017, 2030 annd 2050. As time goes on, the carbon emissions decrease as HP and HPP use electricity and the carbon content of electricity is expected to fall [8].

The carbon content associated with food cannot be ignored. For an average meat eater this equates to 2 tons of CO_2 per year. Table 1 shows the annual carbon tons for various diets. Even the vegan diet is not carbon neutral because of production and transportation. These tons are outside of personal control and rely on government or company intervention.

Table 1: The average annual ton of CO_2 for various diets [9]

Diet	**Annual ton CO_2**
High meat eater	2.62
Medium meat eater	2.05
Low meat eater	1.70
Pescatarian	1.43
Vegetarian	1.39
Vegan	1.05

Switching to electric cars (EV's) is an ideal scenario for reaching net zero on the condition of carbon neutral electricity generation. With EV's reaching cost competitiveness with fossil fuelled cars by 2025 and banning the sale of new fossil fuelled cars in 2030[10], it is reasonable to assume that petrol and diesel cars will be naturally phased out. However, the aviation sector still poses a challenge to the net zero target. Although research into electric planes has increased, they will not be realised before 2050 [11]. Personal changes to combat these emissions include flying less and using offsetting solutions, like planting trees. Again, carbon content of electricity generation is out of the hands of the average person and relies on company and government.

To conclude, for some areas personal lifestyle choices can have a large effect in reducing a person's carbon footprint for example diet, flights and installing hybrid heat pumps. However, there are things beyond personal control like the carbon content of the grid and transportation of goods. Furthermore, the large upfront costs of many solutions will be a major setback for the public. There must be government support or increased research into making these technologies more affordable. Although personal changes can have a large impact in reducing carbon emissions net zero by 2050 will not be achieved unless companies, government and the average person must work together and take joint responsibility.

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