Water Heating

As with space heating, it is not possible to measure directly the water heating shown in SAP. What has been measured is either net heat to the hot water cylinder, net heat from the domestic hot water system output (where there is no cylinder) or in the case of one house where a fuel cell was used, net heat from the thermal store output. These measurements have been normalised to compare them with SAP by dividing by the number of people actually in the house and multiplying by the number of occupants used in SAP (which assumes a direct linear relationship between the number of occupants and the hot water use). The results when compared to the SAP prediction are shown in Figure 22[9].

If the total water consumption is divided by the number of occupants per house in the SAP model, this produces Figure 23[10]. By comparing Figure 22 and Figure 23 it is possible to see that there are some links: The three largest users of energy for hot water, homes DI2, MVHR4 and IEF1 are amongst the four biggest users of water. Home IEF3 had excessive water use due to a water leak external to the property which took some time to resolve. The lowest user of energy for hot water, home IEF2 is also the lowest user of water.

Figure 22: Measured Water Heating (normalised) as a percentage of Gross Domestic Hot Water Shown in SAP

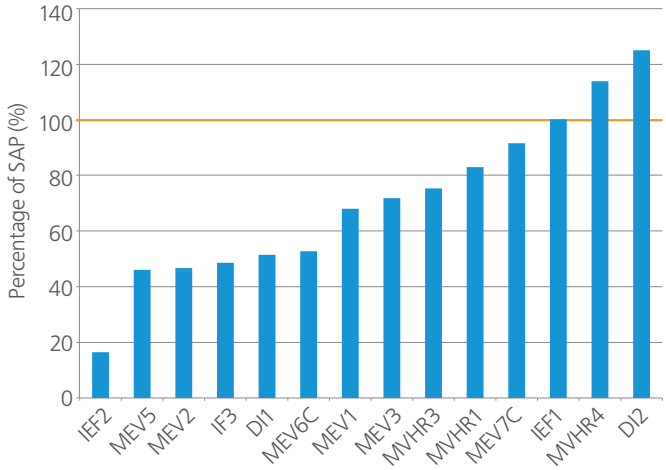
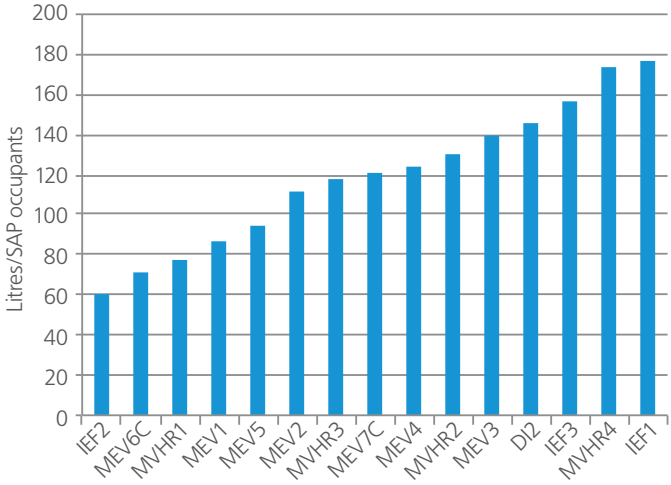


Figure 23: Water consumption per person in SAP



With the exception of three homes all the properties used less heat for hot water than would be expected from SAP.

When interviewed about hot water provision the occupants on the whole described their experiences as positive with only one, MVHR4 experiencing problems. The heating and hot water in this property was uniquely provided by a fuel cell which was installed for the first time in a new build home. Some issues with hot water supply took time to resolve. It is also worth noting that the occupants of home MVHR4 were the second highest users of water in Figure 23. This high water use contributed to the problems with hot water supply via the fuel cell.

Waste Water Heat Recovery (WWHR)

As part of the project the in-use performance of waste water heat recovery units were measured, but due to monitoring equipment failures, only two full sets of results were collected (see Figure 24).

The two cases show extensively more savings than would be expected from SAP. In the case of home MEV7C, the WWHR unit is calculated to give a low saving because the shower in the en-suite to the master bedroom is fitted over a bath.

Energy savings from WWHR can be displayed as a percentage of the total hot water calculated/used (see Figure 25).

This shows that for home MEV3, 25% savings were calculated, but 35% were obtained and for home MEV7C, 15% were calculated and 41% were obtained.

Figure 24: Savings from waste water heat recovery per person

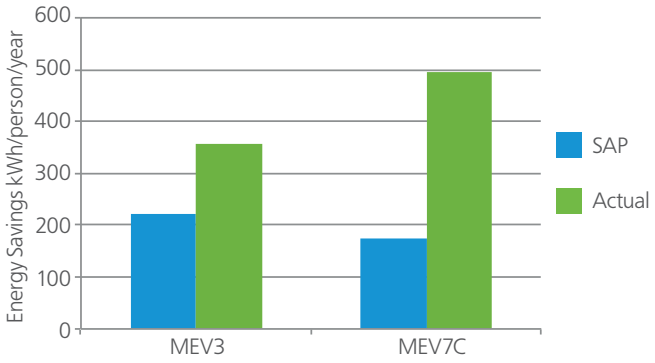
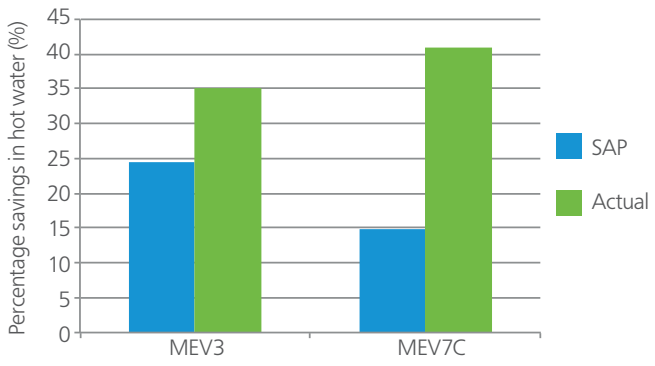


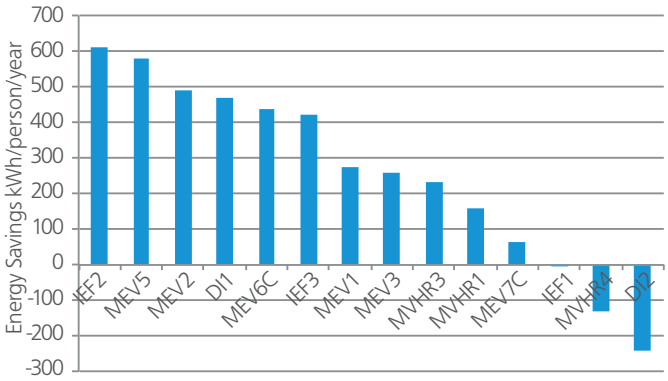
Figure 25: Percentage saving shown in SAP and actual for WWHR



[9] Of the seventeen AIMC4 homes, sixteen were monitored and of these two had problems with collecting the water heating data.
[10] Of the seventeen AIMC4 homes, sixteen were monitored and of these one had problems with collecting the water usage data.

On looking at water heating energy savings per person relative to those indicated by SAP (see Figure 26) it is interesting to note that the eight best performing households, who were all using at least 257kWhr per person per year less energy than shown in SAP, all had WWHR.

Figure 26: Water heating energy savings per person over those shown in SAP



Regulated Electricity Use

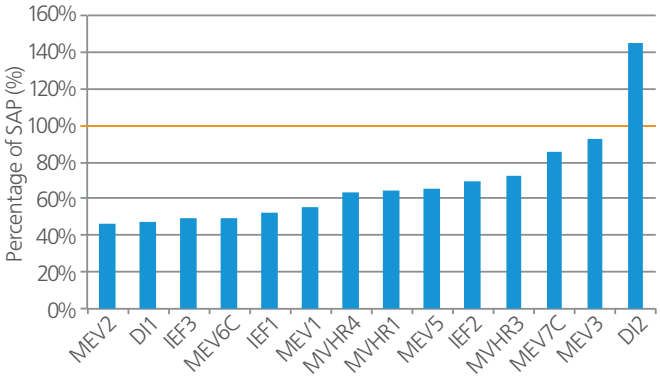
SAP shows electricity use for ventilation fans, the heating pump, the boiler fan and lighting. Lighting and ventilation fans can be directly measured. The heating circuit can be measured and this can be used as a proxy for the heating pump plus the boiler fan.

The results are shown in Figure 27, which compares actual measured usage with the SAP results[11].

All but one household used less regulated electricity than calculated in SAP, with 11 out of 14 using 73% or less.

The best performing household, home MEV2, used only 61kWh of electricity for the heating circuit in comparison to SAP which showed 175kWh. As the house was kept relatively cool it is fair to speculate that the circuit was using less power than anticipated by SAP. This household also used only 34kWh of electricity for lighting instead of the 364kWh shown by SAP.

Figure 27: Regulated Electricity use as compared to SAP



At the other end of the scale the worst performing household, home DI2 used 856kWh to light their house instead of the 555kWh shown in SAP and this was because they changed their light bulbs away from low energy ones after occupation. They also used more electricity for the heating circuit than predicted.

Homes MEV3 and MEV7C also had relatively high light usage (when compared to the other AIMC4 homes), with home MEV3 using 344kWh where SAP showed 316kWh and MEV7C using 362kWh where SAP showed 496kWh.

Homes DI2, MEV3 and MEV7C all used less electricity to run the ventilation fans than SAP showed, but the otherwise low electricity user, home MEV2, used more. This will be discussed further in Information Paper 6.

[11] Of the seventeen AIMC4 homes, sixteen were monitored and of these two had problems with collecting the electricity use data.