

# Hot Water Customisation

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## SUMMARY AND AIMS

This report outlines an examination into the benefits of customising the timing profile for the heating of hot water tanks for tenants on economy 7 tariffs.

In England and Wales, Economy 7 offers a reduced energy price per kWh, between the hours of 12am - 7am. This time period enables heating overnight at a reduced rate, with hot water available early in the morning. This heat dissipates throughout the day and tenants may need to provide a boost during more expensive hours, or may need to go for a period each day without hot water.

In social housing, landlords are responsible for the provision and maintenance of hot water systems, often meaning that the systems aren't sized correctly for the household, they can also often be poorly maintained. As such, different systems will lose heat throughout the day at different rates, depending on these factors, which are not within the tenants control.

The customisation involved altering the start and end times of the hot water tank heating, to suit the tenants energy tariff and their individual hot water heating requirements. Optimising the timing profiles in this way is expected to lead to a decrease in the amount of energy required for hot water heating and thus, a reduction in energy bills which should help reduce fuel poverty.

## SAMPLE SELECTION

Ten tenants were selected for the test group, these were social housing tenants, living in London, who are on time of use tariffs (Economy 7) and who had hot water tanks fitted with control devices as part of the Home Response project.

As is common with people on time of use tariffs, the hot water heating of the tenants in the test group, was set to start at the beginning of the lower rate period, with the heating starting at 12am and continuing until the tank was hot (the exact times varied from system to system). A typical heating profile can be seen in Figure 1.



Figure 1. Typical energy and temperature profile of a domestic hot water heating system

## RATIONALE

As can be seen in Figure 1, a typical profile involves the largest heating event early in the lower rate period followed by smaller heating events later in this period. These later heating events are necessary to keep the water at the required temperature. It is also notable that no hot water was being used during this period.

It is theorised that moving the largest heating event to a different, more optimal time, would reduce the overall heating need without affecting the comfort of the tenant. This reduction in heating need, would reduce the overall energy needs of the tenant and thus, reduce their energy bills.

## POTENTIAL DOWNSIDE FOR TENANTS

Aside from the potential benefits detailed above, there is also the potential that, on some occasions, the tenant may desire hot water during the Economy 7 hours which following customisation, may not be available. Though it can be seen as unlikely, the more likely case being the tenant wanting hot water in the late evening, prior to the economy 7 hours, and this not being available.

The two main examples would be:

- 1) The tenant usually uses hot water during Economy 7 hours and thus, heating at the end of this period would prevent the water being available when they want it. Such tenants would not benefit from the customisation.
- 2) If the tenant wanted hot water during the Economy 7 hours, where they do not normally. In this event the tenant would be able to use the 'Boost' function on their hot water to heat the water (still at the reduced price) to the required level and would still see an overall reduction in their energy consumption for hot water heating.

## METHODOLOGY

In order to reduce the overall heating need for the hot water tanks of the test group, the largest heating event was moved to the end of the lower rate period, as shown in figure 2.

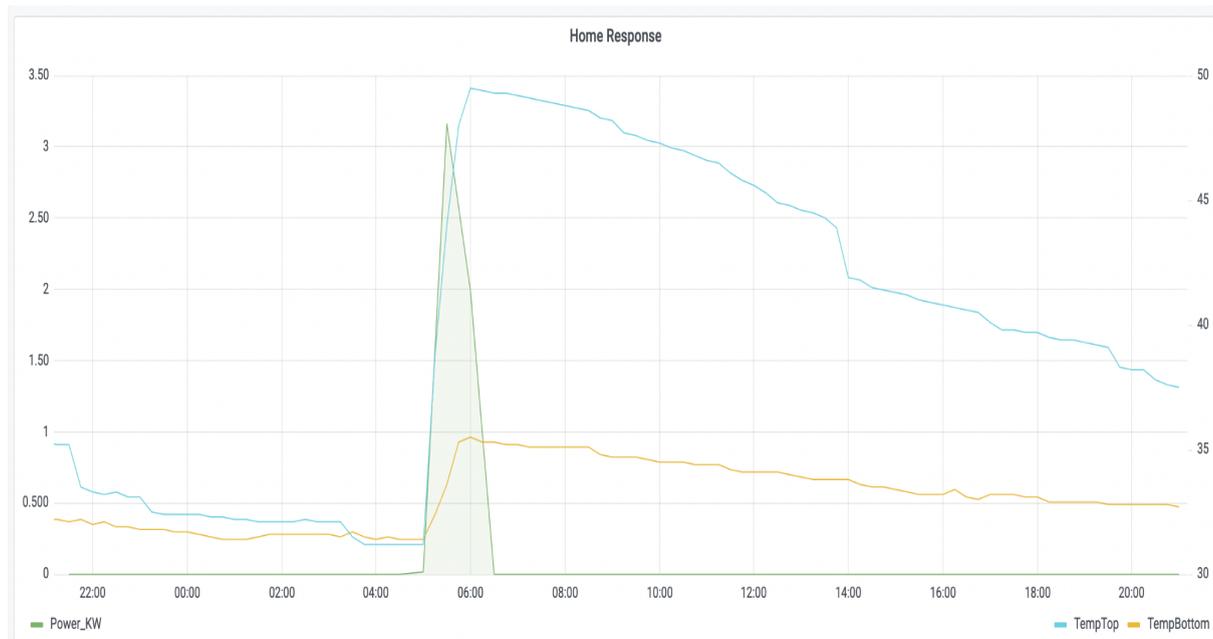


Figure 2. Customised energy and temperature profile of a domestic hot water heating system

This removed the need to keep the water temperature up for the remainder of the period, removing the energy involved and reducing the tenants energy cost.

Data was analysed which covered the 14 day period prior to the customisation and the 14 day period following the change to review what effect this has had on the energy usage for hot water of the tenants in the test group.

The data analysis consisted of comparing the energy use, for hot water heating, for the test group, both as a collective and as individuals, before and after the switch.

## SUMMARISED DATA

On reviewing the data, it can be seen that the average reduction in energy used for hot water, following the customisation, was 0.6 kWh / day.

Figure 3, below, shows the average energy consumption per household, per day for the hot water systems of the test group.

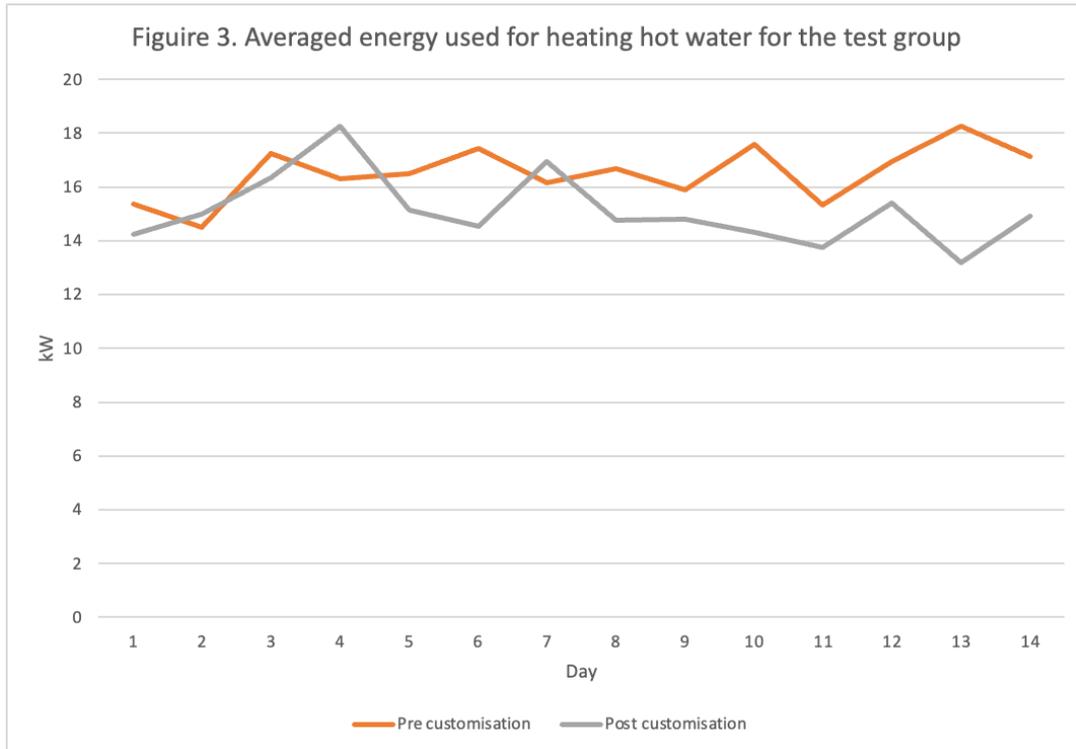


Figure 4. Average daily energy consumption pre and post customisation

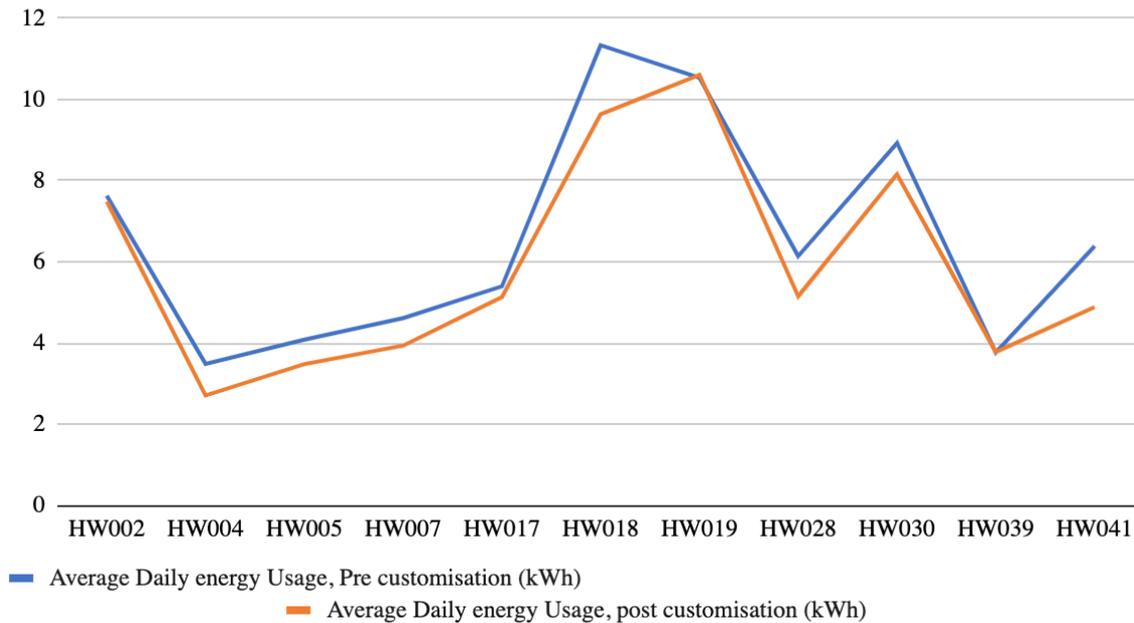


Figure 4 shows the average change in energy use, per tenant, pre and post customisation. The effect of the customisation varied from tenant to tenant, the largest reduction seen was 1.7 kWh/day and the largest increase in energy was 0.07 kWh/day.

## ANALYSIS

Out of the test group 7 tenants reduced their energy consumption for hot water and 3 increased. However, at least one of the test group (HW039) shows a week of no hot water consumption at all, likely indicating no presence at the home. Hot water customisation appears to not be beneficial to the two other customers who should revert to the previous hot water heating schedule.

From the data, it can be seen that many customers on an Economy 7 tariff are able to benefit from hot water customisation. Savings from the hot water customisation have the potential to be significant.

On average, tenants benefited from a reduction in energy use, during their off-peak hours of 10%, compared to their usage prior to the hot water customisation. This is equivalent to 0.6 kWh/day, assuming an average off-peak rate of 14p/kWh, this is £25.55/year saved per property.

The data showed that in general tenants did not need to use the boost function on their hot water system, outside of the economy 7 hours, more or less once the hot water

customisation had occurred. However, one tenant showed a slight increase in use of their boost function, the effect of this being that more energy was used during the higher electricity price periods.

Not all tenants were able to benefit from the hot water customization, so it is important that any changes be reviewed to ensure they are providing savings in each case. Where savings are not being generated, the hot water customization should be removed.

During our analysis, few incidents occurred where a tenant required hot water and needed to use the boost function. However, the possibility of this can not be ignored. Although using the Boost function does decrease the positive impact on the reduction in savings, the overall impact of the customisation is still positive. It is important that the tenants are aware of this and of their ability to use the boost function, so that they are not without hot water when they need it.

## ECONOMY 10 CUSTOMISATION

Additionally, one tenant was identified as having a large heating event outside of the low cost period of the Economy 7 hours. As can be seen in Figure 3, this tenant often uses their hot water during the mid- afternoon. Customisation within the Economy 7 hours does not allow the tenant to obtain a significant savings on their bill so it was proposed that this tenant should be changed to an Economy 10 tariff, allowing hot water during the afternoon.



Figure 3 Profile of customer not suited to Switching within Economy 7 hours

The customer was put on an Economy 10 tariff, which provides cheaper energy during 10 hours of the day, usually in three separate time windows such as 4am - 7am, 1pm - 4pm & 8pm - 12pm. Though the tenant did not need to change their pattern of usage, they were able to benefit from cheaper energy.

The tenant chose to have two HW heating periods - 05.00-06.00 and 15.00-16.00 - the times chosen match with one resident who showers in the morning and the other who showers on return from work after 16.00.

The economy 10 hours cover the afternoon hot water energy use which were previously charged at the higher rate and are now able to be charged at their lower rate. On average, the tenant uses 1.2 kWh of energy each day during this period, which they are now purchasing at the cheaper rate electricity price.

## CONCLUSION

The examination has demonstrated that it is possible to to customise the timing profiles of hot water systems for tenants on an Economy 7 tariff, in such a way that delivers a consistent level of comfort whilst reducing overall bills.

Although such customisation is likely to be of benefit to the tenants, this report had found that the effects can be negative and so it is important to review the effectiveness of customisation once it has been implemented.

Additionally, in some cases, it may be possible to switch customers to an Economy 10 tariff to ensure they receive low costs energy when they like.

## POTENTIAL FURTHER RESEARCH

It would be beneficial to conduct further research to quantify the extent to which tenants understand their tariffs and the best way to use this for their hot water heating needs. It is clear that tenants are not necessarily using their hot water heating in a way that gives them the best value. And there may be potential to provide additional savings through providing information to the tenants.