1800s former farmhouse Cheltenham

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Case study 41

£237 Saving on fuel bills

35% Reduction in carbon emissions

Measures installed	Total cost	Annual CO_2 saving (tonnes)	Annual fuel bill saving
Two air source heat pumps	£15,086	4.20	-£49
Solar PV 3.24 kWp	£14,243	1.60	£286
Total package	£29,329	5.82	£237
Plus income from PV Feed-In Tariff (FIT)			£1,187

The home

This home is an early nineteenth century farmhouse extended in size several times at later dates in the twentieth century. This has helped to improve the energy efficiency of the property as most of the current external walls are of cavity construction and have been insulated. The current owners have lived at the property for thirty years and during this time they have insulated the loft to 300mm and double glazed the majority of the windows. Heating was provided by two gas boilers; the main one being over 30 years old and a slightly newer model serving a separate granny flat on the ground floor.

What they did

The highest priority was to replace the gas boilers and heating controls. The family considered several options to improve this, and although a high efficiency new gas boiler offered the highest fuel bill savings, they were keen to incorporate renewable technologies. Both biomass and ground source heat pump systems were considered, though eventually an air source heat pump was chosen as the best solution for their circumstances.

A solar PV array was also installed as a recommendation from the Target 2050 report. The house has a good south-west facing roof area which was ideally suited to this technology. The electricity generated would also contribute toward the overall annual requirements of the new air source heat pump system.

£1,187 Income from Feed-In Tariff (FIT)

"The teething problems that came with our two air source pumps were considerable but fifteen months down the line we are enjoying the experience."

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Solar electricity

Heat pumps use electricity to move energy from the source (ground, air or water) and upgrade it to achieve suitable indoor temperatures. This meant that the gas bills for The Chestnuts would decrease dramatically, but that electricity bills would rise. In order to offset this, it was sensible for the householders to install a solar photovoltaic (PV) system) on their south west facing roof.

A number of accredited installers were contacted to assess the feasibility of installing the solar system. The householders visited several properties with PV arrays installed by Clear Focus Renewable Energy from Highnam in Gloucester, who were then commissioned to design and install a 3.24 kWp system. The forecast energy output of this system is 2,700 kWh per year.

Air source heat pump

The space required for the storage of biomass fuel and the delivery system meant that as a replacement heating option this had to be ruled out. A ground source heat pump was also rejected because it would have required digging up the established garden and removing several trees to lay the necessary pipe work. An air source heat pump is a far simpler installation, requiring only space for one or more outside "collector" units.

Two Daikin Altherma air source heat pump systems were specified so that separate provision could be maintained for the main house and the granny flat. The collectors for both units are situated discreetly at the side of the property, with the larger 16kW internal unit for the main house located in a porch at the rear and the smaller 11kW unit located in a crawl space underneath the granny flat.

There were some initial problems with the heat pump with the system not providing heat at pre-set times and the household having to resort to manual control. A faulty controller was eventually identified as the source of the problem and replaced.

One of the two air source heat pump units installed outside the house

Further problems were encountered on receipt of the electricity bill following the winter, which was much higher than anticipated. This time it was identified that the heating pattern programmed into the controller did not suit the household's needs. The installer had locked the controller to prevent accidental adjustment. This had to be unlocked, giving the family the means to control their energy use much better.

Although the cost of running the heat pumps would not be offset by solar PV generation during the winter it is anticipated that generation over the summer months, and the resolution of the problems encountered will help to redress this balance. Heat pumps do require electricity to operate, and due to the relatively high unit cost of electricity, savings are at their best when replacing traditional electric heating, or when displacing fuels such as oil or bottled gas.

Energy consumption	Total (kWh)	Per m^2 floor area
Before improvement (2010)	71,827	254
After improvement (2011)	27,497	97
With all possible measures	22,841	81
UK average (2011)	19,800[1]	217[4]

CO_2 emissions	Total (tonnes)	Kg per m^2 floor area
Before improvement (2010)	16.78	59
After improvement (2011)	10.96	39
With all possible measures	9.29	33
UK average (2011)	6.00[2]	66[4]

Running costs	Total	Per m^2 floor area
Before improvement (2010)	£3,607	£12.78
After improvement (2011) - excl FIT income	£3,370	£11.94
With all possible measures	£2,784	£9.86
UK average (2011)	£1,032[3]	£11.34[4]

[1] Ofgem 2011
[2] English Housing Condition Survey 2011
[3] Ofgem 2011
[4] Based on 91m^2 from English Housing Condition Survey 2011

Energy performance and carbon emissions in the Target 2050 exemplar homes have been modelled using the UK Standard Assessment Procedure (SAP). The savings data presented here is based on a standard occupancy pattern. This may not reflect actual usage by the building's current residents but is used to compare homes of different sizes and types in a way that assesses the building itself rather than the behaviour of any particular occupant.