Technology Strategy Board
Driving Innovation

Retrofit for the Future

Project final report

Cover note

This report was prepared by the collaborative project team for this Retrofit for the Future project, to provide fuller context on their experiences and the particulars of their retrofit's specification, construction and occupation.

The authors were encouraged to include honest, transparent and constructive comment, garnered from multiple perspectives across their team. All views are taken to be an accurate account from the time.

There may have been further modifications to the property after this report was produced. It is therefore possible that a small minority of statements will no longer be valid.

Although minor modifications have been made to this report by the Technology Strategy Board, these were only to ensure the privacy of individuals, including the residents, and compliance with the Data Protection Act.

This report may contain links to other websites, such as for project partners or the retrofit project. The Technology Strategy Board is not responsible for the content of those websites.

This report has already proven to be a valuable source of information for the technical and cost analysis reports published by the Technology Strategy Board which are available at: www.retrofitanalysis.org

Retrofit for the Future Project Final Report

Project number: ZA429H
Property number: TSB097

Author:
Sarsen Housing Association

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Government challenges.
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Final Report

Project information

- **ZA reference number: ZA429H**
- **Location of property: Devizes, SN10**
- **Lead participant details: Sarsen Housing Association**
- **Date report issued: May 2011**

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1. Project Details and Directory

Role	Name & Position	Organisation	Contact Details
Property Owner			
Housing Association		Aster Group	Testway House Greenwich Way Andover Hampshire SP10 4BF
Design Team			
Architect		Buckleaze Design & Build	Buckleaze Mill, Buckleaze, Pewsey, SN9 5NY 01672 563607
QS		Buckleaze Design & Build	Buckleaze Mill, Buckleaze, Pewsey, SN9 5NY 01672 563607
Energy Consultant		Camco	172 Tottenham Court Road London W1T 7NS T: +44 (0)20 7121 6100 Web: www.camcoglobal.com
Contractor			
Main contractor		Aster Property	Testway House Greenwich Way Andover Hampshire SP10 4BF
Sub-contractor - heating		Space Air	Willway Court, 1 Opus Park, Guildford, Surrey, GU1 1SZ 01483 504883 info@spaceair.co.uk www.spaceair.co.uk
Supplier - windows		Corsham Building Plastics Lts	Fiveways Industrial Estate, Corsham 01225 811663 enquiries@ corshambp.co.uk www.corshambp.co.uk
Supplier – wall insulation (Spacetherm)		A Proctor Group	A Proctor Group Ltd T: | M: 07970 010 894 | F: www.proctorgroup.com

2. Introduction

This project undertook an advanced, whole house refurbishment of an off-gas rural property to a high standard of energy efficiency, supplemented by an air source heat pump. The works developed a 'template' package of improvements applicable to void properties before they are re-let. The selected property was electrically heated resulting in high energy bills, high CO_2 emissions and restricted comfort and utility for tenants.

The aim was to provide a comprehensive package of measures for the property to achieve more than 80% carbon reduction, in a cost effective manner. Following the 'energy hierarchy', the strategy was to reduce first and seek to generate energy from sustainable sources second.

3. Occupants

The occupants are a family of three; they were new occupants after the retrofit of an empty or void property.

The interview process was carried out by Aster Property to find a family that could grow into and enjoy the property over the life time of the property. Having a good knowledge of energy and green issues was a determining factor.

4. Dates

Event	Date
Project start date (when was the first proposal discussed or agreed)	24-06-2009
Planning application submitted (if appropriate)	20-10-2010
Planning permission granted (if appropriate)	19-11-2010
Building Regulations application submitted (if appropriate)	23-04-2010
Building Regulations approval granted (if appropriate)	May 2010
Contract for work let / signed	May 2010
Occupants moved out (state if they remained or property was empty)	Property Empty
Start on site	17-05-2010
Completion of retrofit	20-08-2010
Occupants moved in	20-09-2010
Monitoring system commissioned and operating properly	September 2010
Building defects corrected	
Building services and controls operating correctly	September 2010

5. Pre-retrofit Property

The property is a three bedroom, electrically-heated, semi-detached house constructed in 1939 and in a rural location. The total floor area is 76m^2, and it had an Energy Performance Certificate Energy Efficiency Rating of 58 and an Environmental Impact Rating of 43.
The property had the following characteristics:

- Cavity wall insulation
- Aging PVC double glazing
- Pitched roof with 250mm loft insulation
- Space heating from electric storage heaters supplemented by coal back boiler
- An electric immersion heater for domestic hot water.

The property has vast garden space, which needed major landscaping.

This property was selected to help make decisions about which energy and sustainability measures are needed, and the level of investment required, to tackle the large proportion of the rural stock that is heated electrically.

6. Design

This project was designed to upgrade all areas of the thermal envelope, with additional insulation to the walls (internally through the innovative Spacetherm product), floor and roof, and replacement high performing doors and 'A' rated windows. Internal wall insulation was specially planned to integrate with internal re-wiring and kitchen and bathroom renovations.

The use of an Air Source Heat Pump (ASHP) was of particular interest to assist in lowering the carbon footprint and running costs of many rural properties. The latest Daikin Altherma ASHP is a highly flexible, energy efficient home heating system that extracts the heat from the outside air, raises this heat to a higher temperature and then distributes warmth around the home. The Altherma split ASHP is particularly efficient as it uses refrigerant to transfer the energy (heat) from outside to indoors. This negates the need for glycol (anti-freeze) in the system, which typically reduces the efficiency of a system by 4%. Altherma units are inverter controlled, which increases the efficiency of a system by between 30% and 50%, compared to non-inverter controlled compressors. With inverter control, the compressor runs at the speed required to meet the exact demand for heating. There are no power surges as the compressor stops and starts.

Underfloor heating was designed for the ground floor and, on the first floor, new Daikin Heat Pump Convectors were proposed. These are designed to be optimised for the Altherma heat pumps. The convectors are ultra-quiet and provide fast heat-up times for the rooms. Each one can be individually controlled to provide the comfort levels required by the occupants. The proposed seasonal efficiency of the whole system (delivering heating and hot water for the selected property) was over 3, which is higher than competing systems for the property.

Another innovative product proposed for this project was Spacetherm insulation for the internal wall insulation. The unique high performance aerogel insulation (with a K factor of 0.013W/mK) used in Spacetherm F, combined with the robustness and durability of Fermacell gypsum board, delivers high-performing thermal conductivity and long term durability. This insulation was selected to ensure high energy savings from the improved thermal performance beyond just cavity wall insulation, whilst minimising the impact on interior space (only 40mm thickness).

This project was designed to dedicate resources to educating future occupiers to promote more sustainable lifestyles. Other sustainability measures included low flow water measures and A-rated appliances. To promote holistic sustainable living, additional measures were designed to reduce energy use and emissions associated with food and transport, such as an unheated greenhouse, allotment space, and bicycle storage.

There were no major changes to the design. Minor changes included:

- Additional joists under first floor to cope with depth of insulation and heating trays
- Modify the positioning of the ASHP equipment to allow the monitoring equipment to be located in the same cupboard.
- Additional electrical and plumbing work to ensure a satisfactory installation.

7. Construction

The Stone Pitts project was tendered by Aster Property Management.

The contract was a JCT agreement for Minor Building Works.

The structure of the contract consisted of one main contractor with other trades sub-contracted; the main contractor for the project was Aster Property, with subcontractors such as Space Air being implemented to aid with the installation of the new heating system. The majority of the works undertaken were completed by Aster Property.

Sub-contractors
There was one main sub-contractor involved in the project: Space Air. Space Air was the heating sub-contractor on the project, providing the Air Source Heat Pumps and installation of those within the property.

Specialist installers The Air Source Heat Pumps were installed through Space Air; the window installations were implemented through Corsham Building Plastics Ltd. The windows installed were triple glazing windows to fit in line with the energy efficiency intention of the project.

Specialist equipment suppliers
The property needed wall insulation which was provided by A Proctor Group supplying Spacetherm insulation. Spacetherm is a slim-line insulation that can be installed without causing any damage to the exterior wall.

Site supervision
The entire site was supervised by a staff member from Aster Property who inspected the site on a daily basis.

8. Commissioning and Occupancy

Commissioning
The Air Source Heat Pump was tested and commissioned by Space Air.

The monitoring equipment was tested and commissioned by Parity Projects.

Occupancy
Sarsen Housing Association and Space Air have provided the new family with training on how to use the equipment within the home, most importantly the new ASHP unit. This interactive session provided the family with a comprehensive introduction to all the controls for the heating system.

The team produced a plain English user-friendly guide for the residents on the use of the equipment.

9. Wash-up Meeting

A wash-up meeting was held on 20th December 2011 once the project had been completed. Attendees were Sarsen Housing Association, Buckleaze Design and Build, Camco and Space Air.

10. Doing it Again

Problems
Construction
There was damage to the under-floor heating pipes following installation. This had to be repaired.

Occasional access problems due to no-one being on site at appointed times.

Delays due to contractor running out of insulation materials for the walls.

Other
At times it was difficult to establish what TSB and Energy Saving Trust required for the purpose of the competition. This was partly resolved by being in contact with both organisations to keep informed of any developments or changes to requirements. However, this did delay progress of completion reports and monitoring strategy.

Location and time resources made it difficult for teams based away from the property to attend meetings and keep updated on progress of project. This was resolved by keeping in phone/ email contact with Sarsen Housing Association and the design team.

Some initial problems with linking collected data to the correct monitoring item.

Good Points
Enthusiasm and co-operation of the project team were the main factors in the successful delivery of this project.

Good communication between Sarsen / Aster, the site operatives and sub-contractors ensured the project ran smoothly.

Clear understanding of the aim of the project by the whole design team and the new tenants. This united the whole project team and allowed for a more cooperative build process.

Inclusion of the residents at a very early stage. The family were willing to contribute to the project and eager to learn about measures brought in and enthusiastic about 'eco-living.'

Lessons learned
Ensure that Space Air had more precise details of other equipment (i.e. sizing of monitoring equipment) that will be in the same location as the ASHP.

Space Air can learn to anticipate and charge for any works over and above the initial specification.

Ensure any competition requirements do not interfere with the schedule of works and progress of the project (e.g. air tightness tests etc).
More consideration for the outdoor measures. For the greenhouse, plastic sheeting requested for health and safety reasons cheapens the appearance. Also, the cross section of the shed framing timbers and their centres seem to be undersized (were chosen via pictures, rather than measured appropriately).

11. Business Benefits

Lessons learned in terms of innovation, efficiency or increased opportunities
The project has enabled Sarsen / Aster to gain valuable experience in retrofitting project work and has also provided an excellent platform to showcase the benefits of retrofitting both to internal staff and external stakeholders.

Business leads and opportunities
The Retrofit for the Future project has proved to be very useful in forging links with suppliers, manufacturers and consultants (Spacetherm, Space Air and Camco, for example). It has also proved to be an exceptional project for showcasing achievements with a great deal of interest from a wide range of stakeholders. The Communication team at the Aster Group arranged for an open day for the public to showcase the completed project.

The project has bolstered Camco’s experience in low carbon refurbishment, contributing to its leadership in this sector. The project provided an opportunity to build on internal insulation and ASHP expertise. The project also highlighted the barriers of implementing retrofit projects on the ground and the importance of other sustainability measures that tackle emissions, such as from local food. This practical learning has supported the high level work Camco is engaged in.