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: ZA349C
Property number: TSB029

Author: Encraft

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Technology Strategy Board
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Final Report

Project information

- **ZA reference number:** ZA349C
- **Location of property:** Birmingham B12
- **Lead participant details:** Encraft, Perseus House, 3 Chapel Court, Holly Walk, Leamington Spa, CV324YS 01926 312159 www.encraft.co.uk
- **Date report issued:** November 2011

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1. Project details and directory

Role	Organisation	Contact Details
Project Manager and Energy Consultant	Encraft	Perseus House, 3 Chapel Court, Holly Walk, Leamington Spa, CV32 4YS Tel: 01926 312159 Website: www.encraft.co.uk
Housing Co-operative	Balsall Heath Housing Co-operative	Fairgate House, 205 Kings Road, Tyseley, Birmingham Tel: 0779 183 9025
Architect	Chapman Design	10 David Road, Rugby, Bilton CV22 7PX Tel: 01788 815756 Website: www.chapman-design.co.uk
Engineer	Encraft Ltd	As above
Main building contractor	Logmoor Ltd	Highgate Road, Birmingham, B12 8DN Tel: 0121 440 3443 Website: www.logmoor.co.uk/
Sub-contractor – electric	RMD Electrical Ltd	126 Formans Rd, Birmingham Sparkhill, B11 3BD Tel: 0121 702 2492
Sub-contractor – heating	New World Solar Installations Ltd	Units 1-3 Waterloo Industrial Estate, Burhill Way, Chelmsley Wood, Birmingham B37 6RF Tel: 0121 779 4876
Sub-contractor solar thermal	New World Solar Installations Ltd	As above
Subcontractor – windows	Green Building Store	Heath House Mill Heath House Lane, Golcar Huddersfield, HD7 4JW Tel: 01484 461 705 Website: www.greenbuildingstore.co.uk
Sub-contractor – wood burning stove	Hagley Stoves Ltd	16 Pochard Close Kidderminster, Worcs, DY10 4UB Tel: 01562 700 005 Email: sales@hagleystoves.co.uk Website: www.hagleystoves.co.uk
Sub-contractor – external cladding	Transcast	Regus Building, Central Boulevard Blythe Valley Business Park Solihull, B90 8AG Tel: 01564 711 116 Website: www.transcast.org.uk
Sub-contractor heating controls	Wattbox Ltd	The Technocentre Coventry University Technology Park,

		Puma Way, Coventry CV1 2TT Tel: 024 7623 6708 Website: www.wattbox.co.uk

2. Introduction

The aim of the project was to demonstrate a whole house holistic approach to deliver an 80% cut in CO_2 emissions for a typical Victorian terraced property found in many parts of Birmingham. The project was developed and managed by low carbon consulting engineers Encraft Ltd, working in partnership with Balsall Heath Housing Co-operative.

The project sought to addresses three specific barriers to large scale low carbon housing retrofit:

i) The technical 'hard-to-treat' challenge

We deliberately chose an extremely hard to treat property, with a mix of historic solid walled fabric and more recent (but typical) un-insulated extensions and modifications; extremely limited space for onsite renewables, and occupied. This is nevertheless representative of a large number of pre-war social housing units in the Midlands and northern industrial towns and cities.

ii) The skills challenge

The project tackled the training and skills challenge head on, working with local contractors willing to undergo training.

iii) The capital and maintenance cost challenge

We addressed this challenge by focusing on technologies which are largely established so there is maximum potential for economies of scale in replication and scale up and minimum maintenance costs.

3. Occupants

The tenants in the property selected for the project are long term members of the co-operative and have lived in the property for more than 20 years.

The plan was for the family to move out of the property temporarily into local private rented accommodation during the full duration of the retrofit (scheduled to be 6 months). This was unavoidable as it would not have been realistic for them to have continued living in the property during the duration of the retrofit as the building works proposed were significant and would have been too disruptive.

Ideally, it would have been preferable (both logistically and in terms of cost) to have decanted the tenants into a similar sized void property owned by the co-operative. However, BHHC is a relatively small organisation with just 78 properties with a long waiting list. The opportunity therefore to use a void is restricted and therefore the co-operative almost always has to resort to using the private rental sector when decanting existing tenants during refurbishment works.

In turned out that the task in securing a suitable property was far more difficult than we had originally expected. This was largely because of an increase in rental demand for large family properties in the local area. The direct consequence of this was that the start date was delayed by several months (from August to November).

The family's personal circumstances are such that the property is likely to be occupied for significant periods of the day (for example most weekdays and weekends). High occupancy patterns are likely therefore to have a material impact on future energy and environmental performance of the property.

The make-up of the occupants before and after the retrofit are as follows:

Age band	Number before retrofit	Number after retrofit
Under 5 years		
5-16 years	1	1
17-21 years		
22-50 years	2	2
51-65 years		
Over 65 years	1	1
Please state if (yes/no):	**Before retrofit**	**After retrofit**
Married couple / partners	No	No
Couple / partners with children	Yes	Yes
Any disabled persons	Yes	Yes

4. Dates

Event	Date
Project start date (when was the first proposal discussed or agreed)	May 2009
Planning application submitted (if appropriate)	Not required
Planning permission granted (if appropriate)	Not required
Building Regulations application submitted (if appropriate)	11 May 2010
Building Regulations approval granted (if appropriate)	21 June 2010
JCT Contract for work signed by main building contractor	August 2010
Occupants moved out (state if they remained or property was empty)	7 October 2010
CDM construction phase plan approved	28 October 2010
Start on site	1 November 2010
Completion of retrofit	7 March 2011
Occupants moved in	17 March 2011
Monitoring system commissioned and operating properly	31 July 2011
Building defects corrected	20 April 2010
Building services and controls operating correctly	25 April 2011

5. Pre-retrofit property

The property chosen for the project is an early 20th Century mid-terraced social housing unit located near to Birmingham city centre. The house has 4 bedrooms and has a total heated floor area of 159m^2. Like many older properties the living area has subsequently been increased by adding a kitchen extension and undergoing a full loft conversion. The property embodied many of the challenges associated with 'hard to treat' buildings. It had solid walls, no insulation (except for a small amount in the kitchen and loft roof) and single glazing throughout. The property was gas heated using an old inefficient gas back boiler together with a number of open gas fires. The house isn't listed or in a conservation area but the facade does have architectural value that we wanted to maintain.

We deliberately chose an extremely hard to treat property, with a mix of historic solid walled fabric and more recent (but typical) un-insulated extensions and modifications; extremely limited space for onsite renewables, and occupied. This is nevertheless representative of a large number of pre-war social housing units in the Midlands and northern industrial towns and cities. For example, the proportion of pre-1919 homes in Birmingham is very high at 33.7%; representing approximately 138,000 units.

Detailed monitoring of pre-retrofit energy consumption was not carried out but we were able to obtain from the tenant several years worth of gas and electricity bills. By analysing this data we were able to estimate what the pre-retrofit energy usage and costs were - a detailed breakdown of this can be found in Appendix I. The main observation was that the actual energy consumption was around 40% lower than that predicted under SAP. One of the main reasons for the discrepancy is likely to be a result of the tenant heating the property to a temperature below that which is considered satisfactory due to worries around high fuel costs.

6. Design

The primary objective in our retrofit strategy was to reduce the heat loss through the building fabric as far as possible by improving insulation levels and making it as airtight as possible (whilst maintaining adequate ventilation levels). We aimed to achieve Passivhaus or very near Passivhaus standards in terms of the target U-values for our roof (0.10), floor (0.20), windows (0.9) and doors (1.2). The external back wall and kitchen extension was to be externally clad to achieve a U-value of 0.20. As we wanted to keep the appearance of the front facade we proposed dry lining the front external wall (to a target U-value of 0.35).

Our design strategy for space heating and DHW specified installing a new gas condensing combination boiler (for primary heating) with a passive flue gas heat recovery device. For free summertime DHW we incorporated a solar thermal packaged system in the brief, designed specifically to work in conjunction with the combination boiler selected. For secondary heating we proposed removing the old inefficient gas fires and fitting a wood pellet stove in the rear lounge (the tenants were keen to maintain a focal point in the main living area).

We proposed fitting low energy light bulbs throughout (CFLs) in addition to new energy

efficient white goods (A+/A++ fridge, freezer, washing machine and dishwasher), grey goods (LCD TV) and cooking appliances (gas oven and stove, microwave). The control systems specified included a new-to-market product called V-Phase for regulating the incoming electricity supply and a close-to-market heating control unit called Wattbox.

The main change prior to the construction phase was the design specification for insulating the side passage wall. The proposal had been to externally clad using 50mm phenolic insulation and insulate internally to achieve a target U-value 0.20. However, the design team was not aware that this was the main/only pedestrian route for a number of other properties owned by the co-operative. A decision was therefore made to drop the external cladding from the design in order to maintain access and instead increase the thickness of the dry lining board to compensate.

During the course of the construction process it was necessary to modify the retrofit design on several fronts. The main differences between the retrofit 'as designed' and 'as built' and the reasoning behind each change made are recorded in the following table.

As designed	As built	Reason for change
The side passageway wall (external wall for front and rear lounge). External/internal insulation. Target U-value 0.20	Internal insulation 70mm phenolic U-value 0.27	Dropped the external cladding as this would have reduced the width of the passageway which was considered unacceptable by the client. To compensate the thickness of the internal insulation was increased.
The side passageway wall (external wall for kitchen). External insulation. Target U-value 0.30	No improvement U-value 0.95	Dropped the external cladding as this would have reduced the width of the passageway which was considered unacceptable by the client. Unfortunately, we were not able to install internal insulation here as this would have required removing the fitted kitchen.
Insulate back lounge concrete floor Target U-value 0.22	No improvement U-value 0.74	The back lounge is situated above a vaulted brick cellar. On investigation we discovered that in the middle of the room the thickness of the concrete slab was only a few cm. There was therefore a high risk that excavating the existing floor risked undermining the structural integrity of the cellar.
The party walls in both attic bedrooms are not insulated as assumed to back onto heated space of adjoining properties	Party walls in both bedrooms insulated internally with 40mm phenolic	This was not included in the design as we assumed that the party walls backed onto a heated space as both neighbouring properties appeared to have attic conversions. On further investigation we discovered that these areas were poorly heated and therefore the party walls would benefit from dry lining.
Install pellet stove in back lounge	Installed wood burner in back	We were concerned that the heat outputs from the pellet stoves available were too high

	lounge	for the size of room. Another worry was the potential noise from the fan motors which in a small room could be a nuisance.
Install a Velux window in kitchen roof extension to improve light levels	Installed sun pipe in place of roof window	The positioning of the roof rafters prevented us from installing a roof window. This was only apparent once works had begun. To improve levels of natural daylight a sun pipe was specified instead.
	Insulate ceiling above passage way directly below first floor bedrooms	This weakness was overlooked at the design stage.

7. Construction

The organisation and management of the construction project is detailed below:

- **Procurement** – the main building contract was awarded to local building contractor Logmoor (framework partner with the client)
- **Contract type** – the contract type was a Standard JCT (minor works) building contract
- **Contract structure** – the building contract covering most trades plus some sub-contractors
- **Subcontractors** – the principal building contractor employed two subcontractors i) for electrical works and ii) roofing work
- **Specialist installers** – a number of specialist installers were used (5 in total) for the following technologies: i) wood stove ii) windows and doors iii) heating and solar system iv) external cladding and v) heating controls and monitoring system
- **Specialist equipment suppliers** – the specialist installers listed supplied all specialist equipment where specified (for example, the Wattbox heating control was supplied and installed by Wattbox)
- **Site supervision** – site supervision was carried out by the main building contractor who was permanently on site
- **Role of architect/design team** – the design team was retained to project manage/oversee the construction works and sign off works with clerk of works

Overall the construction phase went well and the project was delivered on schedule and to budget.

Some of the main problems arose because of issues around construction sequencing. For example, the external cladding works were scheduled to commence early in November but due to the extreme cold weather witnessed in December and January this had to be put back until towards the end of the build. Fortunately the consequence of this delay on other works was minimal and was limited to an increase in scaffolding rental costs and a rescheduling of works associated with re-roofing the kitchen extension. Likewise the cold weather also prevented us from completing the roof works to schedule which put back the fitting of the solar collectors by several weeks.

Wood burning stove - the installation was completed successfully, to plan and with no serious glitches. The installation certainly benefited from a site meeting between the main building contractor and installer at the beginning of the build at which the finer details of the building works required for accommodating the stove were discussed and agreed.

Windows and doors - no delay in supply or installation which went according to plan with no serious problems. We believe the reasons why this part of the build went so well was due to the following points i) the quality of the product and the experience and knowledge of the supplier (Green Building Store) in the retrofit sector ii) the installation work was carried out by the supplier and not sub-contracted out and iii) the supplier carried out a detailed site survey to check and verify the specification/design before the order was placed.

New heating system and solar thermal system - a number of problems/issues occurred

during this part of the project. The main mistake was a misunderstanding by the installer on the type of roof covering that had been specified (the roof integrated system used should have been that for a slate rather than a pantile roof). The consequence of this was that the collector had to be removed and reinstalled using the correct mounting system which incurred additional costs and time. If a detailed M&E design had been put together it is unlikely that this mistake would have occurred.

External cladding - the external cladding work was scheduled to be carried out following the installation of the new windows in late November. However, this had to be put back several months until February due to the very cold winter. Fortunately this didn't cause too many problems or extra costs but on reflection we should have specified a system where the installation was not so weather dependent.

8. Commissioning and occupancy

Commissioning for the various technologies fitted was carried out as follows:-

Space heating system - the new Alpha gas condensing heating system was commissioned and tested by the installer (Gas Safe registered) according to manufacturer's instructions and to relevant Building and Gas Safety Regulations. No issues were discovered during commissioning and no problems have been reported subsequently.

Solar hot water system – the Alpha solar hot water system was commissioned and tested according to manufacturer's instructions and to relevant Building and MCS regulations. However, shortly after this the system unexpectedly stopped working, reporting a fault with the hot water cylinder. The installer was called out but struggled to identify the cause of the fault. Upon further investigation, and with technical support from Alpha Heating, a number of problems were uncovered to do with the positioning of the drain back unit and pipe work which was causing an air lock in the system. This was corrected and the system has since been operating with no further problems. This was the first time that the installer had fitted this particular solar system. On reflection it would have been beneficial if the installer had had prior training in the Alpha product range by attending one of the free training days Alpha run for installers. The incident also questions whether the existing commissioning process/requirements are rigorous enough to ensure the system is performing correctly.

Wood burning stove - the wood burning stove was commissioned and tested by the installer (HETAS registered) according to manufacturer's instructions and to all relevant Building Regulations. The installer also provided hands-on training to the design team and main building contractor on operating the stove correctly and safely. No issues were discovered during commissioning and no problems have been reported subsequently.

One of the key objectives in the design was to avoid where possible specifying measures that required a high level of input from the occupants (experience on similar projects highlights the problems tenants can have with technologies that are technically difficult to understand and operate). The space heating system is controlled by a Wattbox controller which has been designed so that it is much easier to operate than a conventional time clock and thermostat. Also, the controls for the Alpha solar hot water system are hidden from view and have no user interface.

The handover process involved the design team carrying out a walk around with the tenants identifying, explaining and demonstrating each retrofit measure installed. The importance of how changes in behaviour can result in reductions in energy usage was also discussed. For ongoing support the tenants were given a point of contact to answer any queries or to report problems. In addition, the design team has also revisited the property on several occasions to answer any questions in person and to double check that the tenants are correctly using the more unusual retrofit measures like the wood burning stove, solar hot water system and heating controls.

9. Costs

Itemised project costs are detailed in the table below. Please note that it has not been possible to provide a breakdown between materials and labour for building and insulation works.

Item Stage	Design stage		Post-construction		Comments
	Materials	Labour	Material	Labour	
Management and administration		£24,381		£32,996	Includes £5,456 site attendance by main contractor that was not included in design costs
Website		£1,763		£1,763	
Design		£1,175		£1,050	
Clerk of works		£1,956		£1,161	
Construction overall					
- Prelims (CDM coordinator, building control approval, asbestos report, skip hire, move gas meter)		£4,526		£4,111	
- Fabric measures • Insulate attic bedrooms roof • Dry line front bedroom • Dry line front lounge • Dry line back lounge • Dry line hall • Dry line stair/cellar • Dry line party walls attic • Insulate suspended floor • Insulate kitchen roof • Draught proofing • Insulate solid concrete floor • Insulate bedroom floors directly above passage way	 £2,761 £1,000 £900 £600 £200 £300 - £919 £810 £200 £3,459 -		 £2,643 £1,757 £1,806 £810 £257 £1,264 £1,990 £2,224 £579 £204 - £1,263		The design costs for dry lining did not include a cost for parging brickwork and applying skim coat. Design cost for suspended floor insulation did not include cost for supply and fit of masterboard to underside (£943)
- Building services (conventional)	£7,393		£7,656		Cost included training for long term unemployed
- Low /zero carbon technologies • Solar thermal system	 £5,447		 £4,278		
- Windows and doors	£10,617	£4,865	£9,014	£4,803	
- Roof windows	£2,535		£2,001		The Velux in the top bathroom was removed and not replaced. Also, the proposed Velux for the kitchen was replaced with a sunpipe.
- Wood stove	£2,761	£1,968	£1,635	£1,386	Design was to install pellet stove. This

					was changed to a wood burning stove.
- External clad back wall and kitchen extension - External clad side passage way		£8,762 £3,108		£8,203 -	External cladding of passage way was dropped from final design.
- Appliances (A++)	£3,055		£1,910	£180	
- **Consequential costs (Expected)** • Remove front room chimney breast • Carpets/flooring • Decoration • Renew skirting • New roof for main house • New roof for kitchen extension • Electrics • Misc - **Consequential costs (Unexpected)** • Rebuild gable wall • Increase attic bathroom to accommodate heating plant • Rebuild chimneys • Rebuild front room bay (including roof)	 £878 £3,383 £4,459 £1,000 £9,466 £2,919 £2,059 £2,615		 £683 £4,131 £3,959 £1,310 £5,183 £3,381 £3,885 £3,058 £1,325 £1,204 £1,528 £1,491		
Occupant temporary housing	£7,600			£8,888	Includes £6,000 rent for 6 month tenancy. This was greater than we had originally budgeted for.
Monitoring equipment	£1,405		£1,040		
Monitoring and reporting service		£8,850		£3,034	Cost for co-heating test was included in design (£2,937) but this was dropped due to budget constraints.
R&D costs (please detail) - Wattbox - Vphase		 £5,875 £588		 £5,000 £517	The design cost for Wattbox included VAT (@17.5%) which was not applied as Wattbox were not VAT registered.

Consequential improvements that were not expected at the design stage were relatively minor (approximately 3.5% of the total project costs). The key improvements that were encountered were as follows:

- Rebuild kitchen extension gable wall. The poor state of the gable wall was only uncovered after the pebble dash had been removed prior to the cladding works.

- Increase the floor area of the attic bathroom to accommodate the new heating plant. This was an oversight and should have been picked up during the design stage
- Rebuild both chimneys.
- Rebuild front room bay including new roof. The poor structural condition of the bay was only discovered once construction works had commenced.

Construction costs were minimised by ensuring that the main contractor/sub contractors applied the correct VAT rate. For example construction work associated with improving the thermal performance of the building fabric was charged at a VAT rate of 5%. It was surprising that both the external cladding contractor and main building contractor were unaware of this fact.

R & D measures/costs for this retrofit were not that significant at around 4% of the total project cost.

10. Doing it again

What would you definitely do, not do, or do differently if you were doing it again:

1. Definitely do again

- Decanting the tenants - it would not have been possible to carry out the required building works with the tenants remaining in the property.
- Tenant 'buy in' - every effort was made to involve the tenants over the whole project cycle. This was key to the success of the project.
- Appoint a reputable main building contractor with the knowledge (or the willingness to learn) of energy refurbishment.
- Keep the number of specialist subcontractors to a minimum - managing the project was made easier by minimising the number of subcontractors.
- Carry out air-tightness testing at key points during the refurbishment - this proved extremely useful in identifying and correcting weaknesses in the air tightness of the property.

2. Definitely not do again

- Finding suitable private rented accommodation was very time consuming and delayed the project by several months. It would have been far easier if the private rented sector could have been avoided (for example using a void property from another social housing provider).
- If the retrofit is to be scheduled over the winter we would specify an external wall cladding system where the installation was not so weather dependant.
- A detailed M&E design for the heating and solar hot water system was considered unnecessary as the system was deemed relatively straightforward, however on reflection this was a mistake and would have likely prevented a number of mistakes during the installation.

3. Reduction of costs

- Carrying out the works during a break in tenancy would have avoided the need to decant.
- A larger local programme with similar houses (type and age) would have realised savings through economies of scale.
- There may be cost savings if the measures were implemented in phases to tie in with future maintenance programmes.

4. Improvement of the design process

- The assessment, analysis and design process is time consuming and costly. Identifying packaged retrofit measures for particular property archetypes through best practice would be of considerable benefit.
- Using PHPP rather than SAP as a design tool - we believe that PHPP is more suited for this purpose than SAP.
- More attention in the design in developing an effective air-tightness strategy.

5. Improvement of the construction process

- The project would have benefited from a kick off meeting which all contractors were invited to.
- Revise the detail specification of works as changes occurred. This was not done.
- If possible schedule the programme to avoid the worst of the winter weather.

6. Improvement of the commissioning and occupancy process

- Training and education that focused not just on the technologies installed but also emphasised the importance of behaviour changes in reducing energy demand.
- The commissioning of measures is not robust enough to guarantee performance from the outset. More rigorous testing should be required to ensure the system is performing correctly. This is likely to increase costs but should result in a reduction in costs associated with call outs.

11. Business benefits

Balsall Heath Housing Co-operative
The project has whetted the appetite of the Co-op for further retrofit projects. We are optimistic that this will lead to further retrofit opportunities although we are not sure that the Green Deal golden rule will work effectively for some of our hard to treat properties or for some of our residents. It has clarified our understanding that the solutions to hard to treat properties belonging to us and others in the neighbourhood need to focus on cost-effective demand reduction. We are particularly pleased that it has been possible to create business for local suppliers. We have been able to do this because as a small organisation we have relatively straightforward procurement procedures. The challenge for larger organisations such as local authorities and utilities is to make their procurement procedures more accessible to SMEs and social enterprises in order to strengthen the local supply chain.

One key challenge for us in future retrofit activities will be decanting. We found that there was such a short supply of decent rented accommodation locally that it proved difficult to decant the family. It would be a major challenge to decant significant numbers of households in future especially without grant support.

Encraft
Encraft continue to be involved with a number of retrofit projects, both in the public and private sectors. As was the case before the Retrofit for the Future competition, we are often asked to conduct feasibility studies and designs for retrofitting homes, schools, offices, community centres and other buildings. Our most interesting project which came about as a direct result of our involvement with Retrofit for the Future is an ongoing project with Orbit Heart of England Housing Association where we are leading the design and coordination of the retrofit of two adjoining semi-detached Wimpey no-fines houses. One will be brought up to Passivhaus EnerPHIT standard, while the other will have an ‘affordable’ retrofit with a budget of £40k. This project alone has generated an income of around £25k this year. We expect the value of our retrofit business to be in the region of £250k - £1m, totalled over the next 5 years.

Wattbox
Wattbox have launched their entire business off the back of this and other TSB Retrofit for the Future projects. The building performance monitoring and evaluation services were initially offered by Wattbox as an add-on to their heating controller but that aspect has now evolved into a major part of their business and they have gone on to secure further funding from the TSB in this aspect. Wattbox has since been acquired by home energy management company AlertMe (part owned by British Gas) which will integrate the Wattbox technology into its own heating control systems.

Logmoor
This project was the first major domestic energy refurbishment that Logmoor had undertaken. Although the project has not directly resulted in winning similar work they are hopeful that with the introduction of the Green Deal in 2012 this will change.

Transcast

Transcast are currently working on external insulation programmes for several large social housing providers (for example Birmingham City Council, Dumfries & Galloway Council). They are expecting further growth with the introduction of the Green Deal in 2012.

Green Building Store

The Retrofit for the Future project generated significant new business for the Green Building Store especially for their range of high performance windows which were used in a large number of the projects. We understand that our project was the only Retrofit for the Future project to specify their more economic Ecocontract window range which has been developed specifically with social housing providers in mind.

New World Solar Installations

With the introduction of the Feed in Tariff New World Solar Installations has experienced significant business growth over the past 12 months. The company has recently completed its 1000th installation and is hoping to grow further on the back of the Renewable Heat Incentive and Green Deal.

Appendices

Appendix A Pre-retrofit gas and electricity consumption

Electricity Readings

Date	28/08/2008	30/04/2010	07/10/2010
Meter Reading	8356	19295	21573

Estimated annual consumption = 6,265kWh
Estimated cost @ 12p per kWh = £752

Gas Readings

Date	15/09/2009	30/04/2010	07/10/2010
Reading	9019	9648	9828

Estimated annual consumption = 22,890 kWh
Estimated cost @ 3.3p per kWh = £755

Total annual fuel cost = £1,507