

## Generation Homes – Low Carbon Retrofit

### Project Summary

Radian provides around 16,000 affordable homes across the south of England. The Highfield Road retrofit project is being managed by Radian's stock options surveyor, working closely with Drum Housing Associations community project workers and Radian's sustainability manager.

**Location: Highfield Road, Petersfield, Hampshire.**

Existing House Type: Precast concrete, REEMA properties built late 1940's with a 30 year life expectancy.

#### The Project

- Retro-fit to 20 homes (REEMA concrete panel PRC classed as 'hard to treat')
- Reduce average household energy running costs currently >£1,200pa
- Option appraisal of feasible technical solutions
- Core energy efficiency package to reach 70% CO<sub>2</sub> reduction (all 20 homes)
- Plus solar package to reach 80% CO<sub>2</sub> reduction (3 empty units initially)

#### TIME LINE 2009

- January 2009:** Initial resident consultation; work commences on three void homes.
- March 2009:** First residents decanted.
- May 2009:** Open homes for residents viewing and comments. (refurbishment review process commences). 3x decant homes.
- June 2009:** First residents move back into their home.
- October 2009:** Solar panels installed.
- December 2009:** Project completes and post occupancy reviews and performance modelling starts (two homes to be refurbished Spring 2010).





### **Background to the low carbon refurbishment challenge**

In 2008, the Government set a target of reducing carbon emissions by 80% on 1990 levels by 2050 through the Climate Change Act. Such a reduction is considered necessary to help prevent catastrophic consequences as a result of climate change. Over a quarter of the UK's carbon emissions come from energy used in its 26 million homes. Whilst stringent minimum standards are set to make new homes energy efficient, it is predicted that up to 85% of existing dwellings will still be with us in 2050.

Existing homes are much less efficient than new ones and therefore will need to be significantly improved if the UK is to meet its targets. Registered social landlords (RSLs), will have a major role to play in helping to meet these targets. There are over 1,800 RSLs in England, currently managing around 1.7 million homes and housing at least twice that many people.

The Government's draft Heat and Energy Saving Strategy sets an ambition of the 'whole house' retrofitting of 7 million properties by 2020 to a level where carbon emissions are cut by 80% (known as C80 standard). Many of these will be in the South East, which is currently home to about 8.2 million people living in 3.5 million homes. Per capita production of carbon dioxide is currently higher in the South East than any other UK region, as is per capita water consumption.

As well as cutting carbon emissions, Radian wanted to provide its tenants with comfortable, affordable and easily controlled heating.

### **Radian's Retrofit Model**

Radian is in the process of refurbishing 20 properties constructed from reinforced pre-cast concrete known as Reema homes. These properties are classified as 'hard to treat' in terms of energy efficiency improvements as they are of non-traditional construction and do not have cavity walls.

The comprehensive package of energy efficiency measures being installed is designed to achieve an estimated 70% reduction in carbon emissions. In addition, renewable solar energy technologies (comprising hot water panels and photovoltaics generating electricity) have been installed on three of the properties to achieve an estimated 80% reduction in carbon emissions. Due to the cost of the renewable technologies, Radian could not afford to fit these to all properties. The organisation has therefore selected the three properties that were unoccupied at the start of the project, both because this would minimise disruption to residents and it was felt this was the fairest way to choose properties.

All the energy efficiency measures were initially installed in the unoccupied properties as this enabled Radian to identify any likely problems and find solutions to these without disrupting residents. The process was then refined before the core package of energy efficiency measures were rolled out on the 17 remaining homes with the three unoccupied homes used as temporary accommodation for residents whilst work is carried out on their own homes. The 'whole house' refurbishment works on average took 10 weeks per dwelling including the decant period.

Incremental impact of energy efficiency measures installed (Regulated Emissions)					
Scenario	SAP 2005 Rating	EPC Band	Annual Regulated CO <sub>2</sub> Emissions	Approx cost of measure	Percentage Reduction in Regulated CO <sub>2</sub> Emissions
	I-100	A-G	kgCO <sub>2</sub> /yr	£	%
<b>Baseline as existing</b> (Gas heating)	43	E	<b>7,495</b>		--
+ Phenolic foam external wall insulation 100mm thick	61	D	4,826	10,000	36%
'+ Improved air-tightness (pre & post air pressure testing)	62	D	4,776	1,250	36%
+ Double loft insulation to 300mm thick	63	D	4,599	300	39%
+ SEDBUK A-rated gas condensing boiler as part of new central heating system	74	C	2,745	4,000	64%
+ compact fluorescent lighting (100% of internal & external fittings)	76	C	2,594	200	65%
+ New 'A' rated double glazed (1.3 W/m <sup>2</sup> k) windows and insulated core doors	78	C	2,352	5,500	69%
+ Whole house ventilation with heat recovery (85% efficient)	78	C	2,285	2,750	70% (core package)
+ Solar thermal panel to roof 3m <sup>2</sup>	79	C	2,079	4,500	72%
+ Photovoltaics, 1.2 kWp (10m <sup>2</sup> over roof)	85	B	1,636	7,500	79%
<b>Sum of all measures</b>	<b>85</b>	<b>B</b>	<b>1,636</b>	<b>£36,000</b>	<b>79% (advanced package)</b>

One of the three unoccupied properties was formerly heated by electricity. By applying both the core package of energy efficiency measures (including gas central heating) and the solar package to this home, **a reduction in regulated emissions of 85% was achieved.** This is because the baseline emissions were higher, since electric heating results in higher levels of carbon emissions than gas heating.

It is especially pleasing to Radian, that with the exception of the solar panels, the refurbishment work has been managed and undertaken by Radian Services our in house contractor who have gained new skills in low carbon retrofit which included the training of apprentices.

### The technical features

The most dramatic saving in CO<sub>2</sub> was achieved from the external wall insulation. A typical house loses 35% of its heat through the walls. To reduce this, 100mm of high performance insulation was applied behind a new external render system. A further 25% of heat is typically lost through the roof. To minimise this, the thickness of loft insulation was increased from 150 to 300mm. Further reductions in heat loss are being achieved by installing double glazing and draught proofing, including a new loft hatch, following air pressure testing that was carried out both before and after the refurbishment works. The best result achieved on completion was 5.14m<sup>3</sup>/(h.m<sup>2</sup>)@50pascalsair pressure improving in the range which is almost a 50% improvement on minimum building regulation standards for new housing.

Substantial savings were also achieved from the installation of efficient gas condensing boilers which have controls that allow residents to ensure the heating is only on when wanted, and only in the rooms occupied via TRV's.

Savings will also be achieved through providing energy efficient light bulbs for all the fittings. For the same light output, these use around a fifth as much electricity as traditional tungsten lamps.


### Solar technologies

There are two principal types of renewable technology that utilise solar energy. Both have been installed as part of this project.

The photovoltaics that have been installed are expected to generate around 1,000 kiloWatt hours (kWh) per annum for each dwelling (a typical 3 bedroom semi-detached house will use around 2,900 kWh per annum to power lights and appliances). Export meters have been installed to allow residents to sell surplus output back to the grid. Radian estimates that around a third of the output could be exported in this way. With the current energy supplier, Scottish and Southern Energy, paying 0.28p per kWh exported, residents should be able to generate an income of around £100 per annum, to offset their fuel bills. The introduction of the 'Feed in Tariff' in 2010 could raise household income to over £350 per annum.

The solar thermal systems installed as part of this project are expected to meet around half of the houses' hot water requirements annually for non space heating.

### Energy Efficiency Rating

	Current	Potential
<i>Very energy efficient - lower running costs</i>		
(92 plus) <b>A</b>		
(81 - 91) <b>B</b>	85	85
(69 - 80) <b>C</b>		
(55 - 68) <b>D</b>		
(39 - 54) <b>E</b>		
(21 - 38) <b>F</b>		
(1 - 20) <b>G</b>		
<i>Not energy efficient - higher running costs</i>		
<b>England &amp; Wales</b>	EU Directive 2002/91/EC 	

Typical EPC for refurbished home with advanced package



Before

## Water

In addition to energy efficiency improvements, water efficiency is also being addressed with the provision of dual flush toilets, low flow rate showers and water butts. Radian have installed water meters in the three decant homes and will be working with existing residents to see whether they could save money by choosing to have a free water meter installed.

## EcoHomes XB

### breeam:ecohomes

Radian undertook a pre and post EcoHomes XB assessment on the refurbished homes. The 17 homes with the core package achieved a score of 67 out of 100 and the 3 homes with the advanced package an impressive 81 out of 100.

In reaching the above scores a range of other measures were installed in the homes including:

- Services and space for a home office
- Water butts (200 litres)
- Rotary clothes dryer
- Power down devices
- End user manuals

Additionally to the three decant homes

- 'A' energy rated white goods – cooker, fridge freeze and washing machine
- Dedicated internal recycling bins
- Water meters
- Current cost meters (on rotation)
- 'A' energy rated windows ('B' rated elsewhere)
- Whole house ventilation with heat recovery MVHR (Through wall extract fans in kitchens and bathrooms with heat recovery elsewhere)



During



After

## The consultation process

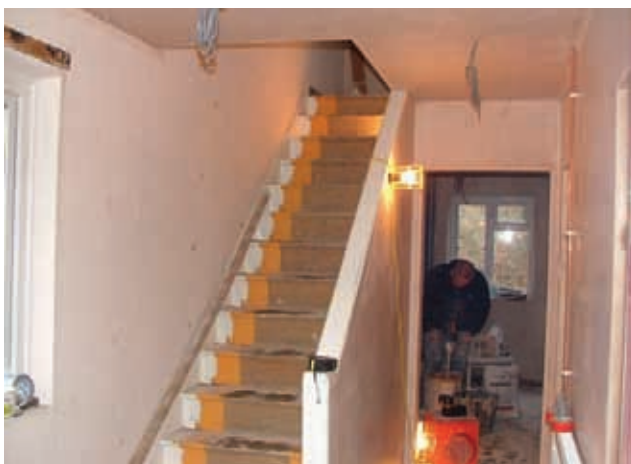
With any major refurbishment programme, the involvement and support of residents is vital. In this project, Radian has fully involved the residents in the process from the outset. Residents were individually consulted during the conceptual design phase and are being kept fully informed throughout the construction phase with regular resident and community focus group meetings.

The survey conducted during the consultation period revealed that residents wished to see improvements to the energy efficiency of their homes, and consequential fuel bill savings. Data gathered by Radian revealed that on average residents had spent at least £1,200 on gas and electric bills in the last year. After the works are completed, bills are expected to be significantly lower.

Due to the amount of work required, residents have been asked to move into temporary accommodation while the work is completed. Radian has appointed a dedicated Community Development Officer for this project to help ensure that this process runs as smoothly as possible and the upheaval to residents is minimised.

Residents are being kept informed of the progress through a monthly newsletter. In addition, detailed home-user manuals are being provided to all residents when they move back into their newly refurbished homes. This will help to ensure that the various technologies deliver the maximum environmental savings.

An 'open house' day has already been held to allow residents to view the first two newly refurbished properties. This allowed residents to see for themselves what their refurbished properties will ultimately look like. A suggestion box was provided so that refinements could be made. The feedback was generally very positive, with the only negative criticism relating to the narrowing of external doors (necessitated by the new insulation). A residents' focus meeting is also planned, to give residents the opportunity to voice any concerns and get any questions answered. Radian also proposes to run an energy saving campaign focusing on helping residents to change their behaviour and attitude to environmental awareness. As part of this approach 'current cost' electrical display meters and 'power-down' devices have been issued to residents.



### Costs and Benefits

Radian is funding the refurbishment of these 20 homes, which is costing in the region of £1.2million. On completion, all homes will be compliant with the Decent Homes Standard and include new kitchens and bathrooms. The core package of energy efficiency measures applied to each home costs approximately £24,000. This figure increases to approximately £36,000 for the three homes which benefit from the solar package.

Radian has secured 50% grant funding towards the cost of the solar energy via the government's Low Carbon Buildings Programme. In addition, it is anticipated that around £1,000 per property will be secured from the energy suppliers' Carbon Emissions Reduction Target (CERT) fund to help to fund the cost of the wall insulation. Radian is grateful to East Hants District Council who contributed approx £15,000 towards the refurbishment project making the three exemplar homes with the advanced package possible to deliver.

### Measuring the benefits

As part of the monitoring, a post occupancy evaluation survey of residents is planned in order to establish levels of satisfaction. Local scheme 'champions' (selected from the residents who have benefited from this work) will be encouraged to participate in the dissemination of the project.

Monitoring of energy use and running costs will be carried out continually after the project is complete, with a full review and analysis undertaken after 12 and 24 months. This will help to show whether the projected carbon dioxide and running cost savings have actually been achieved.

### Open house

Radian proposes to use one of the C80 homes as an open house for one week, prior to it being permanently occupied, in order to promote the exemplar refurbishment approach to both the housing sector and the general public.



### A home fit for life

Mr Childs was the first resident to move back into his old home after the works had been completed. He has been back in his home for over three months and is already noticing the benefits. His gas and electricity is on a pre payment meter and he has noticed that his money is going further.

Mr Childs has lived in Highfield Road for 53 years. He said

***“I love my new home. Three of my five children were born in the front room. Both the house and I have been given a new lease of life.”***



**A special thanks to our partners on this project:**

**Contractor:** Radian Services (main contractor),

**Specialist sub contractors:**

Dulas Solar Ltd.

AES Ltd.

Southern Assessors

**Energy modelling consultants:**

Camco Global

East Hampshire District Council

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