

GENERATION HOMES – ACHIEVING AN 80% REDUCTION IN CARBON EMISSION FROM EXISTING HOUSING

Icon: Sustainable construction

LEARNING POINTS

- ❑ It is possible to achieve carbon savings in excess of 60% in existing homes through energy efficiency measures.
- ❑ Including renewable technologies can increase this to around 80%.
- ❑ Resident buy-in is vital to ensure the technologies deliver their potential savings.

WHAT

'Generation Homes' status is only afforded to existing homes that achieve at least a 60% reduction in carbon emissions. In 2007, a group of properties owned by Drum Housing Association became the first to achieve 'Generation Homes' status. These 1950s properties underwent an extensive programme of refurbishment, comprising energy efficiency measures and renewable energy technologies.



One of the refurbished properties, showing the solar PVs and solar water heating panel.

Looking to repeat this success, Drum is in the process of refurbishing a set of 20 properties constructed from reinforced pre-cast concrete known as Reema¹ homes. Reema 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. According to a report produced for the Energy Efficiency Partnership for Homes², there are around 18,000 Reema properties in the UK.

Generation Homes

Generation Homes is an initiative that aims to establish a systematic approach to reducing carbon emissions from existing houses by more than 60% through deploying integrated low-carbon technical solutions as part of major refurbishment work. Generation Homes involves 11 public and private sector partners and receives funding from the Energy Saving Trust.

Further information can be found at www.generationhomes.org.uk/index.htm.

WHY

In 2008, the Government set a target of reducing carbon emissions by 80% between 1990 and 2050 through the Climate Change Act³. 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 the home. Whilst stringent minimum standards are set to make new homes energy efficient, 80% of existing dwellings will still

¹ **Reema construction** is a system of building using prefabricated reinforced concrete panels which came into being in the late 1940s and was still in use well into the 1960s. The name is likely to have originated after the company REEMA Construction Ltd.

² www.cse.org.uk/pdf/pub1045.pdf: Fuel Poverty and Non-traditional Constructions, March 2005

³ The Climate Change Act was passed in 2008; details can be found at www.defra.gov.uk/environment/climatechange/uk/legislation/.



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), such as Drum, 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 Strategy⁴ sets an ambition of retrofitting 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.⁵ 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, Drum Housing Association wanted to provide its tenants with affordable, easily controlled heating.

HOW

Drum Housing Association is installing a comprehensive package of energy efficiency measures in 20 of its properties in Hampshire. This package is designed to achieve an estimated 70% reduction in carbon emissions. In addition, renewable solar energy technologies (comprising hot water panels and electricity-generating photovoltaics) are being installed on three of the properties. Due to the cost of the renewable technologies, Drum 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.

The following table summarises how, through the cumulative effect of each measure, the carbon emission reductions are to be achieved in these properties. It demonstrates that energy efficient measures alone achieve a reduction in CO₂ emissions of 70%, whilst improving the energy rating from E to C. Including renewable technologies as well takes the savings up to almost 80%.

	Regulated emissions				
Scenario	SAP 2005 rating	Energy Perf. Cert. (EPC) band	Annual regulated CO ₂ emissions (Kg CO ₂ /yr)	Approx cost of measures (£)	% reduction in regulated CO ₂ emissions (%)
Baseline as existing (gas)	43	E	7,495		--
+ 100mm wall insulation	61	D	4,826	10,000	36%
+ Improved air tightness	62	D	4,776	1,000	36%
+ Double loft insulation	63	D	4,599	300	39%
+ A-rated, condensing boiler	74	C	2,745	4,000	64%
+ Compact fluorescent lighting	76	C	2,594	200	65%
+ New 'A' rated glazing	78	C	2,352	6,000	69%
+ Heat recovery ventilation in wet rooms	78	C	2,385	2,500	70%
Renewable technologies – installed on three properties					
+ Solar water heating 3m ²	79	C	2,079	4,500	72%
+ Photovoltaics, 1.2 kWp	85	B	1,636	7,500	79%
Sum of all measures	85	B	1,636		79%

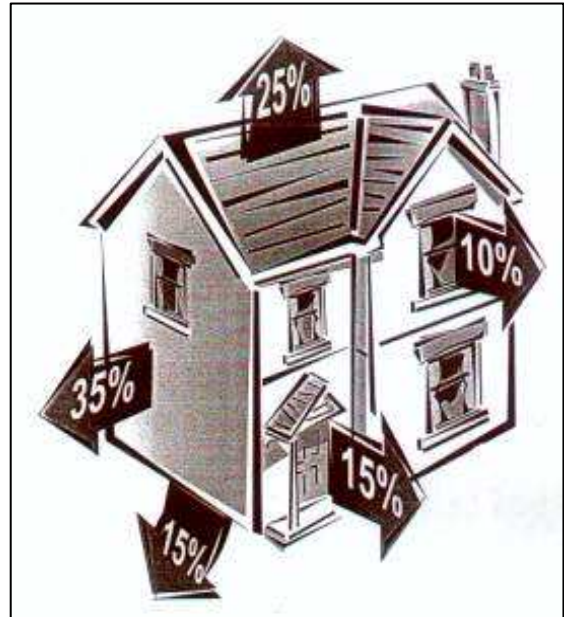
⁴ This Strategy sets out the government's aim for emissions from existing buildings to be approaching zero by 2050. Details can be found at http://hes.decc.gov.uk/consultation/consultation_summary.

⁵ www.gos.gov.uk/497648/docs/171301/815607/815696/Pages_from_RSS-2_section_A.pdf.

All the energy efficiency measures were initially installed in the unoccupied properties as this enabled Drum 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 'decant'⁶ properties for the duration of the works.

One of the three decant 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.

Details of the energy efficiency measures and renewable technologies installed can be found in the boxes below.



How a typical house loses its energy. Image courtesy of Burnley Borough Council.

Energy efficiency measures

As the table above shows, the most dramatic savings in CO₂ are achieved from the insulation measures. A typical house loses 35% of its heat through the walls, as illustrated in the adjacent diagram. To reduce this, 100mm of insulation is being applied behind a new external render system. A further 25% of heat is typically lost through the roof. To minimise this, loft insulation is to be increased to a thickness of 300mm (around double the existing thickness). Further reductions in heat loss are being achieved by installing double glazing and draught proofing.

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.

Savings will also be achieved through providing energy efficient lightbulbs 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 types of renewable technology that utilise solar energy. Further information can be found in the blue box below. Both have been installed as part of this project.

The photovoltaics that have been installed are expected to generate at least 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. Drum 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, residents should be able to generate an income of around £100 per annum, helping to offset their fuel bills.

⁶ A 'decant' is a temporary move to another property while improvements or major repairs are carried out to a householder's normal home.



The solar thermal systems installed as part of this project should meet around half of the houses' hot water requirements.

Solar technologies

Solar photovoltaics (PVs) use energy from the sun to create electricity to run appliances and lighting. PVs require only daylight, not direct sunlight, to generate electricity and so can still generate some power on a cloudy day. PV systems produce no greenhouse gases. They can be used for any building with a roof or wall that faces within 90 degrees of south, as long as no other buildings or large trees overshadow it. If the roof surface is in shadow for parts of the day, the output of the system decreases. PV arrays come in a variety of shapes and colours, ranging from grey 'solar tiles' that look like roof tiles to panels and transparent cells that can be used on conservatories and glass to provide shading as well as generating electricity.

Solar water heating systems use solar panels, called collectors, fitted to a dwelling's roof. These collect heat from the sun and use it to warm water which is stored in a hot water cylinder. They work all year round, although the water will need to be heated further with a boiler or immersion heater during the winter months. They require a roof space, usually of at least 5m², which faces east to west through south and which receives direct sunlight for the main part of the day.

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. Drum will also be working with residents to see whether they could save money by choosing to have a free water meter installed.

Residents' involvement and participation

With any major refurbishment programme, the involvement and support of residents is vital. In this project, Drum is fully involving the residents in the process from the first opportunity. Tenants were individually consulted during the conceptual design phase and are being kept fully informed throughout the construction phase. 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 Drum 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 will be significantly lower.

Due to the amount of work required, residents have been asked to move into temporary accommodation while the work is completed. Drum 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 in touch with progress through a monthly newsletter. In addition, it is planned that a home-user manual will be 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

REEMA Refurb Review
Edition 3 Drum Housing Association May 2009

Come & see ... have a cup of tea ... & make your choice!

We're late! We're late! For a very important date!

Surveyor's Notepad ..

Next edition!

This newsletter is being issued to all residents each month to keep them up to date on the project.

concerns and get any questions answered. Drum 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' devices⁷ will be issued to residents.

Funding and costs

Drum Housing 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. The core package of energy efficiency measures applied to each home costs approximately £25,000. This figure increases to approximately £37,500 for the three homes which benefit from the solar package. Drum 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.

Decent Homes

The Government believes that everyone should have the opportunity to have a decent home, which it defines as being warm, weatherproof and have reasonably modern facilities. By 2010, it is expected that 95% of social housing will meet this 'decent homes' standard.

Monitoring and dissemination

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.

Drum 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.

FURTHER DETAILS

When

Work commenced in March 2009 and is scheduled for completion in winter 2009.

Where

The properties are located in Petersfield, Hampshire.

Who

Drum Housing Association is a subsidiary of Radian, which provides around 16,000 affordable homes across the south of England. The refurbishment programme is being managed by Drum's stock options surveyor, working closely with the organisation's community project workers and sustainability manager.

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⁷ Using a 'power-down' device will ensure that all peripherals are turned off a computer is shut down; this might include a modem, printer or anything else plugged into a computer.