

# retrofit reality

a dissemination report by Gentoo - part 2 of 3



...living for a new generation

“We want to share the lessons learned during the process of actually installing the products.”

**In part 1 of our Retrofit Reality reports we talked about our experiences in ensuring the products we chose were people friendly, that we chose the right homes and the right products to save CO<sub>2</sub> and get value for money. We talked about how we assessed the product options and the lessons we learned from this process.**

*Products we installed as part of the project:*  
Solar hot water systems, A-rated condensing combination boilers, energy efficient showers, double-glazing.

Part 2 of our report will take you further into our journey. We want to share the lessons we learned during the process of actually installing the products.

This is set out in four areas:

- 1. The products** – ones we chose and why
- 2. Installing the products** – Gentoo become experts
- 3. Our customers' thoughts** – the environment is important but money comes first
- 4. Monitoring the results of the retrofit work to homes** – understanding the impact on CO<sub>2</sub> emissions and energy bills

The results of our monitoring and experiences of our customers and staff in understanding, using and benefiting from these retrofits will be the subject of our final report in the series. This will be launched at Gentoo's ecosmart conference on May 19<sup>th</sup> 2010.



## **How we chose the right products**

### **Lesson Learned:**

**Get the specification right and do your own, thorough research.**

Gentoo always look for top of the range products so that maintenance in future years is easier. This project was no exception. Gentoo Construction's technical team spent numerous hours collating information, sending out questionnaires, meeting manufacturers and visiting sites. In fact, the research we did ourselves completely

outweighed any information provided by any manufacturer or supplier. The only problem was that not many manufacturers could meet our high expectations.

**The selection of solar panels was difficult due to our high standard of specification requirements. We decided to use glass panels due to long term maintenance concerns. This ruled out a number of manufacturers.**

We chose a Vaillant solar hot-water system because we were pleased with their product, expertise, service and aftercare.

### **Grants**

The Low Carbon Buildings Programme will fund up to 50% of some products but this was limited to certain suppliers and installers who we felt had limited knowledge and experience on projects of this size. We were surprised to find the grant process more expensive than using direct labour and suppliers for one of the schemes.

**“The Gentoo technical team spent numerous hours collating information, sending out questionnaires, meeting manufacturers and visiting sites.”**

## **Terry Flynn**

### **Project Surveyor, Gentoo Construction**

Terry has been involved in the project from the outset. He worked with specialists to research the technology available for retrofitting our existing stock. Terry led on the procurement and design of the technologies; working closely with suppliers, manufacturers and customers. Terry's involvement has been critical in the successes and lessons learned throughout the project so far.

**“This project has allowed me to gain excellent technical and practical knowledge of the low carbon technologies. This can be utilised within all internal and external refurbishment projects, as we continue to improve the sustainability of our existing housing stock”**



## 2 Installing the products – Gentoo become experts

We want Gentoo staff to understand how to install and maintain all the products used in our homes. Everyone in our team attends an accredited NICEIC training and assessment course at a local training centre. The course covers everything from design to maintenance and gives our plumbers the qualification needed to install hot water systems which can only be fitted by qualified people.

Before we installed the solar water heating we visited the Vaillant factory to go through the specific requirements of the product we were buying. This was a really useful exercise and Vaillant were very helpful.

### Health and Safety

We had to be careful when fitting solar hot water panels on roofs and when installing hot water cylinders. At some properties, roof access can be difficult so full scaffolding or cherry pickers had to be used, which can be quite expensive.

The hot water cylinders needed for solar water heating are large and heavier than conventional hot-water tanks. A structural engineer helped our technical team to make sure the floors could support this extra weight.

## 3 Our customers' thoughts

Residents' behaviour makes a big difference to the amount of CO<sub>2</sub> a home produces. For example, even on a well insulated house, if windows are frequently left open during winter, heating demand is unlikely to decrease.



“I love my flat, it is beautiful and warm. These improvements have given me a new lease of life.”

**Iris Carr** – Gentoo Sunderland resident

“The modernisation and retrofit works are incredible, the place looks fantastic and what was once a drafty and often cold building is now a warm and inviting place for residents to live and socialise in.”

**Linda Bradley** – Support Co-ordinator,  
Gentoo Sunderland

We asked our customers how they felt about environmental issues and the cost of water, gas and electricity and what they did about it. The vast majority of our customers said they are concerned about the environment however, money, as a bigger concern was a greater influence in getting them to act.

More than half of the participants keep track of how much energy they are using by looking at remaining credit on pre payment meters or by monitoring the weekly cost of energy and modifying behaviour when required. Those customers who use pre-payment meters were generally more conscious of their energy use than those people paying bills monthly or quarterly.

Nearly all customers responded positively to the idea of an energy monitoring device to provide more feedback on the day to day use and costs of energy, stating that it would help them control and reduce their energy use. Here are some real figures:

- 89%** of interviewees stated that they make efforts to minimise their energy use at home
- 66%** always try to minimise their water use at home
- 91%** recycle and try to minimise their waste
- 43%** always try to consider their environmental impact when shopping and buying new things
- 46%** always try to travel in an environmentally friendly way
- 60%** would like more information on how to do their bit for the environment. A printed information pack was the most popular form of advice, followed by face-to-face meetings

## Vince Elliott

### **Mechanical and Electrical Co-ordinator, Gentoo Construction**

Vince leads Gentoo Construction's team who were tasked with installing the solar panels. His team had never previously undertaken any work of this kind, but were keen to learn and took a positive approach to acquiring new skills.

“This project has increased the knowledge and skills of both my staff and I. It proves that ‘green’ technologies can be incorporated into existing dwellings, when there is a genuine willingness to do so.”



## Warmer homes and more money to spend

Most of our customers wanted a higher disposable income. They also said that before our retrofit work their homes weren't warm enough. The products we installed will keep them warmer and help save them money. This won't improve their income but it will mean more money to spend on other things.

## 4 Monitoring the results of the retrofit work to homes

Energy use and costs in each home will be monitored for 12 months after installation. We want to know just how much money and CO<sub>2</sub> our customers saved by using the products we installed.

### Energy use and costs before our work

Before we installed anything, we had to work out how much energy people were already using and how much this cost. We made some calculations to work out how much energy we thought they would be using and then we compared these with actual information from their bills.

### Some technical stuff

Our calculations used assumptions. These assumptions are agreed by the Government and are called Standard Assessment Procedures (SAP).

*SAP assessments give homes an energy efficiency rating out of 100 based on the size of a building, the standard of insulation and the type of heating products. Because the assumptions used are the same on every home, we can quickly compare the relative environmental impact and likely cost of heating different homes.*



- Dylan Hawick, Sustainability Project Support Officer, Gentoo Green, giving advice to a retrofit customer.

The homes we selected for the Retrofit Reality project had an average SAP rating of 56. This is better than the national average of 50 but just below the social housing average of 58. We can translate these ratings into estimated costs, energy use and CO<sub>2</sub> emissions.

### Actual Energy Use

Finding out how much energy our customers were actually using was more difficult than we thought.

- First we asked our customers for information but they did not always have their bills and many used pre-payment meters which don't show how much energy had been used in the past.
- Then we asked utility companies for information but this took a lot of time and we didn't get much information, which was disappointing.

With our customers' permission we sent requests for gas and electricity meter readings. From 81 requests we got usable replies on electricity use for 53 properties and on gas use for 16 properties.

- We found the quickest and most reliable method of getting this information was to take meter readings ourselves but this needs to be started well in advance of a project.

### Lesson Learned:

**We found the easiest and most reliable way of getting information on actual energy use is to take monthly meter readings before, during and after the project.**

### So what did we find out?



This part of the study was really useful. It showed us that our estimates about how much energy homes were using were too high.

Our customers were using less energy and producing less CO<sub>2</sub> than we thought, but were paying more! To find out why, we looked back at our assumptions to see where we had gone wrong.

On average, our customers were using 40% less energy than our calculations had suggested.

We think there are two likely reasons for the lower energy use:

- Our customers may be turning their heating down to save on heating bills (perhaps due to fuel poverty)
- On average there are less people in each home than we thought. One area of the project is occupied by older people and the actual occupancy is less than usual

Fuel poverty is usually defined as paying more than 10% of income on energy bills.

On average our customers were paying actual energy costs of around £1,000. For anyone on typical benefits (apart from pensioners) this would mean they are in fuel poverty.

## Ross Haswell

### Energy Assessor Supervisor, Gentoo Sunderland

Ross is responsible for Gentoo Sunderland's Domestic Energy Assessors. He has worked closely with Gentoo Green to help us understand how our properties perform and establish a baseline for which to improve upon. He is now working closely with Northumbria University to determine if the installed technologies are having the desired effects.

“The results of Retrofit Reality show how effective specific carbon reduction measures can be on conventional UK homes. It is very satisfying to know that our business is driving this issue forward, and that both the environment and our customers will feel the benefits for years to come.”



On average, our customers' emissions were 4.4 tonnes of CO<sub>2</sub> per year, per home. This was 20% less than we had predicted... but they were using 40% less energy.

### **So why doesn't the energy use match the CO<sub>2</sub> emissions?**

Our customers were using more electricity and less gas than we had thought. Electricity produces much more CO<sub>2</sub> per unit than gas does because lots of our electricity comes from coal-fired power stations. On average, we had estimated our customers would be paying £955 in energy bills each year. Even though they were using 40% less energy than we had thought, our customers were actually paying more.

### **Why did it cost more for their energy when they were using less of it?**

Although the residents were using less than we expected, the high cost of energy meant annual energy bills were around £1,000. The following table from the Department for Energy and Climate Change shows that SAP assumes lower prices than the actual cost in the market place. We underestimated the costs of both electricity and gas by over 40%.

#### **Unit energy costs in SAP vs 'actual'**

Site	Electricity	Gas
SAP	7.12	1.66*
DECC statistics	12.21	3.49
<b>Variation</b>	<b>42%</b>	<b>52%</b>

\* Assumes standing charge of £34 included at average gas use for the Retrofit Reality properties.

So although residents were using 40% less energy than we expected, they were paying over 40% more for each fuel.

“On average, we had estimated our customers would be paying £955 in energy bills each year. Even though they were using 40% less energy than we had thought, our customers were actually paying more.”

### **How will retrofitting assist?**

We are able to make predictions about how much money, energy and CO<sub>2</sub> our customers would save by updating our original predictions using the SAP assumptions.

Before the installation of products the average SAP rating was 56. This was increased by 15 SAP points to 71 after products were installed.

### **What does this mean?**

In the same way that we predicted the CO<sub>2</sub> emissions, cost and energy of our homes before, we used our updated SAP ratings to predict what the new products would mean for our customers.

## Dr Sara Walker

**Director, Sustainable Buildings and Energy Systems,  
University of Northumbria**

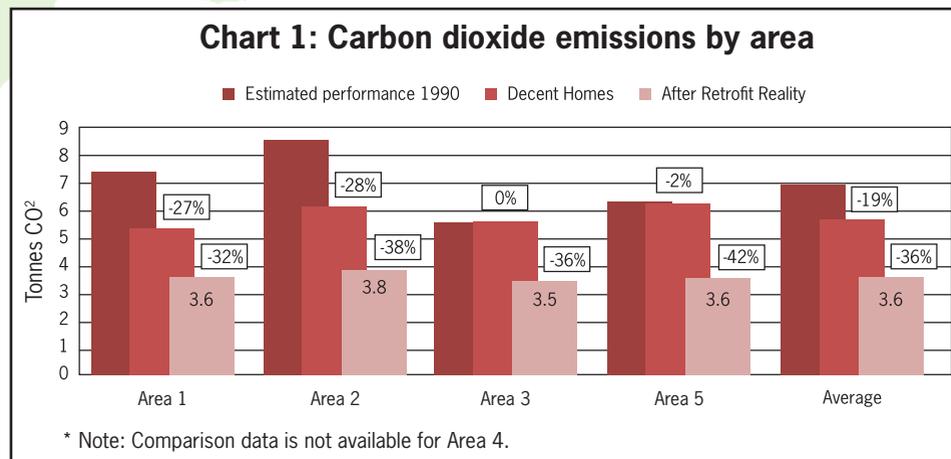
Gentoo is proud to be part funding two PhD Students to undertake research into the behavioural and technological aspects of retrofitting existing housing stock, the findings of which have been disseminated as far and wide as Egypt and Norway. Dr Sara Walker is overseeing this work on behalf of the University.

“Retrofit Reality has enabled the University to undertake research into energy behaviours and solar thermal performance, which is improving our understanding of the influence which householders have on energy demand.”



• Ross Haswell, Energy Assessor Supervisor, undertaking EPC/SAP assessments.

Charts 1 and 2 show predicted average CO<sub>2</sub> emissions and energy costs for individual homes in each area before and after the installation of Retrofit Reality products.



We have highlighted two stages to reductions. The move from the estimated baseline performance in 1990 to a decent homes standard property, resulted in each home contributing one less tonne of carbon output per year (a 28% reduction in carbon emissions). Interestingly Area 3 did not show any improvement. Implementation of the Retrofit Reality standard resulted in between 32% and 42% reductions in carbon emissions. The Retrofit Reality improvements provide a useful benchmark as they comfortably exceed the 26% carbon emissions reductions target for 2020 set out in the Climate Change Act 2008, they are also relatively cheap in comparison to other potential improvements. However, more importantly, they also exceed the 34% cut in emissions on 1990 levels by 2020, laid out in the recent UK Low Carbon Transition Plan. This plots how the UK will reach an overall reduction of 80% by 2050, with the cut for existing homes being described as required to be near zero by this point.

This 34% cut may also increase should a reduction consensus be reached following the Copenhagen Summit.

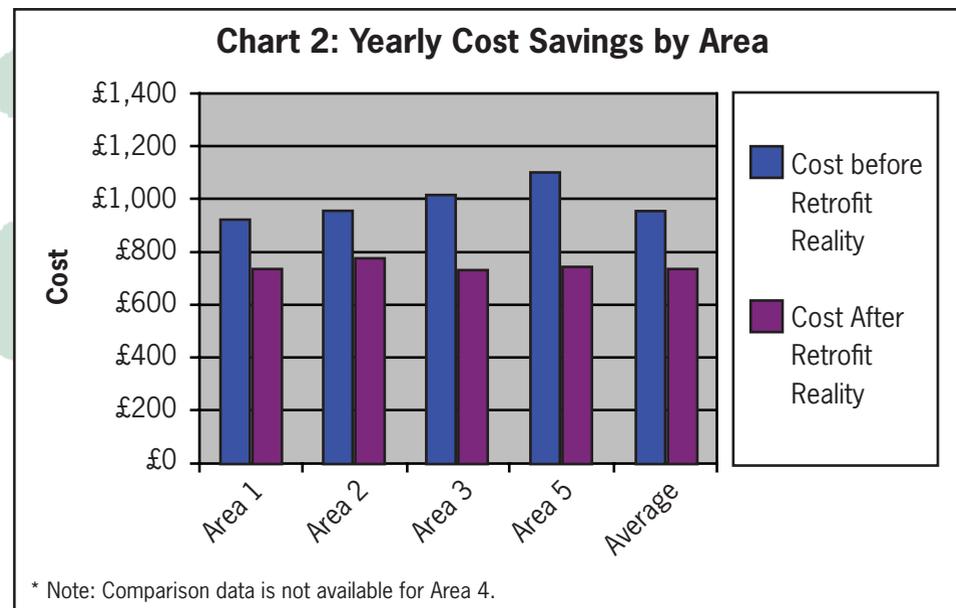
If the Retrofit Reality standard was adopted in all of Gentoo's 29,800 properties it could potentially mean 44,250 less tonnes of CO<sub>2</sub> per year are emitted to heat Gentoo's homes. If Retrofit Reality could be replicated across all UK registered social landlord homes, a huge 3.3million tonnes of CO<sub>2</sub> could be saved per year.

\* Retrofit Reality is expected to result in two tonnes of CO<sub>2</sub> saved per home. Not every home will be able to be improved to this standard. For the above figures, an allowance is made that an average of 1.5 tonnes of CO<sub>2</sub> could be saved across the average home when retrofit reality measures are taken.

The biggest savings will be made by our customers in Area 5. Before the work in Area 5 the CO<sub>2</sub> emissions were 6.2 tonnes each year per home. When we installed the products (a mixture of double glazing,

condensing boilers and external insulation), this was reduced by 42% per annum to 3.6 tonnes.

Chart 2 shows how much our customers are expected to save on energy bills each year.



The average saving per home is predicted to be £213. In Area 5 our customers will save £357 each year.

These results are great news for our customers and the environment.

What is really exciting is that we now know this information for these homes. We can use this to work out how best to upgrade our other properties. We also hope that it will help other people and organisations to learn from what we have done and to do the same in their properties.

# Executive Summary

By trying out products that are meant to make homes more sustainable we have learnt a lot.

We now know more about which products are most effective. We have a trained team of experts who can install these products and over time, we will learn more about how to maintain them.

We have helped our customers to save money and reduce their impact on the environment. We have also helped to make their homes warmer. By asking our customers what they think we know that these are issues that they care about.

We think we will have saved each household an average of £213. We have reduced CO<sub>2</sub> emissions by an average of 35%, to 3.6 tonnes per home.

By monitoring these homes throughout the next 12 months, we will confirm whether this saving is reflected in real improvements. We are really looking forward to finding out!

Gentoo Construction undertook complex research and technical analysis of various technologies considered for use within this project, which we were unable to provide details of within this report. However further details may be available upon request.

**We look forward to sharing other results as our work continues. Watch this space!**

Also, visit [www.gentoo.com](http://www.gentoo.com) for further updates.

## Dylan Hawick

### Sustainability Project Support Officer, Gentoo Green

Dylan works alongside Stephanie Murray and has been the main point of contact for Gentoo Sunderland's customers. He has worked with Northumbria University to undertake behavioural interviews and provide guidance, advice and support on how to maximise fuel savings.

“Working on the Retrofit Reality Project has given me a greater insight and understanding of the work needed to be done to make existing homes more energy efficient. It has broadened my knowledge of the technologies available and has allowed me to gain greater experience in helping customers understand the need to improve energy efficiency and the multitude of ways housing associations can increase environmental awareness for staff and tenants.”



# Closing

This is just a small part of what Gentoo does. Other innovative sustainability projects we are working on include:

- Construction of the UK's first accredited PassivHaus development
- Commercial and residential community sustainability.
- **ecosmart** consultancy services
- Our environmental report, Footsteps
- Carbon footprinting
- Assistance with the selection and installation of low carbon technologies onto existing dwellings
- Waste management advice
- Other innovative carbon reduction projects

Visit our website [www.genttogroup.com](http://www.genttogroup.com) for more information or email us at [enviro.info@gentoo.green.com](mailto:enviro.info@gentoo.green)



**Retrofit Reality is a TSA Innovation and Good Practice supported project.**

## Stephanie Murray

**Sustainability Project Officer, Gentoo Green**

Stephanie is the lead officer for Retrofit Reality and is responsible for co-ordinating the whole project. She has been involved from inception, working closely with internal and external customers and partners, to make this retrofit a reality.

“This is an extremely exciting project which has allowed us to research the most suitable solutions for retrofitting existing stock in terms of performance, cost and usability. We wanted to undertake a project on behalf of the sector which is both replicable and achievable, but also where valuable lessons are learned and shared. I hope this is the start of many more retrofit projects across the country - there has never been a greater need to focus on this agenda.”











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