BERTRAM STREET LOW-CARBON RETROFIT PROJECT
Questions & Answers

Who is involved in the Bertram Street project and how did the project come about in the first place?

In April 2009, the Technology Strategy Board (TSB) launched its Retrofit for the Future competition, an SBRI initiative (Small Business Research Initiative) to 'retrofit UK social housing stock in order to meet future targets in reduction of CO2 emissions and energy use'.

The Sustainable Energy Academy (SEA), manager of the award winning Old Home SuperHome project, submitted an outline of a project to retrofit a home in Camden along with project partners United House, who would be the main contractors, Parity Projects who would be responsible for the modelling and monitoring of carbon savings and energy use, and Camden Council who would provide the property.

This SEA-led consortium was awarded one of 194 contracts (from 345 applications) to put forward a full phase 2 application. This was duly submitted in November 2009.

The WHISCERS1 contract was awarded in January 2010 along with 85 other contracts, covering 118 properties.

What are the aims of the project?

WHISCERS (Whole House In-Situ Carbon Energy Reduction Solution) is a process which can be used to internally insulate a property with exceptional ease and very little mess. Because the methods used result in little or no rework on site they are a suitable solution for social housing and allow for residents to remain in the property whilst the works are completed.

This TSB funding project aims for an overall energy use of 17kg CO2/m2/year (80% CO2 reduction). This will include the WHISCERS process alongside the installation of both solar thermal and solar photovoltaic technologies, alternations to the heating system and major renovations to the existing sash windows.

Why was this property chosen?

Under the rules of the competition, a complete house in social ownership had to be chosen. It was considered desirable to choose a house which was typical of Camden Council's street properties, so that the lessons learned about installing the energy saving measures and their effectiveness on this project could be transferred to other Camden properties. At least one roof aspect had to be south facing in order to maximise the solar gain possible for the solar thermal and photovoltaic panels.

Letters were sent to the residents of the 105 houses that satisfied the conditions above, explaining the project, how they would potentially benefit from the works, and asking who would be willing to take part. The 15 respondents were then interviewed by phone to determine:

- The willingness of residents to engage with the project
- How they would be affected by the disruption, noise and dust involved
- How many people would benefit from the retrofit (the more occupants the better).

[1] International PCT Patent applied for – PCT/GB2010/050756.

From this a shortlist of four properties were visited in September 2009 by the project partners, to determine the most suitable property to retrofit, considerations being:

- How typical the property was of Camden Council's street properties
- Whether the property would be straightforward to retrofit in particular:
  - Absence of major/recent fittings to the internal faces of external walls
  - Standard features e.g. no unusual window shapes or decorative features.

8 Bertram Street is a typical Camden three-storey late Victorian terrace with very few fixtures to the external walls and no unorthodox features. The family of two adults and three children were enthusiastic about participating.

In addition to the energy efficiency measures, the house also benefitted from a major refurbishment. This included fitting a new kitchen, WC and bathroom, paid for by Camden Council as part of their work to improve all residents' homes.

What was the duration of the project, how much did it cost and who funded it?

The build phase has taken some 13 weeks, which included all the WHISCERS work, the installation of renewables and other energy efficiency technologies and the installation of a new kitchen, bathroom and toilet. There was also some unexpected damp works which needed to be undertaken and some advanced materials were delayed in delivery.

The project will continue for some two years whilst the property is monitored (see monitoring section below) to ascertain whether the projected carbon and energy savings can be achieved.

The project was funded by the TSB who granted £150,000 (including VAT) for the development, project management, delivery and monitoring of the retrofit.

What technical solutions were used?

The whole house retrofit included:

- Installation of 100mm Expanded Polystyrene (XPS) internal wall insulation on all external walls (50mm on stair walls), using the WHISCERS process
- Replacement low energy lamps
- Additional roof and loft insulation
- Replacement front and rear doors
- Addition of individual MVHR (Mechanical Ventilation Heat Recovery) units in the kitchen and bathroom
- Installation of TRVs (Thermostatic Radiator Valves) on all radiators
- 8m2 photovoltaic panels
- 8m2 solar thermal panels
- Major renovation of sash windows including the installation of vacuum glazing
- Reduced flow shower head and low flush toilets.

Any other interesting facts about the project?

Now the project has come to an end the residents have agreed to open their home on a regular basis to allow members of the public to view their low-carbon retrofit as part of the Old Home SuperHome project.

How did the project impact on the residents?

A particular area of consideration for this project, with the works happening while the residents continued living in the house, was resident welfare both while works were in progress and at other times.

- Procedures were agreed between the partners and the residents regarding working hours, isolation of working sites, use of protective coverings and end of day procedures to ensure the health and safety of the residents
- Works were scheduled to allow for residents to remain in the house for the duration of the project, with occasions when it was not going to be possible to remain in the house during working hours kept to a minimum
- The residents were given project schedules of the work, updated on a weekly and daily basis as the schedule changed
- The works took place from the end of June until October 2010. The project started gradually, with preparatory (e.g. removal of belongings to storage) and remedial works (damp proofing on the ground floor) in the first few weeks, and disruption largely limited to the ground floor
- The insulation works were started at the end of July. Installation of the solar thermal and photovoltaic systems took place in August. Kitchen replacement was done in mid August, while the residents were on holiday
- It was necessary for the residents to move out of some rooms while works were going on. For the majority of the time, works were done in a manner where it was possible for the residents to remain in the house during the day. Occasionally delays or unexpected problems meant that more works took place than were originally planned, making it difficult to remain in the house. On one occasion utilities were unavailable for the day due to plumbing works
- Although there were regular updates to the residents, it emerged during the project that it was not necessarily clear what the impact of works would be on the residents, particularly when lots of trades were operating in the house at once
- Where the usual utilities were not available outside working hours, replacements were made available
- At the end of works, tools and materials were cleared away, so that rooms were safely accessible, and usually usable in their normal state
- Protective sheeting was used before the works began to minimise dust and dirt, but it was still necessary to do extra cleaning after the works in a room were finished.

What problems/issues arose during the project?

Initial delays to the start of the project were incurred due to contractual issues between the consortium partners, full detailing of specific Health and Safety policies due to residents being in situ (particularly there being children in the home) and agreements being required to deal with any unforeseen issues, such as the damp.

Damp was found in the front and party walls which required treatment before the insulation could be fixed. This caused a slight delay to the project, added to the costs and involved mess on-site which we were hoping to avoid. Further delays were incurred when the vacuum glass delivery date was put back.

Development of the WHISCERS process incurred problems, which is only to be expected with such an innovative solution. Analysis was undertaken to determine the best laser solution for the process and the best board cutting method; water jet and laser cutting was examined and rejected, before we eventually decided on router cutting. There were some errors in board cutting and difficulties with the interface between the software and the cutting machines. The machine itself required additional tools and additional training in their use. There were also concerns about lack of sufficient up/down travel of the cutter. There were issues with delivery of boards to the site and the clear labelling of the boards to note where they should be installed. The consortium also had to determine 'robust detailing' for all features, including sealing the perimeter of the IWI (Internal Wall Insulation) boards.

Concerns were raised about the use of inter-floor insulation and whether it may contribute to cold bridging and rotting of the joist ends. It was agreed to use a number of different solutions and to add additional sensors to monitor the effects.

How will the energy efficiency measures be monitored over time to measure performance?

We are monitoring the house in four distinct ways:

1. Looking at the energy consumption of the house in terms of the total gas and electricity used. The beauty of this project is that we have the same residents before, during and after the project, so we are able to compare 'before and after' statistics
2. Monitoring sub-sets of the total energy used. We are measuring carefully the performance of the boiler, solar panels, and elements of insulation. We take these readings at a fixed frequency, usually every five minutes, so we can also review how the habits of the residents are contributing to peak loads at certain times of the day
3. Looking at how the residents' lifestyle affects or is affected by the changes to the building. Internal temperatures, humidity and levels of CO2 in the air are being monitored, as well as the use of the external windows and doors
4. Checking on the longer term impacts on the building fabric. Projects of this kind rarely check on the build-up of moisture or condensation in closed-off places, which could potentially be a problem. We have installed sensors to check on this risk.

When pulling all of this information together we can build up a very accurate picture of how each part of the retrofit has contributed to the overall performance improvement, including the residents' role in that change.

Will the project lead to future low carbon housing projects in Camden?

One of the challenges of the project was to fit measures which would result in significant levels of emissions reduction to a house within a conservation area, while the residents were still living there. We believe the project has successfully achieved this.

60% of Camden is within conservation areas, where external wall insulation faces major planning obstacles. While the solution used in this project may not be applicable to all our solid walled properties because some residents are too vulnerable to remain while the works take place, being able to insulate internally while avoiding the need to decant residents gives us flexibility in our attempts to reduce the emissions of our hardest to treat social housing stock.

Camden Council is currently looking at the possibility of doing a larger scale low-carbon retrofit, dependent upon obtaining the funding to cover a significant proportion of the costs of the works. The insulation method to be used would depend on the external and internal structure of the building, on planning considerations (it may be possible to externally insulate part of the buildings) and on the costs of the work, but where using internal insulation we would certainly prefer to use the WHISCERS process.

Further development of WHISCERS

SEA has applied for a patent on the WHISCERS process and may use a franchise model in conjunction with United House to make the process available to the market. Further development of the process is required to refine the data handling aspects, to train data interpreters for low cost up-scaling of the process. Volume works will be required to substantiate the cost savings and to allow investment in the high cost of developing automated data processing. It is possible that a better datum will need to be established and a clear decision for the specifications of inter-floor insulation developed.

Bertram Street was the first full-scale test of the process and it is considered that WHISCERS offers the potential to provide a solution to retrofitting older, solid walled housing stock on a volume scale. There are some seven million such homes in the UK.

WHISCERS offers considerable benefits to housing providers and residents – not least saving housing providers thousands of pounds in hotel bills and residents the inconvenience and stress of having to decant from their homes.

Following the success of the trial at Bertram Street, United House has signed a contract with the London Borough of Islington where the process will be used to retrofit internal wall insulation in up to 130 homes using the WHISCERS process.

What changes will the residents experience?

Judging by the experience of the residents of another low-energy, eco-retrofitted Victorian house owned by Camden Council (17 St Augustine's Road), the residents can expect improved levels of thermal comfort, and lower energy bills, particularly in summer when the solar thermal and photovoltaic systems supply heat and electricity to the house.

Already, the residents of 8 Bertram Street have commented that the house feels warmer, and the amount of time required for the boiler to heat the hot water to the required temperature has been reduced since the solar thermal system has been in operation. Although the contribution of the solar systems will decline during the shorter days of winter, the high levels of insulation and advanced glazing should mean that the house will be warmer, and will require far less gas to heat it during the winter months. The insulation and glazing, along with the mechanical ventilation and heat recovery should also mean that condensation will be minimal.

The eco measures are estimated to reduce fuel bills from an average of £17.52 a week to £6.23 a week, a saving £11.29 per week (saving £587 in a year). This is an impressive 64% fuel cost saving and a very impressive 77% carbon emission saving compared with the house before retrofit started.