



Non-Technical Retrofit Innovations in UK Housing

ApRemodel

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Asuinrakennusten korjaamisen ei-tekniset innovaatiot Iso-Britanniassa.
William Swan & Veijo Nykänen. Espoo 2013. VTT Technology 93. 85 p.

Abstract

This report is concerned with 5 case studies investigating the adoption of non-technical innovations in the retrofit of UK housing. The study was undertaken as part of the ApRemodel project, which investigated the retrofit of multi-occupancy buildings in the Finnish context. The aim of the study was to identify how UK organisations were addressing the finance and delivery of retrofit, considering non-technical issues such as assessment, process, finance and behavioural aspects of their projects to ensure effective delivery. The 5 case studies, selected from an initial 18 cases, represent UK exemplars of innovative practice in the UK.

The UK has identified its existing housing stock as a major opportunity for improvement to help it achieve its energy goals. The UK Government has made a legislative commitment to reduce carbon emissions by 80% by 2050, with housing targeted for even greater reductions. UK housing is predominated by older stock with an estimate that 70% of the properties that will be standing in 2050 are already built. This means that there are many properties that have been built with little or no consideration to their energy consumption. New policies, such as the Green Deal, which looks to fund improvements through energy savings, and the Energy Company Obligation (ECO) have been designed to kick start the market for sustainable retrofit. However, the market is still immature in the UK; lack of supply chains, skills, consumer awareness and an understanding of how retrofit might be delivered at scale all present major issues for the UK. These case studies identify how organisations, chiefly in social housing, which has been identified as a test-bed for sustainable retrofit, address these non-technical issues to ensure that effective adoption and delivery can be addressed.

The case studies show that the problem is a socio-technical one. This means that there are technical elements of technology and physical changes to the building, but a more holistic understanding of the problem drives successful delivery. Delivery organisations must be aware not only of the technical choices they make, but also consider issues such as delivery processes, trust and branding, procurement and resident awareness. These cases show us that innovation in sustainable retrofit often required a number of innovations to ensure delivery. Effective delivery processes needed to be aligned with effective procurement, resident engagement and finance models that interlinked to provide a beginning to end process. Lack of attention to any part of this meant that there was a risk of non-delivery.

None of the innovations presented here could be viewed as “radical”. They were often adaptations of existing solutions, with incremental changes to support the delivery of residential retrofit. The complexity arises in the number of small-

scale innovations that have to be combined to ensure a successful beginning-to-end retrofit project.

The case studies show that the UK is still in a developmental stage in the delivery of residential sustainable retrofit. The innovations have been designed to mitigate this immaturity or to develop new skills. Dominant solutions have yet to emerge for retrofit at scale; the case studies discussed here show the first steps in moving towards more developed models to meet the challenges of addressing the wider UK housing stock.

Keywords retrofit, innovations, refurbishment

Asuinrakennusten korjaamisen ei-tekniset innovaatiot Iso-Britanniassa

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Tiivistelmä

Tämä raportti esittelee viisi tapaustutkimusta ei-teknisten innovaatioiden soveltamisesta Iso-Britannian asuinrakennuskannan perusparannushankkeissa. Tutkimus on osa ApRemodel projektia, jossa tutkittiin ja kehitettiin suomalaisten asuinkerrostalojen uudistavaa korjaamista. Tämän tutkimuksen tavoitteena oli tunnistaa kuinka Iso-Britanniassa eri organisaatiot olivat kehittäneet perusparannushankkeiden rahoitusta, prosesseja ja projektien toteutuksen tehokkuutta. Viisi tapaustutkimusta valittiin 18 vaihtoehdosta esimerkeiksi innovatiivisista käytännöistä Iso-Britanniassa.

Iso-Britanniassa vanhan asuinrakennuskannan parantaminen on tunnistettu suureksi mahdollisuudeksi saavuttaa energiavoitot. Iso-Britannian hallitus on sitoutunut lainsäädännöllä hiilipäästöjen vähentämiseen 80 %:lla vuoteen 2050 mennessä. Asuinrakennuskannalla on jopa tätäkin suuremmat säästötavoitteet. Iso-Britannian asuinrakennuskannassa on arvioitu, että 70 % vuoden 2050 rakennuskannasta on jo nyt rakennettu. Tämä tarkoittaa sitä, että monet asuinkiinteistöt on rakennettu kiinnittämättä huomiota lainkaan tai vain vähäisessä määrin energian kulutukseen. Uudet menettelytavat kuten Green Deal, jotka pyrkivät rahoittamaan parannuksia energiansäästöjen avulla ja energiayritysten sitoumukset (Energy Company Obligation) on suunniteltu kehittämään markkinoille kestäviä perusparannuspalveluita. Markkinat ovat kuitenkin kehittymättömät Iso-Britanniassa; puuttuu toimitusketjuja, osaamista, kuluttajien tietoisuutta ja ymmärrystä siitä, kuinka perusparannushankkeita tulisi toteuttaa vastaamaan nykyisiin korjaustarpeisiin ja niiden skaalaan. Näissä tapaustutkimuksissa esitellään sitä, miten organisaatiot toimivat, pääasiassa tuetussa vuokratokannassa, jonka on tunnistettu olevan testauspaikka kestäväälle perusparantamiselle liittyen ei-teknisten innovaatioiden tehokkaaseen soveltamiseen ja toteutukseen.

Tapaustutkimus osoittaa, että ongelma on luonteeltaan sosiotekninen. Tämä tarkoittaa sitä, että tarvitaan teknisiä osatekijöitä ja rakennusten fysikaalisia muutoksia, mutta parempi kokonaisvaltainen ongelman ymmärrys johtaa onnistuneeseen toteutukseen. Korjausrakentamisorganisaatioiden täytyy tiedostaa ei vain tarpeellisia teknisiä valintoja, vaan myös korjausprosesseja, luottamusta, brändäystä, hankintoja ja asukkaiden tietoisuutta. Nämä tapaukset esittelevät meille, että kestävät innovaatiot perusparantamisessa edellyttävät yleensä useita innovaatioita. Tehokkaat korjaamisen toteutusprosessit tarvitsevat tehokasta hankintaa, asukkaiden osallistumasta ja rahoitusmalleja, jotka on kytketty hankkeiden loppuprosesseihin. Jos koko prosessin mihin tahansa osaan ei kiinnitetä huomiota, riskinä on heikko lopputulos. Mitään esitellyistä innovaatioista ei voida pitää "radikaalina". Ne ovat usein omaksuttu käytössä ol-

leista ratkaisuista, joihin on tehty muutoksia tukemaan asuinrakennusten perusparantamista. Kompleksisuus syntyy useista pienistä innovaatioista, joita on yhdistetty varmistamaan onnistunut perusparannushanke alusta loppuun.

Tapaustutkimukset osoittavat, että Iso-Britannia on yhä kehitysvaiheessa kestävässä asuinrakennusten perusparantamisessa. Innovaatioita on suunniteltu vähentämään osaamattomuutta tai kehittämään uutta osaamista. Pääratkaisuja on saatava vielä lisää perusparantamiseen; esitellyt tapaustutkimukset esittelevät ensimmäisiä askelia kohden kehittyneempiä malleja, joilla voidaan vastata Iso-Britannian asuinrakennuskannan perusparannustarpeisiin.

Avainsanat retrofit, innovations, refurbishment

Preface

The ApRemodel (Apartment House Remodelling) project was launched in September 2010. The subject of the study concerns urban infill and redevelopment of residential areas and is focused on apartment buildings. Urban infill can include construction of new buildings, new wings or new storeys of the existing buildings. The infill project and redevelopment concepts can also include a variety of retrofit actions of old buildings. The key research themes of the project have been the occupant (owner and dweller) view of infill projects, joint development models for old residential areas, the benefits and profitability of infill projects from the perspective of housing companies, improvement of the quality and energy efficiency of properties, as well as determining the existing regulative hindrances to infill and redevelopment. Non-Technical Retrofit Innovations was one of the research themes of the ApRemodel project. The goal of the study was to analyse processes and systemic retrofit innovations that have been developed for UK Housing market. Case studies are mainly from the social housing sector, who have been early adopters of large scale retrofit. There are some key differences between tenure types in Finland and UK. In Finland mainly dwellers of the apartment house own shares of a housing company. They govern the housing company and make retrofit and refurbishment decisions in the shareholders' meetings. In the UK social sector, while resident involvement is a central part of the retrofit process, as demonstrated by the case studies, construction and asset management professionals drive the retrofit process. However, many of the lessons from the UK do have applicability in Finland. Here we discuss 5 detailed case studies of non-technical innovations in large-scale retrofit projects in UK housing.

Non-Technical Retrofit Innovations in UK Housing report was done in University of Salford and in collaboration with VTT.

William Swan & Veijo Nykänen

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1. Introduction

The ApRemodel Stage 2 Report is a review of the 5 in-depth case studies identified in the Stage 1 Report. The cases have been developed on the basis of primary and secondary data collected by the research team. The objective of the cases is to give a detailed account of the adopted innovation, or innovations, in UK retrofit projects or programmes. The cases were identified as leading UK examples of innovation against the criteria identified below. The focus of both the Stage 1 and 2 reports was to identify and report on innovations in the UK delivery of sustainable retrofit that were:

- **Non-technical** – a specific focus on process, finance and behavioural innovations was identified.
- **Scalable** – innovations that were being or had the potential to be applied at scale.

On the basis of the Stage 1 report, which identified 18 individual or grouped innovations, the following cases were selected:

- **EcoPod** – this was an integrated project delivered by New Charter Housing in Hyde. It was a technical innovation supported by a number of process innovations, particularly around project delivery and resident engagement.
- **Gentoo Pay as You Save** – this project, undertaken in Sunderland by Gentoo, was a pilot a model whereby energy savings generated by the installation of a sustainable retrofit were used to finance the capital cost of the retrofit. This was developed as a precursor to a major UK policy initiative, known as the Green Deal.
- **Carbon Co-operative** – this organisational model is designed to support the financing and delivery of retrofit into the “immature” owner-occupier market in the UK through the use of mutually owned, not for profit delivery and finance vehicles.
- **Fusion21 Retrofit Delivery Model** – this is a procurement model that has captured knowledge around technical, commercial and behavioural issues in the retrofit market and converted this into a series of tools to increase both the levels of adoption and the effectiveness of sustainable retrofit installations in the social housing market.

- **FutureFit** – Affinity Sutton, a social housing provider, have undertaken one of the earliest examples of a large-scale housing retrofit. The project has been designed as a large-scale study to identify drivers and barriers to the scaling up of delivery in the UK social housing sector.

Here we examine the cases in detail addressing the rationale, contextual factors and provide a detailed review of the innovations. Where available, performance data has been included.

This report builds on the work undertaken in stage 1 by identifying 5 detailed case studies around multi-occupancy retrofit innovation in the UK. The case studies have been written in a stand-alone format. Due to the limited number of case studies, and the variations between them, it was considered that expanding the initial cross-case analysis, undertaken in Stage 1, would add limited additional value, and therefore has not been undertaken.

2. Ecopod at Chartist House

2.1 Abstract

The Ecopod is a fully fitted, self-contained plant room converted from a telecoms cabin. It has been developed by the Belfry Group, an engineering and building services specialist based in Warrington in the North West of England. The Ecopod contains heating equipment consisting of eight 100kW gas fired boilers and tanks, which are linked to 20 solar thermal panels (Figure 1). It is designed to provide a robust, low-maintenance shared heating and hot water system for tower blocks, delivered to residents via heat exchangers.

The first Ecopod was installed on the roof of Chartist House, a 16-storey block of 94 flats, including 38 sheltered flats for older people, owned by New Charter Housing Trust in Hyde in the Tameside local authority area of Greater Manchester in December 2009. CO₂ emissions have been reduced from 160,000kg to 69,000kg pa, a 57% reduction. Residents' individual gas bills have been replaced with a £4 per week addition to their service charge. The new heating system is controlled and monitored via a remote on-line Building Management System.



Figure 1. EcoPod Boilers and Solar Thermal Array.

2.2 Background

2.2.1 Problem and Need

For New Charter, the replacement of an out-dated and inefficient existing gas heating systems at Chartist House, installed in 1993, was planned as part of the 10-year Decent Homes investment programme. Decent Homes was a UK Government

policy designed to bring social housing up to a “decent” standard (DETR 2000), including issues such as comfort and heating. The replacement of heating systems and boilers in individual flats would have been both complex and costly, particularly following the installation of external wall insulation that created a number of access issues. The project aims worked in conjunction with New Charter’s commitment to address fuel poverty and affordable warmth for residents.

2.2.2 Decision-Making Process

The replacement of boilers was not practical for a number of reasons including cost, access and safety issues, with regards to the use of natural gas in multi-occupancy developments, which was considered less safe than other approaches. A district heating solution was identified as a viable option. The emerging green agenda around sustainable retrofit for the social housing sector prompted the consideration of a range of renewable solutions for heating the flats, on the basis that “initially although we didn’t really know what we could do, we wanted a sustainable solution”.

An early option was the installation of a biomass boiler system using a rape-seed fuel, however both this and the alternative gas boiler with solar panel links based at ground floor level were challenging because of the need to construct an external flue pipe up the side of the block of flats. Chartist House already housed a range of BT and telecoms equipment in a tin shed located on the roof, and the “eureka moment”, of designing a heating system located on the roof as an alternative to the construction of a new boiler room and 15-storey external flue, occurred during a regular rooftop inspection.

2.2.3 Desired Outcomes

The following desired outcomes for the project were identified,

- To install a more energy efficient system
- To do so with minimum disruption to residents
- To reduce address fuel poverty by reducing heating bills for residents
- To promote New Charter as a forward-thinking organisation with a first in class renewable energy system.
- To achieve cost savings for the business.

2.2.4 About the Partners/Stakeholders

New Charter Housing Trust were formed in 1999 to own and manage homes transferred from Tameside council. They employ 880 people and manage 18,600

2. Ecopod at Chartist House

homes across Greater Manchester. New Charter was named in the Sunday Times' influential list of 100 best companies to work for in 2009.

The Belfry Group supplies building, engineering and maintenance solutions for a wide range of clients. For the social housing sector, Belfry provides repair, refurbishment and maintenance services. They were recommended as a potential designer for a renewable energy replacement boiler system for Chartist House by Buderus, who provide both the Belfry Group and New Charter with boilers. The emerging relationship between New Charter and the Belfry Group is one of mutual benefit for subsequent renovation by New Charter, where Belfry provide district-level pipework and New Charter's building and maintenance contractor provide the building.

2.2.5 Resources

The project team for the design of the Ecopod included Belfry's Managing Director and consultant designer, and New Charter's Senior Quantity Surveyor and Project Manager. The design of the system was new for the Belfry Group, extending and adapting existing engineering knowledge and technologies to address the specific challenges presented by Chartist House.

For New Charter, the commission and delivery of the Ecopod represented a new situation for a stock maintenance team. The team had no previous direct experience or knowledge of the apartment block. Additionally, they had no experience of removing boilers or the proposed heating system installation. The team gathered knowledge to support the project through a range of trade and housing journals and websites, as well as mechanical and electrical trade fairs and exhibitions.

The project was funded by New Charter's 10-year investment programme, and the tender cost of £850,000, of which the Ecopod installation was £690,000, with the remainder used for additional associated work including re-wiring, lounge extension and conversion of a flat for wheelchair access. This equates to £9,000 per flat, double the original budget for the replacement of Chartist House's heating system. This required Board approval, which was given on the basis of the innovative renewable solution and the value this added to New Charter's profile.

For the Belfry Group, the Ecopod was developed over two years at a cost of approximately £1m. The contract for its installation at Chartist House was put out to tender and attracted four responses. The Belfry Group submitted the lowest price and secured the contract.

2.2.6 Other Contextual Issues

There are a number of additional factors that drove the decision-making process at New Charter.

- The project takes account of anticipated HSE (Health and Safety Executive) legislation to prohibit the installation of individual gas appliances in high-rise blocks of flats for safety reasons.

- New Charter is committed to addressing fuel poverty for its residents. New Charter's residents are generally on low incomes and New Charter have a commitment, like many other social housing providers, to support their residents in heating their homes to a comfortable level at an affordable price.
- The project promotes New Charter's active role in Tameside Council's Low Carbon Economic Area commitment, with a 10% year-on-year CO₂ reduction target. The Low Carbon Economic Area is a designated strategic area for improvement in energy efficiency and carbon emissions specifically connected to the Built Environment (AGMA 2009).
- It is likely that Registered Social Housing Providers will be monitored on CO₂ emissions from housing stock.

2.3 Innovation Complex Map

The innovation complex (Figure 2), which identifies the key linked innovations, for the Ecopod at Chartist House is relatively simple, adopting a linear model to incorporate the stages of the project, all of which were innovative for New Charter.

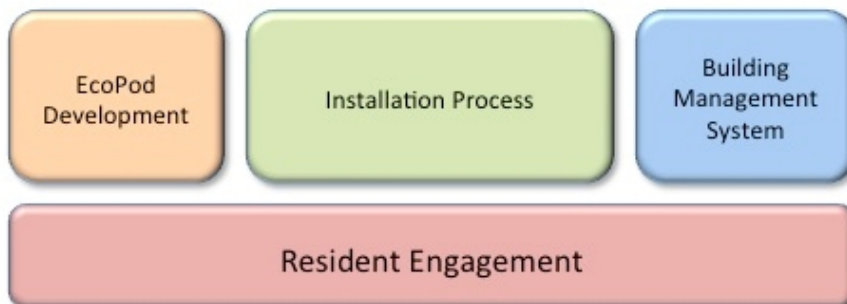


Figure 2. EcoPod Innovation Complex.

2.3.1 Core Innovation – Ecopod

The core innovation, which underpins the overall group of innovations, is the development of the Ecopod technology by the Belfry Group as a mix of existing technologies engineered to provide a solution for heating water for tower block flats.

Development Narrative

The original concept for the Ecopod emerged from the determination of Belfry's Managing Director to generate an engineering solution to improve energy use in high rise blocks following a visit to an elderly woman who had boiled a kettle for hot

water for washing because her immersion heater was too expensive. The cascade boiler and solar panel system emerged over three years as a potential alternative for providing heat and hot water for blocks of flats.

Product Description

The EcoPod is designed with 8 100kW gas-condensing boilers in a cascade system, meaning that they run at higher efficiency than one large boiler. This system is supplemented by 20 flat-plate solar collector panels and delivers continuous hot water to kitchens, bathrooms and radiators via a highly insulated Uponor MCLR riser piping system and compact heat distribution units in each flat. The Buderus GB162 boilers use finned aluminium heat exchange technology that optimises the amount of water in contact with hot surface of the heat exchanger. These were selected by Belfry engineers for their reliability, efficiency and ease of maintenance where access is restricted. The boilers are supplied with pre-fabricated connection kits to reduce fitting time and costs.

The EcoPod system is fitted into a 5.5m x 3m x 2m container weighing 8.5 tonnes and the individual boilers themselves take up 2m² of floor space. The supplementary solar panel system is designed to provide most of the domestic hot water for 6 months of the year, depending on weather conditions. The system includes an optimisation function to enable integration between the solar panels and the boilers. Hot water from the solar panels is stored in tanks holding up to 2,400 litres.

Heat is delivered to the flats, communal kitchen and lounge via heat exchangers, using a wet system, and controlled using a thermostat. It should be noted that, to the untrained eye, this arrangement looks very similar to the gas boilers that the residents were previously used to in terms of both look and control.

2.3.2 Innovation 2 – Resident Engagement

The engagement of residents in both the installation process and in the changes to their heating systems was crucial to the success of the project.

Process

A two-month consultation with residents included three afternoon information sessions held in the communal lounge (Figure 3). Invitations were sent by letter to every flat and meetings were publicised with posters in communal areas. New heating options were introduced by the Ecopod project team, an animated video using non-technical language was used to explain the system, and a question and answer sessions was supported by displays and plans. Attendance by the residents, who are mainly elderly, was good and feedback was positive.



Figure 3. Consultation workshop with residents.

These presentations were crucial in winning support for the Ecopod and its benefits, and enabled Belfry's Managing Director to engage with the few remaining sceptics by promising to pay heating and hot water charges for a year if they were higher than the old system.

A good example of where resident engagement created changes to the project was around the issue of the loss of gas fires. Many residents liked their fires not just for heating, but also as a focal point for the room. A local supplier was sourced to provide an alternative that provided the visual effect of a fire with a traditional surround and mantelpiece in a variety of finishes operated by remote control but not connected to provide heat.

The previous boiler room, storage room and small kitchen was converted and extended into a shared space for residents, including a television room, lounge and kitchen. This space was completed before work to the flats was started, and provided an area for residents to stay during the times their flats were being worked on. Refreshments and lunches were also provided for residents on those days. The large and airy space is an asset to the building and well-used and liked as a communal area for residents.

Goals

The main goals of the resident engagement were;

- To ensure residents agreed to allow access for the upgrade to their properties
- To ensure residents understood the changes and the potential benefits
- To familiarise residents with the new technology so that they understood how it would look and how they could control it
- To understand how best to minimise the impact of the installation process, including any specific needs that individuals might have.

2.3.3 Innovation 3 – Installation of Ecopod at Chartist House

The installation of the Ecopod on the roof of Chartist House is innovative, and the additional benefits of this for the building and the residents are noted.

Product/Process

Installation was planned and achieved over 21 weeks, with practical completion of the project in April 2010. This included the strengthening of the roof and installation of pipes and wiring in existing ducts and to flats. All work within the flats was carried out within one day, including the removal of boilers and meters, and the installation of new heating, so that there was no loss of heat or hot water for residents.

Following references to long-term weather forecasts, the Ecopod's steel platform and the pod itself were successfully delivered to the 160' high roof by crane (Figure 4) and winch on Sunday 6th December 2009. Residents on the upper floors left their flats and went for breakfast in the new communal room. The event generated significant local and regional media interest and was widely reported, including the recording of thanks by New Charter for residents' patience and co-operation.



Figure 4. EcPod Installation.

2.3.4 Innovation 4 – Building Management System

The use of Ecopod technology and its associated monitoring systems generates operational changes for New Charter's management of both the building and the residents. The use of IT supported building management systems within the residential sector is not common. The system, accessible on-line, allows the New Charter team to identify and track energy use by residents, providing a comparison across the different users within Chartist House. Access to data in this way provides two emergent benefits.

- It is possible to identify individuals who might be regarded as excessive energy users and to put appropriate behavioural interventions in place. For example, a resident was using four times the average amount of energy for the flats within the building and was consulted with.
- The capacity to identify when and how much energy is being allows the New Charter team to identify unusual patterns of energy that might suggest a support issue for residents in sheltered flats. If an individual is seen to be not using energy when they might be expected to, it may indicate a need for help that can be provided quickly and appropriately. This extends the capacity of New Charter and Chartist House's management team to provide responsive warden services for its sheltered residents.

2.3.5 Measures of Success

Matching actual outcomes against desired outcomes.

The desired outcomes for the project have been noted as;

- To achieve cost savings for the business;
- To install a more energy efficient system;
- To do so with minimum disruption to residents.

These have felt to have been achieved by the project team.

Key Quantitative Indicators

- The Carbon Dioxide emissions have been estimated as having been reduced by nearly 60%.
- The lowest daily heating cost for the whole building since installation has been £12.90 / 13p per flat.
- The residents' individual gas bills have been replaced by a £4 a week addition to the resident's service charge. There is currently no cap on energy use in individual flats and no charge for overuse.

2. Ecopod at Chartist House

- The Ecopod qualifies for government Renewable Heat Incentive payments, estimated at approximately £6,000 pa that can be used to offset running costs.

Key Qualitative Indicators

Feedback from residents shows that they have been happy with both the process of installation and the new heating systems.

Additional Benefits

Benefits for the building include the creation of an extended communal sitting room with kitchen and meeting space in the old ground-floor boiler room, the re-wiring of shared halls, staircases and corridors, the fitting of new ceiling panels and a new fire alarm system. In addition, a ground floor flat was converted for wheelchair access as part of the work.

Benefits for the management of Chartist House arising from the Ecopod system includes the removal of the costs and time of repair and maintenance responsibilities to individual gas boilers and heating systems, and of the costs and management of annual gas safety checks to every flat (saving an estimated £14,000 p.a.). The Ecopod system requires only two maintenance checks a year. The removal of gas as a source of heat in the flats increases safety, though does not reduce insurance costs.

Benefits for residents include increased storage space from the removal of hot water cylinders and because the heat exchangers replacing the boilers are small. Gas fires and surrounds, and gas cookers, were replaced with electric alternatives selected by residents from a range of options from a local supplier. The Chartist House installation won the prestigious Environmental Initiative of the Year at the UK Heating and Ventilation Awards 2011.

For the Belfry Group, the success of the Ecopod at Chartist House generated interest in, and orders from, other housing providers, local authorities, schools and a major hotel chain, has enabled the creation of a dedicated subsidiary firm with 35 new jobs, including 5 apprentices, with projected turnover of £20m in its first year.

2.3.6 Lessons Learned

The careful commissioning of the first Ecopod system for Chartist House, and the resultant benefits of reduced management and maintenance of heating systems for the flats, reduced cost for residents and reduction of CO₂ generates a useful example for other registered housing providers looking for an efficient renewable energy model for their own retrofit with worthwhile returns on investment. The following lessons learned have been identified;

- Retrofit of social housing can be strongly influenced by the level of resident engagement. New Charter used a resident centred installation process that was supported by a well-designed resident engagement process.
- Changes to technology will have a number of associated issues. The change from an individual gas-fired boiler to the EcoPod and heat exchanger, created a number of wider benefits in terms of cost and safety for New Charter. The systems that were installed, when viewed from the user perspective, operated in the same way and the system that was replaced, removing some of the confusion that might arise from new controls. In addition, the role of how people viewed their fires as not just for comfort, but also as a focal point for their properties, also highlights some of the complex issues around a systems change for residents.
- None of the technology applied was new; Building Management Systems and the combined technologies within the EcoPod are relatively common. However, the combination of the technologies and their application in social housing was new. The EcoPod team identified that looking wider than the social housing market when considering solutions to deliver energy savings and reductions in carbon dioxide emissions.

3. Gentoo Pay As You Save

3.1 Abstract

The Pay as You Save (PAYS) concept was developed as a response to two major issues (DECC 2011). The first was the need for the UK to meet its obligations, both national and international, to reduce the carbon emissions from the existing housing stock. The second was to address the lack of direct capital works funding that might be available to undertake this work, either from the public or private sector. The PAYS model looked at the concept of how the energy savings generated over a fixed period as a consequence of a sustainable retrofit of a property could be used to meet the capital cost of the investment required to upgrade the property.

This case is based on one of 5 pilot projects around the PAYS model, which were reported back to the Department of Energy and Climate Change in 2011. The study addresses a range of issues based around the core innovation of the PAYS model. This is of particular significance as this model is due to be adopted into UK legislation and will be known as the Green Deal.

3.2 Background

The PAYS (Pay As You Save) pilot study is a 2-year, £4m Department of Energy and Climate Change (DECC) initiative delivered by the Energy Saving Trust, starting in 2010 and completed in 2011. Five partners signed up for the study following an open competition; British Gas, Birmingham City Council, Stroud District Council, Kingfisher and Gentoo Sunderland City Council's housing stock, the social housing section of the Gentoo Group, set up to manage Sunderland's council housing stock in 2001. The pilots were designed to test a number of principles that would need to be addressed as part of the study.

Firstly, the studies looked to understand householder attitudes and preferences around the adoption of such a model including the following issues:

- The types of partners that would be most acceptable for householders to deliver schemes and make payments to.

- The acceptable relationship between the distribution of energy savings and repayments between the key stakeholders.
- The types of technical solutions that would be acceptable to householders.
- The potential barriers for measures with high capital costs.
- Potential approaches that might be adopted in marketing to householders.

The second element of the PAYS pilots looked to establish understanding around the following issues concerning delivery and finance:

- The types of delivery approaches that will be most effective in installing energy efficiency measures in the home.
- The different approaches that will be used to diagnose properties to identify the correct upgrades that should be installed.
- The modelling approaches that will establish energy savings and carbon emissions.

The Gentoo PAYS pilot addressed these issues within the context of social housing.

Gentoo Sunderland began a stock modernisation project in 2001 to meet and exceed the Decent Homes (DETR 2000) standard by 2011. The standard was achieved in 2005 and extended by upgrades to kitchens and bathrooms and complemented by a project to upgrade heating systems by 2018. The PAYS project fits into this broader context.

As well as the PAYS project, Gentoo ran another project called Retrofit Reality (Gentoo 2011). Gentoo Sunderland City Council's housing stock Retrofit Reality is a TSA (Tenant Services Authority) Innovation and Good Practice supported project. The aim of the project is to test products that improve the sustainability of existing homes. Although this project is separate to the PAYS project, it extends organisational knowledge and expertise for both practical retrofit and the engagement, as well as developing an on-going relationship with residents around issues of sustainable living.

3.3 Problem and Need

While the PAYS pilot was initiated as part of a Government funded scheme, addressing the energy efficiency of the housing stock is of importance to the social housing sector (DECC 2011ab). Gentoo Sunderland City Council's housing stock of 30,000 homes generates approximately 180,000 tonnes of CO₂ per annum, with associated fuel costs of around £30m. The drivers for social housing, however, are generally associated with fuel poverty (Boardman 2007) and the related health issues for residents rather than high-level climate change aspirations (Chahal et al. 2012).

3. Gentoo Pay As You Save

The PAYS pilot established the desired outcomes for the funders, Gentoo extended this with their own specific goals for the project. The desired outcomes for Gentoo were threefold:

- To test the “future proofing” stock by extending Decent Homes work completed in 2005.
- To ensure better thermal comfort for residents.
- To reduce residents’ heating costs, thereby addressing fuel poverty commitments.

3.4 About the Partners/Stakeholders

3.4.1 Gentoo Group

The Gentoo Group is the umbrella structure for Gentoo’s group of companies providing housing management and maintenance for affordable homes for rent and purchase in the North East.

- The project was led by **Gentoo Green**, which was established in 2007 to oversee improvements in environmental performance by co-ordinating a consistent and holistic approach to environmental sustainability across the group.
- **Gentoo Sunderland** is the group’s Registered Provider of social housing, delivering management and maintenance services to 70,000 customers in 28,500 homes, of which 118 were selected for the PAYS retrofit project.
- **Gentoo Construction** carried out the retrofit work and provide on-going maintenance, using a range of sub-contracted installers and suppliers to specify and fit specified improvements.
- **Gentoo Corporate Services** managed the overall specification and procurement process for the project and provided legal and financial support. All large contracts for equipment, installation and maintenance were OJEU compliant where appropriate.

3.4.2 Energy Savings Trust

The Energy Saving Trust (EST) is the UK’s leading impartial organisation helping people to save energy and reduce carbon emissions. It is part-funded by government and provides national studies and advice for consumers. The EST led the wider project for the Department of Energy and Climate Change (DECC) and assisted with the evaluation of the project, as well as managing the long-term receipt of payments as an accountable body.

3.5 Pre-Project Activity

The Green Deal (DECC 2010), the successor to the PAYS model, has required a change in legislation. The issues of attempting to implement the PAYS model ran up against a number of existing legal frameworks that made it complicated to implement PAYS in terms of initiating a long-term payment mechanism to fund the capital costs of the sustainable retrofit for residents.

The available repayment mechanisms for residents had impacts on the legal positions summarised by the tenancy agreement and these were carefully considered to achieve the most appropriate solution. Options considered included

- An addition to the residents' service charge was not possible, under s18 of the Landlord and Tenant Act 1985.
- A separate agreement with residents would have generated logistical implications for separate accounting and recording procedures, issues for rental card payments and the management of potential arrears and, in particular, any court proceedings against residents for non-payment.

The solution was to send a formal Notice of an amended tenancy agreement to existing residents (under the Housing Act 1985). Right To Buy (RTB) and Right To Acquire (RTA) purchasers have agreements to repay the full loan to the Energy Savings Trust who administered the project on behalf of DECC. RTB and RTA are rights given to renters of social housing to potentially purchase their rented properties.

From an innovation perspective, this is a specific problem that has arisen within the case study. PAYS is a specific type of regulative, or rule-based, process innovation that has required a flexible approach to the existing law in order to be effectively delivered.

3.6 Resources

The funding allowed work to be undertaken in 3 phases, which are shown in the Table 1. Most of these can be viewed as low cost, simple interventions. The target carbon savings under the PAYS model were only 38%, which encouraged less intensive retrofit interventions when compared to other national programmes, such as the Technology Strategy Board's Retrofit for the Future Programme (TSB 2011), which demanded an 80% reduction in carbon emissions.

Table 1. Phasing of Gentoo PAYS Delivery.

Phase	Number of Properties	Approximate Average Value	Upgrades
1	46	£4K	Windows and Boilers
1a	26	£3.5K	Boilers, Windows, PV
2	46	£15K	Boiler, Windows, External Wall Insulation

This was funded through the PAYS pilot project grant from DECC. This was in the form of an interest free loan, to be paid back through recovery from the PAYS model to the Energy Savings Trust. Phase 1a was internally funded by Gentoo, but included as part of the project.

3.7 Innovation Complex Map and Key

The innovation adopted is limited to the PAYS model and an extension of the client engagement model. As such this has not been developed into a map of innovations as has been noted with other case studies.

3.8 Core Innovation

The core innovation is the use of PAYS funding for a group of social housing residents, administered via the housing association. The key elements of the PAYS process are as follows;

- Householder engagement and enrolment – this is an essential part of the process. However, as the approach was fairly basic, the processes developed by Gentoo could not be considered as innovative. Gentoo selected 100 homes with G rated boilers over 2 years. The original intention was for all homes to be void, however PAYS deadlines meant that in the first year, 27 homes had residents.
- Home Energy Assessment – the homes were assessed using the Reduced Data Standard Assessment Procedure (RdSAP), that standard used for UK Energy Performance Certificates for domestic properties, alongside a traditional building survey to identify the baseline energy performance and develop potential recommendations (HM Government 2013). In the case of Gentoo, real energy use data was collected where available. In the first year, 27 occupied and 19 void homes were selected for PAYS retrofit packages, which were standardised across all properties and including boiler and heating upgrades, double glazing, heating controls and thermostatic radiator valves, funded by £400k from PAYS. Additionally, Gentoo funded low energy bulbs, aerated taps, TV and computer power-downs and provided energy advice.
- Recommendations Report and Financial Package – the current performance of the home was modelled against the potential performance of the property post-retrofit. The goal of the report is to identify the recommend retrofit upgrades and identify what savings in terms of energy costs would be made. This would identify whether the installation was economic following the Golden Rule (DECC 2010). The Golden Rule dictates that the costs of repayment of the cost of the capital invested should be equal to or less than the potential energy savings over 25 years. This Golden Rule ap-

proach has been applied in the national Green Deal Programme. Costs are £5k to £15k per home, with an average PAYS charge to the residents of £4.80 a week linked to the property via an amended tenancy agreement as an energy efficiency charge. Repayments are made over 20 years, to make sure that payments are lower than their predicted savings. Before energy saving advice, these are estimated at £313 per annum.

- Final Costing and Installation – the final costs are established and the installation is undertaken, with Gentoo using their in-house construction company. This is carried out in concert with support for residents where the properties are not void.
- Post-occupancy support – the Retrofit Reality study identified the requirement for post-occupancy support particularly in the context of new controls. Post-occupancy support was provided immediately after the installation and again three months afterwards.

3.8.1 Objectives

As stated previously, the goal of the PAYS project was not project specific. It was to test the principles of the model for rollout as a national policy instrument. It was a pilot innovation to demonstrate proof of concept, rather than having specific organisational objectives. In addition to the PAYS pilot objectives, highlighted earlier, Gentoo looked to achieve the following additional objectives;

- Improve asset value of properties in stock
- Improve levels of fuel poverty among participating residents
- Improve comfort/health levels among participating residents.

3.8.2 Innovation Type

This innovation is a process innovation, creating new rules for funding sustainable retrofit. Although some elements of the process, such as surveying and evaluation are undertaken using traditional or slightly modified processes, the overall approach can be described as radical; a model that fundamentally changes the way in which sustainable retrofit is financed.

3.9 Innovation A – Identifying/Engaging with Residents

The original intention had been to install retrofit measures to void properties, however this did not generate sufficient baseline data to support the measurement of the impact of the measures required by the Energy Savings Trust. As a result, a Gentoo Green's Environmental Awareness and Sustainability Impact (EASI) project was developed as a mechanism for communicating information with residents about the PAYS scheme to identify occupied properties for the project, focussing

on properties with the most inefficient boilers and glazing and also on those that were lower down Gentoo's heating upgrade programme, where occupants were prepared to pay for the upgrades.

Marketing was directed at properties that would be eligible for the PAYS package, based on Gentoo's knowledge of their stock, through existing engagement channels such as tenants and residents' associations, door-to-door activity, and the use of existing localised events (such as bingo and barbecues).

Following application, the process stages for retrofit work, covering both void and occupied properties, are shown in Figure 5. Many have these have been covered in the main PAYS model. These are chiefly concerned with pre and post-retrofit support for the residents. The pre-occupancy advice only applies to occupied properties.

3.9.1 Consultation

A 12 page 'Easi Guide to the PAYS' project was sent to residents in identified properties, including information on energy saving tips and an invitation to apply for work. This included engagement with the Resident Liaison Officers (RLO), who have day-to-day dealings with the residents. This allowed the RLOs to be up skilled and be aware of any longer-term issues that there might be with the retrofit technology.

3.9.2 Post-Installation Visits

As part of the changes to the tenancy agreements commitments were made to identify properties as PAYS properties. This meant that there were obligations on current and, in the case of voids, future residents to pay the charge that funded the capital costs for the sustainable retrofit. It also obligated Gentoo Sunderland to support the residents with post-occupancy support.



Figure 5. Resident Consultation and Communication Process (Gentoo 2011).

3.9.3 Monitoring

One of the more innovative approaches adopted in the resident engagement process, was the constant monitoring of resident satisfaction at each stage of the process. The purpose of this was to evaluate where the potential risks of resident engagement lay in the retrofit process. Figure 6 shows the varying levels of resident satisfaction during the whole process. Some of these findings run counter to commonly held views of professionals, who regard the installation process as a key risk factor. It should be noted that Gentoo did use their own installation personnel at these stages, so this may have gone some way to ameliorating the risk of these stages. The key identified risk stages were;

- In the early stage of the programme, due a funding restriction, the works did not commence as planned, and this created a significant fall away in resident satisfaction.

3. Gentoo Pay As You Save

- During the second stage of consultation there was low satisfaction. Further qualitative analysis indicated that much of this was driven by the earlier cancellation of works.
- The final fall in satisfaction was attributed to the fact that some of the works left a requirement for some redecoration. Although this was covered through the use of redecoration vouchers, the time in between the completion of the works and the completion of the redecoration saw a drop in the level of satisfaction.

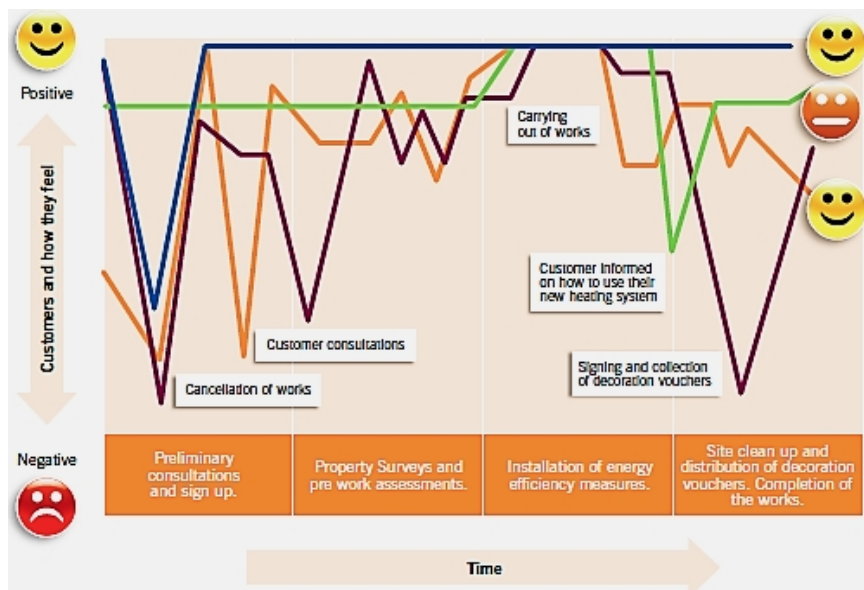


Figure 6. Tracking of Resident Satisfaction During the Works (Gentoo 2011).

This approach could be viewed as a process innovation, but it was viewed by Gentoo as part of the research process in order to better understand new ways of delivering retrofit in a resident focussed way. By identifying potential risks to resident acceptance, future project processes could be more effectively designed to reduce these issues.

3.10 Driver/Enablers

The management of the PAYS project by Gentoo generated three key project enablers.

- Firstly, the landlord's detailed knowledge of their housing stock supported the quick and accurate identification of potential stock for the PAYS project within a limited timeframe.

- Secondly, the value of the existing relationship that Gentoo has with its residents, enabled new ideas and products to be introduced and accepted and on-going maintenance and after-care to be provided within the existing maintenance framework.
- Thirdly, the use of Gentoo's existing suppliers and installers meant that bulk purchase and installation generated scale and cost efficiencies.

3.11 Barriers

The Gentoo team identified the following barriers to implementation

- Following the start of PAYS work on some properties, it emerged that the additional cost of the payback arrangement had not been fully explained to some residents. This was thought to have arisen where a member of the Gentoo Green team had not been able to attend the sign-up meeting, where information was provided to the team. This meant that they were not able to effectively communicate the requirement for a charge to some residents. This reduced the number of properties for Phase 1 from 52 to 45, where work was stopped on seven properties.
- As noted previously, the issue with the PAYS model was not only one of communication. Significant efforts had to be made to ensure that the model was compliant with both law and the regulatory framework with the social housing sector.
- The delay in the funding was a significant factor in lowering levels of satisfaction with the residents.

3.12 Measures of Success

As part of the study there was both modelling, using rdSAP, and monitoring of real data to assess the performance of the properties. Carbon emissions, energy use and costs were all modelled and compared to actual performance.

3.12.1 Carbon Emissions

Figure 7 shows the carbon emissions data for the PAYS projects by the sites.

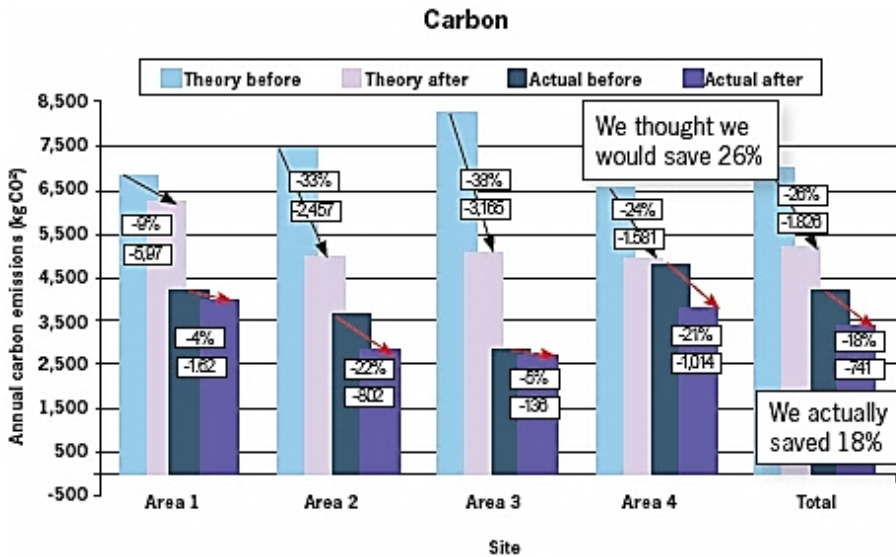


Figure 7. Carbon Emissions Data (Gentoo 2011).

The data shows how the modelled carbon emissions were much higher than the actual emissions, based on higher expectations of modelled energy consumption. The savings in carbon emissions ranged from -4% to -22%, against a modelled prediction of -9% to -38%, potentially based on higher expectations of emissions within the model.

3.12.2 Energy Costs

The differences between energy costs are core to the PAYS principle. If measured energy savings are not as predicted, then the finance models developed will not operate as expected, with the resident potentially taking the pain. Here the relationship is not as clear as with carbon emissions. While overall the predicted cost saving was 18% against an actual saving of 12%, the variance between the different models is much more marked. In site 1 there is an increase in actual savings against those predicted, while site 3 sees a six fold difference in the predicted against the actual reductions. This is shown in Figure 8.

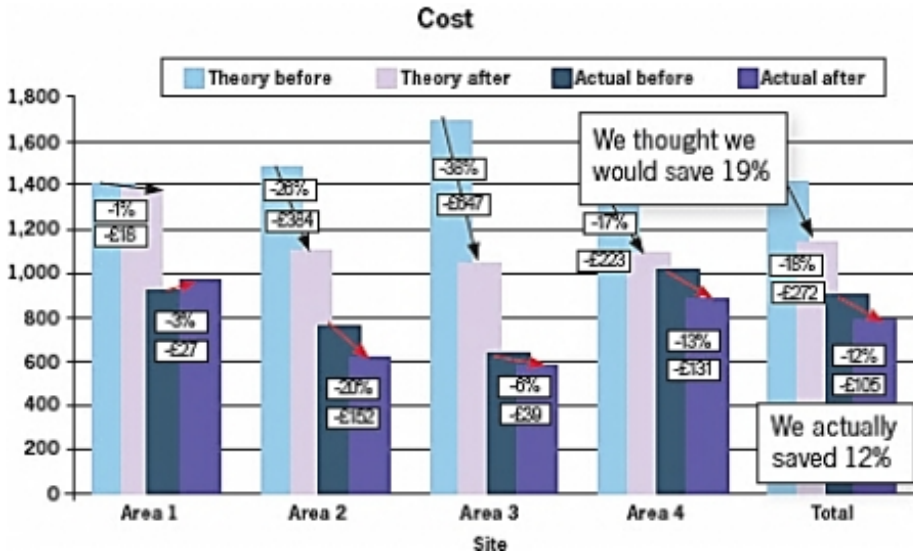


Figure 8. Energy Costs (Gentoo 2011).

3.12.3 Energy Consumption

Figure 9, below, shows the changes in energy consumption in kWh per annum. Again, the predicted values provided through the rdSAP model show a marked difference, generally underestimating both the level of use and savings.

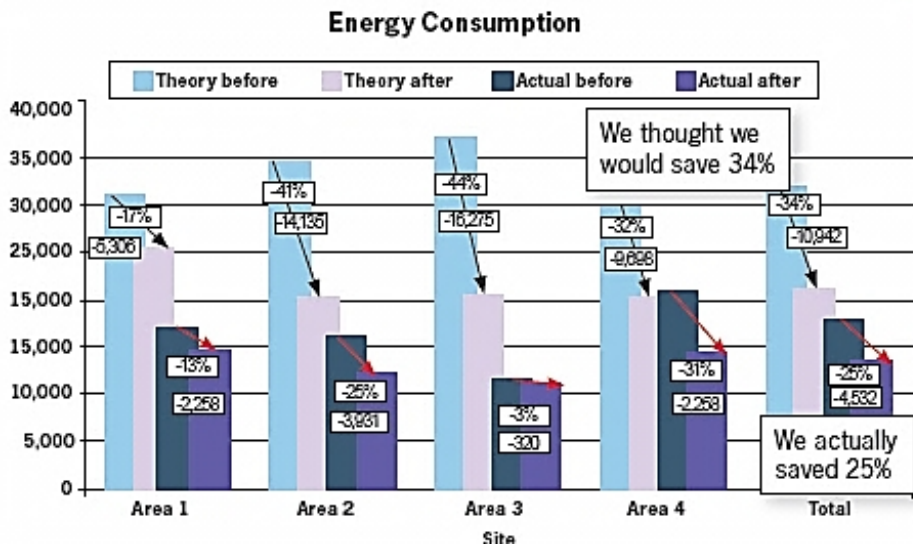


Figure 9. Energy Consumption kWh per annum (Gentoo 2011).

Overall these three sets of data indicate that the rdSAP model tends to overestimate energy use and cannot make allowances for the differences in energy use (118 properties in this case). If the model was correct in terms of projected energy use, one might expect it to even out over a larger sample. It should be noted that this study was undertaken in social housing that generally has lower income residents, but often has more thermally efficient properties than the private sector, both factors that could lead to an underestimation of energy use. Gentoo had completed their Decent Homes work in 2005, so it might be assumed that these properties would have basic measures to ensure thermal comfort, which was one of the Decent Homes programmes key criteria.

3.12.4 Other Indicators

The following additional benefits have been realised through the PAYS project

- The landlord, Gentoo Sunderland, indicated that the upgrades to the PAYS properties mean they would be easier to let and have an associated increase in the value of the asset, although the actual change is difficult to determine at this stage.
- Residents noted the benefits from the installation of the measures, including improvements in thermal comfort, improvements in soundproofing and availability and costs of hot water. Many residents noted an increase in control of the temperature of their properties.

3.13 Lessons Learned

Gentoo identified the following lessons learned from the project;

- The PAYS model required a change to the legal relationship between Gentoo Sunderland and its residents. Social housing is well regulated with protection for residents from changes to bills and service charges.
- The upgrades were selected on the basis of what has become termed the Golden Rule (DECC 2010). This is a calculation that determines whether the savings in terms of energy will meet the capital cost of the sustainable retrofit installation. However, it is a relatively complex concept and some residents struggled with it. Gentoo identified that the explanation of the Golden Rule must be clear and transparent for participants in the PAYS pilot.
- The current method for measuring the energy performance of properties, Reduced Data SAP (RdSAP), was not an accurate predictor of either current or predicted energy use when compared against the real data. This is potentially due to the weaknesses of the RdSAP model, which collects less data, and a lack of understanding of the impact of behavioural patterns on energy use.

- As well as requiring real data for energy use, the real cost of works is required to fully understand the PAYS model. Estimated costs often did not meet final costs.
- The use of void properties does not provide baseline data for measuring the impact of retrofit, as there is no historical data that can be accessed in terms of bills. Additionally, the costs of taking void properties out of the letting cycle in order to undertake retrofit needs to be considered.
- Accessing historical data from energy suppliers to inform use and savings calculations is complex and difficult. The UK has the Data Protection Act (1998) that limits the access to personal data for third parties. Even with permission it was noted that the process of gaining access to this information was difficult.
- Consultation with residents needs to ensure 'buy in' if installation and on going monitoring is to be successful.
- Consultation with and training of housing staff is also critical to ensure that the charges are understood and applied.
- It was helpful to have Gentoo Green staff at the initial consultation, sign-up and energy efficiency visit, so ensure that residents know what has been installed and how to use them effectively in order to realise savings and benefits.

In conclusion, many of the lessons learned here are issues that need to be addressed by the UK Government in the development of the Green Deal, the successor to the PAYS concept.

4. Community Green Deal Model

4.1 Abstract

The Community Green Deal (Urbed 2010) is a sustainable retrofit delivery model initially proposed by Urbed, a co-operative group who provide architectural and research services addressing the low carbon agenda. The goal of the Community Green Deal model is to develop a number of mutually owned community-led organisations that will be able to drive the delivery of sustainable retrofit within local areas across a range of tenures, whilst providing financial models to support the delivery of retrofit solutions to householders. The model has a primary focus on the reduction of carbon emissions, with a secondary focus on community-oriented delivery solutions. The model has been adopted for implementation after a period of 3 years research and pilot studies.

4.2 Background

The development of the Community Green Deal Model has been supported by three years of previous research and pilot projects, which culminated in a feasibility report completed in late 2010. This highlighted the difficulties of encouraging the owner-occupier and private rented sectors to effectively engage with the retrofit agenda. The study identified the 3 following key issues;

- Lack of developed market in sustainable retrofit
- Lack of trust with traditional suppliers of services i.e. energy companies, large corporations and construction companies
- Lack of economies of scale for individual properties undermining the cost effectiveness of sustainable retrofit.

The first issue, that of a lack of developed market place for retrofit, is an important one for the private sector. While the social housing sector is increasingly well served when it comes to the market for sustainable retrofit, they are supported by the fact that many of them have access to specialist procurement and project management expertise. This could be viewed as a commercial market offer, where

the knowledge on the client side is well developed. The sustainable retrofit market for private individuals, which has a requirement for a well-defined and reliable.

The second issue is one of trust in the companies engaged in the market. The data below shows responses from a survey conducted by polling organisation MORI (Figure 10).

Q. And which one of the following groups, if any, would you trust most to have responsibility for the day to day management and maintenance of sustainable community infrastructure?

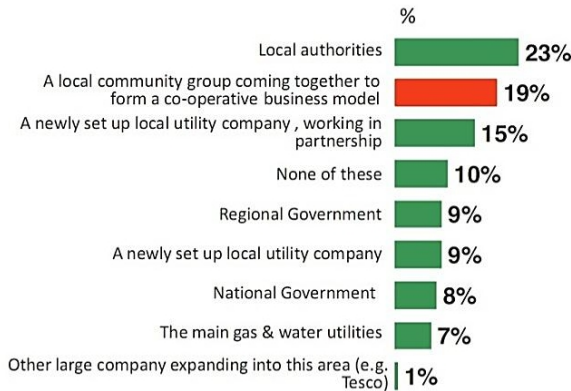


Figure 10. Most Trusted Organisations MORI Poll (Urbed 2010).

It identified a number of actors who could potentially take a role in having responsibility for the management of sustainable community infrastructure and identified those who were the most trusted. Not for profit organisations, such as community groups and municipalities, were identified as being the most trusted. The least trusted were utility companies and other large companies with an interest in the area.

Q. Which of these groups, if any, would you not trust to run such a scheme?

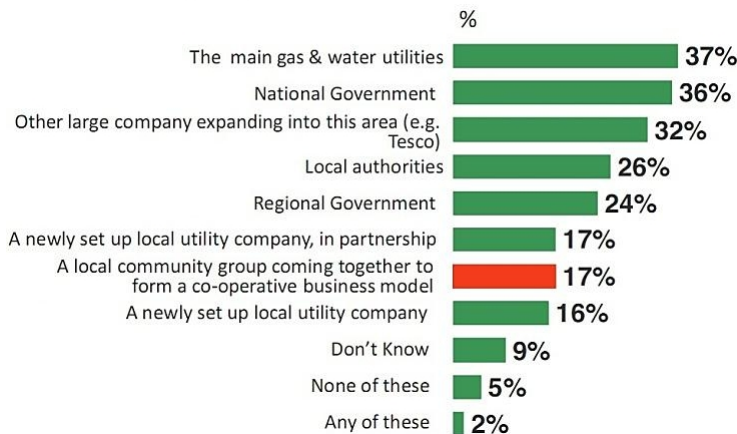


Figure 11. Least Trusted Organisations MORI Poll (Urbed 2010).

The second question considered the role of different actors to run upgrade schemes for local neighbourhoods (Figure 11). The question asks the respondent to identify whom they would not trust. This has a slightly different pattern, but organisations with a local and not-for-profit focus were considered to be the most trusted.

The third issue of scale is of particular relevance for the UK housing market, where many individuals live in single-family dwellings and the market is predominated by owner-occupiers. Owner-occupiers account for approximately 65% of the UK housing market (CLG 2009). This means that they must be engaged on an individual basis. A single householder cannot easily benefit from the economies of scale in terms of volume, workflow or the production process when installing sustainable retrofit in their properties. While this tenure model is less common in Finland, particularly with reference to multi-occupancy buildings, many of the issues of co-operative engagement with residents are relevant.

The proposed solution was to develop a co-operative model. The objective of the Carbon Co-operative as seen by the members is primarily to reduce carbon emissions, with a secondary objective of developing a mutually owned vehicle to achieve this. It was recognised that this needed to be supported by a vehicle to fund retrofits in an affordable way that ensured profits could be reinvested into future activity as far as possible. This addressed the 3 identified issues in the following ways;

- The lack of a developed knowledge within the owner-occupier market is addressed by bringing individuals together into a single organisation. Specialist members of the group bring the knowledge that may be lacking for an individual homeowner. Lessons may be learned and shared within the group ensuring knowledge and experience of early adopters is captured and reapplied for members who adopt later in the cycle.
- The locus of decision-making is within the group, based on democratic principles, with any benefits from activity being shared. The model is designed to be transparent and not-for-profit; therefore risks and rewards are shared between the members of the group, addressing many of the trust issues that arise for individuals engaging with for profit businesses.
- The co-operative model, where a group of individuals come together to act as a single organisation, addresses some of the issues of scale. Groups of works may be co-ordinated into larger, geographically co-located packages, thus benefiting from the economies of scale.

It was recognised by the team developing the co-operative that many of the individuals engaged could be viewed as pioneers. They felt that early projects could present a major opportunity to build an evidence base and develop their own learning around the issues of sustainable retrofit.

4.3 About the Partners

4.3.1 Carbon Co-operative

The Carbon Co-operative is the group formed specifically as part of the innovation. They are a group of approximately 30 owner-occupiers, based in South Manchester, who have formed a mutual organisation to address energy use and carbon emissions within their homes and neighbourhoods. Mutual organisations, or co-operatives, were initially created in the 18th Century as member-owned groups that undertook a specific activity for the mutual benefit of their members, rather than shareholders or individual owners. Examples can be seen in housing, finance and retail. They can be incorporated in a number of different ways, and this will vary from country to country. They have broad principles of member-ownership, democracy, participation, and are generally community focused. While many co-operatives are smaller socially focused groups, there are examples of large-scale co-operatives in the UK, such as John Lewis, a major retailer, the Co-operative Group, including retail and banking services, and a small number of building societies, which offer a range of savings and mortgage products.

4.3.2 Urbed

Urbed are a co-operative consultancy specialising in urban design and sustainability. They have a specific interest in retrofit work, having contributed design services to a number of demonstration projects under the Retrofit for the Future programme, worked with Birmingham City Council on their retrofit work on public housing and led the development of the Retrofit Strategy for Greater Manchester (Urbed 2011). They have provided technical and financial consultancy for the Carbon Co-operative.

4.3.3 Kindling Trust

The Kindling Trust is a co-operative based around community engagement. They were involved in the initial feasibility stage of the project and continue to have a role around the engagement of members and potential members for the Carbon Co-operative.

4.3.4 Resources

The development of the feasibility study was a grant-funded project supported by the Manchester Innovation Fund. The further development of the model and the engagement of the residents has been on a voluntary basis at this stage, although some grant funding through the Department for Energy and Climate Change has recently been won.

4.3.5 Contextual Issues

While engagement with sustainable retrofit has been on-going within the social housing sector, the issue of how to engage the owner-occupier market is still in its infancy. There are examples of private companies engaging with the problem through private pilot projects, but these models are still in development. The issues of trust, supply chains and scale are very much at the core of the problem.

The emerging Green Deal (DECC 2010) provides a context against which the Community Green Deal model is being developed. More detail can be found in the Gentoo Pay as You Save case study. The Community Green Deal model is very much a response to the gap in the market that has yet to be plugged by the private sector, and responds to a growing level of engagement with community based activity around energy issues.

4.3.6 Innovation Complex

The Community Green Deal Model was identified in a report for the Sustainable Homes Action Partnership (SHAP) based in the West Midlands of the UK. It has two main elements, the carbon co-operative and the carbon savings society.

The Carbon Co-operative is;

'A membership-based business that aims to support households to achieve significant reductions in their carbon emissions that would be difficult to achieve on their own.' (Urbed 2010)

This has led to the development of a range of innovations in an attempt to engage householders in the sustainable retrofit agenda and ensure that any benefits generated are retained within the community and used for further works.

There are a number of interrelated functions that underpin the Community Green Deal Model. The overall model of governance is the structure which supports the decision making function of the co-operative and is essential to support any co-ordinated action by the members. The retrofit delivery model is concerned with the process of the delivery of sustainable retrofit, focussing on diagnostic, procurement and project management issues for and with the members. The finance model is concerned with the infrastructure required to fund sustainable retrofit.

4.4 Core Innovation – Co-operative Model

The core innovation is the development of a community-owned organisational model that will support the implementation of low carbon technologies in the home. The organisation will be developed into a legal entity that will have the benefits of a single organisation when procuring and installing sustainable retrofit technologies for their properties. It is fundamentally an organisational innovation as applied to the retrofit problem.

4.4.1 Detailed Objectives

The carbon co-operative has been designed to address carbon emissions for their members, specifically with reference to the energy they use in their homes. As noted before, the co-operative approach has been design to address three specific barriers:

- Trust in supplier of sustainable retrofit services
- Lack of knowledge and consumer market offer for sustainable retrofit
- Issues with economies of scale making sustainable retrofit less affordable for individual homeowners.

4.4.2 Type of Innovation

It can be viewed that the innovation is a paradigm type innovation. It looks at applying a new organisational structure to address the retrofit problem. While there are a number of examples of community owned energy projects and energy/carbon focused co-operatives, this is one of the first in the UK that specifically addresses a long-term engagement with the householder and their home. The question of whether it is incremental or radical is different. For people who may have previously engaged with community co-operatives in this way, it is a recontextualisation of a familiar organisational form. However, for many people, this type of engagement may present a radical change to the way in which they procure goods and services.

4.4.3 Innovation A – Governance Model

The governance models for co-operatives are democratically formed to manage the functions and decision-making processes within the Carbon Co-operative. The member-owned status of the co-operative can make the initial set up of these governance structures complex. The key issues that the co-operative needed to address are:

- Membership and election of the board, including issues such as eligibility, frequency of meetings and terms of reference.
- General meetings and methods of determining activity of the co-operative in a democratic way. This includes key factors of good governance, such as the availability of minutes and the transparency of decision-making.
- Development of an executive board to manage the day-to-day activities of the co-operative.
- Development of specialist working groups to address issues around finance and management of the delivery process (see below).
- Management of issues such as conflict and declaration of interests and participation in the decision-making process.

4. Community Green Deal Model

The development of a member-led governance structure is core to the effective operation of the co-operative. They are essentially voluntary organisations and, therefore, must be seen to be operating in the interests of their members in an ethical and transparent way.

4.5 Innovation B – Management of Retrofit Process

4.5.1 Detailed Objectives

The management of the retrofit process is designed to address the issues of trust, knowledge, shared benefits and scale, with a core objective of delivering carbon and energy savings. The model is designed to address these to ensure that members who have their homes sustainably upgraded.

4.5.2 Description

The management of the retrofit process and the role of the Carbon Co-operative can be seen in the Figure 12, below. The Co-operative is designed to bring cooperative action to bear on three main stages: setting-up, delivery and sustaining. In many respects the model could be seen to replicate the types of processes that a social stockholder might have to go through in the delivery of an effective retrofit project on their owned stock. The stages are defined in non-technical language and are highlighted in blue. The role undertaken by the Carbon Co-operative in support of this stage is shown in red.

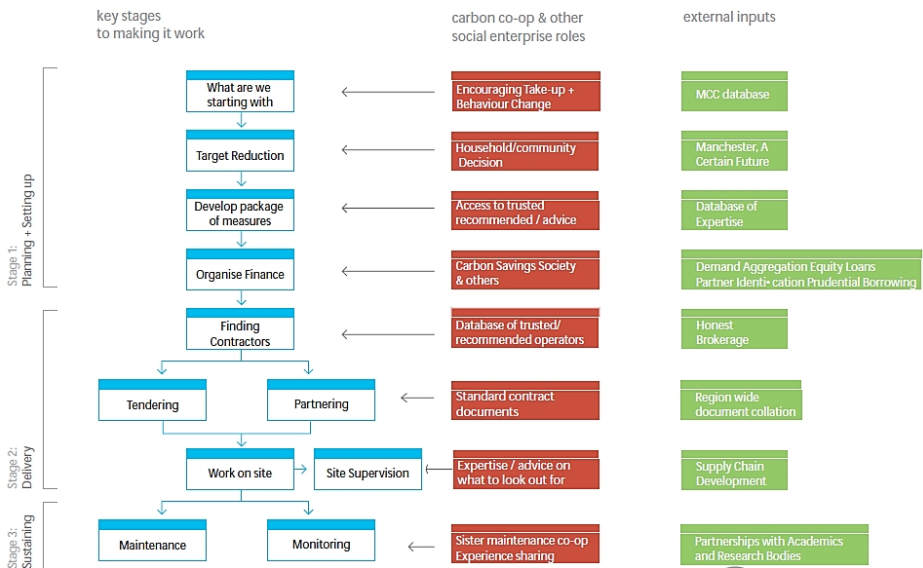


Figure 12. Carbon Co-operative Delivery Model (Urbed 2010).

4.5.3 Setting Up

The Setting Up stage is concerned with identifying need and appropriate technical solutions. The stages identified are as follows:

- What we are starting with – this is essentially about understanding the current stock within members and potential members and highlighting the potential for change that a sustainable retrofit might bring about. Here the Co-operative provides access to members that may have expert knowledge in building surveying, as well as modelling expertise. This also provides an opportunity for individuals to understand the potential savings in terms of energy and carbon that may be attained through a sustainable retrofit.
- Target reduction – this could be potentially viewed as analogous with a business case in a commercial context. The group, as well as individual householders, will identify what options they might have and the goals they wish to achieve in upgrading their homes. Where people are operating in a neighbourhood context, there may be opportunities for people to make decisions with regards to upgrades that may change the aesthetic nature of their neighbourhood, such as external wall insulation programmes for example.
- Develop package of measures – the package of measures will be defined by either internal co-operative skills sets or by reference to a trusted source of knowledge. This will define the package of physical retrofit interventions that will be used to upgrade the carbon/energy performance of the house. It may be that this will progress in a single house approach, but the goal of the co-operative is to deal with groups of properties and thereby gain the economies of scale.

4.5.4 Delivery

The delivery phase is concerned with the supply chain, procurement and installation phases. The stages are as follows:

- Organise finance – the finance options are detailed below.
- Finding contractors – this is the start of the procurement phase. The Co-operative will keep a database of contractors they have worked with that could be identified as trusted. The grouping of works may provide opportunities for the engagement of larger contractors, which would not otherwise be available to single homeowners.
- Procurement route – the Carbon Co-operative identify two preferred routes for procuring contractors, either traditional tendering or partnering, which is a more co-operative risk sharing approach to procurement. The Co-operative will provide standard approaches, including knowledge from previous procurement exercises in terms of good practice, contract form and contract management.

- Work on site – this is the site management aspect of the works. The co-operative will support members in understanding the process and providing client side expertise. This may mean professional support from within the Co-operative or experience from other members who have been through the process.

4.5.5 Sustaining

The sustaining phase is concerned with the on going maintenance and performance of the retrofit installation. The stages are as follows;

- Maintenance – the on-going maintenance issues of a retrofit installation are often overlooked. The Co-operative will look to support the on-going O&M issues through a sister co-operative who will support the operation and maintenance cycles of retrofit installations. This again will be designed to address issues of trust, scale and knowledge, which are equally applicable in the maintenance element.
- Monitoring – the performance of retrofit installations and the individuals within the property will be supported. The co-operative will share knowledge on the effective use of technologies and energy/carbon saving behaviours that will ensure that the savings are maximised.

4.5.6 Innovation B – Financing the Retrofit Process

The UK has in increasingly complex finance regime when considering a sustainable retrofit of a property. Grants and subsidies are available from a number of sources; subsidies such as the Feed in Tariff (for renewable electricity) (EST 2013) and the Renewable Heat Incentive (for renewable heat) (DECC 2012), as well as the forthcoming Green Deal (DECC 2010), which is a method for paying for capital investment through savings on energy bills, all combine to make the funding regime for sustainable retrofit highly complex for the individual homeowner. This is further complicated by the lack of finance vehicles in the market to fund sustainable retrofit improvements.

The Carbon Co-operative is supported by a second co-operative called the Carbon Savings Society. This model is designed to provide the finance for low carbon projects. While this is designed to be a complimentary vehicle to the Carbon Co-operative, it may have the ability to support sustainable retrofit projects for non-members.

The Carbon Savings Society is entirely concerned with finance. The example of how this would work with the Carbon Co-operative is shown in Figure 13.

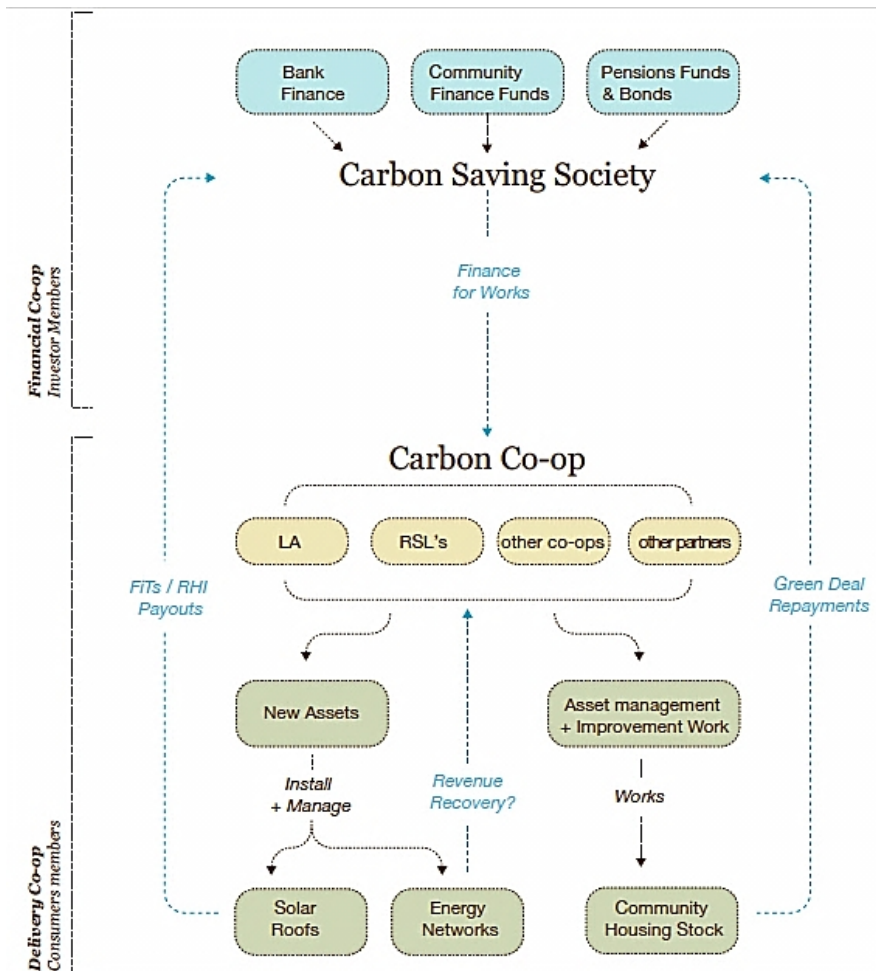


Figure 13. Model for the Finance Co-operative (Urbed 2011).

The Carbon Savings Society is made up of member investors. They may invest their own money or use borrowing through private finance or bonds. This creates a pot of money that may be used to finance low carbon projects. Low carbon projects may generate revenue in a number of different ways;

- Subsidy payments such as the Feed in Tariff or the Renewable Heat Incentive may be used to repay the finance costs of qualifying technology.
- Community energy projects may be developed with revenues coming from the sale of electricity to end-users.
- Sustainable retrofit of people's homes will make savings on energy bills that may be used to generate an income stream to pay for those savings.

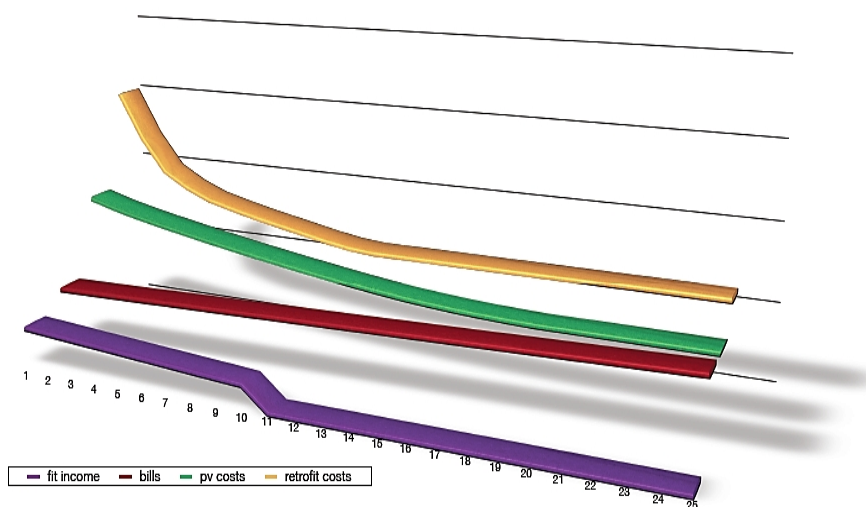


Figure 14. Outline Model of Cost and Income Streams for Retrofit Over 25 Years (Urbed 2011).

The financial modelling that has been undertaken to show the flows of income over 25 years can be seen in outline in Figure 14. This long-term view of income flows and changing values attributable to retrofit is an important perspective in terms of both financial flows, but also in terms of the costs that might be attributable to operating and maintaining retrofit over its lifetime to ensure that these benefits are maintained.

4.5.7 Driver/Enablers

The model is in the early stages of development and therefore the drivers, barriers and measurable benefits are currently emerging. Some of the initial findings are as follows;

- There is a growing understanding of the external context among owner-occupiers. Issues such as climate change and energy prices are commonly addressed in the media and, over the last 10 years, have become more ingrained into the consciousness. While the Carbon Co-operative can be viewed as addressing early adopters, and specifically those who are more community oriented, there is a growing social context that makes the concept easier to engage with than previously.
- One of the key success factors that was identified by the Carbon Co-operative team was the engagement of existing community/voluntary infrastructure. The development of a new model was considered difficult where there was little or no existing social capital on which to build. The use of existing community groups and infrastructures supported the development of the model.

- Policy makers are currently looking for ways to support the engagement of individuals and communities with the sustainable retrofit agenda. The current grant and subsidy arrangements, such as the Feed in Tariff and the Renewable Heat Incentive, provide an opportunity for the Carbon Co-operative to develop the finance model and lever funding.
- The organisations involved have strong skill sets in the delivery of sustainable retrofit, having participated in a number of city region and individual house pilot projects. Having access to this kind of expertise provides the knowledge base that many of the individuals lack, as well as providing a technical credibility that encourages participation.

4.5.8 Barriers

- The policy landscape in the UK can be described as unstable. Delays to the Renewable Heat Incentive, changes in the value of the Feed in Tariff and the transition from grant programmes such as the Community Energy Savings Programme (CESP) (Reeves et al. 2009) and the Carbon Emissions Reduction Tariff (CERT) (Druckman and Jackson 2008) to the Energy Company Obligation (ECO) (DECC 2011b) and Green Deal (DECC 2010) all contribute to a level of uncertainty when balanced against the long-term obligations identified in the Carbon Co-operative and related finance vehicles. This unpredictability can mean that projects that have financial viability in one context, can quickly be undermined in light of changes to the grant or subsidy regimes. This has an impact on the formation of the business case, but also undermine the position of the co-operative as a whole if there are losses associated with membership due to these changes.
- While moving early has an advantage, there are issues in terms of the development of an evidence base. A robust evidence base will support the growth of membership, but many of the tools and approaches are being developed and this does present some issues when extending membership past the very early adopters. However, should the long-term benefits of membership be clear and demonstrable to new members, or new co-operative structures, it is clear that this could become a long-term driver.
- While the existence of a strong knowledge base for the Carbon Co-operative in terms of how to undertake sustainable retrofit exists, there is an issue as to how this would operate at scale given the limited nature of the available resource. While the team are in early adopter/pioneer stage this does not represent a major problem, but if the ambitions to expand to either a larger group or multiple groups are achieved, this would represent a major issue for the team.
- The current nature of finance within the market presents two related barriers. The first is concerned with the costs of finance. Currently, demands for re-

turns within the market are viewed as high when compared to the wider interest rate environment and this means that many of the benefits of a sustainable retrofit could potentially flow entirely to the providers of finance. This could be addressed by the issuing of community bonds for the consumer market, which is currently experiencing record low returns, but this presents its own regulatory complexities. The second issue is the potential for penalty clauses and buy-out issues, which may leave members of the co-operative with long-term obligations that may prove uneconomic in the long-term.

4.5.9 Measures of Success

The following metrics have been identified as measures of success for the Carbon Co-operative.

- Tonnes of CO₂ saved – the core goal of the co-operative is to come together to save carbon dioxide emissions through the vehicle of sustainable retrofit.
- Cost per kg/CO₂ saved – the co-operative will look to drive efficiencies and therefore improve the level of carbon savings per £.
- Number of Retrofitted Properties – while the relationship the number of properties and carbon savings is not fixed, the view from the co-operative team is that numbers of properties retrofitted will have a twofold advantage. Firstly, it will create a greater number of opportunities to capture learning. Secondly, it will go some way to normalising the idea of retrofit within a given neighbourhood or community.
- Membership Numbers/Waiting Lists – the development of a flow of potential work will allow the co-operative to be able to more ably buy at scale, as well as being potentially able to group works into co-located packages, enabling further cost savings.
- Reduction in Fuel Poverty – while it is not a core goal of the network, the improvement in the levels of fuel poverty, those individuals who spend more than 10% of their net income heating their homes to comfortable levels, are considered to be a major potential benefit.
- Equity – the concept of equity, while difficult to specifically define, was considered a major issue for the co-operative. This is concerned with the distribution of benefits between members of the group, as well as external stakeholders.

4.5.10 Lessons Learned

There are two major lessons identified by the Carbon Co-operative team;

- Addressing the cost base for sustainable retrofit – the team have identified that reducing costs through the economies of scale, improvement of practice and further developing knowledge will allow the model to work more effectively, particularly when linked with the developing finance model.
- Pioneers, not early adopters – the co-operative team identified that participants within the Carbon Co-operative should not be viewed as early adopters. The development of sustainable retrofit is currently viewed to be at such a stage that they should be viewed as pioneers. The market is still so immature that these individuals are engaging in something that is still very much under development and the market should be recognised as such.

5. Fusion21 – Framework Procurement for Retrofit

5.1 Abstract

Fusion21 is a social enterprise; a not for profit organisation with socially oriented strategic objectives. It provides procurement services and related job creation and skills brokerage to the UK social housing sector, primarily in the North West of England. This case details the development of the procurement frameworks and related innovations for the delivery of sustainable retrofit solutions for the social housing sector. Fusion21 is wholly owned by 7 social housing organisations and therefore adopts a 'consortium' approach, with its frameworks being used by those seven partners and available to a wider range of social housing providers, giving large volumes and economies of scale. While procurement frameworks, single European Community compliant programme contracts for "bundled" construction contracts, are not uncommon, the sustainable retrofit problem has required additional investment in research and development of supporting knowledge and tools to deliver sustainable retrofit options to the client base. The fundamental goal of the innovation programme was to increase take up of the framework, generating income for Fusion21. However, as a social enterprise, additional work was undertaken to ensure that the delivery of sustainable retrofit to the target group delivered additional benefits, such as jobs and skills, a reduction in fuel poverty for social housing residents and a reduction in carbon emissions. As a social enterprise, all surplus that Fusion21 makes is used to increase the impact it has on local communities.

5.2 Background

Social housing was identified as a "test-bed" for sustainable retrofit in the Warm Homes, Greener Homes Strategy (HM Government 2010) put forward by the previous UK Government. Social housing comprises 18% of the total UK housing stock, or approximately 4.7 million homes (CLG 2009). While the 70% of UK homes are owner-occupied and represent an important group for whole sector reduction of carbon dioxide emissions, the view of the UK Government is that the

market for sustainable retrofit is not wholly mature (Van Sandick and Oostra 2010). The presence of professional asset managers, building surveyors, the scale of retrofit projects and more experience around investment decision-making make social housing a better starting point to build the developing sustainable retrofit market (Jenkins 2010). Additionally, the social housing sector had just come through a large stock upgrade programme known as Decent Homes, which looked to upgrade the living conditions in homes through fabric, heating, kitchen and bathroom upgrades. Whilst not as complex as sustainable retrofit, this shared many of the same issues, such as access to people's homes, resident engagement and scale of delivery. Following Fusion21's example set in 2002–2005, EU compliant procurement frameworks and consortia were developed to deliver many of these programmes across the UK, as they gave the opportunity for clients and delivery teams to manage the work and drive the benefits of scale in terms of cost and supply chain management, as well as allowing longer-term relationships to be developed.

Fusion21 was well established in the market for Decent Homes (DETR 2000), as well as having frameworks for a range of other issues in social housing. It was cited in the influential 'Gershon' report (Gershon 2004) on procurement efficiency in 2005 and won a major award for innovation in procurement in 2005. In 2008-9 Decent Homes was starting to enter its last few years and there was a view that new framework services would be required to replace the core business. At this stage the UK Government had highlighted sustainable retrofit as an issue, but had made limited policy commitments to the Housing Sector, other than through a legislative reduction in carbon emissions (HM Government 2008). It was viewed by Fusion21 that sustainable retrofit was a key area for future development. As such, they engaged a consultant to develop a potential offering. It was quickly identified that there were a number of knowledge gaps; sustainable retrofit was identified as far more complex than Decent Homes with significantly more risk if done incorrectly. During 2009, Fusion21 committed to a joint project with the University of Salford to develop a knowledge base and a series of tools to support the delivery of a retrofit framework. These tools would connect with the existing procurement and project management infrastructure, In>Form, which supported the delivery and planning of programmes. The retrofit programmes would also connect with the existing skills and training infrastructure.

The Fusion21 Retrofit Framework and supporting tools had the following key objective;

- A procurement framework that would allow social housing providers purchase a range of sustainable retrofit elements at lower cost, from a range of pre-approved suppliers at lower rates than they would if they were to individually procure them.

However, it was recognised that this process was more complex than traditional housing construction procurement and, therefore, required a range of additional innovations. The planned innovations identified to address issues identified in the planning process were:

- A Stock Assessment tool to identify the correct range of retrofit options for a range of property archetypes.
- A Business Modelling tool to identify the correct retrofit option, given the identified strategic objectives such as target carbon emissions reduction, fuel poverty targets and financial planning issues.
- A Funding Knowledge Base that would identify the potential leverage of external funding. This includes government-funded approaches such as the Carbon Emissions Reduction Tariff (CERT), Community Energy Saving Programme (CESP), the Feed in Tariff, the Renewable Heat Incentive and the emerging Green Deal and Energy Company Obligation.
- A Community Engagement Toolkit to support social housing providers in improving resident acceptance of new technology.
- A Resident Support Toolkit that would allow social housing providers to effectively support residents in using any new technologies to their best effect.

About the Partners

Fusion21 is a social enterprise, which means that profits from the organisation are reinvested in the organisation rather than distributed to shareholders. Fusion21's core goals are to reduce costs to its clients by managing the procurement and elements of supply chain management as a group to drive value for money, and using the construction spend to support skills training and employment for local people. Although it was founded in Merseyside, it now operates frameworks nationally and seeks to support employment in the areas where the works contracts are delivered.

During the later development of the Asset Management frameworks, a partnership was established between Fusion21 and Procurement for Housing, a national procurement body that delivers a wide range of products, from fleet cars to office consumables. The delivery of the retrofit frameworks has strengthened this partnership with the development of the joint 'Retrofit for Housing' brand under which the new frameworks are marketed.

5.2.1 Resources

Fusion21 recognised that, while sustainable retrofit presented a large potential business opportunity, the skill set required to deliver it was not present within the business. This was in particular reference to understanding the technical issues of retrofit and surrounding policy. It should be stated that retrofit at this point was very emergent and little knowledge was available other than high-level problem scoping reports and some technical background. Fusion21 appointed a consultant to develop the area.

In 2009 Fusion21 committed £80,000 to part-fund a Knowledge Transfer Partnership with the University of Salford. Knowledge Transfer Partnerships are co-funded academic/industry projects funded by the Technology Strategy Board and the research councils to deliver industry-focused research projects. They are co-produced projects, jointly developed between industry and academia that are designed to connect the knowledge base with a specific business problem, sharing similarities with the constructive research/design science approach. This led to the appointment to two associates who were assigned to enhance the Fusion21 retrofit offer in support of the Retrofit Framework.

5.2.2 Contextual Issues

As with many of the organisations engaged in retrofit, Fusion21 is confronted with an uncertain policy landscape. The change of government in the UK in May 2010 saw an overhaul in the approach to rolling out energy efficiency. October 2012 has been identified for the introduction of a range of new policy instruments; the Green Deal, the Energy Company Obligation and the Renewable Heat Incentive. Alongside this will come a number of associated standards for assessment of properties, installation of retrofit packages and legal frameworks. At the time of writing these are all in development and this causes a lack of clarity.

The development of the framework should also be placed in the context of spending cutbacks. A survey of 134 social housing providers conducted by Fusion21, Procurement for Housing and the University of Salford identified that the sustainable retrofit challenge was the most important challenge for 27% of respondents, however, 40% highlighted the general economic downturn as a more important issue. Cost has become an increasing issue for social housing providers that could potentially undermine the business case for sustainable retrofit when compared with other strategic objectives.

In a departure from the previous Government's proposed 'Warm Homes Standard' that social housing providers would have had to meet, the current coalition Government's approach moves away from targets and is focussed on landlords, energy companies and individuals initiating energy efficiency activity in order to gain long term energy bill savings and because they 'buy in to' the need to take action on climate change. There are currently no proposals to set national or regional interim targets for property owners to invest (other than some possible long term restrictions on re-letting the lowest grade privately rented properties).

It appears that Local Authorities may be given an overall strategic role to co-ordinate activity in their areas and identify neighbourhoods on which to focus activity, but no extra public resource is proposed to assist with this. However, it is anticipated that as the situation becomes clearer, some Social Landlords will want to take the lead on delivery of works for their own properties, with the possibility of offering works to adjacent owner-occupiers, to avoid their tenants suffering from the worst impacts of steeply rising fuel prices. If significant activity does not take place immediately following the launch of the new approach, some sort of 'kick-

start' initiative involving targets for the Social Housing providers to deliver might be introduced by the Government.

The area of sustainable retrofit has become increasingly competitive in the last 12–18 months, with a range of providers entering the market offering procurement frameworks for social housing. While there has been some element of first mover advantage, this creates an additional pressure for successful delivery.

5.3 Innovation Complex Map and Key

The innovations adopted and under development have been planned from an early stage. There has been a substantive research and development phase supported by effective engagement with industry networks. The complexity of sustainable retrofit, when perceived as a beginning to end process, has been recognised. Issues around the technical, commercial and social impacts have all been identified and innovations designed to mitigate potential risks to the successful delivery of the procurement framework identified as the core innovation.

The response has been process-oriented with a goal to deliver the optimum number of sustainable retrofit products, but also to ensure the effectiveness of the installations in terms of carbon savings and energy use. The approach has been to adopt the Office of Government Commerce (OGC) Gateway Procurement Process (OGC 2007), with each of the innovations fitting into this structure. A cut down version of the retrofit process is shown in Figure 15.

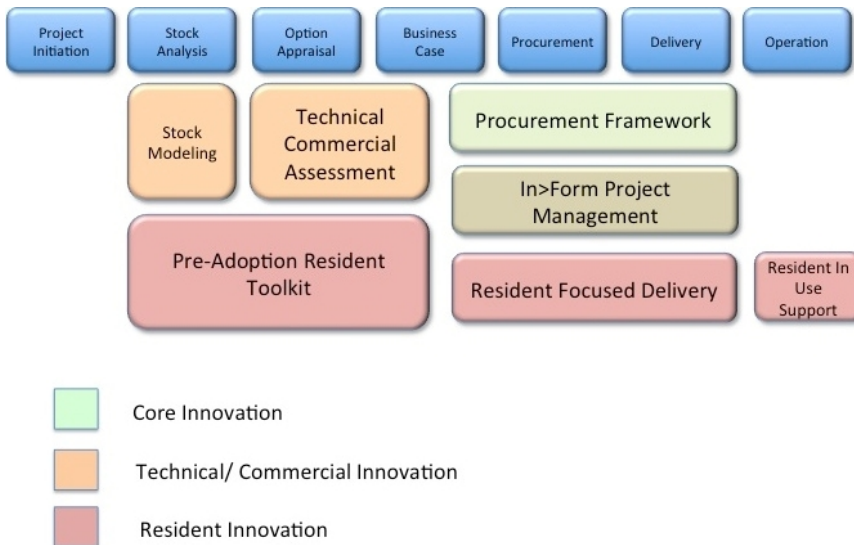


Figure 15. Outline of Retrofit Process.

5.4 Core Innovation – Sustainable Retrofit Procurement Framework

Procurement frameworks were developed as a response to many of the issues raised by one-off construction projects. The Egan Report, Rethinking Construction (Egan 1998), highlighted that many issues such as adversarial approaches to contracts, lack of continuous improvement and lack of investment in training and development in the construction industry, were driven by the single competitive tender approach. Frameworks bring together a number of projects or proposed projects into a single programme, which may be as much as 4 years in length. The overall work programme is brought together and tendered once. This maybe for a single supplier, but generally may be let to a number of suppliers who will then participate in mini-competitions for subsequent individual work packages. This creates more certainty for the contractors and reduces the costs of tendering. Frameworks are usually set up for the public sector, and bound by EU procurement legislation, but the private sector has adopted some of the approaches.

The Fusion21/Procurement for Housing retrofit procurement framework was developed after some initial research was undertaken. This research identified the key product and installation service requirements for the delivery of retrofit to social housing. The products were selected on the basis of three key reviews.

- Technical Review – this looked at the range of products available to the retrofit market and identified those that were most effective and were relevant given the specific stock within the UK housing sector.
- Commercial Review – this identified products that had an effective business case, i.e. were cost effective and likely to be demanded by the client base. This also addressed issues such as insurances and warranties that may be available.
- Policy/Funding Review – this identified the policy landscape, with specific reference to funding and support form the government. Policy instruments such as the Feed in Tariff or the Green Deal, which has a list of allowable products, would provide additional funding to support any investment directly made by the Social Landlord, therefore making those products more attractive.

The product streams that have been selected are,

- Group 1 – Insulation for lofts, cavity walls, and solid walls (internal and external applications), airtightness and MVHR/HRRV
- Group 2 – Photovoltaics, Solar water heating, voltage optimisation
- Group 3 – Air source and ground source heat pumps, gas flue heat recovery.

Detailed Objectives

- The goal of the procurement framework is to generate income for Fusion21. By selling products and services through the framework, a management fee is earned on each transaction. The profits are re-invested in the socially oriented activities of Fusion21.
- For the partner organisations using the procurement framework, costs are reduced through bulk purchasing and supply chain management and research and development involved in identifying new products and supply chains is optimised; the 'learn once, share with many' approach.
- The development of on-going relationships through the framework should drive quality and continuous improvement. However, the frameworks are at an early stage and these issues have not yet become fully visible.

Type of Innovation

This innovation can be viewed as a process innovation. It takes a process that has been applied in another context, that of Decent Homes, and re-applies it to a new range of products and services. It can be viewed as an incremental innovation, in that it is the development of existing knowledge in a new context.

5.5 Innovation A – Stock Analysis and Performance Measuring

Prior to the purchasing of products through the procurement framework, it is important to establish the right product offer given a specific housing stock and strategic objectives. This requires the identification of the nature of the built form and an understanding of performance, as well as the projected performance after the sustainable retrofit has been undertaken. The tool under development has two key roles;

- Analysis of stock to identify correct product selection choices i.e. built form, or potential occupant requirements.
- Performance modelling pre and post retrofit.

The development of this innovation has been complex, with a number of options being investigated. The UK has a number of building assessment approaches that identify the built form and calculate energy use for domestic stock. The Standard Assessment Procedure (SAP) is a detailed model to identify built form, systems and environmental conditions, that is used to evaluate buildings. This is considered reasonably robust. However, the standard model for assessing much of the UK's housing stock is the Energy Performance Certificate (EPC), which uses a reduced data version of SAP, called rdSAP (HM Government 2013). The EPC also includes recommendations for retrofit upgrades that might improve the performance

of the property. The view of the Fusion21 team is that the EPC approach created two main problems; the first is that it was not sophisticated enough to be an accurate predictor of energy use (Wetherall and Hawkes 2011), and secondly, that it did not identify the correct factors to properly select products for making the most effective improvements.

In terms of the performance assessment element of the innovation, a number of assessment approaches have been investigated, including dynamic thermal modelling and a number of commercial products related to the full SAP approach. The final decision has yet to be made, but it is felt that an industry standard approach will be required. From an innovation context, this is important, as the development of tools, especially those that create new metrics, can be a complex exercise when a specific approach is entrenched within the client base. Any new approach in the measurement and modelling of performance has been rejected on this basis. The Government has recognised this issue and has commissioned work on a revised and improved EPC that should take some of these factors into account, but as yet no details are available on its composition. It may be that this revised tool is suitable for the standard approach, and using it would maintain consistency with the likely major future funding model.

The product selection approach has been more innovative. The common approach in the UK has been to select archetypes and pick a standard package of parts that might work for a specific product family. However, this will generally be reviewed at a detailed survey stage, when the assumptions embedded within the archetype are found to be inaccurate, leading to different product selection options. The view taken was that rather than look at the properties, the products should be considered as a starting point. This has led to the development of a rule-based approach that identifies property factors that either lead to a product being rejected, or highlighted as carrying a degree of risk. For example, for solar thermal and photovoltaic panels, understanding the size and orientation of the roof will immediately determine whether they are viable. Then issues such as overshadowing may be considered. Another example may be Solid Wall Insulation, which requires an understanding of flood risk, exposure and built elements, which will lead to the discounting of some products. The approach is an attempt to capture “cognitive rules”, which are still in development in the emerging retrofit market. Cognitive rules may be viewed as a shared understanding of the way things are done. An example might be where thermostats are located. While the knowledge may exist, it is not always well distributed or, currently, formally captured in processes and decision-making.

Some of these issues may be picked up in the traditional surveying approaches, but some are not. Some questions may be answered through the use of desk-based tools, such as the Environment Agency’s flooding database and Google Maps and Streetview, mitigating the need for site visits for some of the major product selection choices. By asking the questions in a hierarchy the required data is reduced and a package can be developed with a follow-up survey designed specifically around the products that are viable for the property on current known

information. This does not remove the need for a site survey, but much of the decision-making can be made, focusing the survey on specific issues.

Detailed Objectives

- An effective performance measurement tool that will be able to establish the change in performance of the property, which may be established in terms of SAP rating, energy use or carbon emissions when a specific package is applied.
- A stock assessment tool that will ensure the correct product selection and minimise the costs of data collection and survey.

Type of Innovation

This is a process innovation supported by information technology tools. It is built on existing knowledge, so should be viewed as incremental, with advances being made in the survey data being collected so that it may more effectively integrate with the production process, through the selection of building appropriate solutions from a more complex range of retrofit options.

5.6 Innovation B – Technical/Commercial Assessment

The decision for a social housing provider to undertake sustainable retrofit of its properties must make commercial sense. There are a number of factors that will determine whether the technical options may be viable. These may be internally determined by strategic objectives, budgets, and existing asset management strategies. Additionally, there may be a number of external drivers such, grant funding, policy drivers and regulatory frameworks.

The goal of this innovation was to build a functional knowledge base against which a number of viable technical options may be tested. During the period of development the external environments for social housing providers have been turbulent, with a commensurate knock-on effect for internal decision-making.

There have been changes in the regulatory framework for social housing providers as a whole. There have been changes in the bodies that regulate them and emerging changes in strategy for the new bodies. There have been changes in approach to funding social housing residents through reductions in social security benefits for the unemployed. All of these factors create pressure on the decision-making process.

In terms of the grant regime specifically related to the funding of sustainable retrofit, there is currently a position of closing out of old programmes and the emergence of new programmes, many of which are still under consultation at the time of writing.

5.7 Old Programmes

- Community Energy Savings Programme (CESP) – a programme funded through energy companies to support large-scale retrofit in deprived areas, particularly those at risk of fuel poverty.
- Carbon Emissions Reduction Tariff (CERT) – a more general programme focused at retrofit for the wider population.

5.8 Programmes Post-2012

- Green Deal – the Green Deal is an investment vehicle that allows for sustainable retrofit packages to be funded with the capital and interest repaid through savings on energy bills. This is attached to the property rather than the occupier.
- Energy Company Obligation – this is being developed to replace the CERT and CESP models with a more flexible approach, although still targeted towards the fuel poor and to ‘hard to treat’ properties. It will work in concert with the Green Deal to ‘gap fund’ projects that may not meet the requirement to fully pay back improvements. Like CESP and CERT, this funding will be provided by the energy companies as part of their obligation to reduce carbon emissions (DECC 2011b).
- Feed in Tariff – the FiT is currently in place and is similar to models used in Europe. This makes payment for renewable electricity generated, as well as providing free electricity for occupiers (EST 2013).
- Renewable Heat Incentive – This works in a similar manner to FiT, but is targeted at heat systems such as biomass (DECC 2012).
- Warmfront – a grant based scheme aimed at low-income households looking specifically at heating and insulation, although this will end in 2013. (Warmfront 2011).

The variety of existing and proposed policy instruments influence the cost of retrofit packages for a range of different technologies and target groups. This complexity needs to be addressed through the development of the knowledge base, identifying how additional funding or potential income streams can be used to defray costs of specific options.

The knowledge base also flags issues such as standards, warranties and other commercial risks that may arise for specific technical options. All of these elements form a technical/commercial options appraisal and feed into the business case for a specific package of works.

5.9 Innovation D – Resident Pre-Adoption Tools

Subject to the current consultation on the Green Deal, social housing residents have the option to refuse any upgrades. This makes it essential that residents understand the rationale, process and benefits. Resident engagement is considered an important part of social housing provision with many providers having resident representatives in their governance structures, running focus groups, consultations and using a variety of media to encourage residents to engage in decision-making processes. Resident engagement is considered essential for the success of all the Fusion21 frameworks, as any refusals from residents would impact take up and therefore income levels, as Fusion21 are paid on the basis of volumes ordered through their frameworks.

Some initial research was undertaken to identify what drivers and barriers there are for residents to adopt sustainable retrofit. A survey of 250 residents was undertaken in partnership with the Tenant Advisory Participation Service (TPAS), a social enterprise to support social housing providers in their engagement with residents. This highlighted some of the key issues for pre-adoption;

- A view that, in the context of property upgrades, social housing providers were generally trusted.
- Issues around pre-works consultation, where residents felt that decisions and approaches were pre-determined without their input.
- Where works were perceived to have failed, a narrative would grow around the residents communities, which would make them more resistant to the changes.
- Poor communication around the works process, where some residents in properties known to have works done, did not know that it had been carried out.
- Lack of clarity around the benefits of energy upgrades for the residents.

The goal of the innovation was to build a process that could be adopted for a variety of social housing providers, as well as recognising the differing nature of some of the residents. This identified a staged process containing a number of specific tools that could be applied to develop a best practice approach to dealing with resident issues pre-adoption. Examples of this include;

- A self-assessment for social housing providers. This is designed to understand the existing infrastructures social housing providers have in terms of resident engagement. It was identified that some providers may not currently have the capability to deliver more sophisticated approaches and, therefore, should have only use those interventions that matched or slightly stretched their current capabilities.
- Training and support for social housing providers and resident groups. In a bid to improve approaches, training was identified as a good way of im-

proving delivery for both social housing providers and residents who are already engaged.

- Consultation and engagement tools. A best practice study has been undertaken to identify those tools that are used by social housing providers successfully and capture these within a framework. Critical paths are identified where interventions may be reliant on one another to work.
- Performance measurement. High-level key performance indicators will be used to identify the effectiveness of particular approaches. These will include adoption rates, by percentage and resident satisfaction levels with regards to the quality of engagement and consultation.

Type of Innovation

This innovation is incremental based on two key areas of work; resident engagement work with regards to property improvement programmes, and the more complex area of energy values, attitudes and habits. Capturing a number of interventions into a framework, with dependencies mapped out, allows an individual social housing provider to develop a bespoke process based on existing successful approaches.

This innovation is planned. The approach has been developed on the basis of research work carried out with residents and social housing providers, capturing critical success factors and recognising reasons for failure of individual interventions.

5.10 Innovation E – Resident Focused Delivery Process

Many of the issues identified in the TPAS survey, as well as work undertaken by Ipsos-MORI for the UK Government, 'The Big Energy Shift' (2009), identified that the installation process has a number of blockers that may mean that residents may not undertake works. These may be generic issues such as disruption, or technology specific such as access to loft spaces for insulation. In addition, poorly co-ordinated and delivered installation processes will impact on the adoption decisions of other residents within the community.

As with the pre-adoption toolkit, the Resident Focused Delivery Toolkit takes a process approach. It identifies a step-by-step approach given a number of factors, such as technology options selected, resident needs, contractor skills, and social housing provider skills. It has identified a number of key risks and looks to implement interventions that overcome some of the common barriers. Some of the key approaches highlighted are;

- **Review of installation process to minimise disruption to residents.** This may include specific issues such as loft clearing, or more generic issues, such as leaving the site clean and tidy, or provision of alternative spaces or accommodation while work is being undertaken. Many of these

issues have been addressed in the Decent Homes programme and the learning has been captured.

- **Effective communication with residents.** These processes are concerned with managing expectations; letting the residents clearly know the process and understanding if they have any specific needs that should be addressed. This includes making them aware when works are being carried out, clearly sticking to times and ensuring that contractors are trained to deal with residents in the front line.
- **Training and quality assurance.** Both contractors and social housing providers will require formal processes that they can communicate to residents to enable them to know what to expect. It is important that these are adhered to ensure that expectations are effectively managed. This may require consistency over a number of organisations and will require training for both the contractors and social housing provider resident liaison teams.
- **Performance measurement.** As with pre-adoption, it is important that the resident experience with the installation process is evaluated to ensure that quality thresholds are met, identify the need for any remedial action to be undertaken.

Type of Innovation

This innovation is incremental, based on existing knowledge brought into a new context. It is process oriented and part of the planned retrofit process.

5.11 Innovation E – Resident In-Use Support

Much of the work around in-use support is an extension of some work currently done, with varying degrees of success, to support residents in their effective use of new technology and energy generally. The need for this has been driven by the emerging evidence that some technologies require a considerable change in patterns and approaches to energy use to be effective, such as new controls or new ways of making energy consumption decisions, when compared with existing options.

While this does not directly impact take up of technology, it is recognised that ineffective delivery, even if driven by poor consumer understanding will create two key issues. The first is that the outcome of the work will not achieve its intended improvement, potentially leading to higher energy bills and carbon emissions, or at least lower savings than predicted. The second is that poor delivery will create “stories” within communities that could lead to reduced adoption by other consumers. Supporting residents well after installation is an important element of closing the loop with residents.

Social housing providers often acknowledge that they have not been effective in providing on-going support, to residents and/or to building managers, after the

installation of new technology, or in monitoring the effect that the technology has had compared to a pre-installation baseline. This is now being addressed either by the providers themselves, who are prioritising resource for ongoing support and monitoring, or through funding requirements, such as from the Technology Strategy Board or European Regional Development Fund, where post-installation monitoring is usually part of the funding conditions.

This resident in-use support process is part of the wider resident support toolkit. This approach is made up of three key elements;

- Generic energy use support, which will be applicable to a large number of residents.
- Technology specific resident support, providing guidance that reflects the retrofit package that has been installed.
- Resident specific element that recognise the differing needs of resident groups such as the disabled, elderly or ethnic groups, who may need information and support tailoring in a specific way.

5.12 Driver/Enablers

There are a number of enablers/drivers that have led to the development of this innovation grouping.

External Factors

The following external, or landscape, factors have been identified as driving the development of the innovation;

- The various policies are a demonstrable driver for all of the innovations under the ApRemodel cases studies. There is a recognised need to upgrade the housing stock and policy initiatives such as the Feed in Tariff, Energy Company Obligation, and Green Deal provide strong drivers.
- The structural advantages within the social housing sector have made it an ideal test-bed for the market making activity that the UK Government requires for the wider private rented and owner-occupier markets.
- Social housing organisations, as social enterprises, are generally more inclined to share information. The sustainable retrofit problem has given rise to a number of demonstration projects and knowledge networks that have allowed effective knowledge sharing.
- Price increases in energy has driven more low income families into Fuel Poverty, creating a further policy driver for sustainable retrofit, in a bid to reduce low income households fuel bills.

Internal Factors

The following organisational factors have been identified as supporting the development of the innovation;

- Fusion21 has an existing skill set based around procurement and supporting social activities that fit well into the new market of sustainable retrofit. It has existing tools, which when updated, can deliver services to its existing client base.
- Fusion21 can be viewed as early adopters in terms of the development of knowledge and related processes. Many social housing providers do not have the capacity to develop new knowledge in this area, placing Fusion21 in a good position to offer support.
- Fusion21 have an existing brand within the social housing market. The move towards sustainable retrofit fits within an existing business model with which Fusion21's clients are familiar, meaning this brand can be carried across to the new market. Additionally, Fusion21's social orientation can be viewed as having more appeal to the social housing sector than more traditional commercial consultancy offers.
- Fusion21 has a culture of investment in research and innovation. It has previously undertaken work with Universities through the Knowledge Transfer Partnership programme, so is well placed to use this model to address a new problem.
- As an externally facing organisation, Fusion21 is engaged with a wide variety of communities of practice. These communities have been augmented by Fusion21's own activities to build knowledge sharing groups around technical, commercial and resident issues. It can be viewed as an outward facing organisation that shares knowledge. These types of organisation are generally better connected to groups and have a wider pool of knowledge available to them.

5.13 Barriers

External Factors

- Policy is uncertain at the moment. New policy initiatives, such as the Green Deal and Energy Company Obligation, are still in development. It is not clear whether their detail will support or impede the business model that Fusion21 are developing. This represents a considerable risk factor.
- The current state of the economy, highlighted by the social housing providers in the national questionnaire undertaken by Fusion21 and the University of Salford, is a major issue for the liquidity of some providers in terms of insti-

tutional lending. This could make sustainable retrofit programmes receive less prioritisation.

- The economic situation has also led to changes within the housing benefit regime, which will have an implication for the payments received by some social housing providers. This also impacts the financial position of social housing providers when determining potential investments into sustainable retrofit.

Internal Factors

- The sustainable retrofit market represents a risk for Fusion21. There has been a high level of investment in developing the required new knowledge, and external factors are uncertain. This said, there is still a high level of current engagement with the market, but external forces, such as policy changes, represent a risk to the business stream.
- This is a new business stream, with a high level of new knowledge to disseminate within the business to ensure it is effectively delivered. This requires a considerable investment of time to ensure the new stream links with the existing offer and all relevant staff understands both the offer and potential risks.
- Sustainable retrofit itself is a far more complex offer than Fusion21's traditional business streams, particularly Decent Homes. This means that external supply chain partners, who will deliver the works, will need to be properly engaged to ensure work is correctly scoped and delivered.

5.14 Measures of Success

Metrics are currently under development. Fusion21 have wider objectives than the profit motive and are also looking to capture value to the client. Initial measures under discussion are;

- Volume of business through the framework
- Savings to social housing providers
- % of target residents adopting sustainable retrofit
- Client satisfaction – residents and housing providers, this will include an analysis of the consultation, delivery and in-use phases
- Energy savings
- Carbon savings
- % Local supply chain
- Level of skills training provided

- Jobs created
- Community benefits.

5.15 Lessons Learned

- The main issue to which Fusion21 have had to respond is the holistic and complex nature of the problem domain of sustainable retrofit. The policy, process, people and technology issues interlink and, as such, require a co-ordinated response that addresses all of these factors. Fusion21 has wide parameters for success, not just the number of installations. This means that they have had to understand a wide range of factors that will potentially drive or block success and build a process that can effectively deliver these objectives. The technical issues are more complex, with greater risk of failure driven by poor specification or installation, and these can be further exacerbated by the failure to effectively support delivery teams and end users. It should be noted that this approach is common across all of the detailed case studies.
- There are a number of existing standards used within the sustainable retrofit market. Measurement processes such as SAP, or standards such as the Microgeneration Certification Scheme to address quality of installation are embedded. They represent areas where any development by Fusion21 will have to accept the current dominant approach, even if it is not viewed as the best technical approach for the delivery of retrofit.
- Policy represents a huge risk in this area. The UK is in a current state of policy transition, moving from CERT and CESP, to the more radical Green Deal and Energy Company Obligation. This will lead to the development of new policy frameworks, which are as yet uncertain. Policy can be seen to have a strong influence on any potential business case, as well as influencing the future shape of process, and potentially, product innovations.
- Retrofit at scale is a different type of problem from the technical solutions that are offered up as a demonstration project. There are wider issues that need to be addressed and it is still an emerging market. Fusion21 are attempting to develop knowledge that moves the market from a technical/consultancy model to a larger scale market for the social housing sector.
- Engagement with external stakeholders, both formally and informally, has been an essential element of the development of the innovations. Links with policy makers, professional networks, residents, academia, product suppliers and installers has been required in order to build a model that can encapsulate the potential roles of a wide number of stakeholders. Understanding the current latest thinking, as well as recognition of stakeholder needs has been an essential element of building the innovation complex.

6. FutureFit, Affinity Sutton

6.1 Abstract

Affinity Sutton is a leading national registered social housing provider managing 56,000 homes. FutureFit is their £1.2m internally funded two-year initiative to sustainably retrofit 102 of Affinity Sutton's 56,000 homes (Affinity Sutton 2011a, 2011b, 2012). 3 packages of works have been developed based on 22 property archetypes within Affinity Sutton's stock. The project is designed to test the costs and benefits of three packages across two distinct phases; works and installation. These phases will continue until summer 2011 and will be followed by a monitoring and evaluation phase. The three energy efficiency works packages are low (£6,500), medium (£10,000) and high (£25,000). The 22 property archetypes represent 75% of English housing stock, based on the English Housing Survey, a bi-annual survey of the English Housing Stock, its residents and condition (CLG 2009).

The second phase of the project assesses the impact of the retrofit work on energy use, as well as the reduced energy consumption associated with advice and support for residents.

This is the first project that has been initiated within the housing sector itself to research every aspect of the low carbon challenge including large-scale retrofit, finance, working with existing contractors, skills and supply chains, and engaging residents in the retrofit agenda.

6.2 Problem and Need

The UK is committed to reducing its CO₂ emissions by 80% by 2050, with an interim target of 34% by 2020 (HM Government 2008). Approximately 70% of homes that will exist in 2050 have already been built, and the sustainable retrofit of these homes, to reduce energy used by their occupants, will have a significant impact on the target. The previous government indicated that social landlords would be expected to deliver low carbon upgrades to their stock to contribute to meeting the legally binding CO₂ reduction targets. However, high volume retrofit, such as that needed for social rented stock owned by registered housing providers and occupied by renting residents, is untested at a scale that makes it both cost-effective

and delivers optimum carbon reduction. Although there are limited numbers of exemplar sustainable retrofit projects to single or small numbers of dwellings, these are often at high cost, externally funded and aiming to reach an 80% CO₂ reduction. An example of this is the Retrofit for the Future Programme (TSB 2011). There is no comprehensive assessment of the potential obstacles to the practical volume delivery of retrofit works at a reasonable cost. Additionally, there are few studies of an appropriate informed suite of retrofit solutions or of the carbon savings associated with this work. A key aspect of the project reflects the practical nature of sustainable retrofit in occupied homes, where just 5 of the 102 properties were void during works.

6.3 Decision-Making Process

The Director of Property Investment generated the original concept with the Group Environmental Sustainability Manager, in response to a call for internally funded project bids. The goal was to scope the practical realities of potential sustainable retrofit approaches in the absence of any other similar projects currently taking place at this scale.

6.4 Desired Outcomes

The FutureFit project has four aims:

- Understanding the practical implications of the delivery of large-scale sustainable retrofit
- Identifying actual costs and energy savings through robust monitoring and evaluation
- Developing best practice and guidance on the delivery and funding of carbon reduction in existing homes
- Engaging residents and stakeholders in the design, evaluation and prioritisation of retrofit packages.

These outcomes will inform retrofit across Affinity Sutton's stock, enabling evidence-based, integrated decisions on process, cost, impact and benefit for the business, partners, and the sector.

6.5 About the Partners/Stakeholders

FutureFit involves a number of organisations that contribute specific skills and knowledge to the project. Representatives from partners have been involved from the early stages.

Affinity Sutton is one of the 10 largest national registered housing providers, with 1,500 staff managing 56,000 homes for 161,000 residents in more than 120 local authority areas. It traces its philanthropic history back to 1900.

Baily Garner are the advisory consultant and have been a key project partner, with early involvement and a place on the FutureFit Project Board. Baily Garner generated a number of the main elements supporting effective project delivery.

- Adaptation of the Standard Assessment Procedure (SAP) as a surveying tool to establish the energy efficiency of the properties and inform a modelling tool for the three packages.
- Development of the Cost model for the three works packages.
- Development of the Works selector flowchart, providing a 15-step process to support the selection and costing of appropriate retrofit work for each property.
- Working closely with surveyors and contractors to provide tailored training and increase knowledge levels and understanding of key issues.
- Development of the stakeholder design workshop as an innovative way of engaging staff, residents and contractors in the design of retrofit works in void properties.

The four partner contractors undertaking the works were Apollo, Community Building Services Ltd (CBS, part of Affinity Sutton), Keepmoat and Rydon, who worked with Bailey Garner to find solutions to make the works as efficient as possible. All the contractors' teams included Resident Liaison Officers (RLOs) who act as the interface between the residents and the contractors. The RLO model is common for contractors undertaking large-scale social housing projects.

Camco and Fontenergy provided the financial modelling and additional archetype analysis. Camco and the Energy Saving Trust were involved in the monitoring of the installation phase addressing the practical limitations of sustainable retrofit, actual costs, potential supply issues and the residents' experience.

- Camco are a developer of low carbon energy and construction projects. They also provide advice on energy and emissions reduction in the UK, including UK Government (Department of Energy and Climate Change). For FutureFit, Camco set up post-works monitoring to calculate payback savings in economic and CO₂ value.
- The Energy Saving Trust (EST) is the UK's leading impartial organisation helping people to save energy and reduce carbon emissions. It is part-funded by government and provides national reports and advice for consumers. For FutureFit, the EST provided a technical appraisal, supplemented with a comparison of predicted and actual costs incurred, to identify hidden costs and to identify opportunities for cost reduction where scaling up to the rest of Affinity Sutton's housing stock.

- Fontenergy provides expertise, tools, and products to generate and deliver low carbon energy projects. For FutureFit, Fontenergy will help to evaluate potential finance mechanisms to fund major refurbishment of its housing stock, examining the typical technical and commercial solutions required to prepare the ground for investment into clean energy and energy efficient building.

The second project phase monitors energy and cost savings for the 102 retrofitted homes. A baseline comparison is provided by a number of Affinity Sutton homes that have had no works. The impact of lifestyle advice will also be monitored through FutureFit Living, which involves half the 102 homes that have had the works, along with a further group who will just receive advice. Monitoring is carried out in partnership with Parity Projects.

- Parity Projects provide independent retrofit advice and services. For FutureFit, they will collate and analyse data transmitted from monitoring equipment (including temperature gauges, gas meters, electricity meters and data loggers) in all retrofitted and Living Homes properties to form the central part of the final report due to be completed in summer/autumn 2012.

In addition, the FutureFit project has been approved as a Housing Forum demonstration project. The Housing Forum is a national network of leaders and their supply chains from all sectors in housing development and construction. Its demonstration projects **highlight learning and good practice throughout the sector**. FutureFit has established a best practice sharing mechanism between the partners, as well as a Key Performance Indicator process to support continuous improvement.

6.6 Pre-Project Activity

The key pre-project activity focussed on the rationalisation of Affinity Sutton's stock database as preparation for its use in generating property archetypes and identifying potential properties for the FutureFit project. This included the co-ordination of reference photographs with addresses and gap-filling with images from Google Street View, and the identification and correction of minor postcode inconsistencies.

Having identified specific properties across the regions, local housing management teams were involved to check for rental arrears, potential Anti Social Behaviour risks and other tenancy management issues that many have compromised work on individual homes.

6.7 Resources

FutureFit has been set up as a discrete project with a full-time project manager within Affinity Sutton, working with existing staff to investigate and assess capacity and skills, and with existing supply chains to carry out works.

The £1.2m investment in FutureFit is internally funded and the project works had to be completed within the 2010–2011 financial year (i.e. by the end of March 2011). This target was achieved.

6.8 Other Contextual Issues

The FutureFit project dovetails with many of Affinity Sutton's corporate objectives, as follows.

- Improving services to customers – FutureFit improves customers' quality of living;
- Increasing influence – FutureFit generates an action plan for environmental investment within the sector based on real evidence;
- Going for growth – FutureFit works with partners to investigate the application of new technologies and processes in renewable markets;
- Financial strength – FutureFit generates financial models for stock management and the funding of retrofit.

Within the broader social housing context, it is possible that CO₂ emissions from housing stock will be regulated in the future, and FutureFit provides knowledge, expertise and tools as a basis for this, both for Affinity Sutton and the wider social housing sector.

6.9 Innovation Complex Map and Key

The FutureFit project itself is recognised as innovative because its aims and objectives address a previously untested area of the retrofit agenda for social housing stock. Using this as an overarching framework for the case study, a series of associated innovations are identified.

The innovation complex for FutureFit, Figure 16, is characterised as linear rather than networked. This model reflects the dynamic process of the project through its two key phases and associated stages, and reflects the evolving external landscape of government policy with, for example, the development of the Green Deal and associated mechanisms (e.g. ECO, FIT); the growth of retrofit technologies and techniques and their markets.

The starting point for the Innovation Complex Map is the development of 22 archetypes, followed by the development of three works packages and the engagement of residents and stakeholders, and summarised in the capture of knowledge.

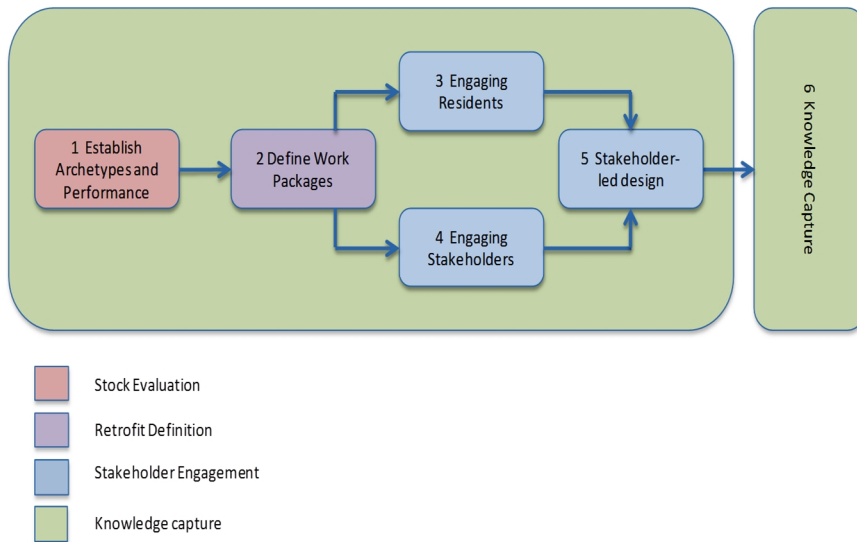


Figure 16. FutureFit Delivery Process.

6.10 Core Innovation

As was identified in the Stage 1 Report, it is often a complex process to identify a single innovation. FutureFit is a planned group of innovations, which adapt existing processes to suit a new problem. FutureFit has elements of a large-scale “first run study”, as might be applied in a lean construction approach. The process contains a number of planned, specifically developed process elements to deliver the goal of creating a robust evidence base for Affinity Sutton, with a view to large scale sustainable retrofit roll-out.

6.10.1 Innovation A – Establish Archetypes and Performance

The FutureFit project based its property selection for retrofit work on physical features and aspects of the properties, rather than on energy use and characteristics, as these are factors that determine potential retrofit options. This approach reflects a traditional asset management model by looking at the housing stock in terms of representative property types and locations.

Property archotyping was developed in conjunction with Baily Garner, using information on directly managed general needs housing from the stock database. Eight criteria were used based on four property aspects; built form (mid/end terrace); wall construction (cavity/solid/system-built timber frame); age (bandings between 1900 and 2002) and property type (flat/house/maisonette). This originally generated 151 archetype groups, refined by 5 further criteria to 20 and delivering a list of potential properties for the project. Further work with Camco and Fontenergy

increased this number to 22 so that the archetypes were even more representative of Affinity Sutton's stock.

The resulting 22 archetypes represent 75% of housing stock based on the English House Condition Survey (CLG 2009).

The goal for the selection of 22 property archetypes was to define a representative sample of Affinity Sutton stock to provide a detailed basis by which to establish sustainable retrofit packages. This has proved a complex process for a number of organisations in establishing potential sustainable retrofit options as, at a detailed level, it can become increasingly complex to ensure that retrofit options will be ideal for a specific house type.

The establishment of archetypes is an incremental innovation, a small progression from the traditional asset management process with a view to addressing energy rather than a simple responsive repair and maintenance issues commonly undertaken by asset managers.

Having identified archetypes, the properties selected were surveyed using the full SAP system, normally used for new build housing. RdSAP, the energy assessment tool for existing homes, did not capture or analyse enough information to meet FutureFit's project aims. Extended SAP, for example, includes diagrams showing the location of the cylinder and boiler to decide whether insulation of the pipe work or replacement of the cylinder were appropriate measures.

SAP data was collected at a selection of properties, using a traditional surveying format that formed the basis of three target packages for each archetype. Extended surveys were completed for all properties, using a 16-page adapted workbook as the basis for SAP calculations.

The goal for this co-ordinated nationwide approach for all selected properties was a consistent baseline survey generating data for SAP calculations to inform the design of works packages and for assessing the success of these by re-measuring SAP after installation.

This approach takes existing models and extends them to address the specific challenges of FutureFit. Using more detailed approaches to both archetype definition and energy performance modelling are incremental in nature, but they reflect an advance on the current practice within many conventional retrofit projects in the social housing sector.

6.10.2 Innovation B – Definition of Sustainable Retrofit Packages

Three potential energy works packages were developed in conjunction with Bailly Garner around alternative cost models of £6,500, £10,000 and £25,000. At least one low and one medium package were specified per archetype, with high packages applied where suitable. Due to practical limitations with the properties and the high cost of further SAP improvements to supplement work previously carried out, it was not possible to implement medium works packages in 4 of the archetypes. The cost element was developed to identify and record the actual cost of energy savings, both financial and energy-based, to illustrate potential future funding

options. The model allows for scaling-up of results across stock and for modelling different scenarios, such as the impact of Greening the Grid and of increasing energy costs. The model was created in consultation with Affinity Sutton's finance team and has the capacity to connect to business planning.

The hierarchy of work within the packages starts with improvements to building fabric, followed by services, technologies such as panels, pumps and Mechanical Ventilation and Heat Recovery, and including an assessment of revised SAP ratings. Initially, there was a uniform approach to the development of a package for each home, but this was adapted on site as all homes and residents are different. The three costs came to represent ceilings or approximations, where slightly more investment would generate considerable additional benefit, or alternatively that a lower investment delivered perfectly acceptable comfort and savings for residents. The cost model element enables automatic calculations to show the impact of adding or removing certain measures to a specific property in terms of CO₂ saved, fuel bill saving and SAP point improvement.

The goal for this approach was twofold: to generate a link between the property information and the potential sustainability improvements, and to use this to summarise a costed works schedule for the contractor.

6.10.3 Innovation C – Engaging Residents

Although Affinity Sutton has a comprehensive resident engagement programme, the FutureFit project needed to engage residents across the property archetypes to sign up for the work and to participate in on-going monitoring and behaviour change activities. As FutureFit project is property-led, i.e. selection for inclusion is based on the physical characteristics of the property, rather than resident-led, there was no opportunity for residents to “self-select” or register interest in advance of property selection. Neither were there any incentives offered for their participation.

800 preliminary invitations were sent to residents outlining the opportunity to have their homes retrofitted as part of an eco-project, based primarily on the benefits of increased comfort from improved warmth (rather than on saving money from reduced bills as this could not be guaranteed). Letters were followed up with 294 phone calls, from which 45% agreed and 52% said no.

The FutureFit project manager, Affinity Sutton and contractor RLOs (Resident Liaison Officers) carried out an on-going engagement programme before, during and after the work on the processes and benefits of the work. This included a formal pre-works home visit to outline the commitments for both the resident and the contractors in the form of a Code of Conduct, to list the energy upgrade works and to gain consent for access to past energy bills. The project works were summarised for each resident in terms of energy savings “equivalent energy to make a number of cups of tea per annum”.

Residents were not decanted during the works because of the addition of cost, time and complexity at the scale implied for mass retrofit. The FutureFit rationale was based on the assumption not to decant and to work with residents in situ.

Detailed work schedules were provided for residents, and practical help, including the movement and replacement of furniture and possessions as necessary.

During works installation, resident satisfaction with the process was monitored through the use of log books and diaries for each property kept by residents, contractors, RLOs and staff.

Following works completion, the properties that Rydon worked on received their resident manual, explaining the work, technologies and features for each home. The usual defects period for works applies to all installations and these are also included in Affinity Sutton's normal responsive repairs process and cyclical maintenance schedule as appropriate.

On-going engagement is only provided for the FutureFit Living homes, to ensure that the process of just installing retrofit works can be accurately tested.

The research model, predicated on the selection of properties for retrofit rather than on resident interest in volunteering their homes, meant that resident engagement was crucial to the success of the FutureFit project at the scale needed to test the financial packages across the property archetypes. Thus innovative, proactive and on-going engagement is assessed as an innovation for FutureFit with the aim of signing up residents and then keeping them "on board" for Phase 1 and Phase 2 (works and monitoring).

6.10.4 Innovation D – Engaging Stakeholders

The FutureFit project recognises that retrofit engagement expands beyond residents to other stakeholders, specifically organisation staff and contractors.

The engagement of existing staff in the FutureFit project was crucial to its success across a range of business functions including those in resident engagement and other resident-facing roles, asset management and the repairs teams. The retrofit agenda presents a new knowledge set for Affinity Sutton and the project enabled the business to identify and address uncertainties around changes to processes, job functions and remits supported by modelling and staff training and awareness initiatives. This included recognition that the overt message and underlying business philosophy for residents from staff on energy use at home is new and needs a consistent set of messages, tools and methods.

FutureFit workshops were arranged for staff and invited contractors by Baily Garner using photographs and floorplans to model works packages and potential improvements in energy use. Additionally, the Energy Savings Trust (EST) held workshops on achieving and testing air tightness as part of the installation phase aimed predominantly at contractors, although staff were also invited.

The FutureFit project includes an on-line Knowledge Hub to store and share project information. This provides information to address the knowledge gap for sector stakeholders and its associated interactive forum continues to host relevant debate using social media, including a monthly online discussion on topics including resident lifestyle, monitoring and evaluation and resident incentives. The

Knowledge Hub has 38 active members including staff members and 11 contractors and consultants directly involved with the FutureFit project.

The goal for this approach was to engage a range of stakeholders in the FutureFit process as a way of extending awareness, interest and knowledge of the retrofit challenges for the sector.

6.10.5 Innovation E – Stakeholder-Led Design

A key feature of the engagement process was stakeholder-led design, developed to share and test the concept of retrofit and to support an understanding of the issues and processes involved and of the potential outcomes for small groups of staff and residents not directly involved in the FutureFit project, and with no previous interest in or knowledge of retrofit.

Four empty properties around the country were identified and 15 staff and residents (8 to 10 for each property) were invited to day events, including a tour, house diagrams, flashcards to summarise the costs and benefits of each measure, quizzes, and question and answer panels. Stakeholder groups devised sustainable retrofit packages for the properties, with the maximum £25,000 budget available. This was not always utilised since the aim was value for money, using the Baily Garner works and cost models. The packages were installed and fitted by contractors, residents have moved in and their energy use is monitored and reported.

Although this was a small part of the FutureFit project in terms of numbers of people involved, the investment in the properties was significant and positive feedback confirms the success of the engagement mechanism and the generation of interest in the project and the wider retrofit agenda. The issue of adoption and end user acceptance has been identified as a key barrier to adoption of sustainable retrofit in the UK. While there are a number of technical issues that must be addressed in identifying the potential package, allowing residents to engage in the process allowed issues such as usability and aesthetics of the packages to be engaged with by residents.

This type of stakeholder engagement had been used by a number of organisations during the Decent Homes Programmes (DETR 2000), which looked at the upgrades of kitchens, bathrooms and fabric. However, these types of upgrades are generally more familiar to, and welcomed by, residents. Sustainable retrofit presents a more complex problem of understanding and this part of the project not only engaged residents in the process, allowing them to make choices, but also provided an opportunity for knowledge sharing with the FutureFit team.

6.10.6 Innovation F – Knowledge Capture and Sharing

As one of the over-arching aims of the FutureFit project is to develop best practice and guidance on the delivery and funding of carbon reduction in existing homes, the capture and sharing across the sector of the project stages and findings are vital.

The project timeline includes the publication and launch of two reports; the first following the installation of the works in Autumn 2011 and the second and final report in summer 2012, covering actual energy use and fuel bill savings for the residents in properties involved, evaluating the impact of the FutureFit Living (phase 2 of the project giving support and advice to residents on reduction of energy use) and including a project review.

The goal for the sharing of knowledge captured in the reports disseminates information based on the practical experience of large-scale retrofit to the sector. The FutureFit project has generated interest at sector and government levels and its findings will make a valuable contribution to future policy development.

6.11 Driver/Enablers and Barriers

FutureFit has been enabled by a number of factors, as follows.

- The project is entirely self-funded which means that it can be shaped, maintained and adjusted within the organisation. The level of funding to the project indicates a strong level of organisational commitment to FutureFit and the potential learning it might generate.
- Affinity Sutton has good working relationships with existing partners, including the four contractors who carried out the works.
- Affinity Sutton is a forward-thinking organisation that is open to and enthusiastic about innovative ideas and projects.

6.12 Barriers

Three early barriers were identified as part of the Housing Forum demonstration project application.

- Developing the archetype profile to represent a significant proportion of Affinity Sutton's stock was challenging and involved a number of adjustments. These were accommodated in the long planning stage for the project.
- Retrofit is a relatively new and therefore untested area for the organisation and the sector, and the lack of general understanding has been a challenge. This has been addressed in the FutureFit project by open and collaborative working with partners, and regular communication with other sector projects.
- A significant barrier within the emergent retrofit landscape has been a lack of policy certainty at the point the research was being undertaken. This has been addressed with allowances for a variety of policy decisions which adds to the value of the project in, for example, the cost model which in-

cludes the flexibility to model the impact of increased energy costs and the impact of Greening the Grid.

6.13 Measures of Success

Key Quantitative Indicators

Quantitative indicators, as noted in the Housing Forum demonstration project application, include:

- The energy performance of the homes
- The reduction in carbon emissions from the homes
- A developing evidence base of the potential for sustainable retrofit upgrade packages
- A developing evidence base of the effect of behavioural change on energy performance
- Reduction in fuel poverty for residents (a household is defined as being in fuel poverty if it spends more than 10% of its annual income on fuel bills to maintain a satisfactory level of comfort at home)
- A detailed understanding of the costs and the benefits of retrofit
- The development of a robust process that can be scaled up based on the FutureFit pilot study.

Key Qualitative Indicators

Qualitative indicators (i.e. indicators that do not rely primarily on numeric data) include:

- The capacity for retrofit both internally and for supply chain partners
- Resident satisfaction with the retrofit process and retrofit homes.

6.14 Lessons Learned

The lessons for Affinity Sutton, and for the sector, arising from the FutureFit project, impact on the large-scale sustainable retrofit of social housing at two levels. First, the practical delivery of works to residents' homes within budget constraints, and secondly the use of conclusions to inform the refining of the retrofit agenda as it prepares for the Green Deal. Key findings from the Stage 1 report are as follows:

- Initial findings suggest that there is a funding gap of approximately £3,000 per property between the net cost of carrying out the works and the value

of energy savings. This has implications for the Green Deal programme, where funding will be provided the costs can be met by energy savings

- A 'low' £6.5K package achieved only an 18% reduction in carbon emissions – and even with all other potential savings taken into account there is still 26% carbon to be saved by 2050.

Resident engagement will be vital to the success of the Green Deal and require sustained and intensive awareness campaigns. FutureFit's offer of free works resulted in only a 4.8% initial response rate and 23% dropout from sign-up stage to completion of works. Training is required to address a lack of technical skills as a result of a sector being "dumbed down" by the previous decade's focus on the Government's Decent Homes Standard.

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Title	Non-Technical Retrofit Innovations in UK Housing
Author(s)	William Swan & Veijo Nykänen
Abstract	<p>This report is concerned with 5 case studies investigating the adoption of non-technical innovations in the retrofit of UK housing. The study was undertaken as part of the ApRemodel project, which investigated the retrofit of multi-occupancy buildings in the Finnish context. The aim of the study was to identify how UK organisations were addressing the finance and delivery of retrofit, considering non-technical issues such as assessment, process, finance and behavioural aspects of their projects to ensure effective delivery. The 5 case studies, selected from an initial 18 cases, represent UK exemplars of innovative practice in the UK.</p> <p>The UK has identified its existing housing stock as a major opportunity for improvement to help it achieve its energy goals. The UK Government has made a legislative commitment to reduce carbon emissions by 80% by 2050, with housing targeted for even greater reductions. UK housing is predominated by older stock with an estimate that 70% of the properties that will be standing in 2050 are already built. This means that there are many properties that have been built with little or no consideration to their energy consumption. New policies, such as the Green Deal, which looks to fund improvements through energy savings, and the Energy Company Obligation (ECO) have been designed to kick start the market for sustainable retrofit. However, the market is still immature in the UK; lack of supply chains, skills, consumer awareness and an understanding of how retrofit might be delivered at scale all present major issues for the UK. These case studies identify how organisations, chiefly in social housing, which has been identified as a test-bed for sustainable retrofit, address these non-technical issues to ensure that effective adoption and delivery can be addressed.</p> <p>The case studies show that the problem is a socio-technical one. This means that there are technical elements of technology and physical changes to the building, but a more holistic understanding of the problem drives successful delivery. Delivery organisations must be aware not only of the technical choices they make, but also consider issues such as delivery processes, trust and branding, procurement and resident awareness. These cases show us that innovation in sustainable retrofit often required a number of innovations to ensure delivery. Effective delivery processes needed to be aligned with effective procurement, resident engagement and finance models that interlinked to provide a beginning to end process. Lack of attention to any part of this meant that there was a risk of non-delivery.</p> <p>None of the innovations presented here could be viewed as "radical". They were often adaptations of existing solutions, with incremental changes to support the delivery of residential retrofit. The complexity arises in the number of small-scale innovations that have to be combined to ensure a successful beginning-to-end retrofit project.</p> <p>The case studies show that the UK is still in a developmental stage in the delivery of residential sustainable retrofit. The innovations have been designed to mitigate this immaturity or to develop new skills. Dominant solutions have yet to emerge for retrofit at scale; the case studies discussed here show the first steps in moving towards more developed models to meet the challenges of addressing the wider UK housing stock.</p>
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Nimeke	Asuinrakennusten korjaamisen ei-tekniset innovaatiot Iso-Britanniassa
Tekijä(t)	William Swan & Veijo Nykänen
Tiivistelmä	<p>Tämä raportti esittelee viisi tapaustutkimusta ei-teknisten innovaatioiden soveltamisesta Iso-Britannian asuinrakennuskannan perusparannushankkeissa. Tutkimus on osa ApRemodel projektia, jossa tutkittiin ja kehitettiin suomalaisten asuinkerrostalojen uudistavaa korjaamista. Tämän tutkimuksen tavoitteena oli tunnistaa kuinka Iso-Britanniassa eri organisaatiot olivat kehittäneet perusparannushankkeiden rahoitusta, prosesseja ja projektien toteutuksen tehokkuutta. Viisi tapaustutkimusta valittiin 18 vaihtoehdosta esimerkeiksi innovatiivisista käytännöistä Iso-Britanniassa.</p> <p>Iso-Britanniassa vanhan asuinrakennuskannan parantaminen on tunnistettu suureksi mahdollisuudeksi saavuttaa energiavoitteet. Iso-Britannian hallitus on sitoutunut lainsäädännöllä hiilipäästöjen vähentämiseen 80 %:lla vuoteen 2050 mennessä. Asuinrakennuskannalla on jopa tätäkin suuremmat säästöavoitteet. Iso-Britannian asuinrakennuskannassa on arvioitu, että 70 % vuoden 2050 rakennuskannasta on jo nyt rakennettu. Tämä tarkoittaa sitä, että monet asuinkiinteistöt on rakennettu kiinnittämättä huomiota lainkaan tai vain vähäisessä määrin energian kulutukseen. Uudet menettelytavat kuten Green Deal, jotka pyrkivät rahoittamaan parannuksia energiansäästöjen avulla ja energiayritysten sitoumukset (Energy Company Obligation) on suunniteltu kehittämään markkinoille kestäviä perusparannuspalveluita. Markkinat ovat kuitenkin kehittymättömät Iso-Britanniassa; puuttuu toimitusketjuja, osaamista, kuluttajien tietoisuutta ja ymmärrystä siitä, kuinka perusparannushankkeita tulisi toteuttaa vastamaan nykyisiin korjaustarpeisiin ja niiden skaalaan. Näissä tapaustutkimuksissa esitellään sitä, miten organisaatiot toimivat, pääasiassa tuetussa vuokratilakannassa, jonka on tunnistettu olevan testauspaikka kestäväälle perusparantamiselle liittyen ei-teknisten innovaatioiden tehokkaaseen soveltamiseen ja toteutukseen.</p> <p>Tapaustutkimus osoittaa, että ongelma on luonteeltaan sosiotekninen. Tämä tarkoittaa sitä, että tarvitaan teknisiä osatekijöitä ja rakennusten fysikaalisia muutoksia, mutta parempi kokonaisvaltainen ongelman ymmärrys johtaa onnistuneeseen toteutukseen. Korjausrakentamisosanisaatioiden täytyy tiedostaa ei vain tarpeellisia teknisiä valintoja, vaan myös korjausprosessiä, luottamusta, brändäystä, hankintoja ja asukkaiden tietoisuutta. Nämä tapaukset esittelevät meille, että kestävät innovaatiot perusparantamisessa edellyttävät yleensä useita innovaatioita. Tehokkaat korjaamisen toteutusprosessit tarvitsevat tehokasta hankintaa, asukkaiden osallistumista ja rahoitusmalleja, jotka on kytketty hankkeiden loppuprosesseihin. Jos koko prosessin mihin tahansa osaan ei kiinnitetä huomiota, riskinä on heikko lopputulos. Mitään esitellyistä innovaatioista ei voida pitää "radikaalina". Ne ovat usein omaksuttu käytössä olleista ratkaisuista, joihin on tehty muutoksia tukemaan asuinrakennusten perusparantamista. Kompleksisuus syntyy useista pienistä innovaatioista, joita on yhdistetty varmistamaan onnistunut perusparannushanke alusta loppuun.</p> <p>Tapaustutkimukset osoittavat, että Iso-Britannia on yhä kehitysvaiheessa kestävässä asuinrakennusten perusparantamisessa. Innovaatioita on suunniteltu vähentämään osaamattomuutta tai kehittämään uutta osaamista. Päätökset on saatava vielä lisää perusparantamiseen; esitellyt tapaustutkimukset esittelevät ensimmäisiä askelia kohden kehittyneempiä malleja, joilla voidaan vastata Iso-Britannian asuinrakennuskannan perusparannustarpeisiin.</p>
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