

Delivering and Funding Housing Retrofit: A Review of Community Models



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The report content is the view of the authors and does not necessarily represent the views of Arup or the Institute for Sustainability.

Research Partners

Arup

Arup is the creative force at the heart of many of the world's most prominent projects in the built environment. We offer a broad range of professional services that combine to make a real difference to our clients and the communities in which we work.

We are truly global. From 90 offices in 35 countries our 10,000 planners, designers, engineers and consultants deliver innovative projects across the world with creativity and passion.

Founded in 1946 with an enduring set of values, our unique trust ownership fosters a distinctive culture and an intellectual independence that encourages collaborative working. This is reflected in everything we do, allowing us to develop meaningful ideas, help shape agendas and deliver results that frequently surpass the expectations of our clients. The people at Arup are driven to find a better way and to deliver better solutions for our clients. We shape a better world.

Arup has long been a designer and promoter of energy efficient buildings and infrastructure; the firm has also served as a strategic advisor to cities, public agencies, non-governmental organisations and funds on establishing energy efficiency programmes. Arup's own investigation into how to upgrade the physical infrastructure, and energy efficiency, of whole communities has led to this research partnership with the Institute for Sustainability. Arup considers this research essential in sharing best practice and lessons learned from retrofit programmes around the world, in order to better inform its own work and the work of others in this sector.

The Institute for Sustainability

The Institute is an independent charity established in 2009 to accelerate the delivery of economically, environmentally and socially sustainable cities and communities. Its focus is on developing innovative demonstration projects and programmes to capture and share learning and best practice.

Through its work, the Institute seeks to:

- create market confidence in order to encourage investment and the take-up of innovation;
- identify financial, economic and social models which allow transformation at scale;
- connect communities with jobs and skills development opportunities, and improve quality of life; and
- inform and support a step change in industry practice.

Foreword

Ian Short

We are living on the cusp of transformational change, perhaps at a scale not seen since the industrial revolution. This change is being driven by a range of global challenges including climate change, resource scarcity and resource security, which are compelling us to review the fundamentals of how we live. These challenges however also bring a fantastic opportunity to address some of our biggest social and economic issues. If we are prepared to think about working and living in different ways we should be able to overcome the obstacles in a way that improves quality of life both now and for future generations.

The easiest place to start in these budget constrained times is to look at making more of what we have, to invest more effectively and to deliver more efficiently. Increasingly people are seeing that to do this we need to move to an integrated approach to planning and investing in our communities and cities. The logic is that by looking at cities or neighbourhoods or even buildings as interrelated systems rather than lots of individual components it will be easier to identify where the maximum economic, social and environmental returns are and how to deliver them more cost effectively.

Buildings offer us an important entry point to delivering sustainable cities and neighbourhoods. The built environment is the single biggest contributor to carbon emissions in the UK (40%), the focus for Government environmental policy incentives and legislation, and critically, is an area of continued significant investment.

Our homes account for more than 28% of total UK energy use and the related carbon emissions (based on 2009 figures). Given the average replacement rate of our national stock is less than 0.5% per year 80% of existing dwellings will still be in use in 2050.

That's 20 million homes that need to be retrofit in order to increase energy efficiency (probably by 60% - assuming reductions are also made through decarbonisation of the grid and through zero carbon new build housing). Improving 20 million homes by 2050 requires a retrofit rate of more than one per minute.

The shifting emphasis to retrofitting existing housing stock is evidence of more joined up and holistic thinking. While only five years ago the focus in the UK was primarily on new buildings and effort was deployed in the search for 'wonder' technologies, today the emphasis is on looking at how buildings operate as a whole and on integrating the process from design through to implementation, and beyond to user behaviour. Attention has also moved on to how delivery and financing models can support the large scale take-up of effective buildings retrofit.

This report provides a clear and useful analysis of what has been implemented both in the UK and internationally and the lessons we can learn from these undertakings, which I hope will contribute significantly to the delivery, not just of sustainable buildings, but also of sustainable neighbourhoods and cities. I'd like to thank colleagues at Arup for the opportunity to collaborate on this report and play a part in furthering this vital agenda.

Ian Short, Chief Executive
Institute for Sustainability

Executive Summary

This study represents the culmination of a year-long research project to understand the delivery models and funding mechanisms that are being used internationally to implement community retrofit, particularly in housing.

Understanding the options, challenges and opportunities is critical to the delivery of successful retrofit programmes. It is hoped that the findings of this study will help to guide organisations around the world who are currently involved in trying to implement community-focused programmes on the types of issues they need to consider.

Community retrofit is central to tackling some of the main challenges that urban areas face in ensuring their long-term sustainability.

These challenges include:

- decreasing energy usage in existing buildings and infrastructure to both increase energy security and reduce fuel poverty¹;
- enhancing or sustaining property values;
- reducing the public health costs² of poor-quality housing and infrastructure;

- improving quality of life for residents;
- creating jobs and stimulating economies through investment in the built environment; and
- reducing greenhouse gas (GHG) emissions and contributing to city, national and international targets to tackle climate change.

The study's main focus within the community retrofit model is on the retrofit of residential property. Energy efficiency in housing has moved to the forefront of national carbon emissions reduction policies and programmes. Understanding how energy efficiency can be delivered to the housing sector will be a crucial element in delivering wider community retrofit aspirations.

Implementation is not easy. Retrofitting a home to be energy efficient is a lot more difficult than maximising the efficiency of new homes. It means aligning the interests of multiple stakeholders, who often have differing priorities and needs. It involves developing innovative delivery models and funding mechanisms to make, what can often be unattractive, business cases fundable. It also requires scale and volume to reduce transaction costs, create economies of scale and attract private finance. The public sector alone cannot bear this funding burden.

The study disseminates best practice and lessons learned from international case studies which have been chosen as the most informative and relevant from a long list of over twenty delivery models and funding mechanisms. These are included in Tables 1 and 2.

¹ A term used in the UK, fuel poverty describes a household which needs to spend more than 10% of its annual income on fuel to maintain an adequate level of warmth.

² The National Housing Federation's 2010 report *The social impact of poor housing* states that costs to the NHS of poor-quality housing are £2.5 billion annually.

Delivery models	Case studies
Public-sector-led models	New Barracks Estate retrofit scheme, Salford, UK, 2010 Kirklees Warm Zone, Kirklees, UK, 2005-2010 Aberdeen Heat and Power, UK, 2002-present
Community-led models	Low Carbon West Oxford and West Oxford Community Renewables, UK, 2009-present
Market-based models	Birmingham Energy Savers, Birmingham, UK, 2012-present

Table 1. Delivery model case studies

Funding mechanisms	Case studies
Public-sector-supported grant and loan schemes	KfW Bank Energy Efficient Construction and Refurbishment programme, Germany, 2001-present
Revolving funds	JESSICA programme, Estonia, 2009-present Clean Energy Works Oregon, 2010-present Bay Area Affordable Multifamily Retrofit Initiative, California, US, 2010-present
On bill financing and repayment	Home Energy Affordable Loan, Arkansas, US, 2011-present
Market-based tools	Victorian Energy Efficiency Target, Australia, 2009-present

Table 2. Funding mechanisms case studies

The study highlights many findings that should be important in influencing the decisions and programmes of potential retrofit providers, be they public sector organisations, community groups or financial institutions.

Finding 1

There is no “one-size-fits-all” approach when it comes to housing retrofit

The three main types of delivery model identified are:

- public-sector-led models that incorporate a range of funding mechanisms, can require significant amounts of time and investment in stakeholder engagement, and tend to be focused on social housing. The challenge for these programmes is to combine enough low-cost public sector finance with subsidies to make the business case attractive to the private sector. These programmes can range from small to large scale and have the potential to be replicable within similar legislative backgrounds.
- innovative community-led models that use a mixture of public sector funding and bespoke financing tools to invest in programmes that are focused on engaging and involving local communities but have not, as yet, been replicated elsewhere; and
- market-based models such as on-bill financing and repayment, public sector extension of credit-lines to retail banks or revolving funds, that try to deliver programmes through providing new financing options for individual homeowners.

Recommendations

- It is clear that there is no “one-size-fits-all” approach. Local communities, national and local governments, will need to investigate what might work well in their own community and how best to engage both suppliers and homeowners. A recent study by the Milken Institute in the US found that a cross-sector group of stakeholders agreed that “until it is clear which of these programs works best, it is important to support as many as possible and to ascertain which programs fit which regions.”³

Finding 2

The public sector needs to act as first-mover in promoting and implementing housing retrofit schemes

- Many of the successful models reviewed in the study relied on the public sector as a first-mover, often subsidising or incentivising the costs of retrofit, but involving the private sector in funding and/or underwriting projects.

Recommendations

- Subsidies and incentives including loan rebates, free energy assessments and subsidised interest rates are important in attracting homeowners to public and private sector schemes. The Clean Energy Works Oregon programme found that 50% of people who undertake an initial retrofit assessment eventually signed up to the programme. The public sector providing an upfront subsidy or incentive can therefore be important in driving programme take-up.
- Revolving funds can be a useful way to circumvent budgetary limitations and deadlines, and ring-fence finance for retrofit. These can be set up at many different scales: the case studies analysed included company, municipality, regional and national-level funds.
- Governments should support the roll-out of large scale demonstration projects to understand how transaction costs can be minimised and realise economies of scale.

Finding 3

Stakeholder engagement for community models needs to be extensive and involve a wide range of partners including tenant groups, social housing and government organisations

- The Institute for Sustainability in its Total Community Retrofit demonstrator projects in East London has found that retrofit programmes require participation at many different scales. The Institute also found that programmes that are powered by residents are more likely to be successful.

³ *Financing the Residential Retrofit Revolution*, Financial Innovations Lab™ Report, the Milken Institute, 2010

Recommendations

- Designers of retrofit programmes should ensure they use all existing channels to engage with communities including resident groups, forums and other community initiatives. Setting up steering groups involving local residents can also be important in ensuring that retrofit programmes have sufficient local demand and buy-in.
- Public sector organisations should therefore factor in sufficient time and cost for stakeholder engagement in the design of new retrofit programmes.

Finding 4

The main drivers for housing retrofit are comfort and sustained or improved asset values

- The main drivers for housing retrofit are not energy savings and carbon reduction, but comfort levels and sustained, or even improved, asset values.

Recommendations

- This finding affects social and private homeowners differently. Social housing owners, particularly local government, should look beyond the direct benefits of housing retrofit (such as a potential reduction in fuel poverty), and recognise that retrofit supports other policy agendas and targets, most notably public health. Additional socio-economic benefits should be fully analysed in business cases for retrofit programmes.
- Private sector owners will need to see evidence that energy efficient retrofit is necessary to sustain or improve their asset values and rental premiums.
 - For rental property, legislation such as the UK Energy Act 2011 which regulates against the rental of energy inefficient properties will be important, and setting this at an appropriately high level will be essential.
 - For all property tenures strengthening the link between energy performance and property values will be critical; energy efficient labelling of homes is an important start and one that needs to be strongly enforced by central government.

- Other benefits that could be seen in the medium to long term are higher loan to value ratios for mortgages on energy efficient properties. For this the banking sector will need to be convinced that these properties offer better security for their loans. Analysis into value uplifts from certain energy efficiency measures should be undertaken by think tanks, governments and other interested organisations to support this market development.

Finding 5

Delivery models and funding mechanisms that incorporate capital improvements and housing modernisation into energy efficiency schemes are more successful

- Homeowners are more likely to be interested in schemes that offer them the opportunity to improve their properties above and beyond energy efficiency measures. This is because there is a tried and tested link between modernised homes and property values, as opposed to as-yet untested links between energy efficient homes and property values. For example, KfW Bank's programme allows homeowners to finance a wide range of modernisation measures for a loan value of up to €75,000. This has proved very popular in the German housing market. On the other hand, the Bay Area Affordable Multifamily Retrofit Initiative in California enabled homeowners to access limited amounts of financing for a small number of energy efficiency measures and suffered from poor take-up.

Recommendations

- Funding schemes should include facilities for home modernisation. The UK's Green Deal programme could be expanded to include other improvements such as double glazing, and new front doors, for example.
- On the other hand, energy efficiency measures need to be marketed not just as technical "add-ons" but as part and parcel of attractive, healthy, and high-value homes. This is an important recommendation for any organisation offering retrofit programmes.

Finding 6

There is a lack of information on actual in-use performance of energy efficiency measures which affects uptake and financing

- There are a multitude of retrofit programmes being implemented internationally. However, it remains difficult to get detailed analysis on the costs and benefits of energy efficiency measures. Understanding the actual performance of measures and the impacts of consumer behaviour will be important in convincing homeowners and private sector lenders that there is a business case for energy efficiency.

Recommendations

- The demand for energy efficiency measures needs to be encouraged in two ways: both by seeing them as part of overall property modernisation and by encouraging transparency in the understanding of their performance. The former can be encouraged through financing programmes such as the Green Deal and the latter through the analysis of large-scale demonstration programmes.
- Further analysis is needed on the in-use performance of energy efficiency measures. The analysis into required measures and their respective performance should be supported by the public sector as imperative to ensuring success of the Green Deal and other programmes.

Finding 7

Uptake of residential retrofit is constrained by the skills and capacity of local supply chains

- One of the study's main findings is that significant uptake of residential retrofit is constrained by the skills and capacity of local supply chains.

Recommendations

- To some extent this is a "chicken and egg" scenario whereby increased capital investment will stimulate the labour market. However, there will also need to be direct investment in the labour market through training schemes and associated certification, by the public and private sectors.

- Strengthening the supply chain needs to occur in parallel with research on the technologies that are needed in the future. Only through fully understanding future technologies for housing retrofit will governments and private sector organisations be able to effectively plan for skills development. This research needs to be supported by the public and private sectors as an essential aspect of supply chain development.
- Community retrofit programmes can help to stimulate local supply chains through ensuring that contractors set up training centres for local employees.

Finding 8

Financing products for housing retrofit need to be competitive, and well aligned with mortgage finance

- Financing products for housing retrofit need to both be competitive, and aligned, with mortgage finance. In the US the Property Assessed Clean Energy mechanism has struggled over conflicts with senior lenders and the Green Deal is intended to be offered at approximately 7% (higher than many mortgage products). This may be looked on unfavourably by homeowners.

Recommendations

- Products such as the Green Deal will need to be marketed effectively to demonstrate their advantages over homeowners extending their mortgages to cover the costs of retrofit measures.

Research methodology

The aim of the study was to review international projects, programmes and funding mechanisms aimed at implementing community retrofit to demonstrate how drivers and opportunities have been capitalised on, and how challenges have been tackled.

The study aims to explain what currently works, what needs to be improved and what needs to change for community retrofit to be implemented at scale.

The research undertaken encompassed literature reviews, case studies and consultation including a variety of published reports, websites, and interviews. The research analysed over twenty case studies of delivery models and funding mechanisms and this report contains findings from the most useful and relevant. The majority of case studies used came from the UK, Northern Europe, the US and Australia where information about housing retrofit has been well documented.

The approach to the case study analysis was to look at three of the main components of community retrofit models: stakeholder engagement, delivery models and funding mechanisms. Successful models rely on all three of these components being well designed. However, there is no “one size fits all” solution; the details of every programme depend on the individual characteristics of an area, stakeholders, technical projects and available capital.

The stakeholder engagement case study comes from the Institute’s experience in Bromley, and Poplar, in east London.

Case studies of delivery models have all been taken from the UK. This is because the UK has a diverse range of drivers and funding mechanisms, as well as a variety of community-focused schemes. The study identifies local authority-, community- and market-based models to analyse some of the best practice elements and lessons learned that can be used to inform future retrofit projects and programmes.

There is a wide range of funding mechanisms being used to implement housing retrofit internationally. These include: government incentives, public-sector supported grant and loan schemes, revolving funds, on-bill financing, energy performance contracting and market-based tools. The study analyses these mechanisms in detail, in addition to looking at specific case studies that have used one or more to successfully implement projects.

Introduction to the study

Arup and the Institute for Sustainability have undertaken this research because community retrofit is central to tackling some of the main challenges that urban areas face in ensuring their long-term sustainability.

These challenges include:

- decreasing energy usage in existing buildings and infrastructure to both increase energy security and reduce fuel poverty⁴;
- enhancing or sustaining property values
- reducing the public health costs⁵ of poor-quality housing and infrastructure;
- improving quality of life for residents;
- creating jobs and stimulating economies through investment in the built environment; and
- reducing greenhouse gas (GHG) emissions and contributing to city, national and international targets to tackle climate change.

Focusing on community initiatives is essential to creating a healthy, safe, secure and low carbon society. The UK's Sustainable Development Commission's 2010 report *The Future is Local: empowering communities to improve their neighbourhoods*, states that "failing to upgrade our local infrastructure will have a negative effect on all areas of life in the UK, hampering our ability to deal with climate change, future housing and transport needs, ill health and unemployment."⁶

Governments around the world are now investigating and piloting potentially game-changing programmes to help stimulate retrofit markets. This research looks specifically at the types of delivery models and funding mechanisms that are being used, and could be used, to implement community retrofit programmes.

What is community retrofit?

The concept of community is regularly defined, interpreted and debated. For this study, community is defined as more than just a collection of households within a geographical area, but as people linked by shared resources and needs – whether residents, employees or business owners. When we talk about community retrofit, therefore, we mean the retrofit of all community infrastructure: housing, transport and social infrastructure, lighting, heating, green space and others. We also imply a participative retrofit programme rather than one which is imposed; one that has been developed and delivered by residents themselves. In this way community retrofit can generate and support valuable community networks and social capital. The Institute for Sustainability's Total Community Retrofit (TCR) aspiration defines this well:

"Local people are at the core of TCR and will be instrumental in planning, designing, delivering, owning and managing the programme... It will develop and deliver on a vision which addresses the full needs of the community including transport, utilities provision, building efficiency, public spaces and economic activity."⁷

⁴ A term used in the UK, fuel poverty describes a household which needs to spend more than 10% of its annual income on fuel to maintain an adequate level of warmth.

⁵ The National Housing Federation's 2010 report *The social impact of poor housing* states that costs to the NHS of poor-quality housing are £2.5 billion annually.

⁶ See: www.sd-commission.org.uk/presslist.php/112/the-future-is-local

⁷ See: www.instituteforsustainability.co.uk/tcr.html



Figure 1. The Institute for Sustainability's Total Community Retrofit model

Why focus on retrofit at a community scale rather than on individual projects?

Retrofit works are often not undertaken at a community scale. Energy conservation measures (ECMs) are often implemented in individual buildings, paid for by building owners, and work perfectly well on this basis. However, in the case studies analysed it was found that community retrofit has many benefits including:

- increasing the scale of projects so that they can be more attractive to private finance and reduce transaction costs;
- encouraging participation which can help to strengthen community networks and secure long-term commitment to programmes; and
- enabling local companies to be actively engaged, thereby generating employment and economic growth.

Why focus on housing?

The study's main focus within the community retrofit model is retrofit of residential property. This is because housing is one of the most important components of community retrofit and also the most difficult to target.

The housing sector can be a large energy user and source of carbon emissions. However, across the world this varies based on factors such as climate, the age/condition of the housing stock, standard of living and grid emissions intensity. In the UK, residential energy use represents 28% of total energy consumption⁸ and accounts for about 23% of the total country's emissions⁹; in the US, the housing sector consumes about 22% of energy use¹⁰ and its emissions are about 17%¹¹; while in Australia, the housing sector consumes about 13% of energy use and its emissions are about 10%¹².

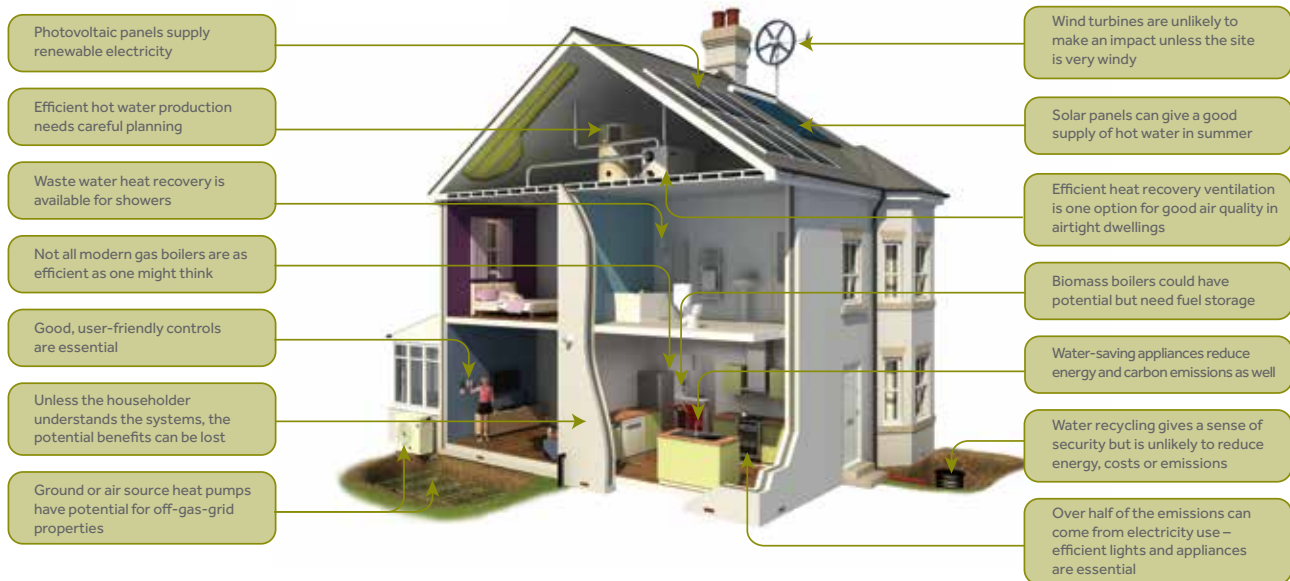
⁸ DECC (2012)

⁹ UK Committee on Climate Change (2010)

¹⁰ US Energy Information Administration (2012)

¹¹ See: www.c2es.org/technology/factsheet/ResidentialBuildingEnd-Use

¹² See: www.climatechange.gov.au/en/what-you-need-to-know/buildings/homes.aspx



Source: Institute for Sustainability

Energy efficiency in housing has moved to the forefront of national carbon emissions reduction policies and programmes. Understanding how energy efficiency can be delivered to the housing sector will be a crucial element in delivering wider community retrofit aspirations.

Implementation is not easy. Retrofitting a home to be energy efficient is a lot more difficult than maximising the efficiency of new homes. It means aligning the interests of multiple stakeholders, who often have differing priorities and needs. It involves developing innovative delivery models and financing mechanisms to make what can often be unattractive business cases fundable. It also requires scale and volume to reduce transaction costs, create economies of scale and attract private finance. The public sector alone cannot bear this financing burden.

This research study examines how a wide range of organisations, including local, city, regional and national governments, community groups and private-sector companies, have delivered housing retrofit programmes in their communities. In this way, it aims to help organisations which are engaged in trying to implement retrofit projects and programmes by providing some guidance on how they have been delivered elsewhere, and the main issues that need to be considered.

What is included in energy efficient retrofit?

Energy efficient retrofit in residential properties includes a wide range of measures. Implementation will depend on factors such as building type, age, occupancy, and the financial and business case.

Energy efficiency measures are usually identified through an audit or assessment undertaken by a qualified assessor. The image above demonstrates the types of measures that may typically be undertaken in an energy efficient retrofit of residential property. Payback periods for measures will depend on utility tariffs, availability of incentives and the energy savings associated with each measure.

Research summary

This section summarises the case study research on delivery models and funding mechanisms for housing retrofit programmes. Detailed information on each case study is available later in the report.

Delivery models

Delivery models have been separated into: public-sector-led, community-led and market-based. However, in all the types it is clear that the public sector takes a key role either by leading and managing the programme or through funding, or both. This is due partially to

the public sector's ability to achieve scale in housing retrofit (compared with fragmented ownership structures in private housing), and also, to the need for public sector funding to improve the attractiveness of business cases for energy efficiency measures.

	Programme name	Dates active	Key characteristics	Key findings
Public-sector-led models	New Barracks Estate Retrofit Scheme, UK	2010	Holistic, energy efficient retrofit of 78 single-family properties in Salford, UK led by Salix Homes (local social housing organisation). Funded by grants, utility obligations and city council.	Retrofit was found to create a positive social return on investment (SROI), including benefits captured through energy savings, business income, reduced CO ₂ emissions, employment creation, avoided public health costs, increased government revenue and saved maintenance time. This emphasises the diverse and significant benefits that can be achieved by retrofit programmes.
	Kirklees Warm Zone (KWZ), UK	2005 - 2010	Largest local authority home insulation (loft and cavity wall) scheme in UK between 2007 and 2010. Funded through asset sale and utility obligations. Yorkshire Energy Services managed programme and delivered through partnership with contractor Miller Pattison. Results included installation of insulation in more than 50,000 properties and estimated net social benefits of £249 million.	Partnership working was essential in delivering a programme of this scale. However, involvement of all partners took approximately one year to organise. Miller Pattison established a local depot and recruited local employees to deliver the scheme. This is a good way to harness local economic benefits of retrofit programmes.
	Aberdeen Heat and Power Company Limited (AH&P), UK	2002 - present	Aberdeen City Council (ACC) established AH&P to deliver low carbon energy to Aberdeen through district heating and combined heat and power (CHP) schemes. The programme is funded through utility obligations and bank loans.	Blended finance (a combination of no-cost utility obligation grants, and private finance) was essential in delivering the programme. The arm's length company enabled the local authority to raise off-balance-sheet capital and accelerate refurbishment plans.
Community-led models	Low Carbon West Oxford (LCWO) and West Oxford Community Renewables (WOCORE), UK	2009 - present	LCWO set up WOCORE as a community-owned Industrial and Provident Society in 2009. WOCORE sells power generated from micro-renewables to the local community and excess power to the grid. Profits raised are reinvested in low carbon projects in the community. The programme is funded by two separate grants won through government-funded competitions, and a share issue.	The local revenue raising and reinvestment of profits empowered the community and strengthened community networks. However, this scheme has relied on grant funding and funding raised from the local share issue is minimal as a percentage of total funding. This demonstrates that innovative schemes may rely on public-sector subsidies.
Market-based models	Birmingham Energy Savers (BES), UK	2012 - present	Birmingham City Council (BCC), in partnership with the Birmingham Environmental Partnership, set up BES to stimulate a retrofit market in the city. The objective of the programme is to implement the retrofit of 60,000 properties by 2020 using an on-bill financing mechanism. BCC is also expected to provide financial support alongside grants and subsidies.	BES is one of the first attempts to implement a large-scale Green Deal financed retrofit scheme in the UK. It has blended many sources of finance, and demonstrates that this is essential in making the business case for retrofit at scale.

Funding mechanisms

The research undertaken identified five main mechanisms for housing retrofit programmes: government incentives and utility obligations; public-sector-supported grant and loan schemes; revolving funds; on-bill financing and repayment;

and market-based tools. The table below provides some headline findings on the funding of case studies analysed in the study.

	Programme name	Dates active	Key characteristics	Key findings
Public-sector-supported grant and loan schemes	KfW Bank energy efficient construction and refurbishment programme, Germany	2001 - present	<p>Since 2001 KfW has committed approximately €40 billion to energy efficient construction and refurbishment programmes in housing. The programmes are delivered through an "on-financing" model whereby KfW extends credit lines to German retail banks that originate loans with homeowners.</p> <p>Each housing can unit can receive up to €75,000 for pre-defined investment packages for a maximum of 30 years. KfW also offers debt relief to homeowners who achieve a level of energy efficiency greater than that required for a new building under German regulation.</p>	<p>The standardisation of investment packages has been very effective in marketing the products to consumers, as well as reducing technical and financial transaction costs.</p> <p>The €75,000 limit means that homeowners can undertake general modernisation as well as energy efficiency projects, which makes the loan more attractive.</p> <p>KfW transfers credit risk to retail banks that will often have pre-existing relationships with customers and therefore can better judge risk. This means that financing costs can be minimised for homeowners.</p>
	Clean Energy Works Oregon (CEWO), USA	2010 - present	<p>CEWO is a non-profit programme for residential energy efficiency. It was seed-financed by the federal government under the American Recovery and Reinvestment Act of 2009 (ARRA).</p> <p>CEWO finances lending partners, including a number of regional and local retail banks. Homeowners can borrow up to \$30,000 to use on energy efficiency upgrades (scaled according to levels of energy efficiency reached). The loans are repaid through heating bills. CEWO also offers performance-based rebates.</p>	<p>CEWO made an effort to reduce barriers to entry through offering a rebate on energy assessments – they found that 50% of people who undertook an assessment eventually took out loan finance.</p> <p>The level of security required differs by lending partner. Some require a loan attached to the property, and others offer unsecured loans.</p> <p>Participants are able to fund non-energy improvements through the programme's loan products. This increases the attractiveness of the financing products to homeowners.</p>
	Bay Area Affordable Multifamily Retrofit Initiative, California, US	2010 - 2011	<p>The initiative set up a revolving fund to invest in energy efficiency retrofits using traditional property-secured loans. The fund was partially financed by State Energy Programme (SEP) funds under ARRA, and by leveraged finance from other sources.</p>	<p>The programme has not been successful in terms of take-up. Low participation rates have been attributed to:</p> <ul style="list-style-type: none"> - Financing amounts that were explicitly linked to energy savings and therefore were often small and not attractive; and - Lack of demand among property owners, particularly due to the amount of time needed to negotiate small amounts of financing, and lack of consumer protection.

	Programme name	Dates active	Key characteristics	Key findings
Revolving funds	Estonia JESSICA programme (Joint European Support for Sustainable Investment in City Areas) programme	2009 - present	<p>JESSICA enables managing authorities across the EU to invest some of their European Regional Development Fund (ERDF) into revolving funds called Urban Development Funds (UDFs). These UDFs can invest in a range of public-private partnership projects that focus on sustainable urban development and form part of an integrated urban plan.</p> <p>The Estonia JESSICA programme was set up to invest in energy efficiency projects in multi-family housing. It is managed by KredEx, an Estonian national bank, and the UDFs are managed by SEB and Swedbank AS.</p> <p>The financial products offered are long-term (up to twenty years) bank loans with fixed interest rates for the first ten years. In addition, loans can be supplemented by grants from state government and municipalities based on the levels of energy efficiency reached.</p>	<p>Swedbank, the retail bank, originates and services the loans which reduces the credit risk as they have pre-existing relationships with apartment associations. This enables the programme to lend at more competitive rates than generally available in the market, and therefore supports the development of the energy efficiency market in Estonia. Access to competitive rates of finance is important in making the business case for energy efficiency.</p> <p>The loan products are made more attractive by the state grants which help to lower the cost of financing energy efficiency projects for apartment owners.</p>
On-bill financing and repayment	Home Energy Affordability Loan (HEAL), Arkansas, USA	2011 - present	<p>The HEAL programme is essentially an employee benefits programme.</p> <p>HEAL provides technical assistance and finance to companies undertaking commercial retrofit. The company has to dedicate a portion of their energy savings to a revolving fund. This fund is available to its employees to identify and finance energy efficiency measures in their own homes.</p> <p>Employees repay debts to the fund through payroll deductions, with the repayment schedule tied to savings realised through lower utility bills.</p>	<p>The programme is too new to comment on specific findings. However, it is an interesting example of an innovative programme that aims to implement commercial and residential energy efficiency projects concurrently.</p>
Market-based tools	Victorian Energy Efficiency Target (VEET), Australia	2009 - present	<p>VEET operates by placing a liability on large energy retailers in Victoria to create a specified number of Victorian energy efficiency certificates (VEECs) each year. Retailers can create certificates directly by undertaking energy efficiency measures in residential property, purchasing certificates in a competitive market, or both.</p>	<p>VEET appears to be successful in leveraging private finance into energy efficiency projects, and creating a market for a range of energy efficiency measures. However, it is primarily driven by policy and replication elsewhere would depend on the attractiveness of implementing policy and legislative changes. It is yet to be seen how successful this programme will be in the long term and whether it is adopted by other municipalities.</p>

What are the drivers, opportunities and challenges for housing retrofit?

Drivers and opportunities

National governments, cities and local authorities in industrialised countries around the world are actively creating retrofit programmes designed to target the housing sector. While some programmes have been around for 20-30 years, the last five years have seen a significant growth in programmes to promote energy efficiency and carbon reduction in housing.

Drivers for housing retrofit can be seen at both a national and local level, and include the following:

- **Energy and environmental drivers:** Energy used by households represents a significant and, in some cases, growing, segment of total energy use, and is a prominent driver of carbon emissions.
- **Rising energy prices:** Energy prices have witnessed strong real growth in recent years in some countries, creating significant burdens on low-income segments of the population. In the UK, the Fuel Poverty Advisory Group estimates that 9 million people could meet the criterion of fuel poverty by 2016. It is for this reason that many housing energy efficiency programmes target the lowest-income population segments.
- **Social and health drivers:** The inability of households to adequately heat their homes due to rising fuel costs can also have a significant cost to society. Recent studies from the UK have shown the negative effects of cold homes, particularly on children and the elderly. Cold homes have a strong impact on or exacerbate, respiratory problems, mental health problems, minor illnesses, and children's educational attainment and wellbeing,

and are linked to higher levels of excess winter deaths. According to AgeUK, illnesses related to cold homes cost the NHS £1.36 billion every year.¹³ Thus the social return on investment from retrofit is quite high.

- **Economic drivers:** Housing retrofit can also be a means of improving quality of life, creating jobs, up-skilling the workforce and unlocking economic regeneration. The US Government's Recovery through Retrofit strategy is aimed at jump starting the market for retrofit to create thousands of jobs and opportunities for small businesses. One of the main objectives of the Green Deal, the UK Government's new programme targeted at implementing housing retrofit at scale, is to generate local supply chains that will help to reinvigorate local economies as well as make the UK a market leader in green technologies.¹⁴

For countries and communities around the world, the opportunities for retrofit are massive. According to Recovery through Retrofit, energy efficiency retrofitting in the US could reduce household energy use by up to 40%, reduce greenhouse gas emissions by up to 160 million metric tons a year by 2020 and save households up to \$21 billion in energy bills every year.¹⁵

Illnesses related to cold homes cost the UK National Health Service £1.36 billion every year.

Source: AgeUK

¹³ See: www.ageuk.org.uk/latest-news/archive/cold-homes-cost-nhs-1-point-36-billion

¹⁴ DECC (2011) (b) p2

¹⁵ Middle Class Task Force Council on Environmental Quality (2009)

Challenges to implementing housing retrofit

Although the drivers are numerous and, in many cases, urgent, there are still considerable challenges to overcome before resource efficient retrofit is implemented on a large scale.

Challenges to implementation include a lack of information on the true costs and benefits of retrofit, the perception among homeowners and their funders that the business case is weak, fragmented ownership structures, a lack of finance and access to capital, and a lack of a trained workforce skilled in implementing ECMs, among others.

There is a lack of information on the true costs, benefits and risks of housing retrofit

Limited awareness of, and lack of information about, the costs, benefits and risks associated with retrofit are a barrier to high levels of uptake. Even in countries which have established energy efficiency labels for housing, homeowners still do not fully understand the energy use performance of their home, let alone the costs and benefits of making improvements.

Furthermore, there is huge uncertainty about the performance and benefits of implemented measures, in particular the impact of occupant behaviour. Some retrofit projects have witnessed energy savings that are reduced or, often, offset by what is known as the performance gap (the difference between designed and actual performance of energy efficiency technologies)

and the “rebound effect” (an economic term that refers to the increased consumption that results from actions that increase efficiency and reduce consumer costs).

The rebound effect can be direct, for example, when occupants heat their homes for longer because they cost less to heat; or it can be indirect, for example, when occupants spend their energy savings on more energy-intensive uses such as air travel or car ownership. Both the performance gap and the rebound effect represent a key risk in any energy efficiency programme.

The Energy Institute at University College London (UCL-Energy) and the Institute for Sustainability have undertaken the first independent analysis of demonstrator projects, funded by the UK Technology Strategy Board’s Retrofit for the Future (R4tF) programme, which evaluates both project team and occupant experience. They found that energy savings were often not as estimated pre-retrofit due to users not understanding, or using, systems effectively. A key lesson from this study was that installers needed to invest time in the handover process after measures had been installed to ensure that occupants could use them as intended.¹⁶

Estimates on the amount of rebound effects in residential property vary widely, but most studies indicate that they can consume a significant proportion of the energy savings achieved by the measures implemented.

¹⁶ UCL-Energy Institute and the Institute for Sustainability (2012)

Housing ownership structures can impede uptake and may remove incentives for retrofit

Housing tenure type affects the type of stakeholder engagement, delivery model and funding mechanism required. In Australia, Canada and the US, the home ownership rate is about 70%.¹⁷ However, these are national averages and ownership rates in large cities tend to be lower. For example, in England and Wales the majority of housing (64%) is owner-occupied, with socially-rented and private-rented property each representing 18% of the total.¹⁸ In London, this profile differs somewhat, with only 45% owner-occupied and 24% socially-rented.¹⁹ Tenure type can offer opportunities and challenges. Socially-rented property provides an opportunity to retrofit housing at scale: many of the case studies analysed in the study involve social housing.

However, the rented sector also suffers from the “split-incentive” problem whereby the tenant benefits from retrofit or energy efficiency measures that are paid for by the housing owner.²⁰ Therefore, at present there is little incentive for the owner to undertake retrofit, particularly without proof that it will increase the value of the property. The changes being implemented by the UK Energy Act 2011 are set to change this somewhat by legislating that landlords with the least energy efficient property will not be able to re-let those buildings after 2018. However, the level at which this is set will be very important in determining the depth of retrofit measures. In the case of socially-rented property there remains a split-incentive problem. However, many local authorities and Registered Social Landlords (RSLs) can see the benefit in energy efficient retrofit to help tenants better manage their fuel bills, secure their rents, and sustain their asset base.²¹

There is a lack of access to finance, and the value of retrofit is perceived to be less than the costs

From the perspective of investors, financial returns and risks are unclear. In a typical investment scenario, initial costs are offset over time by increasing revenue streams. However, in the case of energy efficiency, costs are typically offset by calculated savings rather than quantifiable revenue streams (unless retrofits are supplemented by incentives such as Feed-in Tariffs).

Estimated avoided cost is not equivalent to a revenue stream, making access to finance a challenge.

The perception that the value of retrofit is less than its cost can make it extremely difficult to induce a homeowner to participate in a programme. It also means that homeowners may choose to undertake only the energy efficiency measures which are financially most attractive. This means that properties could be retrofitted to a level that is less than their potential, and that it could become more difficult to justify the cost of deeper measures in the future, thereby making it harder to meet long term energy saving and carbon reduction targets.²²

Over time, as the market becomes more sophisticated and starts to place greater value on energy efficiency and to equate an energy efficient home with a high-quality home, the driver for retrofit could become the increased market value. This value could translate itself into homes which sell faster, earn higher sales premiums or can attract higher loan-to-value mortgages. Energy efficiency labelling will be essential to drive this.

To promote the greatest level of uptake of retrofit, the business case needs to focus on factors such as comfort levels, reducing fuel poverty, health benefits, and value generation, not just energy bill savings.

In terms of funding, although there are banks and investment funds interested in supporting energy efficiency, few programmes have developed funding offers that are standardised, replicable and scalable. This standardisation is essential to reduce transaction costs and increase the number of projects.

The business case for undertaking retrofit needs to focus on factors such as comfort levels, reducing fuel poverty, health benefits, and value generation, not just energy bill savings.

Arup

¹⁷ http://en.wikipedia.org/wiki/List_of_countries_by_home_ownership_rate#cite_note-1

¹⁸ Office for National Statistics (2011) Census

¹⁹ Ibid

²⁰ European Commission Directorate General for Energy (2012) p8

²¹ Energy Saving Trust (2009) p1

²² See: www.edcmag.com/articles/94750-rotten-fruit

It is difficult to achieve the scale that would attract private sector finance

Residential property tends to be owned by individual homeowners, private landlords or large social housing organisations and local authorities. In the latter, scale is achievable and leveraging private-sector investment is feasible; in the former it is more difficult due to fragmented ownership structures. Few programmes have been able to achieve the volume of transactions needed to secure significant financing amounts with low cost of capital. The Green Deal is the first programme in the UK which aims to create this scale and thereby attract large-scale private sector finance into the housing retrofit sector.

Supply chains to deliver housing retrofit are currently underdeveloped

Due to the low pace of retrofit in most countries, strong supply chains have not evolved and economies of scale have not been fully exploited. The UCL-Energy/Institute report on retrofit demonstrators found that one of the barriers to housing retrofit was an underdeveloped supply chain, including a lack of an experienced and skilled workforce. One of the main conclusions in their study was that more work is required “to develop local/UK supply chains and to embed the knowledge needed to successfully routinise large-scale retrofit.”²³ In the US, a similar conclusion was reached in the Recovery through Retrofit strategy. The report notes that there are “currently not enough skilled workers and green entrepreneurs to expand weatherization and efficiency retrofit programs on a national scale”.²⁴ It includes recommendations about creating uniform workforce certification and training standards.

Developing the supply chain will rely on analysis of what retrofit measures will be required in the future. It is only once technologies have been tried and tested, that labour force planning can be done effectively.

Taking a retrofitting program to scale requires improvement in several areas: marketing of products and services to likely customers; a trained workforce capable of extensive, quality field implementation; financing offers that are replicable; and the ability to sell loan pools into a national secondary market, allowing for a more rapid and systematic recycling of funding back into loan programs.

Financial Innovations Lab™ (2010),
Financing the Residential Retrofit Revolution,
the Milken Institute.

Stakeholder engagement for retrofit programmes is time and resource intensive

Stakeholder engagement is a real challenge that needs to be tackled when implementing retrofit at scale. The UCL-Energy/Institute report states that engagement, communication and information are central in supporting retrofit projects to align the interactions between systems, occupants and installers.

For all community schemes that require the buy-in of multiple homeowners and tenants there needs to be a significant investment in engagement in both time and money.

The case studies analysed in this research make real attempts at tackling some of these challenges and taking advantage of some of the opportunities offered by housing retrofit. For example, the UK’s Green Deal programme incorporates important consumer protection measures, to make the business case for ECMs more transparent to homeowners and ensure that savings are equal to or greater than the cost of ECMs over their lifetime. Programmes such as KWZ, have specifically

²³ Institute for Sustainability and UCL-Energy (2012) p34

²⁴ Middle Class Task Force Council on Environmental Quality (2009)

tried to stimulate local supply chains through procurement processes which favour installers that use local employees. The split-incentive problem seems more difficult to address, particularly in the private-rented sector. It appears unlikely that this will be overcome without regulation preventing the rental of energy inefficient property.

Stakeholder engagement

Cities offer many of the biggest challenges and opportunities in dealing with climate change. Sustainable and climate-resilient cities require systemic solutions.

These are extremely difficult to implement, requiring multiple parties to work together in new ways, and are exacerbated by shrinking budgets, fragmented governance and, often, a lack of clear leadership.

This case study is based on the Institute's work in east London to model, co-develop and co-deliver a holistic, community retrofit initiative with local people. In partnership with the local authority, RSLs and community organisations, the Institute is seeking to demonstrate its TCR approach in a real world setting by placing communities at the centre of decision-making and delivery.

Although it is too early to evaluate the success of the project at this stage, lessons learned so far indicate that TCR requires significant, continuing engagement and relationship building with both decision makers and residents. This enables the project team to identify market needs, develop business and financial structures, create partnerships and identify investments where there are opportunities to bring added value and scale up for the wider adoption of sustainability measures.

Total Community Retrofit – stakeholder engagement, London, UK

Description

TCR is an integrated whole-community approach to achieving sustainable, resilient neighbourhoods and cities. It seeks to address all aspects of renewal, including energy efficiency, building retrofit, mobility, green space, infrastructure, jobs and skills. This project started in late 2011 and is ongoing.

Objectives

The objectives of the programme are to:

- achieve environmental, economic and social sustainability while ensuring that investment delivers maximum benefit for people and businesses;
- address sustainability challenges at community scale giving local people a key role in implementing positive changes in their environment through deep engagement and project ownership; and
- deliver solutions that improve community cohesion, quality of the environment, health and well-being, while having a positive impact on economic issues such as fuel poverty.

Scale and scope

New approaches and initiatives to deliver cohesive community-scale retrofit are being trialled at three scales:

- London Borough (approximately 220,000 people) - activity includes a community energy cooperative which has been set up to coordinate group energy purchase for local people, which is now developing plans to extend to group purchase of renewables and buildings retrofit services
- Innovation zone/pilot hub, Bromley by Bow and Poplar (approximately 50,000 people) identified as the core of currently planned investments in low carbon technologies in the Borough
- A “Community Budget” pilot area (24,000 people in 10,000 dwellings) within an existing Local Area Partnership which will explore innovative approaches to consolidating budgets – one of 14 UK government supported pilots.

Delivery model

A strong partnership, led by the Institute for Sustainability, has come together to develop a model for delivery of the sustainable community of tomorrow. Core partners include the local council and service providers including an arm’s length management organisation (ALMO), an RSL and a community centre.

The partners are driving real-world trials of a range of integrated and innovative projects. Local people are being placed at the core of the project so that they can be instrumental in planning, designing, delivering, owning and managing the programme. Delivery is structured into projects of two types:

Enabling projects:

- Business and management models, including creating new governance and finance structures.

Delivery projects:

- Community owned initiatives and activities (such as growing groups, recycling and management of green space)
- Buildings and infrastructure improvements (such as home energy management systems trials, low disruption retrofit research and an electric vehicle car club).

Funding method

The Institute has received time-limited funding from the EU Climate Knowledge Innovation Community programme (Climate KIC). To this end, the Institute is prioritising supporting the main organisations that are already embedded in the community, known by local people and committed locally for the long term. TCR project activities are funded from a variety of sources; the Institute brings together project partners, identifies potential funding sources, and brings added value to planned investments.

New financing models being explored as part of the project are developing innovative applications for:

- a community co-operative to enable residents to achieve large scale purchasing power at a community level
- a community budget pilot to enable project partners including the local council and service providers to share resources towards achieving common goals
- a carbon offset programme to enable investors to support sustainable activities in the community
- delivery by local enterprise to bring economic benefits to community based businesses and facilitate ownership of sustainable initiatives.

Best practice guidance and lessons learned

- It is not enough to consult; change powered by people is far more likely to be successful. TCR pilot activities have been most successful in gaining momentum where people and groups have been given an opportunity to step forward as part of the solution.
- Stakeholder engagement at a community scale requires participation at a number of different levels, engaging executive level decision making organisations as well as local business, service providers and individuals at various levels.
- Establishing a Senior Steering Group for policy level decisions as well as a Community Group for getting things done “on the ground” has been a key part to working successfully at the various scales of the project.
- Use of existing channels, forums and organisations (for example, resident engagement workshops, growing groups) combined with a designated Sustainability Coordinator working in the community as a representative for the project partnership has been very successful in engaging residents to become involved in sustainable activities and pilot project demonstrations such as home energy management system trials.
- The local project partnership has enabled organisations in the community to communicate more effectively, incorporate sustainability goals into their policies and work together towards a common goal on issues of environmental, economic and social sustainability. Through this collaboration, the team has identified areas where the project partners are able to do the initial groundwork needed in community retrofit, while developing a clear plan of how people can get involved, and obtain the necessary skills (if needed) to take ownership in the long run.

Delivery models

Delivery models for community retrofit tend to be public-sector driven, either directly, or through a variety of arrangements with partners. The public sector tends to play the role of the “first mover,” de-risking transactions and providing an evidence base for others to follow.

To this end, the UK and the US in particular are driving the use of market-based mechanisms to catalyse large-scale housing retrofit as evidenced by the Green Deal and Property Assessed Clean Energy (PACE) programmes discussed later in the study. In addition, there is evidence of models whereby cooperatives started by local communities have partnered with private-sector and third sector organisations to implement retrofit programmes.

This section of the study looks at the types of models that have been seen in practice and provides some lessons learned and best practice guidance on what could be used in the future.

The delivery models have been segmented into:

- public-sector-led models;
- community-led models; and
- market-based models.

Public-sector-led models

One of the most basic delivery models is where a public-sector organisation coordinates and secures funding for a retrofit programme.

These types of schemes are relatively straightforward to implement in terms of procurement, delivery and finance. However, they still require significant amounts of investment in occupant engagement.

By their nature, they are often implemented in social housing, although the Institute is currently evaluating a large-scale retrofit programme that incorporates both social and private housing.

This section contains three case studies demonstrating how local authorities can lead and deliver retrofit programmes:

1. A social housing organisation-led procurement approach (Salix Homes, New Barracks Estate, UK)
2. A partnership approach (Kirklees Council, KWZ, UK)
3. Creation of an arm's length delivery company (AH&P, UK)

New Barracks Estate Retrofit, UK

Salix Homes' retrofit project in the New Barracks Estate is a good example of the potential of the first procurement model. Salix Homes is Salford Council's arm's length management organisation (ALMO),²⁵ and therefore is entrusted with the operation and maintenance of its housing stock. The case study demonstrates an example of an ALMO that has taken an innovative approach to building refurbishment not only by focusing not only on physical improvements, but also on energy efficiency measures. Arup was commissioned in 2011 to undertake a study on evaluation of SROI²⁶. The study found that for every £1 invested, £1.58 of social value was created. Value came from energy savings, business income, reduced CO₂ emissions, employment creation, avoided public health costs, increased government tax revenue and saved maintenance time.²⁷

This case study demonstrates the wide range of benefits and societal value that can be created in a retrofit project, and encourages social housing owners to think beyond physical improvements. This programme does not follow the Green Deal approach – social landlords did not have to make any contribution to the capital works either up-front and occupants did not “payback” costs from energy savings through their utility bills. Salix viewed this programme as an opportunity to improve its housing stock in a holistic manner, and to improve its own asset base and the quality of its tenants' housing. Arup's SROI study was commissioned to engage directly with tenants, assess the retrofit programme's impacts on energy use, and to analyse and monetise the wider social impacts.²⁸

New Barracks Estate retrofit scheme, Salford, UK, 2010

Description

Salix Homes, Salford's ALMO, retrofitted 78 single-family properties on the New Barracks Estate. In 2009, 54% of the people in this area were suffering from income deprivation, 28% were receiving benefits and many also suffered from significant health problems.²⁹ The homes that were retrofitted were generally in poor repair, including old, inefficient heating systems, and a lack of insulation and ventilation. The programme set out to achieve the ALMO's Decent Homes Plus standard.³⁰

Objectives

The overall objective of the programme was to make holistic improvements to the building stock in the New Barracks Estate, sustaining the long-term asset value, and reducing fuel poverty and the negative societal impacts of poor-quality housing.

Scale and scope

Works undertaken in the retrofit programme included: boiler replacement; double glazing; internal insulation of external walls; installation of mechanical ventilation systems; new bathrooms; new kitchens; new front doors; and re-wiring.

Delivery model

Community engagement was undertaken through the tenant management organisation (TMO), called the New Barracks Cooperative. Salix Homes procured a private contractor to undertake the works.

²⁵ In the UK, an arm's length management organisation (ALMO) is a non-profit company that provides housing services on behalf of a local authority. Ownership of the housing stock is usually retained by the local authority.

²⁶ See: www.salixhomes.org/Salford-tenants-save-from-retrofitting-programme.htm

²⁷ Arup (2012) p2

²⁸ Arup (2012) p5

²⁹ Arup (2012) p4

³⁰ Arup (2012) p1. The Decent Homes Standard is a technical standard for public housing introduced by UK government in 2000. The idea is that the standard should be understood as a minimum level below which investment is triggered. In reality many social housing organizations improved just to the standard, whilst others, particularly in inner cities suffering from high levels of fuel poverty, developed local Decent Homes Plus standards including significantly more ambitious thermal comfort targets.

Funding method

Funding came from a Decent Homes grant (majority of funding), Salford City Council, utility contributions, and the New Barracks Cooperative.

Best practice guidance and lessons learned

- A social housing organisation, through thinking about retrofit in a holistic and strategic manner, can gain benefits that are wider than simple physical improvement. The Arup SROI study found that the benefits from a retrofit programme can be seen on many different scales including benefits to tenants, the NHS, suppliers, the environment and central government.
- Interestingly, although before the retrofit energy savings were thought to be one of the main benefits, post-retrofit it was found that improved comfort levels were more important to tenants. Whereas before the retrofit, tenants had been living in cold, uncomfortable housing, often choosing not to heat their entire properties due to costs, post-retrofit they had considerably higher comfort levels even though their energy usage may not have changed significantly.³¹ Although this is positive in terms of health and well-being, and general quality of life improvements, it does mean that there can be significant rebound effects in housing retrofit. This risk factor is also partially why the cost of capital in housing retrofit is high (as seen in the case of the near 7% interest rates demanded by the Green Deal).
- Even though Salix did try to procure local suppliers, it was found that a skilled workforce was not present locally and they did need to look at a national level for the supply chain. This is an important lesson for future projects and programmes when trying to harness local economic benefits. Even if local supply chains are not available, there could be a way to ensure that some skills benefits are retained locally through apprenticeships or training programmes.

Kirklees Warm Zone, UK

One example of a programme that did make a concerted effort to retain local economic benefits of retrofit is the KWZ. A Warm Zone is an area-based programme that is intended to deliver a targeted approach to identifying and reducing fuel poverty through energy efficiency improvements. Warm Zones tend to be funded through partnerships between local governments, EU agencies, energy companies and other stakeholders. KWZ was the largest local authority home insulation scheme in the UK between 2007 and 2010 and the first to offer free loft and cavity wall insulation to every suitable property in Kirklees.³²

KWZ demonstrates the need for local authority or public sector involvement in retrofit programmes of this nature. Kirklees Council itself states that “a successful comprehensive scheme cannot be left to an insufficiently controlled and regulated market... Without strong pressure to achieve challenging targets, companies in the marketplace will deliver at a level that is within their technical and capacity comfort zone”.³³ This suggests that market and subsidy-driven schemes are not likely, on their own, to meet national carbon reduction or fuel poverty ambitions.

KWZ is also an example of a programme that made a concerted effort to localise the wider economic benefits of retrofit through their partnership with contractor Miller Pattison, whose contract obliged them to train local residents to become part of the installation team.

³¹ Arup (2012) p14

³² Kirklees Council (2010)

³³ Ibid p23

Kirklees Warm Zone, Kirklees, UK, 2005-2010

Description

KWZ was a local-authority-led programme to deliver free loft and cavity wall insulation to private homeowners.

Objectives

The objectives of the KWZ were to reduce fuel poverty, deliver a low carbon Kirklees, increase disposable income through reduced fuel bills and create new jobs. Operational targets included achieving a 70% assessment take-up rate, and insulating over 55% of all houses in Kirklees (including those already insulated).³⁴

Scale and scope

Key outputs from the scheme included³⁵:

- visits to 165,686 households
- 133,746 energy assessments
- 111,394 homes referred to the insulation contractor for a technical survey
- 42,999 properties installed with loft insulation, 21,473 with cavity wall insulation, and a total of 51,155 households with measures installed
- estimated net social benefits of £249 million

Delivery model

Day-to-day management of KWZ was delivered by Yorkshire Energy Services³⁶, a national community interest company that specialises in managing energy efficiency schemes on behalf of social housing organisations, with engagement, operational and marketing support given by Kirklees Council and Scottish Power. Installation was undertaken by Miller Pattison.

Door-to-door assessments were undertaken by Yorkshire Energy Services and freelance assessors.

Funding method

KWZ was funded through a utility obligation and an asset sale.

Best practice guidance and lessons learned

- Miller Pattison made the unique offer of establishing a local depot and recruiting local employees to deliver the scheme. This enabled skills to remain in the community after the scheme ended. This type of procurement stipulation could be used in similar cases.
- Kirklees Council states that “One of the key touchstones of KWZ success is clearly linked to the nature of the partnership working which evolved between key partner delivery organisations.”³⁷ However, involvement of partners took approximately a year, and “they strongly advise future schemes that it needs this level of discussion”³⁸ to ensure that all potential partners are comfortable with all aspects of the project.
- Kirklees Council also found similar problems with the supply chain to Salix, stating “At the start of the KWZ programme there was a regional and national shortage of key skills – surveyors and installers – even though this is a well-established industry.”³⁹ Clearly this will be an issue for the implementation of the Green Deal and other schemes going forward.

³⁴ Ibid p11

³⁵ See: www.kirklees.gov.uk/community/environment/energyconservation/warmzone/warmzonemenu.shtml

³⁶ See: www.yorkshireenergyservices.co.uk

³⁷ Kirklees Council (2010) p19

³⁸ Ibid

³⁹ Ibid

Aberdeen Heat and Power, UK

AH&P is an example of a local authority establishing an arm's length company to deliver low carbon energy to the community. It also is an example of a local-authority-led programme that incorporates private finance, repaid through utility bills.

Aberdeen Heat and Power Limited, Aberdeen, UK, 2002 - present

Description

Aberdeen City Council (ACC) established the not-for-profit AH&P to deliver affordable low carbon energy to the people of Aberdeen through district heating and CHP schemes. It began as a response to the Council's 1999 Affordable Warmth Strategy. The initial buildings selected for retrofit were those considered to be the most energy inefficient of the city's housing stock. Decentralised energy was determined to be the most cost-effective technology.

Objectives

The main objectives were to reduce fuel poverty, reduce CO₂ emissions, create training and employment opportunities, and provide safe and reliable heating and hot water.

Scale and scope

To date, the scheme supplies heat and hot water to 1,200 flats in multi-story blocks and 8 public buildings, and pipe work extensions are being undertaken to supply more public buildings. Total project cost was £1.6 million.

Delivery model

AH&P was set up by ACC as an arm's length, independent, not-for-profit company limited by guarantee. It has a membership structure rather than shareholders and a voluntary board. ACC has two permanent seats on AH&P's board and step-in rights to ensure security of heat supply on behalf of social tenants. The board also includes tenant representatives and six unpaid independent directors. AH&P can obtain local authority rates on debt financing when it borrows capital. It has a 50 year framework agreement with ACC to provide district heat and power in their housing and public buildings.

AH&P contracted First Class Gas to train installers and part of their remit was to train local unemployed people.

Funding method

Initial capital costs of the scheme were high, and therefore ACC required external funding. AH&P was set up to develop and manage CHP schemes across Aberdeen, and a legal agreement was set up between AH&P and ACC. This commits ACC to provide funding of £215,000 a year to AH&P to repay capital costs on bank loans.

Financing of AH&P was 40% through utility obligations and 60% through private bank loans which were underwritten and guaranteed by ACC.⁴¹ Land on which the energy centre was built is owned by ACC. Retrofit works are delivered to residents free of charge and the debt is repaid through energy bills.

Best practice guidance and lessons learned

- AH&P's blended finance approach has been cited as a key programme strength and integral to success. The grant funding strengthened the project business case. Blending financing to lower the average cost of capital is often essential in making the business case for housing retrofit.
- The establishment of the arm's length company enabled the local authority to raise off-balance-sheet capital and accelerate their refurbishment plans.

⁴⁰ See: <http://www.aberdeenheatandpower.co.uk>

⁴¹ Energy Saving Trust (2003) p6

Community-led models

The United Nations International Year of Cooperatives⁴² in 2012 highlighted the strengths of the cooperative business model as an alternative means of doing business and furthering socioeconomic development.

Cooperatives are essentially enterprises that are owned and controlled by the members that they serve. This means that decisions tend to be balanced between the desire for profits and the needs of the members. They are, therefore, well suited to community retrofit models whereby returns are sought to service debt and other finance, but it is also important that all stakeholders are engaged and have bought into the process.

Most community cooperatives to date have invested in renewable power generation rather than energy efficiency. However, one case study researched demonstrates the potential for using the profits of renewable energy generation and reinvesting them in local energy efficiency and carbon reduction projects.

West Oxford Community Renewables, UK

In Oxford, Low Carbon West Oxford (LCWO), a registered charity, established WOCORE an Industrial and Provident Society, to invest in community renewables, including solar photovoltaics (PV), micro-hydro and small wind turbines.

Low Carbon West Oxford and West Oxford Community Renewables, UK, 2009 - present

Description

LCWO was set up in November 2007 and brought together a number of local environmental initiatives. It became a registered charity in 2010. LCWO set up WOCORE as a community-owned Industrial and Provident Society in 2009.⁴³ It sells power generated from micro-renewables including solar, wind and hydro, to the local community and excess power to the grid.

Objectives

Objectives are to generate power for the local community, and to fund carbon reduction and behavioural change projects in the local community. The overall target is to achieve an 80% reduction in carbon emissions in the community by 2050.⁴⁴

Scale and scope

The scheme applies primarily to social housing, and industrial and commercial estates, as the most suitable for energy generation. It is intended to produce 400,000 kWh a year. It has invested in low carbon living and behavioural change projects, including behavioural change and energy efficiency programmes in housing, introducing energy efficient streetcars and street vans, tree planting and beautification.

Delivery model

WOCORE implements the renewables projects. The Industrial and Provident Society model allows WOCORE to make profits and attract investors. Projects generate income through the sale of electricity and the Feed-in Tariff. Profits are reinvested in the community via a range of carbon reduction projects.

⁴² See: <http://social.un.org/coopsyear>

⁴³ See: www.nesta.org.uk/areas_of_work/public_services_lab/past_projects_public_services_lab/big_green_challenge/finalists_big_green_challenge/assets/features/low_carbon_west_oxford_one_year_on

⁴⁴ See: www.wocore.org.uk

Funding method

£730,000 from the Low Carbon Communities Challenge, £100,000 from the Big Green Challenge competition, and £30,000 locally raised share capital.⁴⁵

Best practice guidance and lessons learned

- The LCWO/WOCORE model has empowered the community to develop its own renewable energy projects, and reinvests any profits in further carbon reduction projects in the community. This model empowers the community to invest their time and resources in the project, strengthening social capital and community networks.
- However, the scheme has relied on grant funding from the Low Carbon Communities Challenge and prize money from Big Green Challenge. Funds raised from the share issue are still small as a percentage of the total funding (approximately 3%). This could mean that the public sector is required to subsidise these sorts of schemes to enable their establishment.

Market-based models

It is clear from the many case studies analysed that public authorities have an important role to play in catalysing the retrofit market, managing retrofits and taking the first-mover position. However, with public sector financial and capacity constraints, there is a realisation that the public sector alone cannot achieve the scale of retrofit required to meet energy efficiency and carbon reduction targets.

With this in mind, the US and now the UK have introduced market-based mechanisms intended to catalyse large-scale housing retrofit, and, on the whole, target individual homeowners.

The UK's Green Deal is a market-based model introduced by the UK Government and aimed at catalysing a housing energy efficiency market, reducing carbon emissions and fuel poverty and, simultaneously, stimulating economic growth and job creation.⁴⁶ The Green Deal is intended to create a financially attractive method for homeowners to make energy efficiency improvements with no up-front costs.

The Green Deal will be arranged through registered Green Deal providers (GDPs). They will be responsible for contracting the initial energy assessments by registered assessors, arranging the implementation and financing the works. Essential to the Green Deal's feasibility is the "golden rule," whereby GDPs will only be able to offer measures that result in estimated energy savings greater than or equal to the costs of implementation and financing.⁴⁷ This is meant to act as consumer protection. However, currently, there is no guarantee element incorporated.

Consumers will repay their Green Deal loans through a charge on their utility bill. The utility charge is linked to the property itself rather than the occupier, and it will remain with the property if the occupier moves. As yet there is no evidence of how this will affect the property's sale or rental.

The Green Deal is targeted at homeowners or commercial property-owners, and it is the first delivery model in the UK that is aimed at tackling energy efficiency in private housing. The on-bill financing tool is pivotal in providing the financing mechanism to deliver retrofit at scale.

⁴⁵ See: www.nesta.org.uk/areas_of_work/public_services_lab/past_projects_public_services_lab/big_green_challenge/finalists_big_green_challenge/assets/features/low_carbon_west_oxford_one_year_on

⁴⁶ See: www.gov.uk/green-deal-energy-saving-measures/how-the-green-deal-works

⁴⁷ See: www.gov.uk/green-deal-energy-saving-measures/repayments

However, there are also models being investigated where local authorities are instrumental in marketing, providing and delivering Green Deal projects.

Local authorities can choose to play different roles in supporting Green Deal implementation⁴⁸, including:

- providing the Green Deal to local residents and businesses, by coordinating finance and delivery;
- working in partnership with private-sector GDPs and community partners to deliver and/or facilitate delivery; or
- promoting the Green Deal locally through marketing and educational activities.

The Green Deal has only recently been launched in the UK. However, there have been pilot projects operated by local authorities to test these types of mechanisms. There is a recognition that the social housing sector needs to take a lead role in community-wide delivery of housing retrofit. This is to generate economies of scale and deliver the pilot projects needed to provide inspiration and confidence to private homeowners to commit to the Green Deal approach.

Birmingham Energy Savers, UK

The BES⁴⁹ case study is an example of a local-authority-led pilot programme which has aimed to implement a Green Deal approach to housing retrofit. BES has been successful in implementing a large-scale programme, although to date it has concentrated mainly on solar PV. The roll-out of a wider, whole-building Green Deal framework on an estimated 200,000 homes is planned and is expected to be completed in 2026.

Birmingham Energy Savers, Birmingham, UK, 2011 - present

Description

Birmingham City Council (BCC), in partnership with the Birmingham Environmental Partnership, set up BES to stimulate a retrofit market in the city. It is essentially a pilot Green Deal project that demonstrates how a large-scale, local-authority-led Green Deal programme may work in the UK.

Objectives

The main objectives of the BES programme are to deliver retrofit of residential and non-residential buildings and to become a leading hub of a low carbon economy, as part of the council's carbon reduction target. It aims to create employment through management and installation of measures, and to develop scale in the supply chain.

Scale and scope

BES is funded by BCC, energy suppliers and commercial banks, initially up to £100 million, to support the energy efficiency of 15,000 homes in disadvantaged areas by 2015.⁵⁰ This will include solar PV, insulation and replacement of boilers, among other measures.

The next phase is to implement the retrofit of 45,000 properties by 2020.⁵¹

Delivery model

BCC has partnered with Carillion Energy Services to deliver the installations. The contract value is £600 million over the next 5 years.⁵²

⁴⁸ DECC (2011) (b) p3

⁴⁹ See: www.birminghamenergysavers.org.uk/

⁵⁰ See: www.slideshare.net/sustainableCoRE/birmingham-energy-savers-preparing-for-the-green-deal-by-dave-allport

⁵¹ See: www.carillionplc.com/news-media/news/2013/birmingham-energy-savers-gets-official-launch.aspx

⁵² See: www.birminghampost.net/news/west-midlands-news/2012/10/09/carillion-lands-600m-birmingham-energy-savers-contract-65233-31993261

Funding method

BCC is expected to provide up to £75 million for the initial programme, with another £25 million to support “hard-to-treat” households. This will be repaid under the Green Deal scheme, supported by Feed-In Tariffs, the Renewable Heat Incentive, and other funds and grants.⁵³ It is not known yet how financing will be raised for the full programme of 60,000 households.

Best practice guidance and lessons learned

- The BES case study demonstrates how a blend of financing sources is needed to make the business case for retrofit. Combining grants and subsidies, debt and incentives is important to build an attractive business case.
- It also demonstrates how public-sector actors are essential in driving retrofit at scale, particularly to provide the technical assistance necessary in making schemes deliverable and minimising transaction costs.

⁵³ See: www.cnplus.co.uk/news/carillion-wins-pioneering-600m-birmingham-green-deal-contract/8636884.article

Funding mechanisms

To some extent it is difficult to separate funding from delivery because the two are so inextricably linked in implementing retrofit programmes. However, it is useful to make the distinction in order to explore the wide range of funding mechanisms that have been used internationally to deliver housing retrofit models.

The research undertaken revealed that the following five mechanisms tend to be used in the majority of housing retrofit programmes;

1. Government incentives and utility obligations
2. Public-sector supported grant or loan schemes
3. Revolving funds
4. On-bill financing and repayment
5. Market-based tools

In addition to these, homeowners have the option of using existing credit lines available through their mortgage providers. However, this funding option has been curtailed by depressed property prices and the credit crunch.

Many of these funding options are not mutually exclusive, and some programmes may combine two or more. There is also no one-size-fits-all solution. The right option for an individual programme will depend on country-specific policy and regulation, access to capital, building typologies and technical interventions. This section, therefore, concentrates on description rather than prescription, although there are clearly some options that are more suitable for large-scale retrofit deployment than others.

Government incentives and utility obligations

Government or utility-sponsored incentives are often essential in supporting the business case for retrofit. A US study undertaken by the National Home Performance Council found that of 126 “whole-home” retrofit programmes in the US, approximately 86% include some form of rebate or incentive.⁵⁴

Incentive schemes usually involve cash rebates or subsidies for specific retrofit measures, such as energy efficient boilers, duct sealing and double-glazed windows. In some programmes, home owners can receive a rebate only if the energy auditor’s recommendations have been fully implemented. In many countries, programmes have been established to provide grants to install insulation in the lowest income homes, such as the US Weatherization Assistance Program. These have been largely successful, although they target only a small segment of the market.

In addition, some countries offer incentives that encourage homeowners to install renewable energy technology, such as photovoltaic panels. These incentives for renewable electricity and heat generation include Feed-In Tariffs, which are being implemented worldwide, and in the UK, the Renewable Heat Incentive for renewable heat generation, which is the first of its kind.

Most energy utility companies internationally have regulatory obligations to sponsor energy efficiency programmes. In the US about 90% of whole-home retrofit programmes are sponsored by utilities.⁵⁵

In the UK, an important complement to the Green Deal is the Energy Company Obligation (ECO) which replaces other supplier obligation schemes. The ECO, initially providing funds of £1.3 billion per year, will fund a range of “hard-to-treat” households.⁵⁶ In some circumstances, namely where customers meet the fuel poverty criterion, the ECO will fund all the Green Deal approved energy efficiency measures.

Public-sector-supported grant and loan schemes

Municipalities, regional authorities and national governments have the option of supporting grant and loan schemes to deliver energy efficient retrofit in their communities.

KfW Bank, Germany

One of the most effective and far-reaching schemes is the German state-owned bank KfW’s energy efficient refurbishment loan programme as detailed in the case study below. KfW does not have its own distributional network so it has set up an “on-lending” mechanism whereby credit lines are extended to German commercial banks. These banks then handle loan applications from project owners and, most importantly, take the credit risk. Through this mechanism there is no legal relationship between the loan beneficiary and KfW.

KfW Energy Efficient Construction and Refurbishment Programme, Germany, 2001-present

Description

KfW, founded in 1948, is the promotional bank of the Federal Republic of Germany. It is a publicly-owned bank with 80% shares owned by the Federal Republic and 20% by the federal states. The housing modernisation programme was partly catalysed by the need to modernise the building stock of the former GDR in the early 1990s.

Since 2001, approximately €40 billion has been committed to housing projects. KfW’s promotional programmes have contributed nearly 50% to the achievement of German climate protection goals in the housing sector.⁵⁷ It is also estimated that, since 2006, an average of 200,000 jobs have been created or safeguarded each year.⁵⁸

⁵⁴ National Home Performance Council (2010)

⁵⁵ Ibid

⁵⁶ See: <http://bob.instituteforsustainability.org.uk/knowledgebank/retrofitguides/guide-A/Pages/A-3-The-Energy-Company-Obligation.aspx>

⁵⁷ OECD (2012) p14

⁵⁸ Ibid

Objectives

The objectives of the programme are to increase the energy efficiency and comfort of German homes and to reduce carbon emissions in line with the German carbon reduction target of 40% by 2020.

Scale and scope

Each housing unit can receive up to €75,000 of funding for structured pre-defined investment packages for a maximum tenure of 30 years.⁵⁹ Each package relates to a different level of “Effizienzhaus,” or KfW-Efficiency House, a standard that has been developed by KfW to define different levels of energy efficiency. A KfW-Efficiency House 100 (KfW-100), for example, meets the same energy efficiency criteria as a new building, as defined in the German Energy Savings Ordinance for Buildings (EnEV). A housing unit which meets an efficiency of more than a KfW-100, for example, a KfW-70, will receive more funding and also a corresponding level of debt relief. This debt relief (in the form of a grant) can range from 2.5-17.5% of the total cost of the retrofit. Passivhaus (the most energy efficient housing) correspond to KfW-55 and KfW-45, depending on the types of ECMs installed.⁶⁰

In order to meet the high energy standard of an Effizienzhaus, investments such as renewal of heating systems, insulation and double glazing are usually required. The high level of standardisation facilitates streamlining of the technical and financial assessment of projects.

Delivery model

KfW extends low-cost credit lines to local banks for retrofit projects in private housing. In addition it subsidises loans if homeowners reach certain levels of energy efficiency, in line with their Effizienzhaus financial products.

This model enables KfW to access a broad distribution network through local banks. These local banks will then undertake the project risk assessment and take on the credit risk.⁶¹

Funding method

KfW raises funds on the capital markets and then finances retail banks which, in turn, finance the homeowners. The retail banks make a margin on the interest rate provided to homeowners and this covers their handling costs and credit risk. The difference between KfW’s cost of capital and the interest rate provided to the retail banks is subsidised by the Federal Government through KfW.

The loan is secured on a secondary land charge over the property, with the first-ranking charge remaining with the first mortgage holder. The interest rate provided by the commercial banks depends on the collateral value of the property.⁶²

The homeowner has to pay up-front for an energy audit but this can be financed from the long-term loan if the project is accepted.

Best practice guidance and lessons learned

- KfW has standardised its investment packages so that transaction costs relating to technical and financial assessment are minimised. This also helps with the marketing of products to customers, including dissemination of information about retrofit measures. The debt relief associated with increasing levels of energy efficiency acts as an incentive to homeowners. The €75,000 limit means that homeowners can undertake standard modernisation and energy efficiency projects and makes the loan very attractive.
- KfW subsidises loans granted by regional banks. It raises its funds on the capital markets, and, due to its high credit rating, can grant low cost credit lines. This means that its loans are competitive and are popular with homeowners.
- KfW transfers credit risk to local banks. These banks generally have pre-existing relationships with homeowners through their mortgages or other financial products and are best placed to understand homeowners’ credit risk.

⁵⁹ See: www.kfw.de/kfw/en/Domestic_Promotion/Our_offers/Housing.jsp

⁶⁰ OECD (2012) p11

⁶¹ Ibid p8

⁶² UCL Energy Institute (2011) p40

Revolving funds

A revolving fund allows the returns from particular investment activities to be “revolved” and re-invested without the limitations introduced by fiscal or financial years. This enables the fund to continue, in theory, in perpetuity.

Revolving funds have become popular for financing energy efficiency projects whose paybacks often span a number of years. In addition they benefit programmes that require significant planning and implementation before returns are realised as is the case with many energy efficiency projects. In the case studies analysed, revolving funds have been used to leverage private-sector investment into programmes and projects with the public sector acting as the first mover.

JESSICA programme, Estonia

One example of a large-scale revolving fund programme is the European Commission and European Investment Bank’s JESSICA programme.⁶³ JESSICA enables Managing Authorities across the EU to use some of their ERDF to establish revolving funds for a range of equity, debt and grant instruments to invest in sustainable urban development projects that form part of an integrated urban plan.

Over 35 urban development funds (UDFs) have been established to date.⁶⁴ Some Managing Authorities have decided to focus their funds on implementing energy efficiency and renewable energy projects, including the UK, Estonia and Lithuania.

The ERDF contribution provides interest-free capital that can be used to subsidise commercial rate loans providing attractive, blended rates of finance to project developers.⁶⁵ This ERDF contribution must be matched or co-financed by either the public or the private sector. The level of match funding required depends on the specific country.

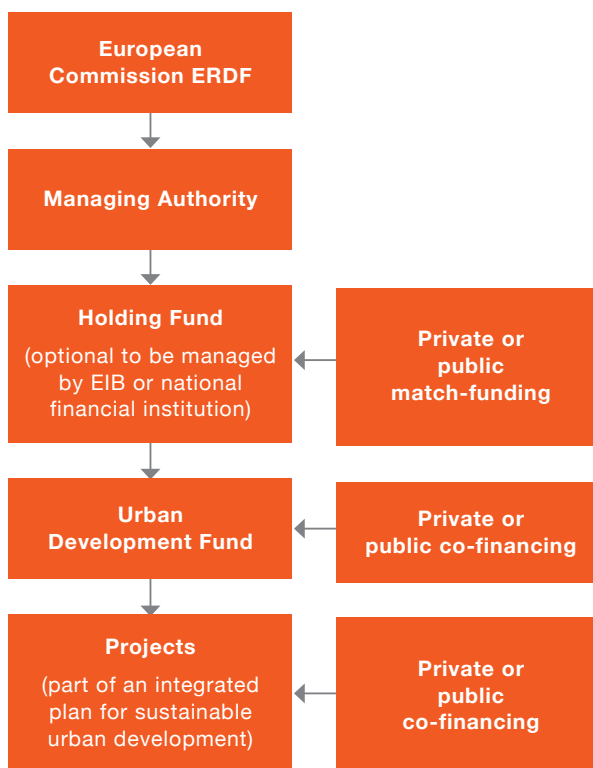


Table 4. Governance Structure of a JESSICA Urban Development Fund (Source: Arup)

The case study overleaf examines how the JESSICA programme operates in Estonia and finances energy efficiency projects in housing.

⁶³ See: http://ec.europa.eu/regional_policy/thefunds/instruments/jessica_en.cfm

⁶⁴ See: www.eib.org/products/jessica/funds/list.htm

⁶⁵ Because JESSICA involves EU funding there are a number of legislative provisions and regulations concerning its use, including State aid regulation. Details of these regulations can be found at: http://ec.europa.eu/regional_policy/thefunds/instruments/jessica_legislation_en.cfm

JESSICA programme, Estonia, 2009-present⁶⁶

Description

The JESSICA programme in Estonia is operated through the KredEx national bank, acting as the Holding fund, and the Ministry of Economic Affairs and Communications. Two UDFs have been set up, operated by retail banks in Estonia (Swedbank AS and SEB). These UDFs make loans to apartment building associations and take on the credit risk.

Objectives

Approximately 75% of Estonia's population live in multi-apartment buildings. Many of these are of low quality and, as a result, have poor energy efficiency, leading to the majority of residents living in fuel poverty.⁶⁷ The fund's energy-related targets are to improve energy efficiency by at least 20% in apartment buildings of up to 2,000 sqm and by at least 30% in apartment buildings over of 3,000 sqm.⁶⁸ The objectives are to reduce fuel poverty amongst Estonian homeowners, and to improve the quality and sustainability of homes.

Scale and scope

The revolving fund was initially capitalised with €33 million and is further leveraged through Swedbank's own funds. The interventions financed can include: insulation of frontages; roofs; walls and cellars; replacement of windows and doors; renovation of heating systems; mounting renewable technologies; and replacement of controls systems, among others.

The results to the end of 2011 were: refurbishment of over 350 apartment buildings and 11,000 apartments, involving investment of more than €30 million. The average energy saving over the programme is estimated at 36%.⁶⁹

Delivery model

The KredEx Holding Fund was capitalised by €17 million from the ERDF and €29 million from a loan from the Council of Europe Bank (CEB) backed by an Estonian state guarantee.⁷⁰

The UDF revolving funds are held as separate blocks of finance held by Swedbank AS and SEB. The majority of the loans made are to apartment and housing associations which have existing relationships with the bank. Loan repayments are treated as separate charges to the utility bills for their individual apartments and are managed by the apartment associations.

Funding method

The financial products are long-term (up to 20 years) bank loans with fixed interest rates for the first 10 years (between 4.3% and 4.8%).⁷¹ There is no maximum amount because it depends on client requirements.

Beneficiaries can also obtain grants from the State government and municipalities to supplement their low interest rate loans, this can be up to 35% of the loan amount. This depends on the levels of energy saving that can be achieved – i.e. for a 35% grant they need to achieve an energy saving level of at least 50%.⁷²

Best practice guidance and lessons learned

- Swedbank, the retail bank, originates and services the loans reducing the credit risk since it has pre-existing relationships with apartment associations. This enables the programme to lend at more competitive rates than are generally available in the market, and therefore supports the development of the energy efficiency market in Estonia. Access to competitive rates of finance is important in making the business case for energy efficiency.
- The loan products are made more attractive by the state grants which help to lower the cost of financing energy efficiency projects for apartment owners.

⁶⁶ See: www.buildup.eu/publications/24200

⁶⁷ KredEx (2011) p4

⁶⁸ Ibid p10

⁶⁹ KredEx (2011) p18

⁷⁰ Ibid p8

⁷¹ Ibid p10

American Recovery and Reinvestment Act: Clean Energy Works Oregon programme, US

In the US, \$3.1 billion funding has been made available for State Energy Programs (SEPs)⁷³ under the American Recovery and Reinvestment Act of 2009 (ARRA). ARRA specifically encourages the creation of long-term funding mechanisms such as revolving funds. Many states have applied for and established revolving funds to invest in energy efficiency and renewable energy projects.

One example of the use of an ARRA revolving fund is in the Clean Energy Works Oregon programme. It has primarily used ARRA funds as a loan-loss guarantee to reduce the credit risk to local banks offering finance to homeowners.

Clean Energy Works Oregon, US, 2010 - present

Description

Clean Energy Works Oregon (CEWO) is a non-profit programme for housing energy efficiency established in the state of Oregon as an on-bill financing programme for large-scale energy efficiency retrofit across the state. The federal ARRA programme has contributed \$20 million to seed-fund the revolving fund.

Objectives

Objectives include upgrading homes, reducing carbon emissions, and creating well-paid jobs for residents.

Scale and scope

The programme is aimed at Oregon homeowners interested in improving the energy efficiency and comfort of their homes. Within 24 months of the programme launch, 4,660 housing evaluations had been completed, 1,916 housing energy upgrades completed, and 1,851 housing loans were provided for a total of more than \$23 million.⁷⁴

Delivery model

The fund is operated as a revolving fund and backed by an ARRA loan-loss guarantee. Loans are originated and serviced by local banks.

The programme offers support and expertise at all levels, including energy audits, recommendations, financing and contractors.

Funding method

CEWO finances lending partners, including a number of regional and local retail banks.⁷⁵

Homeowners in Oregon can use up to \$30,000 of finance on energy efficiency upgrades with a loan involving no up-front costs that is then repaid on their heating bills. There is also an incorporation of up-front rebates for some areas within Oregon. Maximum loan amounts are based on the modelled energy savings of homes – 15% = \$10,000, 20% = \$20,000, 30% = \$30,000⁷⁶

Borrowers repay loans through an additional fee on their utility bill. Financing costs are calibrated to match the borrower's income.

CEWO offers up-front rebates on energy assessments, performance-based rebates and limited-time bonus rebates. The limited-time bonus rebates have been found to attract the attention of new customers every time they are offered. The up-front rebates have been found to incentivise customers to undertake an initial energy assessment which then makes it much more likely that they will go on to finance the upgrade. Performance-based rebates are currently set at \$500 for 15% savings, \$1,000 for 25% savings and \$1,500 for 30% savings or more.⁷⁷

⁷³ See: <http://ase.org/resources/recovery-act-state-energy-program-funding-opportunity-announcement>

⁷⁴ See: www1.eere.energy.gov/buildings/betterbuildings/neighborhoods/oregon_profile.html

⁷⁵ See: www.cleanenergyworksoregon.org/rebates-financing

⁷⁶ See: www.cleanenergyworksoregon.org/faq

⁷⁷ Better Buildings (2012) p2

Best practice guidance and lessons learned

- A revolving fund facilitates re-investment of project proceeds and extends the programme beyond the first investment phase.
- CEWO made an effort to reduce barriers to entry through offering a rebate on energy assessments – it found that 50% of people who undertake an assessment eventually do the upgrade and take out loan finance. Therefore, this small subsidy up-front encourages overall uptake of the programme.
- Each lending partner requires different security. Some require liens on property which equate to an additional mortgage. Others require a “UCC-1” filing which is not a lien but is placed on the property title and means that when a property is sold or transferred the full amount of the loan balance will be payable.⁷⁸ This could be a disincentive for property owners to take out these types of loans, and may affect their value in the property market. However, some partners, including a regionally-based bank, offer unsecured loans.
- Participants are able to fund non-energy improvements through the programme’s loan products and can account for either 20% or 49% of the total project cost depending on the loan product selected.⁷⁹ Attaching energy efficiency funding to funding for overall home improvements (such as in the KfW model) appears to be a good way of encouraging market demand.

Bay Area Affordable Multifamily Retrofit Initiative, California, US

Of course, not all programmes are successful and there are some important lessons learned to be learned from ones that have experienced challenges. One such example is the Bay Area Affordable Multifamily Retrofit Initiative. Take-up of this programme has been minimal and is mostly due to complicated programme procedures, a lack of consumer protection and financing explicitly linked to energy savings, leading to small amounts of funding that were not attractive to homeowners.

Bay Area Affordable Multifamily Retrofit Initiative, California, US, 2010-11

Description

The Initiative was funded by the State Energy Programme (SEP) and undertaken by Enterprise Community Partners and the Low Income Investment Fund in conjunction with many local governments in the Bay Area. The Bay Area Multifamily (BAM) Fund was set up to invest in energy efficiency retrofits using traditional property-secured loans.

Objectives

The objectives of the programme were to create jobs and stimulate the economy through implementing energy retrofits in existing residential buildings. It aimed to do this through providing finance mechanisms, demonstrating effective marketing and outreach and streamlining participant, contractor, and administrative processes.

⁷⁸ Ibid

⁷⁹ Better Buildings (2012)

Scale and scope

The core services of the BAM Fund included:

- investment grade energy audit;
- financing through a favourable termed loan from the BAM Fund;
- assistance in assembling other funding for the retrofit project;
- quality assurance and verification inspection following completion of the retrofit project; and
- resident education and operations and maintenance staff training services.

The programme has sought to target 26 multifamily buildings / 1,600 multifamily units. Although a total of 51 properties received an energy audit, only 3 owners and 6 properties agreed to participate.⁸⁰

Delivery model

The San Francisco Mayor's Office of Housing was the prime contractor for the initiative, responsible for contract administration and programme oversight. Enterprise Community Partners and the Low Income Investment Fund were responsible for programme implementation, origination and technical support.

Funding method

The initiative created a green retrofit revolving loan fund using approximately \$3 million of SEP funds and \$6 million of public and private-leveraged funding. The SEP funds allowed the revolving fund to offer finance with a lower blended cost of capital and on a non-secured basis to housing energy efficiency projects.

One of the elements of the programme was to explore the possibility of combining many different funding resources to undertake deep, whole-building, retrofits i.e. other public funding programmes.

Best practice guidance and lessons learned

- Research demonstrates that the low participation rates were due to:
- owners not being able to justify spending a lot of time negotiating with existing mortgage holders to add a small amount of financing.⁸¹
- debt levels were explicitly linked to energy savings and therefore were often small and not attractive.
- owners were not willing to take on the risk of not achieving energy savings, i.e. there was no consumer protection involved in the scheme.⁸²

In addition, leveraging many different funding programmes to undertake whole-building retrofits was difficult and time-consuming.

This programme demonstrates the greater potential of bundling ECMs with other capital modernisation projects to create larger loan sizes. This both reduces transaction costs and makes a more attractive business case for homeowners and lenders. Research shows that in successful projects capital for energy efficiency could be leveraged into larger financings for holistic renovations of property, in line with asset replacement cycles and/or re-financing. In this way small loans can be integrated into much larger loans, potentially at reduced interest rates.

⁸⁰ California Energy Commission (2012)

⁸¹ California Housing Partnership Corporation (2012) p4

⁸² Ibid

On-bill financing and repayment

On-bill financing is one of the most prevalent methods of financing for housing retrofit. It is primarily used in one of two ways: either through a charge on utility bills or through property taxes. The former is being tested in the UK's Green Deal and the latter has been used in the US's Property Assessed Clean Energy (PACE)⁸³ programme, both discussed later in this section.

On-bill financing is a mechanism through which energy efficiency improvements are implemented and repaid via a charge on a utility bill. On bill-tariffs refer to a specific type of on bill finance through which repayment is attached to a meter- thus the obligation to repay remains with whoever is the homeowner. Similarly, the utility company may have a right to disconnect energy supply if the repayment is not made, reducing default risk. By spreading the repayment cost over an extended period of time (such as 12-15 years), the homeowner can benefit from a net reduction in utility bills. On-bill loans are another type of on-bill finance in which the utility company provides short-term (e.g. five year) low-cost loans to homeowners which are paid back via utility bills. The key difference is that the loan is not passed on to others if a property is sold; it must be paid back by the initial homeowner.

Power Smart Residential Loan, Manitoba Hydro, Canada

In Canada, Manitoba Hydro offers its customers a Power Smart Residential Loan, which allows them to borrow up to \$7,500 per residence for a maximum period of 5 years for energy efficiency measures and 15 years for high efficiency boilers at an interest rate that is fixed for the first five years at 4.8%.⁸⁴ Nearly 60,000 households participated in 2010/2011, and, over the last ten years, the programme has had about 295,000 residential customers.⁸⁵ The programme, which is over 20 years old, has been described as the most successful on-bill finance plan in North America, saving residential customers about \$25 million in 2010/2011. It also has high recognition in the community – 93% of customer survey respondents said they recognise the Power Smart brand. Manitoba Hydro has continued to expand its energy efficiency programmes; in 2012 it launched a programme whereby residential customers can access longer term finance and transfer the financing obligation to the next homeowner.

The Green Deal, UK

Under the Green Deal, UK homeowners can turn to their utility companies or other organisations to register their interest and have an energy assessment conducted by a Green Deal assessor. Financing is arranged by GDPs, who are the counter-signatory to the Green Deal plan and are responsible for arranging the finance and installation of energy efficiency measures. The Green Deal Finance Company has emerged as an industry coalition, set up as a not-for-profit organisation, to deliver low-cost financing to support the implementation of the Green Deal. It intends to serve as a national aggregator that can pool funding needs to minimise transaction costs and attract the lowest sources of finance in the market. The recently established UK Green Investment Bank may also provide low cost financing support for the Green Deal. Green Deal plans set out the financial terms of the agreement and must also include extra consumer protections such as warranties to cover the measures and installation. Like PACE financing, the programme benefits include the removal of up-front costs and the ability to transfer loan obligations to the next homeowner.

The Green Deal is attached to utility bills, not property taxes. It will, therefore, not interfere with mortgage finance. However, it is yet to be seen how it will affect a property's value when it comes to re-sale or rental. The potential scale of the programme is huge: the UK Department for Energy and Climate Change expects to leverage up to £14 billion in private finance between 2012 and 2022.⁸⁶ The UK Government has also introduced supporting legislation including that from April 2016 private residential landlords will be unable to refuse tenants' requests for reasonable energy efficiency improvements, and, from April 2018, a law banning landlords from renting out residential or commercial property with an EPC of a to-be-agreed-upon rating.⁸⁷

However, there remain many doubts in the market about the potential uptake of the Green Deal, particularly due to the high cost of capital (just under 7%, which may reflect the perceived risk of Green Deal finance), assessment charges of up to £150, lack of guarantee for energy savings, and early repayment penalties. The UK government is enticing early adopters by offering cash-back of up to £1000 depending on the

⁸³ See: www1.eere.energy.gov/wip/solutioncenter/financialproducts/pace.html

⁸⁴ See: www.hydro.mb.ca/your_home/power_smart/residential_loan/index.shtml

⁸⁵ 2010/11 Power Smart Annual Review, Manitoba Hydro (released 2012)

⁸⁶ See: www.gov.uk/government/news/homes-and-economy-to-benefit-from-energy-and-climate-policies-huhne

⁸⁷ See: www.legislation.gov.uk/ukpga/2011/16/contents/enacted

⁸⁸ See: www.guardian.co.uk/environment/2013/jan/27/green-deal-unlikely-deliver-promises

measures installed. There have also been criticisms made that the Green Deal will benefit mainly large energy service companies rather than small and medium-sized enterprises because GDPs need to be able to offer the full range of services rather than just a few such as boiler replacement or double-glazing. In this way it could exclude small businesses.⁸⁸

Property Assessed Clean Energy finance, US

PACE programmes finance energy efficiency upgrades in residential and commercial properties through long-term loans repaid by a voluntary increase in property taxes over 10 to 20 years. Homeowners receive the benefits of low up-front costs and the ability to transfer the remaining loan payments to a new owner if the property is sold. However, the main challenge for PACE's implementation is that a PACE loan is designed to take seniority over an existing mortgage. Most mortgages are not technically held by the original lender and are placed in securitised loan pools, which are held by a large number of investors. These investors, including the two largest – the US Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac) - have objected stating that they will not accept such loans.⁸⁹ Due to the amount of leverage that these organisations have in the mortgage market it has effectively stalled or halted the PACE programme in residential property. However, it is expected that PACE may have much stronger potential in the commercial retrofit market.

Home Energy Affordable Loan, Arkansas, US

The last type of on-bill repayment scheme researched is a new example – the Arkansas Home Energy Affordability Loan (HEAL),⁹⁰ a project of the William J. Clinton Foundation's Clinton Climate Initiative – Arkansas, and partially funded by ARRA. This is an innovative employee benefits programme designed to implement both corporate and residential energy efficiency projects.

Home Energy Affordability Loan, Arkansas, USA, 2011-present

Description

According to the Clinton Presidential Center's website, HEAL is a “unique, energy-based, employee benefits program designed to improve quality of life, at both the corporate and homeowner levels, by reducing GHG emissions and improving energy performance in commercial and residential buildings.”⁹¹

In 2010, a Home Performance Resource Centre White Paper showed that there were four main reasons why residents of Arkansas were not retrofitting their properties: a lack of time and knowledge, a lack of access to capital, a lack of awareness of savings, and a lack of availability of services.

HEAL was set up in 2011 to provide an innovative response to retrofitting both commercial and residential property.

Objectives

The aim of the programme is to facilitate a housing carbon market through converting savings to verified and tradable emissions certificates.

HEAL's goal is to decrease homeowners' energy bills by an average of 20% or more leading to safer, more comfortable homes.

Scale and scope

The total federal funding for the scheme was \$500,000. As of September 2012, the HEAL programme had completed 131 housing retrofits, and 141 energy upgrades.⁹²

⁸⁸ See: www.nytimes.com/2010/07/01/business/energy-environment/01solar.html?pagewanted=all&r=0

⁹⁰ See: www.clintonpresidentialcenter.org/about-the-center/heal

⁹¹ Ibid

⁹² See: www.epa.gov/statelocalclimate/local/showcase/littlerock.html

Delivery model

Stakeholders involved in the delivery of the programme include: William Jefferson Clinton Foundation's Clinton Climate Initiative, US Department of Energy (ARRA Funds), State of Arkansas Energy Office, State of Arkansas Governor's Office, AmeriCorps VISTA, Little Rock Workforce Investment Authority, and the Central Arkansas Planning and Development District

Funding method

The process is as follows:

1. HEAL provides technical assistance to companies that are planning to undertake commercial retrofit of the properties they own
2. HEAL lends money to finance improvements at 0% interest
3. The company dedicates a portion of its energy savings as a result of the retrofit to a revolving loan fund
4. This revolving loan fund is available to its employees to identify and finance energy efficiency measures in their homes

Employees repay debts to the fund through payroll deductions with the repayment schedule tied to savings realised through lower utility bills.

Best practice guidance and lessons learned

The programme is too new to comment on best practices or lessons learned from its implementation. However, it is interesting as an innovative approach to leveraging funding for housing retrofits.

It is likely that it will work with only large corporations or public sector bodies since a high level of energy savings would need to be generated in order to set up a revolving fund to fund employees' home retrofit projects.

Market-based tools

The last type of financing mechanism analysed is market-based tools. These are still very much in their infancy but they provide an interesting view on how local energy efficiency markets could be developed.

The case study below demonstrates an innovative market-based mechanism that has been set up in Australia.

Victorian Energy Efficiency Target, Australia

Victorian Energy Efficiency Target (VEET), Australia, 2009-present

Description

VEET is administered by the Essential Services Commission (ESC). The scheme was established under the Victorian Energy Efficiency Target Act 2007 and is administered in accordance with the Victorian Energy Efficiency Target Regulations 2008. It is legislated to continue in three-year phases until 1 January 2030.⁹³

The scheme operates by placing a liability on energy utilities in Victoria to surrender a specified number of energy efficiency certificates each year. These retailers can create certificates directly by undertaking 35 prescribed activities, or purchase certificates in a competitive market, or both.⁹⁴

Each certificate represents one tonne of greenhouse gas abated and is known as a Victorian energy efficiency certificate (VEEC).

Objectives

VEET's aim is to make energy efficiency improvements more affordable, reduce GHG emissions, and encourage investment, employment and innovation in the energy efficiency market.

⁹³ See: www.veet.vic.gov.au/Public/Public.aspx?id=Overview

⁹⁴ Ibid

Scale and scope

For the first three year phase (2009-2011) of the scheme the target is 2.7 million VEECs per annum, increasing to 5.4 million VEECs per annum during the second three-year phase (2012-2015)⁹⁵

Delivery model

VEECs are created when accredited parties install energy efficiency improvements in homes through discounted purchase programmes at participating home improvement centres. The certificate creators (the accredited installers) then sell the VEECs to energy utilities that have an obligation to purchase certificates. Utilities largely absorb this cost, as their ability to raise energy tariffs is limited by regulation. Therefore the financing of the scheme is effectively undertaken by the energy utilities through decreased profits.

The scheme has many innovative features:

- households assign their right to create certificates to an accredited certificate creator in exchange for discounted or free installation;
- the scheme is able to set an overall reduction target and allow certificate creators to respond. The value of the certificates induces certificate creators to undertake prescribed measures as cost effectively as possible; and
- intermediate funding risk lies with the certificate creators who are most likely to directly benefit financially from the programme.

The scheme is now moving beyond the housing sector to include businesses and public sector buildings.⁹⁶

Funding method

Revenue generated by the certificate creators, through the sale of VEECS, funds their ability to sell the efficiency products at a discount. Similar schemes have been established in New South Wales and South Australia.

Best practice guidance and lessons learned

The VEET appears to be successful in leveraging private finance into energy efficiency projects, and creating a market for a range of energy efficient installations. However, it is primarily driven by policy and replication elsewhere would depend on the attractiveness of implementing policy and legislative changes. It is yet to be seen how successful this programme will be in the long term and whether it is adopted by other municipalities.

⁹⁵ Ibid

⁹⁶ See: www.ecovantage.com.au/index.php/partners/latest-news/314-veet-rebates-now-available-for-businesses

Key findings and recommendations

The study highlights many findings that should be important in influencing the decisions and programmes of potential retrofit providers, be they public sector organisations, community groups or financial institutions.

Finding 1

There is no “one-size-fits-all” approach when it comes to housing retrofit

The three main types of delivery model identified are:

- public-sector-led models that incorporate a range of financing mechanisms, can require significant amounts of time and investment in stakeholder engagement, and tend to be focused on social housing. The challenge for these programmes is to combine enough low cost public sector finance with subsidies to make the business case attractive to the private sector. In programmes such as BES, KWZ and AH&P the public sector tends to take the “first-mover” position. These programmes can range from small to large scale and have the potential to be replicable within similar legislative backgrounds.
- innovative community-led models, for example the WOCORE or HEAL models, that use a mix of public sector finance and bespoke financing tools – a share issue in the case of WOCORE and a corporate revolving fund in the case of HEAL – to invest in programmes that are focused on engaging and involving local communities but have not, as yet, been replicated elsewhere; and
- market-based models such as on-bill financing and repayment, public sector extension of credit-lines to retail banks or revolving funds, that try to deliver programmes through providing new financing options for individual homeowners. These models can be seen in the KfW, BES or Estonian JESSICA fund case studies.

Recommendations

- It is clear that there is no “one-size-fits-all” approach. Local communities, and national and local governments, will need to investigate what might work well in their own community and how best to engage both suppliers and homeowners. A recent study by the Milken Institute in the US found that a cross-sector group of stakeholders agreed that “until it is clear which of these programs works best, it is important to support as many as possible and to ascertain which programs fit which regions.”

Finding 2

The public sector needs to act as first-mover in promoting and implementing housing retrofit schemes

- Many of the successful models reviewed in the study relied on the public sector as a first-mover, often subsidising or incentivising the costs of retrofit, but involving the private sector in financing and/or underwriting projects.

Recommendations

- Subsidies and incentives including loan rebates, free energy assessments and subsidised interest rates are important in attracting homeowners to public and private sector schemes. The CEWO programme found that 50% of people who undertake an initial assessment eventually signed up to the programme. The public sector providing an upfront subsidy or incentive can therefore be important in driving programme take-up.
- Revolving funds can be a useful way to circumvent budgetary limitations and deadlines, and ring-fence finance for retrofit. These can be set up at many different scales: the case studies analysed included company, municipality, regional and national-level funds.
- Governments should support the roll-out of large scale demonstration projects such as the BES programme to understand how transaction costs can be minimised and realise economies of scale.

Finding 3

Stakeholder engagement for community models needs to be extensive and involve a wide range of partners including tenant groups, social housing and government organisations

The Institute for Sustainability in its Total Community Retrofit demonstrator projects in East London has found that retrofit programmes require participation at many different scales. They also found that programmes that are powered by residents are more likely to be successful.

Recommendations

- Designers of retrofit programmes should ensure they use all existing channels to engage with communities including resident groups, forums and other community initiatives. Setting up steering groups involving local residents can also be important in ensuring that retrofit programmes have sufficient local demand and buy-in.
- Public sector organisations should therefore factor in sufficient time and cost for stakeholder engagement in the design of new retrofit programmes.

Finding 4

The main drivers for housing retrofit are comfort and sustained or improved asset values, not energy savings

- The main drivers for housing retrofit are not energy savings and carbon reduction, but comfort levels and sustained, or even improved, asset values. This is supported by evidence found in the New Barracks Estate retrofit scheme, and the popularity of funds that allow for spending on wider capital improvements than just energy efficiency measures.

Recommendations

- This finding affects social and private homeowners differently. Social housing owners, particularly local government, should look beyond the direct benefits of housing retrofit (such as a potential

⁹⁷ The Milken Institute (2010)

reduction in fuel poverty), and recognise that retrofit supports other policy agendas and targets, most notably public health. As mentioned previously, illnesses related to cold homes are estimated to cost the NHS £1.36 billion per year. Additional socio-economic benefits should be fully analysed in business cases for implementation of retrofit programmes.

- Private sector owners will need to see evidence that energy efficient retrofit is necessary to sustain or improve their asset values and rental premiums.
 - For rental property, legislation such as the UK Energy Act 2011 which legislates against the rental of energy inefficient properties will be important, and setting this at an appropriately high level will be essential.
 - For all property tenures, strengthening the link between energy performance and property values will be critical; energy efficient labelling of homes is an important start and one that needs to be strongly enforced by central government.
- Other benefits that could be seen in the medium to long term are higher loan to value ratios for mortgages on energy efficient properties. For this the banking sector will need to be convinced that these properties offer better security for their loans. Analysis into value uplifts from certain energy efficiency measures should be undertaken by think tanks, governments and other interested organisations to support this market development.

Finding 5

Delivery models and funding mechanisms that incorporate capital improvements and housing modernisation into energy efficiency schemes are more successful

- Homeowners, and tenants, are more likely to be interested in schemes that offer them the opportunity to improve their properties above and beyond energy efficiency measures. This is because there is a tried and tested link between modernised homes and property values, as opposed to as-yet untested links between energy efficient homes and property values. For example, KfW Bank's programme allows homeowners to finance a wide range of modernisation measures for a loan value of up to €75,000. This has proved very popular in the German housing

market. On the other hand, the BAM initiative enabled homeowners to access limited amounts of financing for a small number of energy efficiency measures and suffered from poor take-up.

Recommendations

- Funding schemes should include facilities for home modernisation. The Green Deal could be expanded to include other improvements such as double glazing, and new front doors, for example.
- Energy efficiency measures need to be marketed not just as technical "add-ons" but as part and parcel of attractive, healthy, and high-value homes. This is an important recommendation for any organisation offering retrofit programmes.

Finding 6

There is a lack of information on actual in-use performance of energy efficiency measures which affects uptake and financing

- There are a multitude of retrofit programmes being implemented internationally, however it remains difficult to get detailed analysis on the costs and benefits of energy efficiency measures, and, in particular, what is needed in the future. Rebound effects and performance gaps also complicate matters and can erode expected energy savings. Understanding the actual performance of measures will be important in convincing homeowners and private sector lenders that there is a business case for energy efficiency.

Recommendations

- The demand for energy efficiency measures needs to be encouraged in two ways: both by seeing them as part of overall property modernisation and by encouraging transparency in the understanding of their performance. The former can be encouraged through financing programmes such as the Green Deal, and others, and the latter through large-scale demonstration programmes.
- Further analysis is needed on the in-use performance of energy efficiency measures including rebound effects and performance gaps. The analysis into required measures and their respective performance should be supported by the public sector as imperative to ensuring success of the Green Deal and other programmes.

Finding 7

Uptake of residential retrofit is constrained by the skills and capacity of local supply chains

- One of the study's main findings was that significant uptake of residential retrofit is constrained by the skills and capacity of local supply chains. This can be seen in the Institute/UCL Energy demonstrator programmes and the US Recovery through Retrofit analysis.

Recommendations

- To some extent this is a “chicken and egg” scenario whereby increased capital investment will stimulate the labour market. However, there will also need to be direct investment in the labour market through training schemes and associated certification, by the public and private sectors. Without understanding what measures are needed, it will be difficult to know what training resources are required.
- Strengthening the supply chain needs to occur in parallel with research on the technologies that are needed in the future. Only through fully understanding future technologies for housing retrofit will governments and private sector organisations be able to effectively plan for skills development. This research needs to be supported by the public and private sectors as an essential aspect of supply chain development.
- Community retrofit programmes can help to stimulate local supply chains through ensuring that contractors set up training centres for local employees

Finding 8

Financing products for housing retrofit need to be competitive, and well aligned with mortgage finance

- Financing products for housing retrofit, particularly in the private sector, need to both be competitive, and aligned, with mortgage finance. In the US the PACE programme has struggled over conflicts with senior lenders and the UK Green Deal is intended to be offered at approximately 7% (higher than many mortgage products). This may be looked on unfavourably by homeowners.

Recommendations

- Products such as the Green Deal will need to be marketed effectively to demonstrate their advantages over homeowners extending their mortgages to cover the costs of retrofit measures. The advantages need to be made clear to be competitive in the marketplace.

Glossary

ACC	Aberdeen City Council	JESSICA	Joint European Support for Sustainable Investment in City Areas
AH&P	Aberdeen Heat and Power Company Limited	KWZ	Kirklees Warm Zone
ALMO	Arm's length management organisation	LCWO	Low Carbon West Oxford
ARRA	American Recovery and Reinvestment Act of 2009	PACE	Property Assessed Clean Energy
BCC	Birmingham City Council	PV	Photovoltaics
BES	Birmingham Energy Savers	R4tF	Retrofit for the Future
CEWO	Clean Energy Works Oregon	RSL	Registered Social Landlord
CHP	Combined heat and power	SEP	State Energy Program
ECM	Energy conservation measure	SROI	Social Return on Investment
ECO	Energy Company Obligation	TCR	Total Community Retrofit
EPC	Energy Performance Certificate	UCL-Energy	The Energy Institute at University College London
ERDF	European Regional Development Fund	UDF	Urban Development Fund
GDP	Green Deal provider	VEEC	Victorian Energy Efficiency Certificate
GHG	Greenhouse gas	VEET	Victorian Energy Efficiency Target
HEAL	Home Energy Affordability Loan	WOCORE	West Oxford Community Renewables
The Institute	Institute for Sustainability		

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