



# Building a Greener Britain



## Transforming the UK's Existing Housing Stock by Gavin Killip

Environmental Change Institute, University of Oxford

A report for the Federation of Master Builders



ENVIRONMENTAL  
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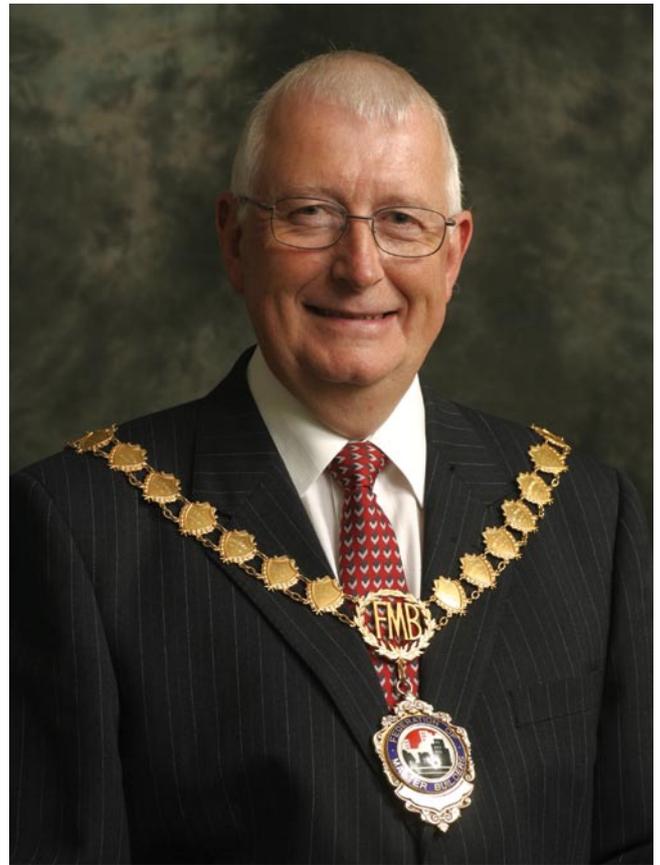
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# Foreword

Few now doubt climate change and its impact on the world is one if not the most important challenge of our time. How we respond to this challenge is key to ensuring we leave the world in a better and sustainable condition for future generations. With homes contributing 27 % of the UK's total carbon emissions, builders have a key role to play in rising to the challenge that we now face. I'm therefore delighted that the FMB has teamed up with the University of Oxford to examine how we can transform our existing homes to make them more energy efficient and greener. Given that 85% of our homes will still be standing in 2050 there is little time to waste if the UK is to achieve its ambitious target to cut carbon emissions by 80% by 2050.

Significant steps have already been made to tackle new build but for existing homes much remains to be done. It is therefore encouraging that this research tackles the issue in a practical way recognising that government, the construction sector, and the public all have a key role to play. FMB for its part will be taking forward the recommendations of this report and will be seeking to work with our partners, both existing and new, to translate the ideas and policies into reality. We have the opportunity now to build a greener Britain and we must not lose this opportunity whilst we still have a chance to do something. I therefore commend this report to everyone who not only wants to make our homes better and more sustainable places to live but is committed to handing over a more sustainable, energy efficient built environment to the next generation.



Geoff Lister MCIQB  
President,  
Federation of Master Builders

## Federation of Master Builders

The Federation of Master Builders (FMB) is the largest trade association in the UK building industry, representing over 13,000 building companies. Established in 1941 to protect the interests of small and medium-sized building firms, the FMB is independent and non-profit-making, lobbying continuously for members' interests at both national and local levels.

The FMB is a source of knowledge, professional advice and support for its members, providing a range of modern and relevant business building services to save them time and money. The FMB also offers advice to consumers via its find a builder and check a builder websites.

For more information please visit: [www.fmb.org.uk](http://www.fmb.org.uk)

## Lower Carbon Futures team at Environmental Change Institute, University of Oxford

The Lower Carbon Futures team (LCF) at the Environmental Change Institute has over 15 years' experience of analysing energy and environmental impacts within the context of policy at UK and EU levels.

LCF's research approach is inter-disciplinary, combining analysis of technology and behaviour, as well as tracking demographic trends and the future impacts of a changing climate. LCF explores the potential for reducing demand for energy as well as developing low-carbon supply options, giving equal weight to the technological and social drivers of change. By comparing these future scenarios with current policy and practice, it is possible to highlight priorities for policy and set out key strategic issues for the future.

For more information please visit [www.eci.ox.ac.uk](http://www.eci.ox.ac.uk)

# Executive Summary

The Government has set itself an ambitious target to cut the UK's carbon emissions (CO<sub>2</sub>) by 60% by the year 2050, although recent climate science suggests this figure should be revised upwards to 80%. With 27% of the UK's CO<sub>2</sub> emissions coming from energy use in homes, action is clearly needed in this sector if a national target of 80% CO<sub>2</sub> reductions by 2050 is to be met.

Several studies using computer modelling and scenarios have shown that deep cuts in CO<sub>2</sub> emissions from the UK's housing stock are indeed possible, but that existing policies will not take us far enough. It is not enough to be working towards zero carbon new homes, important though that work is. Refurbishment of the existing housing stock to advanced, low-carbon standards is needed as well. A small number of demonstration projects show that it is technically feasible to achieve large enough reductions in CO<sub>2</sub> emissions in the existing stock while maintaining comfortable, healthy homes as well as reducing the impact on householders from future energy price rises.

What is needed is a coherent strategy for the existing housing stock that mirrors the approach that is now being taken with new house-building: an ambitious future standard has been set (zero carbon new homes by 2016 in England; by 2011 in Wales; and advanced, Scandinavian-inspired standards in Scotland), with intermediate milestones. The house-building industry is now taking this ambitious target seriously and facing up to a period of major change. A similar long-term policy signal is needed in the refurbishment sector in order to give industry sufficient confidence to make the necessary investments to begin to meet the challenge. Investments are needed in training and skills just as much as in the development of products and supply chains.

Existing energy efficiency programmes, based on a list of 'cost effective' measures, need to be continued in the short term but achieving deep cuts in CO<sub>2</sub> emissions from existing homes will require a transition from the measures-based approach towards a standards-based approach. This has far-reaching consequences in terms of the stakeholders involved in delivering the changes required and the policy framework which is needed to stimulate industry to innovate.

The stakeholders involved in refurbishment are quite different from those involved in new house-building, with the smaller businesses in the construction industry being typically involved in repair, maintenance and improvement (RMI). Over £23 billion per year is spent on RMI works to existing housing, and much of this is a missed opportunity in terms of low-carbon refurbishment. Energy performance has begun to be visible in the housing market with the introduction of Energy Performance Certificates (EPCs), and the UK has an opportunity to build policies, skills programmes and financial incentives around the EPC. For building firms and product manufacturers and suppliers, this represents a new business opportunity, which is estimated here (based on limited data) to be worth between £3.5 billion and £6.5 billion per year. One key to minimising costs and the disruption involved in these more substantial refurbishment works is to seize every opportunity. Where householders or landlords are undertaking other works, the Small and Medium-sized Enterprise (SME) construction firms who generally carry out this work need to be ready and equipped to offer low-carbon options as part of that service. These firms are beginning to be aware of this potential new market.

SME construction firms have well established ways of working which need to be considered when developing policy ideas and strategies for making low-carbon refurbishment mainstream. Key to a successful transition is to ensure that the refurbishment works that building owners specify are 'buildable'. This concept is based around eight items on a practical checklist. If the buildability criteria are all met, then the SME construction sector is more likely to accept changes to custom and practice, and become a willing and able partner in delivering a low-carbon housing stock.

A clear policy signal from government is needed to start a process of innovation, skills development and capacity-building in the construction industry, moving towards a future standard for housing refurbishment that is consistent with an 80% reduction in CO<sub>2</sub> emissions by 2050. There needs to be a consistent commitment and vision for the medium- to long-term, so that the industry can respond by beginning to innovate in the key areas of training and supply chains.

# Recommendations

**Recommendation 1:** Department for Communities and Local Government (CLG) to review the implementation of EPCs and make the necessary changes to improve accuracy and reliability.

**Recommendation 2:** CLG in partnership with local authorities to set up a national database of EPC ratings and use it as a tool to improve understanding of local stock conditions and to aid targeting of interventions.

**Recommendation 3:** Scottish Government and CLG to implement consequential works policies for existing housing as part of the next revision to Building Regulations Approved Documents Part L (England & Wales) and Part J (Scotland).

**Recommendation 4:** Trade associations to work with the Energy Saving Trust and others to review both the content and distribution channels for existing information, aiming to make it more widely available to SME builders in ways which fit better with established custom and practice (for example, promotion via trade associations; free publications at builders' merchants; linked to product promotions in association with manufacturers and merchants; and materials promoted via the trade press).

**Recommendation 5:** Government to work within the institutions of the European Union to establish a Value Added Tax (VAT) framework which allows permanent reduced rates on domestic property renovation and repair.

**Recommendation 6:** Government to apply a 5% VAT rate on housing refurbishment across the UK, not just the Isle of Man, as soon as possible.

**Recommendation 7:** Government to review options for innovative uses of financial incentives, using Council Tax rebates as a delivery mechanism (but using funding from other sources to finance the rebate in order to maintain Council Tax receipts and local service delivery).

**Recommendation 8:** Energy Efficiency Partnership for Homes to commission research on the knock-on benefit to the green mortgage market of any future tax rebates as financial incentives for low-carbon refurbishment.

**Recommendation 9:** Government to introduce a feed-in tariff to stimulate greater uptake of micro-generation technologies.

**Recommendation 10:** Government and other stakeholders to consider the need for 'buildability' when proposing innovation and change in established practices among SME construction firms.

**Recommendation 11:** Government to send a strong policy signal of its long-term commitment to low-carbon refurbishment, so that manufacturers and suppliers can invest early and with confidence in the development of the necessary supply chains.

**Recommendation 12:** ConstructionSkills to co-ordinate a review of existing training (including short courses) and develop a strategy for incorporating standards-based, low-carbon refurbishment into National Occupational Standards.

**Recommendation 13:** ConstructionSkills and SummitSkills to develop a strategy for integration of skills in a 'whole home' target-driven low-carbon refurbishment process.

**Recommendation 14:** ConstructionSkills and SummitSkills to be involved in the development of a voluntary standard (or set of standards) for low-carbon refurbishment, which is consistent with an 80% reduction in CO<sub>2</sub> emissions from all energy use in the entire housing stock by 2050.

**Recommendation 15:** From 2009, the new Homes and Communities Agency to take forward the development of a voluntary low-carbon standard for refurbishment in the social housing sector in England.

**Recommendation 16:** CLG to co-ordinate a study tour of relevant European countries for key UK stakeholders to learn about refurbishment standards and their implementation.

**Recommendation 17:** Government to set out a timescale and policy framework for establishing mandatory refurbishment standards that are consistent with an 80% CO<sub>2</sub> reduction target by 2050.

**Recommendation 18:** Regional and devolved development agencies to initiate/coordinate partnerships that are relevant and useful to the development of the low-carbon refurbishment agenda.

# Introduction



This report focuses on the role of SME tradespeople in delivering low-carbon refurbishments in the UK's existing housing stock. Recent government initiatives and policy announcements on housing in the context of climate change have been predominantly to do with reducing the CO<sub>2</sub> emissions from new developments, but the bulk of the environmental impacts come from the large and inefficient stock of some 26 million existing homes.

Several studies in the past few years have analysed the technical feasibility of achieving CO<sub>2</sub> emissions reductions in the range 60 – 80% by 2050, and recent climate science suggests that the target needs to be at the top end of this range, as set out in the Climate Change Bill, currently before Parliament.

This means that low-carbon refurbishment of UK homes will need to shift away from being a niche market for enthusiasts and begin to become mainstream. In order to achieve this goal, the research conducted for the FMB's 'Building a Greener Britain' campaign has asked whether and how the existing mainstream can adapt. Several barriers exist, which were recently summed up at a seminar on the topic organised by the Sustainable Development Commission as: 'There's no demand, no delivery capacity, no knowledge and no incentive.' From this low starting point, what can be achieved?

# Climate change and the existing housing stock

Greenhouse gas (GHG) emissions are already at levels which climate scientists consider to be significantly risky. The atmospheric concentration of carbon dioxide (CO<sub>2</sub>) was 379 parts per million (ppm) in 2005, compared to a pre-industrial level of about 280 ppm. Atmospheric CO<sub>2</sub> concentration has risen by an average 1.4 ppm annually since 1960 (1960 – 2005 average) and the rate of increase itself is also going up, with an average rise of 1.9 ppm per year in the ten years from 1995 to 2005 (Intergovernmental Panel on Climate Change 2007). When other GHGs are taken into account to produce an overall concentration in terms of CO<sub>2</sub> equivalent (CO<sub>2</sub>e), atmospheric concentrations are at about 430 ppm (Stern 2006).

The UK Government, in its Energy White Paper (Department of Trade and Industry 2003), set itself a target of a 60% reduction in CO<sub>2</sub> emissions by 2050, based upon a global target of stabilising atmospheric CO<sub>2</sub> concentration at 550 ppm. The International Symposium on Stabilisation of Greenhouse Gas Concentrations – Avoiding Dangerous Climate Change took place in February 2005 at the invitation of the then Prime Minister, Tony Blair, and brought together over two hundred scientists and representatives from government and civil society from some thirty countries. It summarised the risks as they were understood at the time as:

“...limiting warming to two degrees Celsius above pre-industrial levels with a relatively high certainty requires the equivalent concentration of CO<sub>2</sub> to stay below 400 ppm. Conversely, if concentrations were to rise to 550 ppm CO<sub>2</sub> equivalent, then it is unlikely that the global mean temperature increase would stay below two degrees Celsius. Limiting climate change to two degrees Celsius above pre-industrial implies limiting the atmospheric concentration of all greenhouse gases. Based on new insights into the uncertainty ranges of climate sensitivity, a stabilisation at 450 ppm CO<sub>2</sub> equivalent would imply a medium likelihood (~50%) of staying below two degrees Celsius warming.”

(Tirpak et al 2005, pp. 6-7)

A global temperature rise of two degrees Celsius is seen as critical because of the increasing risk of irreversible, large-scale impacts. The likely temperature rises of different stabilisation levels and their likely effects are summarised in Figure 1. The Stern Review of the economics of climate change argued that massive investment on a global scale is needed to mitigate climate change; that investing to mitigate climate change is ultimately less costly than doing nothing; and that the costs are bearable and will only increase if the decision to invest is delayed (Stern 2006).



Despite the probabilistic nature of these risk assessments by climate scientists and the additional uncertainty implicit in long-term forecasting, the scientific consensus is that stabilisation targets need to be lower than was previously thought. In relation to CO<sub>2</sub> emissions, this means that a 60% reduction target, as advocated in the 2003 Energy White Paper, is almost certainly not enough. The required reductions are more of the order of 80%, as discussed in the draft Climate Change Bill, currently before Parliament (House of Commons Environment Food and Rural Affairs Committee 2007), and adopted in the Home Truths and How Low reports (Boardman 2007, Centre for Sustainable Energy, Association for the Conservation of Energy and Moore 2008).

Climate change is, by definition, a global problem requiring global solutions, but it has its origins and solutions in the many everyday decisions that are made around the world. Practical steps to tackle climate change need to be seen in a global policy framework, but action on the ground needs to be seen in terms of nations, regions and economic sectors.

The UK accounts for some 2% of global GHG emissions (Department for the Environment, Food and Rural Affairs website) and, within the UK, energy used to provide heating, hot water, lighting, cooking and the electricity for electrical and electronic devices in homes accounts for almost 30% of the national emissions total (Department for Business Enterprise and Regulatory Reform 2007a). If a national target of 80% CO<sub>2</sub> reductions by 2050 is to be met, housing is one area where activity needs to be delivered.

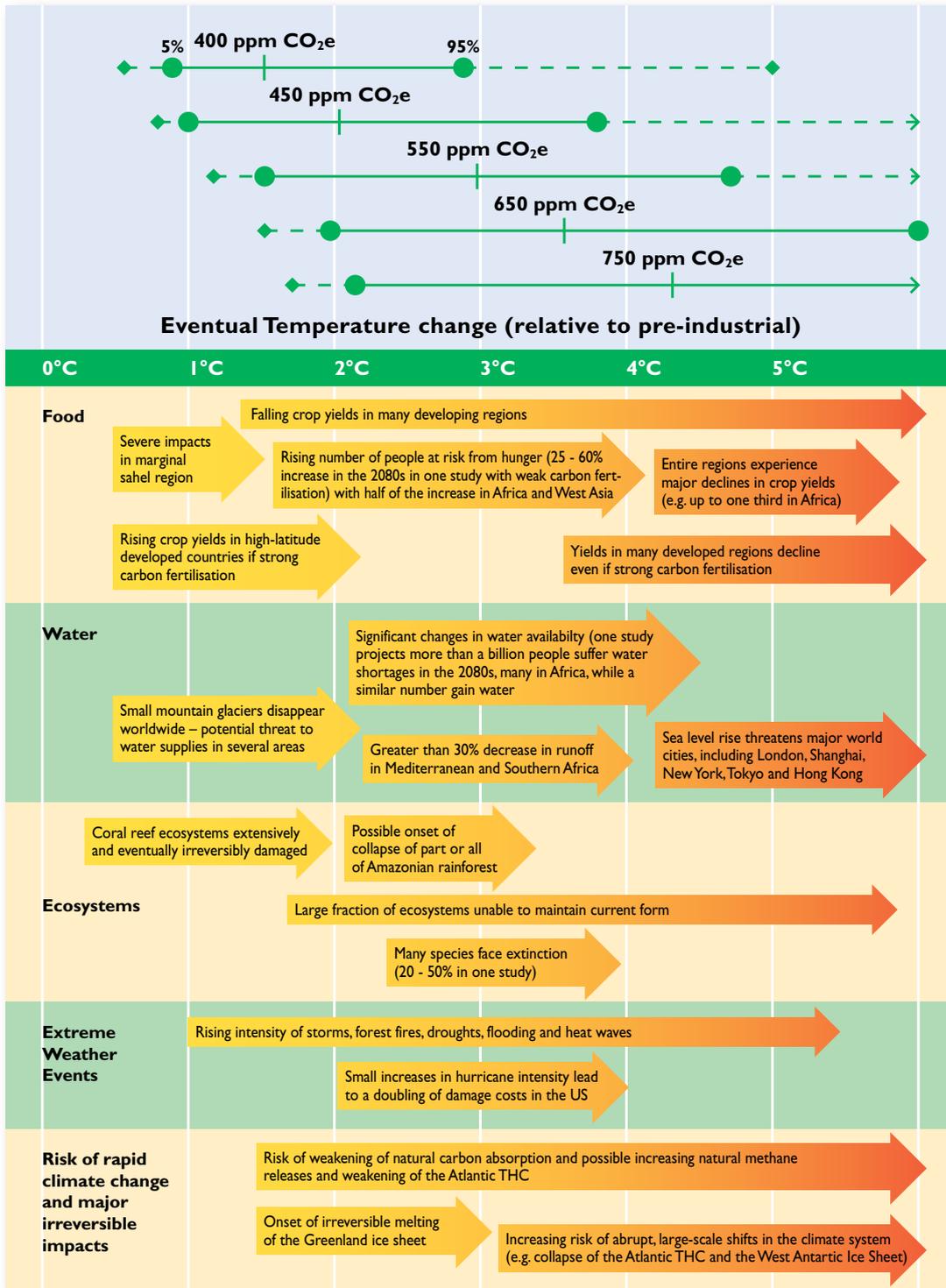


Figure 1. Summary of likely global atmospheric temperature rises based on different stabilisation levels of atmospheric CO<sub>2</sub> equivalents (CO<sub>2</sub>e) and the likely impacts of rising temperatures (source: Stern 2006).

# Models and scenarios for the UK's housing stock

Several studies since 2003 have used computer models and scenarios to explore the feasibility of achieving deep reductions in CO<sub>2</sub> emissions from housing by 2050<sup>1</sup>. Most of them describe a future in which there is significant uptake of measures for reducing energy demand that go beyond what is currently cost effective and promoted by government policy (Table 1), as well as describing large-scale installations of low-carbon technologies (ie those which use fossil fuel more efficiently than conventional options) and zero-carbon technologies (ie renewable energy technologies) – Table 2.

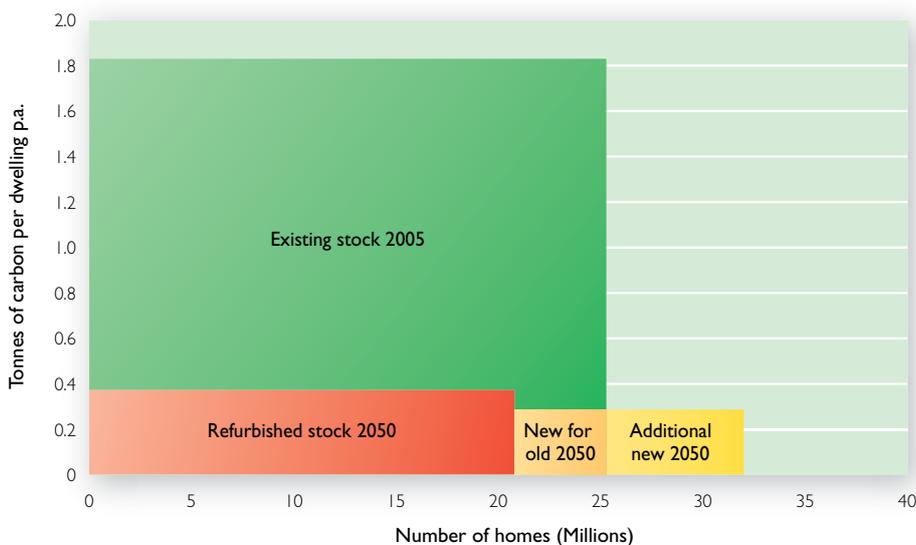
The only one of these studies which limited demand reduction measures to the current set promoted through policy was the report by BRE. This report modelled five scenarios, of which one reached a 60% CO<sub>2</sub> reduction by 2050, achieved by a 100% uptake of the insulation measures currently supported by government programmes, a large-scale switch to biomass and electric heat pumps for heating, and a halving of the emissions factor for grid electricity (Shorrock, Henderson & Utley 2005). Taken together, these studies demonstrate that a 60 - 80% reduction in CO<sub>2</sub> emissions by 2050 is possible, but that it will require significant new activity and investment in renovating housing and in low- and zero-carbon generation technologies. The importance of reducing emissions from new housing can be summarised as the need to limit what is added to an already large problem: the potential for real reductions comes from existing housing (Fig 2).

Measures supported by government programmes	Other technically feasible refurbishment measures
Cavity wall insulation	Solid wall insulation
Loft insulation	Ground floor insulation
Draught-proofing	Other measures to reduce air infiltration (for example, blocking up redundant chimneys, flues)
Hot water tank insulation	Passive solar design features (where site conditions allow)
Efficient heating boiler <sup>2</sup>	Mechanical ventilation with heat recovery
Heating controls	
High-performance glazing	

**Table 1. Measures to improve building fabric and heating systems.**

	Type of useful energy provided		
	Heat only	Heat & electricity	Electricity only
Low-carbon	Heat pumps	Combined heat & power (CHP)	-
Zero-carbon	Solar thermal Biomass boilers	Biomass CHP	Solar photovoltaics (PV)

**Table 2. Classification of Low- and Zero-Carbon technologies (LZCs).**



**Figure 2. CO<sub>2</sub> emissions from refurbished and new-build housing in a scenario achieving 75% CO<sub>2</sub> reductions by 2050 (source: Royal Commission on Environmental Pollution 2007).**

1. Johnston 2003, Johnston, Lowe & Bell 2005, Boardman et al. 2005, Shorrock, Henderson & Utley 2005, Sustainable Development Commission 2006, Royal Commission on Environmental Pollution 2007, Boardman 2007, Centre for Sustainable Energy, Association for the Conservation of Energy & Moore 2008.

2. Condensing boilers were supported under early years of EEC, but have been largely ineligible for support since they were mandated in most circumstances by minimum standards introduced in 2005.

# Demonstration projects

Several dozen homes have already been renovated to achieve low emissions – at or close to the level required – while also ensuring comfort and health, and providing increased resilience to increases in fossil energy costs (Parity Projects 2008, Poyzer, Schalom 2003, Sustainable Energy Academy 2007). While this number of demonstration projects barely scratches the surface of the problem, they do reinforce the arguments made in the published studies based on computer models and – most importantly – they do so in a very practical, down-to-earth way. Some of these demonstration homes have been used successfully as tools for learning through open days and study tours.

The Leicester Eco House was set up to be an educational resource and has had tens of thousands of visitors (Groundwork Leicester & Leicestershire website). Other demonstration projects are planned by BRE and partners (BRE website) and the University of Nottingham in collaboration with E.On (University of Nottingham website).

These pioneering refurbishments have predominantly been carried out by private householders using their own money (and skills in many cases), although some landlords have also been innovators. Co-ordination of learning from these activities is in its early stages and, given that many are private householders, information is not widely available. However, they demonstrate that the combination of investment in technology and a commitment to conserving behaviour result in levels of CO<sub>2</sub> emissions that are broadly consistent with the scenarios described above.

In the social housing sector there are also a number of case studies, with information co-ordinated by the Sustainable Homes and Green Street websites<sup>3</sup>. Some of these case studies give quantified CO<sub>2</sub> emissions reductions, reporting deep cuts.

These demonstration homes with quantified results show what is possible.

## Case Study I

### 3-bed terraced house, Birmingham



Year/period of construction	1929
Tenure	Social rented
Energy-saving features	<ul style="list-style-type: none"> <li>Insulated ground floor</li> <li>External wall insulation</li> <li>Insulated loft</li> <li>Efficient A-rated appliances</li> <li>Sun pipe</li> <li>Low-energy lighting</li> <li>Insulated hot water tank and pipework</li> <li>Timber-framed double glazing</li> <li>Passive ventilation system</li> </ul>
Low- and zero-carbon technologies	<ul style="list-style-type: none"> <li>Solar water heater</li> <li>Ground-source heat pump</li> </ul>
Water-saving features	Water-efficient bathroom suite; rainwater butt
Other 'green' features	Re-used and reclaimed timber; bricks and other materials; non-toxic paints and finishes; porous paving; 'green' sedum roof
CO <sub>2</sub> emissions reduction	Being monitored in 2008, compared with an unrefurbished house
Builder's comments	This is the seventh project we've done like this and it is fast becoming our speciality. Each time we complete a project we put that experience to good use on the next one, we are learning very quickly what works and what doesn't and how to build in new technology

3. [www.sustainablehomes.co.uk](http://www.sustainablehomes.co.uk) and [www.greenstreet.org.uk](http://www.greenstreet.org.uk)

# Opportunities, costs and benefits

A common feature of many of these demonstration projects is the re-specification of major works to include low-carbon products and methods. In this way, both the costs and the disruption are kept to a marginal level. The availability of a skilled person to project-manage this process is one key to success, combining some tasks which are familiar to contractors (for example, re-wiring and re-plastering) with other tasks which are not (for example, solid wall insulation). Very little real data is available for the cost of this type of work, and there is an inevitable grey area over what should count as a marginal cost. For example, if a property is bought with electric storage heaters and the refurbishment replaces them with a gas-fired central heating system, should that count as a 'normal' renovation decision or a marginal 'low-carbon' decision? In the data for the renovations in Table 3, a new gas-fired central heating system is counted as 'normal' and extra insulation or solar panels are counted as marginal 'eco' costs. These properties achieved low absolute CO<sub>2</sub> emissions at the same time as increasing floor space by converting the loft in each case (figures quoted here are for the house including the loft conversion, not per square metre).

With some £23.9 billion spent on repair, maintenance and improvement (RMI) works in UK housing in 2005 (Department for Business Enterprise and Regulatory Reform 2007b), some of this work represents a missed opportunity for low-carbon refurbishment – but how big a missed opportunity? A breakdown of this RMI figure by type of work and the potential for incorporating low-carbon elements would be a useful analytical aid, but it is not currently published.

Based on the figures from the two projects in Table 3, a programme to deliver low-carbon refurbishments on 500,000 homes per year would cost in the region of £3.5 billion to £6.5 billion per year above the current spending on RMI and represents a significant potential new market for construction firms working on housing RMI. It should be borne in mind that the small number of eco-refurbishments of this nature that currently exist have all been developed as one-off prototypes and unit costs will decrease as the market grows.

	£ total inc. VAT	£ for marginal 'eco' elements	£ VAT @ 17.5%	Resulting tCO <sub>2</sub> /year	CO <sub>2</sub> emissions reduction
Oxford 3-bed terrace	55,000	7,000	9,625	2.2	-65%
London 3-bed semi	82,000	12,440	14,350	2.9	-60%

**Table 3. Costs, marginal paybacks and CO<sub>2</sub> emissions reductions for two recent low-carbon refurbishment projects of pre-1919 houses (one in Oxford, one in London).**

Where major works are being undertaken anyway, the additional cost of incorporating 'eco' elements can be smaller than the total Value Added Tax (VAT) bill, perhaps in the range 13 – 15% of the total, although this is clearly project-specific. The disruption of measures such as solid wall insulation (included in both renovations in Table 3) can be a major barrier, but this too can be overcome if the insulation work is timed to coincide with re-wiring, re-plastering or other major re-modelling work.

The potential scope for replicating this approach – a holistic, 'whole-home' approach to future-proofing a property – needs to be studied in more detail. Room-by-room approaches are also possible. Anecdotal evidence suggests that new kitchens and bathrooms are good opportunities for incorporating some of this work, as are some of the scheduled maintenance works in the social rented sector. If roof repairs are needed on a property, this is likely to be a good time to install solar panels, saving the duplicate costs of scaffolding, labour and materials and keeping the disruption for residents to a minimum. In order to be able to seize such opportunities, the additional money needs to be available (possibly through borrowing), but so does a unified approach to project management, in which the low-carbon agenda is integrated with other refurbishment activities. There are likely to be local and regional differences for these opportunities, depending on the general state of the housing market and availability of finance.

Between 2002 and 2006 residential gas and electricity prices rose by 65% and 44% respectively (Boardman 2007). With further sharp increases recently in energy prices for domestic customers, the decision to invest in this scale of renovation can be seen partly as an attempt to insure against future price hikes. The concept of 'payback' may begin to shift from the question 'can we afford to do the work' to 'can we afford not to'.

Energy price rises have a disproportionate effect on the fuel poor, creating hardship among vulnerable members of society and leading to over 26,600 excess winter deaths in 2002/2003 (National Energy Action 2005). Making low-carbon refurbishment mainstream has the potential to help deliver the Government's legally binding obligation to eradicate fuel poverty by 2016.

For all householders, not just the fuel poor, there are significant benefits to be enjoyed from living in a low-carbon home in terms of health and comfort, as well as reductions in energy costs and CO<sub>2</sub> emissions. SMEs in construction stand to benefit economically, while the national policy objective of increasing energy security is also supported by a significant reduction in fossil energy demand from the housing sector.

# Managing a transition

In the short-term the measures-based approach to energy efficiency in housing will continue to be needed, as are initiatives to accelerate the rate of take-up of measures in existing programmes. The remaining potential for uptake of these measures is still significant - for example, roughly 10 million cavity walled homes do not have their cavity walls insulated (Cavity Insulation Guarantee Agency 2008). At the same time, an acknowledgement is needed that this policy approach is both time-limited and insufficient to

meet CO<sub>2</sub> reduction targets. Development of a new approach to mainstreaming low-carbon refurbishment will take time, and work on this needs to start soon. In the short-term this means carrying on with existing measures, while simultaneously preparing for a shift of emphasis in the next few years. In the medium term there is a need for a move away from a measures-based approach (as uptake begins to saturate) and towards a standards-based approach.

## Energy Performance Certificates

Providing reliable, accurate information on energy performance is one key element of a strategy to move towards a standards-based approach. The introduction of the Energy Performance Certificate (EPC) as part of the Home Information Pack (HIP) was completed for property sales in December 2007 and is to be extended to rental properties from October 2008. An energy rating on an A – G scale has to be calculated at the appropriate trigger point, and the result displayed in an easy-to-read form (Fig. 3). There have been some 445,000 assessments lodged in the first six months of the scheme being fully implemented for sales, with over 97% of those using the quickest assessment method, the 'reduced data Standard Assessment Procedure' (rdSAP) (Kennedy Pers. Comm.). There are still some technical problems with the implementation of EPCs, notably that rdSAP does not capture the true performance of advanced low-carbon refurbishments. Some technical changes to the assessment method are needed if the EPC is to work in a future market where low-carbon starts to become mainstream (Banks forthcoming).

Assuming the accuracy is improved, the EPC is a potentially powerful tool, with enough activity to make an impact on the scale required. Transformation of the stock of 26 million homes by 2050 will require 500,000 refurbishments of the older, inefficient

properties to a low-carbon standard every year. The EPC provides information on energy in large enough numbers and at a key potential intervention point, that of property transactions. It has been argued that it may be necessary to require EPCs at other times as well in order to capture all of the stock, including those homes which change occupant very infrequently (Boardman 2007). Getting accurate EPC coverage across the stock is a key issue, but the realisation of the EPC's full potential will require the introduction of other policy measures to provide incentives to stimulate demand, as well as activities in training and supply chains to build capacity to deliver the necessary service. An energy rating – though crucial – is not enough on its own to bring about the necessary transformation of the market.

**Recommendation 1:** Department for Communities and Local Government (CLG) to review the implementation of Energy Performance Certificates (EPCs) and make the necessary changes to improve accuracy and reliability.

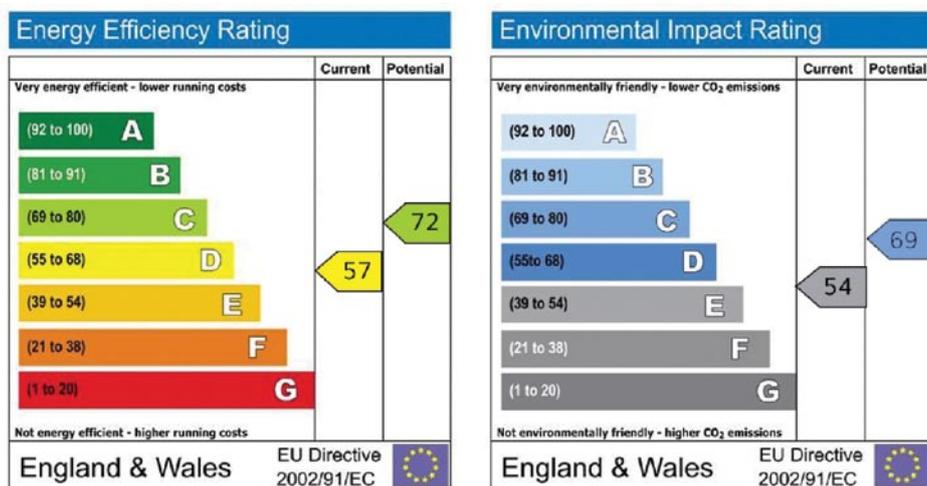


Figure 3. Energy efficiency and environmental impact ratings of homes, as shown on Energy Performance Certificates (EPCs).

# Short term policies and programmes

## Existing programmes for energy efficiency

Much of the current work to improve energy efficiency in housing is funded by an obligation on energy suppliers, known as the Carbon Emissions Reduction Target (CERT)<sup>4</sup>. The CERT framework further emphasises the underlying cost-benefit analysis, with energy supply companies free to choose the means by which they achieve the prescribed savings: not surprisingly, they look for the cheapest means to reach the target.

The only minimum standard applied to the existing housing stock has been Decent Homes, a programme to provide central heating and other energy efficiency improvements, as well as modern kitchens and bathrooms. Decent Homes applies to all social housing and the standard has done much to improve living conditions for some of the most deprived groups in society, but the energy efficiency standard is unambitious (for example, a home can meet the Decent Homes standard with 50mm loft insulation, whereas the recommended depth is 270 mm). In terms of climate change mitigation policy, Decent Homes can also therefore be seen as a limited approach.

The Lower Carbon Buildings Programme offers grants towards the capital costs of installing Low- and Zero-Carbon technologies (LZCs), and an estimated 107,000 homes are served by some LZC technology or another (including an estimated 25,000 served by community CHP) (Boardman 2007). Uptake of these technologies in the UK lags far behind other countries, such as Germany and Spain.

## New policies to accelerate uptake of measures

New policies to accelerate the uptake of measures are to be welcomed, although they are not a substitute for a policy shift to a standards-based approach in the medium term. The value of these new initiatives is not just in energy conservation, but also in making use of two intervention points which might be useful in the future: use of the EPC; and use of householder choices to undergo a major refurbishment.

### Green Homes Service

The Green Homes Service, announced in November 2007 and due to launch late 2008, is to have an initial budget of approximately £10 million per year for three years. It aims to target energy efficiency advice services at properties that have recently received an EPC with an energy performance rating at the bottom end of the efficiency scale – a rating of F or G.

In the short term, this new service aims to improve the very worst performing buildings in the stock but of at least as much interest for future policy is the implied establishment of a database of EPC ratings, which is then to be used to help target services from the Energy

Saving Trust. This precedent is important, given concerns about data protection, and it needs to be exploited as fully as possible. An accurate, up-to-date database of EPCs could help target resources and inform renovation strategies for social housing providers, as well as giving local authorities a useful tool for reporting on the condition of the entire stock. Data on home sale prices is freely available on the internet (see, for example, [www.houseprices.co.uk](http://www.houseprices.co.uk)), and it is hard to see how the energy rating information could be deemed to be more sensitive than that.

**Recommendation 2: CLG in partnership with local authorities to set up a national database of EPC ratings and use it as a tool to improve understanding of local stock conditions and to aid targeting of interventions.**

## Building Regulations for 'consequential works'

In the consultation draft for the 2006 revision to Building Regulations Part L (England & Wales) there was a proposal to bring in 'consequential works' for the first time, although this was dropped from the final revision, which included 'consequential improvements' instead. The regulations in force since 2006 require any thermal element of a building to be thermally upgraded if it is substantially transformed. So, for example, if an external wall needs to be substantially re-built or repaired, it should also be insulated at the same time. With 'consequential works' the principle applies to the whole of the existing building, not just the thermal element which needs work, and a threshold expenditure is specified, say an additional 10% of the project budget should be spent on cost-effective improvements.

One local authority, Uttlesford District Council (north west Essex), has adopted a policy for consequential works through Planning. This policy states that, for refurbishment works that require Planning permission (extensions and conversions), a requirement is made to install all cost-effective energy efficiency measures up to an additional 10% of the project budget on the building(s) which existed at the same property address before the Planning application was made (Uttlesford District Council website).

It might be thought that such a policy would deter local residents from submitting plans, but the number of such applications received went up from 360 to 900 in the first year of the policy being in force (Roos Pers. Comm.). This seems to suggest that the state of the housing market and the economy generally are stronger factors influencing people's decision to 'move or improve' than the consequential works policy itself. The Council also provides advice and support for applicants and, by limiting the scope of the policy to the cost-effective measures, is deliberately aiming for relatively easy wins. Planning decisions are open to appeal, so the Council has taken a cautious approach – another reason for sticking to 'easy win' measures.

4. The first round of CERT runs from April 2008 – 2011. This was previously known as the Energy Efficiency Commitment (EEC), which ran from 2001 – March 2008.

Making the principle of consequential works apply through Building Regulations would have the advantage of extending the policy to the national level. Also, Building Regulations are not subject to appeal, as Planning decisions are, and would arguably provide a more robust base for policy. Even so, Uttlesford District Council has not had any appeals in the first year of the policy being in place (Roos Pers. Comm.).

**Recommendation 3:** Scottish Government and CLG to implement consequential works policies for existing housing as part of the next revision to Building Regulations Approved Documents Part L (England & Wales) and Part J (Scotland).

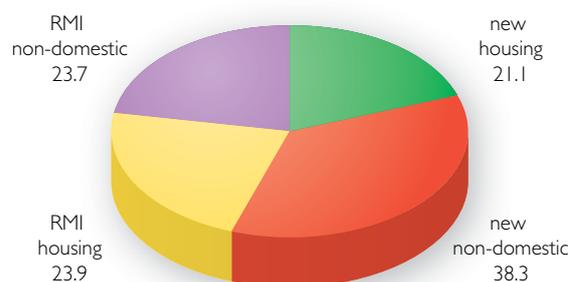
## Medium term policies and programmes

Going beyond the existing programme requires a new approach, which makes low-carbon refurbishment a mainstream 'normal' decision for people. Key to managing this transition is to engage more fully with the construction industry, specifically the SME firms who are already involved in housing repair, maintenance and improvement works. If the opportunities for low-carbon refurbishment are to be exploited fully, this kind of renovation needs to be on offer every time a building tradesperson is asked to quote for work.

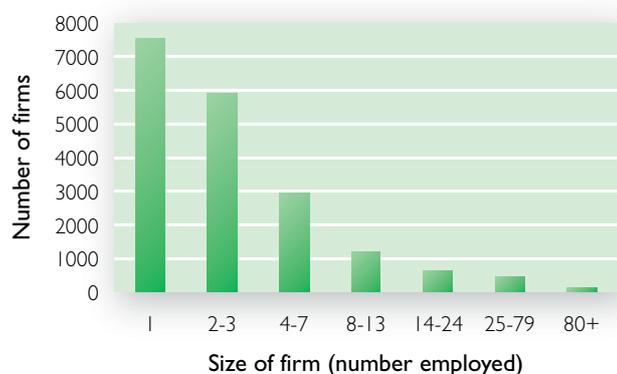
different market from non-domestic work. This creates a broad four-way split, with housing RMI accounting for some £23.9 billion of the total in Great Britain in 2005 (Fig 5). Many individuals working within the industry move across these boundaries as their careers progress and as the availability of work and sub-contractual arrangements shift in response to wider economic forces. Some firms specialise in one particular type of work, while others are generalists; some concentrate on domestic work, some stick to commercial projects, and some do both.

### The UK construction industry

Construction is a major employer in the UK economy, providing roughly 1.2 million jobs and generating over £107 billion of economic activity in 2005 (Department for Business Enterprise and Regulatory Reform 2007b). Construction is multi-faceted, ranging from major infrastructure projects, such as the 2012 Olympics, right through to decorating and handyman services in people's homes. The industry as a whole is made up of a small number of very large firms and a very large number of small firms (Fig 4). New construction is a different market from repair, maintenance and improvement (RMI), just as construction work in housing is a



**Figure 5. GB construction output by sector in 2005, £ billions (Department for Business Enterprise and Regulatory Reform 2007b).**



**Figure 4. Distribution of UK construction industry firms by number of employees, 2005 (Department for Business Enterprise and Regulatory Reform 2007b).**

SMEs are predominantly involved in RMI work, although some are developers of new housing, mainly on a small scale. Of the 13,000 members of the Federation of Master Builders, approximately 75% concentrate on RMI work and 25% build new homes.

## Custom and practice in SME construction firms

This section summarises the lessons from the interviews with SME firms carried out as part of the research. The purpose of these interviews was to understand better how SME firms really operate; how they manage relationships with others; what their attitudes to innovation are (ie using new products or techniques); what their trusted sources of information are; how they value training and view existing training provision; what their priorities are at work; how they view regulations that affect them; whether they are aware of the energy rating on the recently introduced Energy Performance Certificate; how they view the environmental impacts of buildings and building work; and how they view the future for themselves and the industry more generally. See the appendix for more details of the interviews.

Most SME construction firms work in a geographically defined local area, partly through the practical convenience of travel to and from site, and partly as an enduring legacy of traditional approaches to running a family business. Long-established firms take pride in their position as well-known members of a particular community. Some new entrants to the sector have taken a very different approach, typically offering added value to customers in terms of specific project management skills, but ultimately relying on recruiting and managing local labour for site work. Other new entrants have chosen to become tradespeople as a deliberate switch of career, partly through choice and partly out of economic necessity.

Several directors of larger firms were interviewed, as well as sole traders. People enter into contractual arrangements with each other in a variety of ways, although a consistent preference was expressed for being a main contractor rather than a sub-contractor, because of the importance attached to being in control of decisions on any given job. Joint-working with other tradespeople is commonplace, however, and all have lists of people to contact in case of need. Specialisms tend to be quite narrow, with each tradesperson typically taking responsibility for that one trade: plasterers don't do woodwork and carpenters don't do wet trades.



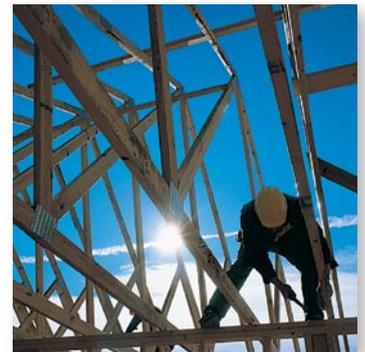
General builders may well be competent in more than one trade, but they also tend to know better-skilled specialists in different trades, who they can call upon as sub-contractors if the job merits it.

Of all the different professions involved in housing refurbishment, SME building tradespeople express a strong preference for working with practical, hands-on people and generally report good relations with other tradespeople, suppliers and builders' merchants and, in many cases, with Building Control inspectors, who are perceived as being focused on finding solutions to practical problems that inevitably arise.

Relationships with clients are key, and can be both positive and negative. As the provider of work, the customer is 'always right' and providing customer satisfaction is seen as crucially important in maintaining a good local reputation and therefore a steady flow of work.

However, builders probably have as many horror stories about bad clients (for example, changing their minds about things, refusing payment for work completed) as householders have about nightmare builders (for example, breaking appointments, being untidy). Among SME building firms a common stratagem for managing this tension is to pick and choose which jobs to bid for, deploying a sort of sixth sense about what kind of person a prospective client is. If the gut reaction to a prospective client is wrong, then there are a number of ways in which the job can be avoided, from simply choosing not to communicate any further, through to submitting a deliberately high quote to put the client off. Where there is a particularly good relationship between builder and client, the scope for experimentation and innovation is increased significantly. The contractor's willingness to try new things seems to be influenced by an informal approach to risk management, based on respect and trust. If the client is seen to be reasonable and the rapport is good, then there is less likelihood that unfair blame will be attached to the contractor. If innovative products and methods are being tried with a good client, there is a greater likelihood that practical solutions will be sought rather than recriminations if there are problems along the way. Developing such relationships clearly takes time, and there is more scope to achieve it where clients have portfolios of property and therefore issue repeat contracts.

SME building tradespeople tend to use their own set of preferred products, materials and suppliers. In large part, this is because they have to guarantee their own work and it saves time and money to use tried and tested methods, rather than constantly try new things. Widespread and rapid availability of materials is also important, so the products and manufacturers which dominate the established supply chains will tend to be favoured. Trade discounts also allow





tradespeople to make additional profits through retail mark-ups. Innovation is not unknown, however, and new products do get tried out (sometimes out of curiosity but often in response to client demand). Some of these innovations are then enthusiastically adopted, especially ones which have genuine benefits in saving time and/or money. The assessment of money- and time-saving takes account of quality and reliability over time (not just the immediate cost and time taken for installation): a product will quickly lose favour if the installer is called back frequently to remediate something that does not work properly. Conversely, a product which leads to few complaints or call-backs is seen as reliable and will tend to be re-used on other jobs. This tends to create a self-reinforcing case for sticking with what is familiar: 'I use it because it does the job, and it does the job because I use it regularly and know how to make it work.'

Education and training are viewed as very important, because recognised qualifications confer professional status and are seen as a basic badge of competence. (Note, though, that none of the interviewees was untrained). SME building firms tend to be supportive of apprenticeship schemes and the training levy system (through which industry pays for a substantial part of training provision), even if they have had negative experiences (for example, by supporting an apprentice to achieve a recognised qualification, only for the apprentice to then leave the firm for better-paid work elsewhere). The quality of training in construction colleges is seen as patchy, and some respondents expressed a frustration that college training is almost all targeted at school-leavers. There is a minority of more mature entrants to the industry, often coming from other sectors where jobs became scarce. For these people, who often have strong educational backgrounds and high motivation levels, college courses can seem slow.

Trusted sources of information among SME tradespeople include other people on-site, merchants and suppliers, the trade press, trade associations (both for publications and telephone advice services), and product manufacturers (although product claims do not go unquestioned). In some cases, Building Control officers are seen as useful in flagging up impending changes to regulation. Many SME firms attend big trade fairs to maintain a watching brief on new developments, and 'tool-box demos' at merchant outlets to hear what manufacturers have to offer. The internet is used enthusiastically by a minority, especially those with a strong inclination towards innovation.



Priorities at work revolve around customer satisfaction. Avoiding difficult clients is part of that, but once engaged, SME building firms know that customer satisfaction is key to them maintaining their reputation and creating a steady flow of work through word-of-mouth recommendation – widely perceived as the best form of marketing. Making a profit is also important, of course, but the primary source of what makes a 'good job' is most often the relationship with the client.

The regulation of building work is accepted as a necessary and generally positive thing, although rapid changes to regulation cause some resentment, because of the time and cost of attending refresher courses. Generally, people are happy to go along with new regulations once they have found a way to accommodate them in day-to-day practice.

The environmental impacts of buildings and building work are both seen as significant, with waste management on-site being a common object of comment. Energy and CO<sub>2</sub> emissions were generally viewed as being adequately dealt with by current regulation and technical developments (for example, improvements to boiler technology). Respondents who had worked on projects with notable environmental features (for example, building a straw-bale house, installing solar water heaters on a regular basis) showed a greater awareness and understanding of a wider range of low-carbon products and methods than those who had not. Energy Performance Certificates were not widely recognised (but this may be at least partly explained by the timing of the interviews, which were conducted only a few months after the complete introduction of EPCs for property sales). Discussion of EPCs prompted a double reaction: that there was not enough information available for builders to be able to respond, should a customer request energy

performance improvements in relation to the EPC; and that the introduction of EPCs represents a potentially large new market for SME building firms.

Generally, all respondents thought the future for business in their part of the construction industry was healthy, founded on the fact that the UK has a lot of buildings to keep going. Reported job satisfaction was high, often linked to a sense that the work is providing a valuable service to ordinary people in maintaining a roof over their heads and in preserving or increasing the asset value of customers' property.

The importance and prominence of sustainability issues in construction is much lower on the ground than among policy-makers and strategists. Two of the top ten skills issues for CITB-Construction Skills are 'making sustainability a reality in construction' and 'improving the skills base and competence through client-led demand, enhancing industry's responsiveness to technical change and productivity improvement' (CITB-ConstructionSkills 2008).

In the SME sector working on housing refurbishment, there is a long way to go before these aims are met. In a survey of 152 members of three trade federations in Scotland, on average only 10% had received any form of training on sustainable development whilst 6% reported ever having lost business for environmental or social reasons. On this evidence, few clients make sustainability a primary objective of the work that they commission. At the same time, 50% of all respondents to the Scottish survey believed that the pressure to be more environmentally responsible would grow over the next 1-2 years, and over 80% thought this pressure would definitely increase within five years (Brannigan, Tantram 2008). The pressure is largely perceived as being policy-driven, rather than driven by demand in the market for refurbishment work. At the same time, the opportunity for new business is significant and some of the more innovative, forward-looking firms are actively searching for information that can help them make the most of those opportunities. In many cases, information does exist (for example, publications from the Energy Saving Trust, including good practice guides) but the perception (especially among those who do not use the internet) is that information is not easily available. This suggests that some useful and relevant information is not being disseminated through the channels of communication that most SMEs use and trust. It could be a role for trade associations – which are seen as trusted sources of information – to help disseminate existing information that is available from other bodies.



**Recommendation 4:** Trade associations to work with the Energy Saving Trust and others to review both the content and distribution channels for existing information, aiming to make it more widely available to SME builders in ways which fit better with established custom and practice (for example, promotion via trade associations; free publications at builders' merchants; linked to product promotions in association with manufacturers and merchants; and materials promoted via the trade press).

# Case Study 2

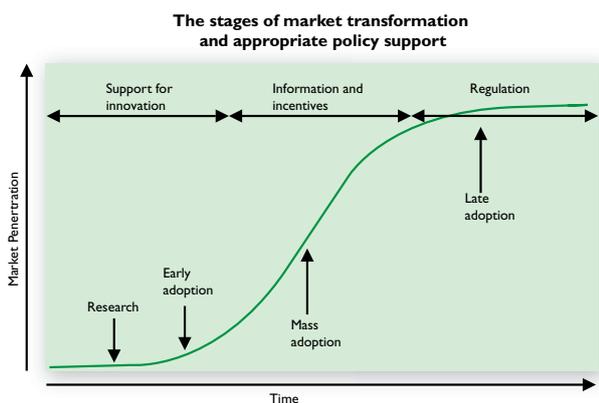
## 2-bed terraced house (loft conversion to make 3 bedrooms), Oxford



Year/period of construction	1908
Tenure	Owner-occupied
Energy-saving features	<p>Ground-floor insulation (suspended timber floor)</p> <p>Internal wall insulation</p> <p>Loft insulation (2004)</p> <p>Loft conversion (2007), re-specified to exceed Building Regulations</p> <p>Efficient A-rated appliances</p> <p>Mostly low-energy lighting</p> <p>Gas condensing boiler; programmable thermostat, thermostatic radiator valves</p> <p>Insulated hot water tank and pipework</p> <p>Double glazing</p> <p>External blinds on rooflights to reduce summer over-heating</p>
Low- and zero-carbon technologies	None. A solar water heater was judged to be too expensive but the hot water tank is 'solar ready' for a future installation
Water-saving features	Dual-flush WCs, flow regulators, rainwater & greywater collection for garden use
Other 'green' features	Re-used and reclaimed timber and other materials; non-toxic paints and finishes
CO <sub>2</sub> emissions reduction	The house was not monitored before the refurbishment so initial CO <sub>2</sub> emissions were estimated to be about 6 tCO <sub>2</sub> (it had 90% double glazing, 100mm loft insulation, electric storage heaters). In 2006-2007 CO <sub>2</sub> emissions were 2.2 tCO <sub>2</sub> – a reduction of approximately 65%
Water savings	Unknown – a water meter was not installed because the water supply is shared with the house next door
Number of occupants	2 adults
Behaviour	Both occupants are energy-conscious, turning off unwanted lights and appliances. Heating is set to 18°C with radiators turned down in unoccupied rooms
Resident's comments	It's been great. There are a few things we would do differently if we had the time again, but overall it's made the house warm and cheap to run. Our neighbours are amazed that we have a stripped wooden floor downstairs with no draughts. The insulation is invisible but really effective

# The low-carbon refurbishment challenge: making it mainstream

The market for low-carbon refurbishment is clearly in its infancy in the UK, at a point close to 'research' on the classic market transformation curve, but on the way towards 'early adoption' (Fig 6). Some of the unease expressed by SME builders about not knowing where to go for information on low-carbon refurbishment can be understood in relation to this graph. EPCs have introduced information into the market, potentially leading to increased consumer demand, but there has not been a concerted programme of support for innovation. This is now needed if the process is to be successful.



**Figure 6. Stages of a market transformation approach, showing the progression of innovation, incentives, information and regulation as a market develops. (Eyre Pers. Comm.)**

Regulation against a minimum energy performance standard will be needed at a later date, once there is evidence of much increased demand and a much better-developed capacity to deliver. Before a minimum standard can realistically be enforced, there needs to be a period of innovation, learning and dissemination, in which the standard is voluntary. Many of the innovations that are needed are about new partnerships and new connections between existing structures and organisations. Training, skills and standards will all need to be developed and integrated into existing frameworks and institutions. If the SME construction industry is to deliver this new kind of refurbishment service, then a concerted programme of work is needed to provide the necessary support services, with the SME construction industry involved in the process. In order to be relevant to and understood by the industry, the work needs to follow custom and practice as much as possible. This is not to

say that SME tradespeople themselves do not need to change the way they work – clearly they do, if these new opportunities are not to be missed – but the process of change itself is more likely to be effective if it is carried out in ways that fit with customary approaches to innovation.

## Consumer demand and delivery capacity

Currently, low-carbon refurbishment is a niche activity for enthusiasts, although there is evidence among the many community groups that have sprung up in recent years to tackle these issues that an impatient minority wishes to make significant reductions in their environmental impact. There are 'transition town' initiatives in at least 45 towns and cities in the UK (Transition Towns website) and a rapidly growing Low Carbon Communities Network (Low Carbon Communities Network website).

In general, however, demand for low-carbon refurbishment is very low, as is the availability of services geared to deliver. Anecdotal evidence suggests that a minority of architectural practices offer specialist services focusing on reduced environmental impacts. The majority of architects, like the rest of the construction sector, view the energy standards in Building Regulations as a maximum to aim for, rather than a minimum that can be exceeded in many situations. In any case, there are many instances of major refurbishment work where a design professional is not needed, and the contractor takes the lead on specifying and carrying out the work.

Where Building Regulations do not apply at all, energy issues are typically ignored, even though there are many potential intervention points during refurbishment for insulation and other works (for example, during re-wiring, re-plastering, structural timber repairs). A small number of new businesses are emerging to offer such services, and these enterprises are generally new entrants to the construction sector, having been founded by individuals with relevant experience and knowledge from other business sectors.

Activity is clearly needed to stimulate both demand and the capacity to deliver relevant services. Established firms have no reason to invest time and money in developing a new service if there is not enough market demand. The work of pioneers among clients and building contractors provides a starting point for additional work to build up both sides of the demand/capacity challenge.

## Stimulating demand for low-carbon refurbishment

At the same time as conducting work 'behind the scenes' on research and innovation, there needs to be a co-ordinated strategy to communicate the benefits of low-carbon refurbishment to householders, as well as the introduction of financial incentives to stimulate demand.

### Communications

Maximising the potential of the EPC is partly about making it as visible as possible, so that the general public come to see the energy rating as part of the basic information that anyone looking to buy or rent would want to know about a property. Some estate agents

are now displaying EPCs on their property particulars but not necessarily in all marketing media (print, web, window displays), and the practice is generally not common.

The benefits of low-carbon refurbishment (low running costs, low CO<sub>2</sub> emissions, comfort and health) need to be actively promoted while the market for this type of work is still small, as most UK householders have little direct experience of what a truly energy-efficient home is like to live in. A network of demonstration homes, the Old Home Super Home Alliance, was started in 2007 to expand and co-ordinate activity in this area, aiming to educate and inspire with web-based materials, 'open house' events and other activities across the UK (Sustainable Energy Academy website). Other, more local initiatives have also taken place, for example in Oxford and Birmingham (Bournville Village Trust website, Climate Outreach Information Network 2007). With a remit that is wider than just the UK housing stock, the Ashden Trust has an annual award for innovative sustainable energy projects (Ashden Trust website) and the Federation of Master Builders has three renovation categories and an 'energy efficiency' category in its annual Master Builder of the Year awards (Federation of Master Builders 2008).

On their own, these initiatives will not make low-carbon refurbishment mainstream, but they can form part of a wider communication strategy.

## Financial incentives

Financing the necessary change could be managed through a combination of straight-forward tax rebates, private-sector borrowing and grants or loans funded by the public purse. Tax reform is needed where the existing regime provides perverse incentives, but private-sector finance also has the potential to contribute a significant amount, particularly in the mortgages market.

## Value Added Tax (VAT)

The relatively high VAT rate on refurbishment compared to new-build is cited in the housing and environment community as putting a disproportionate emphasis on new-build as a solution to housing problems. A 5% VAT rate applies to domestic energy supply in recognition of the disproportionate hardship experienced by those in fuel poverty. The rate on professionally installed energy-saving products (on an approved list) was equalised with the rate on energy in recognition of the need to remove a perverse incentive to consume rather than conserve if energy was taxed at 5% but insulation and other energy efficiency measures were kept at 17.5%.

	VAT rate
New construction	0%
Domestic energy	5%
Professionally installed energy-saving products	5%
Refurbishment – all other goods and services	17.5%

**Table 4. Current UK VAT rates in relation to domestic energy and construction.**

The Sustainable Development Commission (SDC), the Commission for Architecture and the Built Environment (CABE) and the Royal Institution of Chartered Surveyors (RICS) all support the principle of reducing VAT on refurbishment works to help incentivise moves towards a more sustainable built environment (House of Commons Communities and Local Government Committee 2008). The 'Cut the VAT' Coalition is an industry alliance of 13 organisations, similarly arguing for a reduction of VAT on all refurbishment works from the current 17.5% to 5% in order to reduce the competitive advantage of firms offering illegal 'cash-in-hand' services, thereby under-cutting VAT-registered companies (Federation of Master Builders website).

As part of a European experiment to apply reduced VAT to certain named labour-intensive services, the Isle of Man first trialled a 5% VAT rate on domestic property renovations and repairs on 1 January 2000, subsequently extended to 31 December 2010 in the light of the positive results of the trial. The threefold aims of the Isle of Man government were to create employment, cut back on the parallel economy (ie reducing VAT-dodging by offering 'cash in hand' deals), and to improve the housing stock. From the introduction of the reduced rate of VAT in 2000, both the total sales and the total tax output from construction increased compared to previous years, and the figures for construction increased faster than for the Isle of Man economy as a whole (Table 5). The impact on the parallel economy appears to have more than compensated for the loss of VAT receipts that might be expected from a 12.5% reduction in the VAT rate (Isle of Man Government 2003).

In its report on the original experiment to the European Commission, the Isle of Man government concluded:

“...the experiment has been successful in achieving its and the EU's aims of creating employment and reducing the size of the shadow economy. In addition there have been other benefits to the Government and people of the Island, including improvements to the existing housing stock and reduced pressure on green field site developments. There has been far less pressure on builders to cut corners, reduce prices and work outside the system - the knock on effect of this, according to the Employer's Federation is happier customers and staff, fewer complaints and staff movements, all of which contribute to improved profitability. All concerned have expressed the desire to continue with the regime and for it to become a permanent feature.”

(Isle of Man Government 2003)

The UK's ability to change VAT rates is subject to European law, and the right to apply 5% VAT on domestic refurbishment has only been extended to the end of 2010 for those Member States taking part in the experiment. In the UK, the experiment was expressly restricted to the Isle of Man, not Great Britain and Northern Ireland. However, the European Commission launched a political debate in July 2007 on how to simplify VAT rules, including the application of reduced rates on labour-intensive services (European Commission 2007).

Sales growth (year on year)		Year	VAT receipts growth (year on year)	
Construction	Whole economy		Construction	Whole economy
+14%	+17%	1999	+9%	+7%
+25%	+14%	2000	+10%	+7%
+23%	+20%	2001	+13%	+9%

**Table 5. Analysis of growth in sales and VAT receipts immediately before and after introduction of 5% VAT rate on domestic property renovations and repairs on 1 January 2000 in Isle of Man (analysis based on Isle of Man Government 2003, table 9).**

**Recommendation 5:** Government to work within the institutions of the European Union to establish a VAT framework which allows permanent reduced rates on domestic property renovation and repair.

**Recommendation 6:** Government to apply a 5% VAT rate on housing refurbishment across the UK, not just the Isle of Man, as soon as possible.

## Stamp duty

A precedent exists in the new-build housing sector for using Stamp Duty rebates to reward high environmental performance. New developments achieving the highest zero-carbon standards qualify for zero Stamp Duty (for homes costing up to £500,000) or a rebate of £15,000 on Stamp Duty (for homes costing over £500,000) (HM Treasury 2007).

For Stamp Duty rebates to work in the market for existing homes, some time delay would have to be designed in to the scheme, for example offering the rebate for a period of up to 12 months after purchase. Otherwise, the financial reward is unavailable to the property buyer; who pays the tax before refurbishment works can be started. Within the existing structure of Stamp Duty, a full rebate would provide the biggest incentive for the owners of the most expensive properties (a higher percentage tax on a higher initial amount – Table 6), and can therefore be seen as socially regressive. A partial rebate scheme could be devised to counter this (for example, setting an upper limit to the available rebate), but it would reduce the overall impact of the incentive. The need to provide capital up-front is also a barrier to many home-buyers, who are often financially stretched at the time of purchase. On balance, Stamp Duty is probably not the strongest vehicle for providing tax incentives for low-carbon refurbishment, although it may still play some role.

Purchase price	Rate of Stamp Duty Land Tax
Upto £125,000	Zero
£125,001 - £250,000	1%
£250,001 - £500,000	3%
£500,001 or more	4%

**NB** In designated 'disadvantaged' areas, the 1% rate starts at £150,000.

**Table 6 – Stamp Duty rates on residential property purchases.**

## Council Tax

Energy suppliers are under an obligation from government to pay for energy efficiency improvements under the Carbon Emissions Reduction Target (CERT). British Gas found that the take-up rate on the insulation subsidies they offer under CERT rose from 15% to 60% when the subsidy was in the form of a rebate on Council Tax as opposed to a direct grant (Boardman 2007). This may well be because Council Tax is unpopular and the offer of a rebate influences people's decision-making in a way that exceeds what might be explained by economic rationality alone. Another reason for the relative success of this approach may be that it makes intuitive sense to people if a local authority is seen to be offering incentives for energy efficiency measures and LZCs, rather than an energy company. The funding may still come from the energy supplier; through the supplier obligation, but the logical connection in the public mind is between a government tax incentive and a government policy objective.

Council Tax rebates are not only motivating for people, they are also available at any time, as Council Tax applies every year, unlike Stamp Duty. In order to maintain adequate revenues to support essential local services, these rebates on Council Tax need to be funded from elsewhere. A direct government grant could be introduced to fund the more innovative, low-carbon projects, leaving CERT to continue to finance existing programmes.

To extend the coverage beyond the remit of CERT towards more innovative low-carbon refurbishment projects, one option would be to create a link between energy rating bands on the EPC with Council Tax bands. Doing refurbishment works on a property could shift the energy rating up and the Council Tax banding down. So, for example, a property which was refurbished to achieve EPC band C would qualify for a reduction equivalent to moving down one Council Tax band; a property moving up to EPC band B would move down two Council Tax bands, and so on. The incentive would not be available to properties which achieved the higher EPC ratings without investment, so some certification of works would

be required (as would a second EPC to show the 'before' and 'after' improvements). The level of incentive would also have to be considered: how many years worth of Council Tax discounts would be sufficient incentive?

**Recommendation 7:** *Government to review options for innovative uses of financial incentives, using Council Tax rebates as a delivery mechanism (but using funding from other sources to finance the rebate in order to maintain Council Tax receipts and local service delivery).*

## 'Green' mortgages and private loans

So-called 'green' mortgages can be linked explicitly to energy improvements in the home or to carbon off-setting programmes, or both. Off-setting involves making a payment to carbon reduction programmes elsewhere, rather than seeking to reduce the CO<sub>2</sub> emissions from the property on which the loan is secured. A review of available products in May 2008 concluded that seven lenders offered a mortgage, loan or additional loan (mortgage top-up) which did not include carbon offsetting, and which therefore conformed to the definition of a green mortgage as set out by the Energy Efficiency Partnership for Homes (Energy Efficiency Partnership for Homes 2008). The market for these financial products is very small, estimated at less than 1% of total mortgage borrowing, although perhaps a third of lenders are considering offering a green mortgage. Some 87% believed that there is a market for green mortgages, regardless of whether or not their own company offered one. The review also found that 'many lenders believe that to be truly effective green mortgages need a push

from government in terms of: financial incentives, such as grants, discounts off council tax or stamp duty; and legislative means, such as compulsory undertaking of recommended measures on energy performance certificates.'

**Recommendation 8:** *The Energy Efficiency Partnership for Homes to commission research on the knock-on benefit to the green mortgage market of any future tax rebates as financial incentives for low-carbon refurbishment.*

## Feed-in tariffs

A common policy in those countries with large-scale uptake of LZC technologies is a feed-in tariff arrangement, where owners of small-scale renewable energy systems (such as roof-mounted solar panels) are guaranteed a premium rate for each unit of electricity that they export to the grid. This form of incentive is not only effective at stimulating the market, it also encourages property owners to invest in larger systems, in order to maximise the rewards. In the UK, where grants cover a percentage of the capital costs of installation, and there is no reward for the electricity generated, uptake rates have been much slower (Mitchell, Bauknecht & Connor 2006).

**Recommendation 9:** *Government to introduce a feed-in tariff to stimulate greater uptake of micro-generation technologies.*

# Building capacity to deliver low-carbon refurbishment

## Buildability

For SME building tradespeople to deliver low-carbon refurbishments on a large scale, the sector's capacity to do this kind of work needs to be developed – almost from scratch. As the research interviews show, the work to build capacity in the sector needs to take account of established custom and practice – or the endeavour will result in rejection by most practitioners. This insight is captured in the idea of 'buildability' – a term intended to capture the reality of how builders operate and the fact that, whenever refurbishment is carried out, the contractors have to be confident of their ability to do the work and achieve satisfactory results, both for themselves and for their clients. If a low-carbon refurbishment strategy can be devised in such a way that it takes account of the need for 'buildability', then the strategy has the greatest chance of acceptance by the SME construction sector. Without it, it is likely to be ignored or subverted on the ground.

Key elements of the 'buildability' idea are that building work needs to be made up of products and methods that have all of the following characteristics:

- **Practical** – solutions need to be relatively simple and quick to implement
- **Replicable** – a refurbishment package needs to be something that can be installed many times over by the general population of installers, rather than being the preserve of some kind of elite
- **Affordable** – unit costs may well come down over time and can be influenced by policy, but there is no point in promoting items at any given time which are out of reach of a viable market
- **Reliable** – products and systems need to work well and be robust, including being easily understood by the householder
- **Sellable** – the costs and benefits to both customer and installer need to be readily understood

- **Available** – specialist products that take weeks to order will not find favour among the mainstream: developing product supply chains is key
- **Guarantee-able** – installers make their reputation on delivering things that work and, conversely, will abandon products or methods which lead to repeated call-backs and complaints
- **Profitable** – firms need to be able to make a living from it.

Where new products are needed to help meet the low-carbon refurbishment agenda, the key stakeholders (in addition to the SME building tradespeople) are the manufacturers and suppliers. Where new supply chains need to be developed, the key to success is a strong long-term policy commitment from government. This will stimulate investment and strategic business developments, both among existing players in the market and among potential new market entrants.

**Recommendation 10:** Government and other stakeholders to consider the need for 'buildability' when proposing innovation and change in established practices among SME construction firms.

**Recommendation 11:** Government to send a strong policy signal of its long-term commitment to low-carbon refurbishment, so that manufacturers and suppliers can invest early and with confidence in the development of the necessary supply chains.

## Case Study 3

### 3-bed semi-detached house, London



Year/period of construction	Victorian
Tenure	Owner-occupied
Energy-saving features	<ul style="list-style-type: none"> <li>Ground-floor insulation (suspended timber floor)</li> <li>Internal wall insulation, cornices re-created</li> <li>Loft insulation</li> <li>Light pipe</li> <li>Efficient A-rated appliances</li> <li>Mostly low-energy lighting</li> <li>Gas condensing boiler; controls, thermostatic radiator valves</li> <li>Insulated hot water tank and pipework</li> <li>Double glazed sash windows at front; high performance casement windows to rear</li> </ul>
Low- and zero-carbon technologies	Solar water heater with integral solar panel to power the pump
Water-saving features	Rainwater & greywater collection for garden use
CO <sub>2</sub> emissions reduction	Estimated 60% reduction

## Training and skills

Skills provision for the UK economy is divided between 25 industry-led Sector Skills Councils (SSCs), working within a skills policy framework that is the preserve of the Learning and Skills Council (LSC) in England (and other bodies in Scotland, Wales and Northern Ireland). The relevant SSC for construction is ConstructionSkills (which is itself a partnership between three separate organisations: CITB-ConstructionSkills, Construction Industry Council and CITB Northern Ireland). SSCs are largely directed by employers' needs, so innovation in the national skills curriculum typically comes about when employers perceive a need.

The structure for training and apprenticeships comprises the National Occupational Standards (NOS), which are written by SSCs and define the standard of skills that is required. The NOS in turn informs the development of individual qualifications – the Scottish Vocational Qualifications and National Vocational Qualifications (S/NVQs) – by Awarding Bodies (such as City & Guilds, Edexcel). It is these S/NVQ courses which are taught at further education colleges and, for apprentices, through work-based training.

Although SSCs all administer a publicly-funded budget for training, construction is unusual in that its training programme is substantially funded through an industry levy, with all registered firms (except the very smallest) contributing to the training fund, administered by CITB-ConstructionSkills. In 2007, £165.4 million was collected in levy contributions and £137.7 million was administered in training grants to nearly 22,000 firms. Taking account of all CITB-Construction Skills' activities, not just the training grants, for every £1 of Levy received in 2007, the industry received a direct benefit of £1.17. Half of the total training support went to small and micro businesses (CITB-ConstructionSkills 2008) and 75% of levy payers supported the continuing existence of the levy in 2006 (CITB-ConstructionSkills 2006). The funding system for construction training is valued by and delivers benefits for the industry as a whole.

The skill-sets of traditionally-defined tradespeople (for example, plasterers, electricians, etc) will need to be expanded so that they understand enough of the low-carbon refurbishment agenda to play their part effectively. This is likely to include a better understanding of how the interaction of different trades on-site can lead to loss of overall building performance (for example, airtightness can be compromised if wet plaster is stopped at the height of skirting boards instead of reaching floor level; the performance of vapour

barriers and insulation materials can be compromised by inaccurate installation and subsequent drilling of holes for pipes, ducts, wires and recessed light fittings).

In relation to the installation of LZCs, the relevant SSC is Summit Skills, which



has identified these new technologies as key to the future of mechanical and electrical building services, and begun a process of setting NOS for training on the installation of LZCs, starting with a review of the short courses and other forms of training that have emerged during the early period of market development (National Energy Foundation 2007). This work confirms a widely-held observation that innovation in skills training does not start with S/NVQs, but with short courses. Developing short courses into S/NVQs is an important part of mainstreaming the capacity to deliver new services.

The traditional focus of training has been on traditionally defined trades (plumbing, plastering etc), but the challenge of the new LZC technologies is to move towards training requiring elements of several traditional trades, as well as new competences – the so-called multi-skilling agenda. For a whole-home refurbishment that incorporates building works (for example, wall insulation, re-plastering) as well as energy systems design, the multi-skilling challenge is greater and includes aspects of project management (for example, optimal ordering of works on-site) as well as integrating demand reduction measures with energy supply technologies (for example, working out how much heating a well-insulated property will require and sourcing heating system technology to match). This represents an additional shift of emphasis away from trades and specific technologies to an integrated 'whole home' refurbishment focus, including some technical understanding of energy systems and building physics.

Some of the more technical aspects of this work may be best addressed through the development of one or more packages for refurbishment (ie an all-inclusive design and specification, which can be applied without understanding all of the reasons behind it). Having said that, there is a risk that packages may not work well in practice (or in certain situations), as the assumption that 'one size fits all' is almost certain to be misplaced, given the variety and size of the housing stock.

The low-carbon refurbishment agenda therefore presents a series of challenges for training and skills, with the strong possibility that existing NOS may have to be amended (leading to changes in S/NVQs) and, fairly probably, that one or more new sets of NOS and S/NVQs will be needed.

Without a perceived need from the industry leaders who guide the development of new skills through ConstructionSkills, none of this work on mainstreaming skills for low-carbon refurbishment will come about. This is another reason for concluding that a first step is a strong policy signal from government that the low-carbon refurbishment agenda is being actively supported. Industry can then choose to respond.

**Recommendation 12:** *ConstructionSkills to co-ordinate a review of existing training (including short courses) and develop a strategy for incorporating standards-based, low-carbon refurbishment into National Occupational Standards.*

**Recommendation 13:** *ConstructionSkills and SummitSkills to develop a strategy for integration of skills in a 'whole home' target-driven low-carbon refurbishment process.*

**Recommendation 14:** *ConstructionSkills and SummitSkills to be involved in CO<sub>2</sub> emissions from the entire housing stock by 2050.*



# Role of the social housing sector in fostering innovation

Social housing makes up about 20% of the stock. Both the energy efficiency of the social housing stock and the rate at which it is improving are better than the stock average (Department for Communities and Local Government 2008a). Private housing still lags behind.

Registered Social Landlords (RSLs) would appear to be in the best position to take forward the low-carbon refurbishment agenda, as potentially innovative clients working with the construction industry to bring about change. As professional housing managers, RSLs have experience of managing repairs and improvements, and are repeat clients for such work, often with established long-term relationships with contractors. One of the lessons from the research interviews was that such established partnerships are better for fostering innovative practices than one-off contracts.

Although they vary in size, RSLs typically each have sizeable property portfolios, which represent a significant opportunity for scaling up activity and learning about low-carbon refurbishments. RSLs are regulated by the Housing Corporation, and funding for

RSLs has been conditional on meeting environmental criteria (based on the EcoHomes methodology) for several years, providing a framework which can be used to apply minimum standards in the future.

The investment arm of the Housing Corporation is to be merged in 2009 with English Partnerships, the Academy for Sustainable Communities and some regeneration and housing functions of CLG to create a new Homes and Communities Agency for England (Department for Communities and Local Government 2008b). While this new agency will undoubtedly take time to get established, there is a clear role for it in taking on the work started by the Housing Corporation, and developing it further:

**Recommendation 15:** From 2009, the new Homes and Communities Agency to take forward the development of a voluntary low-carbon standard for refurbishment in the social housing sector in England.

## Case Study 4

### 2-bed end-terrace house, Birmingham



Year/period of construction	1884
Tenure	Owner-occupied
Energy-saving features	Internal wall insulation Loft insulation Efficient A-rated appliances All low-energy lighting Gas condensing boiler; programmable thermostat, thermostatic radiator valves Timber double glazing (low-emissivity glass)
Low- and zero-carbon technologies	None
CO <sub>2</sub> emissions reduction	64% reduction
Number of occupants	1 adult
Behaviour	Conserving. Indoor clothes dryer rather than tumble dryer (NB no garden for clothes line)

# Standard(s) for refurbishment

In contrast with new-build housing, there are no energy standards for refurbishment in the UK. Standards exist for some individual components or sub-systems (for example, central heating boilers, windows) but not for the entire building's energy performance. In Scotland the Sullivan Review, while mainly focused on new building, also includes a recommendation for the 'consideration of developing practical performance standards for existing buildings (aligned with the energy performance certificates).' (Sullivan 2007). If Scottish politicians choose to develop such standards, it will provide a precedent for the rest of the UK to follow. The A-G rating scale introduced for the EPC could clearly frame the public expression of such a standard.

The EcoHomes XB methodology is a credits-based system for making improvements to existing homes. It is a development of the EcoHomes methodology, which was originally developed for new-build housing. The subsequent development of EcoHomes into the Code for Sustainable Homes has crucially included two minimum performance standards – one for energy; one for water – which are not tradeable against other credits in the methodology. A comparable development is needed for refurbishments, possibly taking the EcoHomes XB methodology and adding a minimum standard for energy to it (and possibly one for water), thus creating a 'Code for Sustainable Existing Homes' or a 'Code for Sustainable Homes – Refurbishment'. Research will be needed to establish the standard (or standards, maybe different for different dwelling types), but it needs to be challenging in order to be consistent with the 80% CO<sub>2</sub> emissions reduction target. At first, very few homes would meet the standard, but the necessary level of innovation will only be made clear by setting the voluntary standard at a high enough level. The process for moving the agenda forward for the existing stock can thus be seen as a complement to the 'zero carbon' agenda for new homes.

The Home Truths report commissioned by Friends of the Earth and the Co-op Bank argued for a standard which applies at the point of sale or rental of a property and gets tougher over time. In this scheme, the regulation would relate to re-sale or re-letting, so that it would be possible to purchase a property whatever its rating, but that it could not be re-sold later without meeting the minimum standard (Boardman 2007). Initially that standard would be F or E, but would move to D or C within a few years, thereby encouraging people to invest in a more ambitious package of measures and 'future-proof' their property. Research will be needed to establish a suitable standard (or set of standards), which are consistent with the CO<sub>2</sub> emissions reduction target.

Voluntary standards for refurbishment exist in Germany, and in Switzerland and France – which both use the Minergie standard (German Energy Agency 2008, Minergie website). In these countries, the approach has been to aim for a quantified target. Rather



than seek incremental improvements, these standards require a major renovation, which should then be adequate for many years. However, the continental standard-based approach has not yet achieved as much as the policy-makers might have hoped for: relatively few renovation projects to these high standards are undertaken each year. The challenge is to find a way of creating a renovation programme which achieves low-carbon standards across the entire stock.

A low-carbon refurbishment standard will need to be voluntary initially, but needs to become mandatory once the initial period of innovation and research has led to significant take-up, ie once a market for low-carbon refurbishment services has been established.

**Recommendation 16:** CLG to co-ordinate a study tour of relevant European countries for key UK stakeholders to learn about refurbishment standards and their implementation.

**Recommendation 17:** Government to set out a timescale and policy framework for establishing mandatory refurbishment standards that are consistent with an 80% CO<sub>2</sub> reduction target by 2050.

# Regional innovation networks

There are several reasons for thinking that a regional focus is needed to foster some of the innovation implicit in the low-carbon refurbishment agenda, as summarised below:

**Housing stock variations:** Locally and regionally, UK housing has quite different characteristics - from Scottish tenements to back-to-back terraces in northern English cities; from rural houses made of traditional materials (for example, Devon cob) to inner-city high-rise flats. While some dwelling types are common and ubiquitous, there is also geographical diversity. Tackling these issues at the level of a devolved administration or an English region would allow for more detailed work on the predominant types in that particular part of the country.

**Climate and climate change impacts:** Heating demand is typically higher in colder Scottish winters than in Cornwall, while the changing climate may lead to a significant increase in demand for summer cooling in London and the south east, but not elsewhere.

**Devolved administrations:** Both Wales and Scotland have taken different paths to England in terms of the zero-carbon new-build agenda, while Scotland's Building Regulations are also significantly divergent. As refurbishment moves up the political agenda, it seems reasonable to assume that the devolved governments will want to define their own strategies for the existing housing stock as well.

**Business networks.** Most SME construction firms work at a local level, but federations and business-to-business networks

typically operate at the slightly larger scale of English regions, nations (Scotland and Wales) and the province of Northern Ireland.

**Regional/devolved development agencies.** There is considerable potential for new jobs and new economic development, much of which could benefit from financial assistance and other development services that are available at a regional level.

**Training centres.** ConstructionSkills and the FE college network can usefully be integrated into a regional structure. In light of the far-reaching implications that low-carbon refurbishment has for skills, the involvement of these institutions is key.

Developing the low-carbon refurbishment agenda will require co-ordination of information, opportunities for networking and knowledge transfer activities. All of these can usefully take place at a regional level and, in many instances, there are existing partnerships or stakeholder networks in which the low-carbon refurbishment agenda could be accommodated, making good use of existing structures.

**Recommendation 18:** *Regional and devolved development agencies to initiate/coordinate partnerships that are relevant and useful to the development of the low-carbon refurbishment agenda.*



# Conclusion: making low-carbon refurbishment mainstream

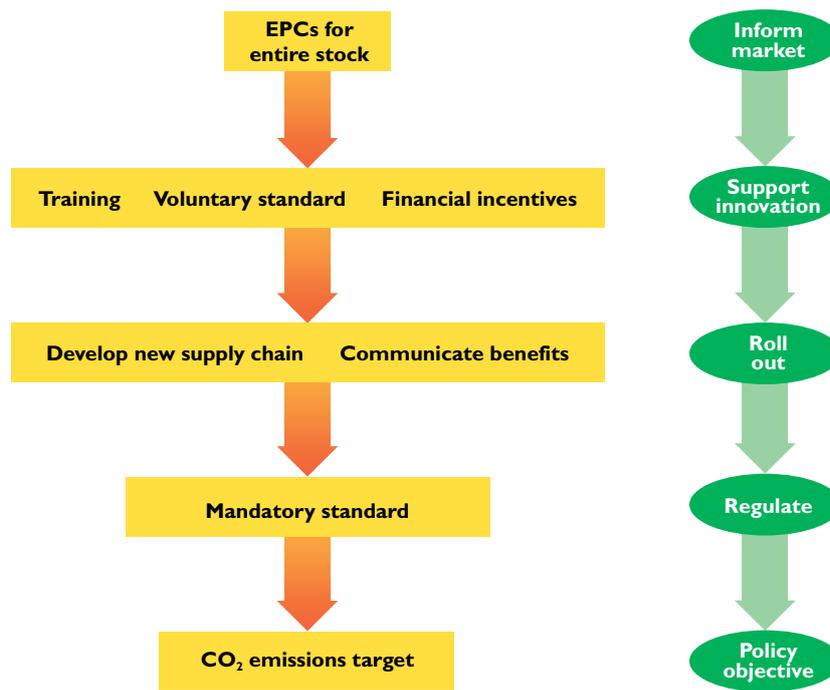
This report has set out some of the issues around low-carbon refurbishment and proposed some ideas and recommendations for government and other stakeholders to consider. Much more work is clearly needed to bring about the transformation of the UK housing stock to meet low-carbon standards. This amounts to a completely new service provided by the SME construction industry, potentially adding between £3.5 billion and £6.5 billion to the existing market for housing RMI (£23.9 billion).

A new kind of service is needed, combining new and traditional skilled trades in ways which result in low-carbon refurbishment. Many S/NVQs will need to be amended so that awareness of energy and carbon issues among the SME construction industry is significantly improved and practices changed to meet these

new requirements. Innovations are needed in mainstream training provision, beginning with a review of innovative short courses. Product supply chains will also need to be developed.

To increase the chance of success, all these initiatives need to be compatible with the concept of 'buildability' – taking as a starting point the ways in which SME building tradespeople operate, and making the objectives of policy practically deliverable on the ground.

A set of policies founded on incentives, information and regulation has the potential to achieve it, with a possible strategy over the coming decade being to build a considerable amount of new policy and training around the Energy Performance Certificate (Fig 7). With strong leadership, adequate resources and a clear strategy, such a process might be possible within ten years.



**Figure 7. Elements of a possible strategy for reaching a mandatory minimum standard for low-carbon housing refurbishment.**

# Appendix

## Research aims, methods, sampling and interview questions

### Research aims

- To summarise recent research analysing the need and potential for reducing CO<sub>2</sub> emissions from the UK's existing housing stock
- To explore the role played by SME construction firms and other tradespeople in refurbishing the UK's housing stock
- To investigate custom and practice in the SME construction sector and to draw lessons for the development of effective partnerships
- To highlight relevant projects and programmes from outside the SME construction sector and to suggest possible collaborations
- To set the wider political agenda for low-carbon refurbishment in terms of a 'market transformation' approach, including the provision of information, financial incentives, and leading to the introduction of a regulated minimum standard for property renovation in terms of energy and CO<sub>2</sub> emissions.

### Research methods

This work was carried out between December 2007 and May 2008 and consisted of four principal activities:

1. A desk study of research into CO<sub>2</sub> emissions reductions from UK housing and policy tools to effectively transform markets in the context of climate change.
2. A round of in-depth, semi-structured interviews with sixteen SME building tradespeople to investigate custom and practice; attitudes to innovation and risk; sources of trusted information. These interviews covered a wide geographical range, from Totnes to Hexham; from Bridgend to Cleethorpes, but did not include representatives from Scotland or Northern Ireland. Interviewees included 13 builders/small developers (11 of whom were FMB members), one electrician and two plumbers. The semi-structured interview method ensures that the same core of topics and specific questions are covered in each interview but with sufficient flexibility to explore issues in more depth as each conversation develops. Interviews ranged from 34 – 141 minutes in length (mean 74; median 70 minutes) and were all conducted face-to-face except one telephone interview.
3. A round of interviews with six stakeholders in the housing/ energy/ refurbishment sectors to explore and further refine some of the ideas emerging from the first round of interviews and the desk study. Interviewees represented the following viewpoints and areas of expertise: private homeowner; private

landlord, social landlord, social housing policy, local government (Planning), short-course training and standards development.

These interviews ranged from 23 – 66 minutes in length (mean 44; median 41 minutes). Three were conducted face-to-face and three took place over the telephone.

4. A series of meetings with stakeholders (a total of 15) to discuss the issues around low-carbon refurbishment of UK housing and the FMB's Building a Greener Britain campaign. Meetings were held with government officials, elected representatives (covering UK, Scotland, Wales and Northern Ireland), construction training experts, low-carbon refurbishment pioneers, property developers.

In addition, relevant and useful information was gathered at a pilot training session on low-carbon refurbishment for FMB members, delivered by Russell Smith of Parity Projects and co-sponsored by the London regional branch of the Federation of Master Builders and London Borough of Croydon.

### Sampling, representation and bias

Conducting in-depth interviews with SMEs is made difficult by the fact that these busy people often do not have time to talk, and builders spend a lot of time on-site, making the practicalities even more tricky. Many interviews had to be re-scheduled or were missed completely because of urgent business matters arising unexpectedly. A random sample of 100 FMB members with email addresses elicited only one interview. The most successful recruitment strategy was for the FMB to hand-pick active members, which resulted in ten interviews. The remaining five interviewees among SME tradespeople were recruited through a combination of persuasion and personal favours through existing social networks. These sampling techniques are far from ideal and are acknowledged as carrying an intrinsic risk of bias. For example, the one respondent out of 100 contacted by email was actively considering setting up an eco-refurbishment element of their business, which undoubtedly affected the decision to take part. Nonetheless, the interviews as a whole cover a wealth of experience and do seem to offer insights into the business of SME construction.

The process of stakeholder engagement needs to be extended and this report is presented in the hope of provoking wider and further debate among all sectors of society with a stake in the future of the housing stock.

# Interview questions

## Consent and Data Protection

I undertake to keep your personal identity and personal data in the following way:

- you will only be quoted in a way that protects your personal identity;
- nothing given to a third party without your explicit consent;
- records stored in compliance with Data Protection legislation;

OK to take part in the research on this basis? Written consent form or verbal?

## Respondent profile

- name, trade, company size and geographical area
- type of work you do (include skills and specialisms)
- Sole trader / Owner/director / Employee / Other
- Main contractor / Sole contractor / Sub-contractor (%ages?)
- Personal history in the trade
- trade associations? Which? Member benefits?

## About your relationships with people at work

- Design team (Architects, Engineers ...)  
other tradespeople
- suppliers / merchants / manufacturers clients
- planners, building control other – who?

Experience with particularly demanding clients? Architects/designers?

## About the 'tools of the trade': your relationships with material things at work

- What are the tools of your trade, ie what do you use regularly, day in, day out?
- last time you worked with a new tool or product? What was it like?
- Imagine ... free sample of a new product. Would you use it? Why/why not? Prompt if necessary:
  - o Brand recommendations (who from?)
  - o Performance claims Sense of quality ('feel')
  - o Cost – is it cheaper? Claims of durability/reliability
- Where would you first try out a new product? Prompt if necessary:
  - o At home On current job
  - o On next job Keep it in mind (what conditions?)
- How do you react if a customer wants to use a new product on a job?

## Education, training and sources of information

- recognised qualifications (for example, City and Guilds, NVQs), dates, subjects

- top-up courses or CPD courses in the last five years giving (for example, new part L)
- what did you think of the quality of your training? For example, how relevant?
- sources of reliable news and information. Prompt if necessary:
  - o Other builders Wholesaler/supplier
  - o Product manufacturer Trade press
  - o Internet Fairs, events (for example, product demos)
  - o Planning / BC Architects / designers
  - o Surveyors / estate agents Other (who?)

## Your priorities in relation to work

What are your priorities on a job? Prompt if necessary:

- customer satisfaction profit
- familiarity of materials/techniques speed of work
- predictability of the overall job other (what?)

## About your relationships with regulations

- Does your work regularly come under Building Regulations? Planning?
- What is your view of Building Regulations?
- What is your view of Planning?
- How do you find out about changes in regulations? (prompt: magazines, conversations on-site)

## Your views on environmental impacts of buildings and building work

- Have you ever worked on a building project with unusual environmental features? If so, give details – what was the project, what was your experience?
- Do you think the environmental impacts of buildings are important?
- What do you think can/should be done to reduce the environmental impact of buildings?

## Thinking about the future

- Do you get satisfaction in your work?
- Has your job satisfaction changed in the last few years? If so, how and why?
- Where do you see your work going in the next 5 years?
- What about the next 10 – 20 years?
- If a young person came to you for advice about starting a career in building, what would you advise them?
- What are your views on the future of the building business generally in the UK?
- What do you like best about being in the business you're in?
- What do you like least?

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# Author's biography



## Gavin Killip

Gavin has ten years' experience of energy efficiency and building-integrated renewable energy projects in the voluntary and public sectors. He has a BA in Linguistics from York University and an MSc in Architecture: Advanced Environmental and Energy Studies from the University of East London, in association with the Centre for Alternative Technology. Gavin's MSc thesis was on the prospects for sustainable energy use in English housing, addressing what is required to reduce carbon emissions from the domestic sector by 60% by 2050.

Gavin joined the Environmental Change Institute at Oxford University in 2004 working on the 40% House project, Building Market Transformation and background research for the Royal Commission on Environmental Pollution's report on the urban environment. His current research focus is the role of small-scale building trades in the low-carbon refurbishment of UK housing, funded by the Engineering & Physical Sciences Research Council and the Carbon Trust.

Gavin has reduced CO<sub>2</sub> emissions in his own home by 65% through major refurbishment.

# Notes



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