Installer Power

The key to unlocking low carbon retrofit in private housing

Catrin Maby & Alice Owen

September 2015

asiantaeth ynni SevernWye energy agency

UNIVERSITY OF LEEDS

Installer Power

ACKNOWLEDGEMENTS

We would like to offer our thanks to all the research participants who took time out of their busy schedules to speak to us and made this research such an interesting and enjoyable experience.

Thank you to the Sainsbury Family Charitable Trusts Climate Change Collaboration for their interest in this topic, and for their invaluable support, without which this project would not have been possible.

Catrin Maby, Severn Wye Energy Agency

asiantaeth ynni
SevernWye
energy agency

Alice Owen, Sustainability Research Institute, University of Leeds

UNIVERSITY OF LEEDS

Supported by the Sainsbury Family Charitable Trusts
Climate Change Collaboration

The Climate Change Collaboration

Contents

Executive Summary

Improving the energy performance of existing homes is an essential element in dealing with the challenges of climate change, fuel poverty and security of energy supply, with home energy use accounting for more than a quarter of final UK energy consumption. All buildings need to move towards being 'zero carbon', compensating for other sectors where it is even more difficult or less cost-effective to reduce emissions. As we are replacing buildings very slowly, this will only be achieved by retrofitting existing ones.

The UK housing stock is old and inefficient, with a wealth of architectural detail, and regional and local variation in design and materials. Future-proofing it requires a complex mix of measures, and effective integration of retrofit technologies into existing buildings and building services. With around 65% of UK homes owner-occupied, a major challenge is that of motivating homeowners to invest in such improvements.

There is untapped potential in the trigger-point opportunities to include energy improvements in other work offered by general home repairs, maintenance and improvements (the RMI market). This is a significant area of economic activity, a large proportion of which is delivered by micro enterprise and sole-trader building tradespeople. The homeowner's need or wish for such works offers a 'route to market' for energy improvements, and the associated costs and disruption may become relatively marginal when combined with other works.

Despite the vital importance of building trades micro enterprises in achieving low carbon retrofit, their views are rarely heard within policy debates. These micro enterprises usually fall outside of trade organisations and 'green-focussed' accreditation schemes, are mainly active at a local level, and little is reported about what drives their professional behaviours. As the first point of contact for many homeowners who want building work done, they have a great deal of potential to influence these customers, and a huge wealth of knowledge to bring to retrofit. They could be the frontline in communicating, selling and implementing energy improvements.

This research collected in-depth qualitative data from building tradespeople on the issue of making energy improvements to existing homes. We asked them for their perspective on this issue, and about their working practices, such as geographical range, sources of information and knowledge, and how tradespeople linked with each other. The majority of the research participants were either self-employed sole traders or in a company with less than 5 employees, and were working mainly in rural communities and towns, rather than big cities.

CONCLUSIONS AND RECOMMENDATIONS

The fragmented nature of both the industry and its direct customers makes it a particularly difficult area to reach for national policy makers, but it need not be difficult to reach for policy. The scale of activity within this sector and its unique access to knowledge of, and decision making about, the buildings that constitute the private housing market, make it a vital area for policy and action.

In talking to building tradespeople about their work, a picture of a localised, knowledgeable and connected system has emerged. Each element of this system can either increase or limit the potential of RMI work to deliver low carbon homes. We offer the following ideas for policy and practice, rooted in our research findings, to make sure that the system works effectively for a low carbon future.

Develop policy which supports localised action

Key to success in low carbon retrofit is recognising and understanding the local and small scale nature of the RMI construction industry. It is crucial that policy and practice go with the grain of the good practice that many are already undertaking, and builds upon the knowledge and skills that exist at local level. Keeping work local has social, environmental and economic benefits, ticking all the boxes for a sustainable economy.

Local informal networks are an important route for learning about new products and methods. These networks are routes to influencing practice, particularly along the supply chain and between trades. The characteristics of networks make them a positive enabling factor in moving towards deeper retrofit. In seeking routes to disseminate information and innovation, policy needs to reflect and build on the reality of the business and social networks that operate at local level, rather than attempting to impose top-down structures.

Design programmes for energy efficiency in buildings to engage the existing, locally active, RMI industry in maximising the inclusion of energy improvements in general building works

RMI work (in rural areas at least) is characterised by micro businesses working at a very local level, getting their work through social and neighbourhood networks and personal recommendation, with benefits to the tradesperson as well as the customer in terms of avoidance of time-wasting and other risks. The very local nature of building trades RMI activity indicates a good fit with local delivery of integrated energy efficiency schemes, including energy advice and assessments, and community-scale awareness raising and partnerships.

Match consumer protection with small business protection

Not all micro enterprises are planning for growth. Maintaining business activity at local level is a positive outcome. Policy and guidance around consumer protection should be matched by, and consistent with, policy and guidance for the small business, so that both parties are protected and enabled to provide what the other needs.

For example, there are potential benefits to customers and tradespeople to working on a day rate, with the customer paying directly for materials, rather than to a fixed quote, and this should not be seen as an indication of an unprofessional approach. Similarly, running a business at less than the VAT threshold should not be seen as an indication of poor quality or business instability, but taken at face value as a business with a small turnover, maintaining low overheads by keeping administration as simple as possible. Guidance for both businesses and homeowners on pricing options and payment arrangements could help avoid problems and misunderstanding.

Effective economic development policy must acknowledge the strength and resilience of the micro enterprise and the informal network as a positive response to economic insecurity.

Develop advice services that can provide independent, expert advice to both homeowners and builders to support them through all stages of the retrofit journey

There is a need for new knowledge and exchange at all levels and amongst all key actors involved in potential retrofit work. Builders as well as homeowners would benefit from access to expert, independent and practical advice from a trusted source, at all stages of the process of getting building works done. This would support tradespeople in being able to influence customers to take up energy improvements, and help to avoid customers being confused by contradictory advice from different contractors.

Advice provision should include good quality home energy assessments. While these will need to be subsidised for low income customers, they should also be realistically priced so that it is possible to deliver them accurately and professionally, with information made available to explain differences in price for more complex assessments. Public promotional activity should avoid devaluing energy assessments by suggesting they are 'free', unless public sector funding is envisaged; where energy assessments are offered as a free or low cost service, any subsidy or private commercial interests involved should be made transparent.

There is also a need for accessible information for tradespeople and homeowners about how to avoid risks and potential problems that may arise in relation to retrofit.

Identify and support good practice for suppliers to enable small and micro companies to use their products: guarantees, training, site-specific and follow-up product support

Suppliers of energy efficiency materials and products should be encouraged to develop the capability to provide training and pre- and after-sales services to micro enterprises and for smaller projects and not just major developments. This might be arranged through a local or sub-regional clustering arrangement, to make it more cost-effective, perhaps facilitated by local authorities.

Identify, support and disseminate good practice in communications within retrofit and RMI

Both general RMI work and retrofitting energy improvements can involve a number of different people and roles, and the effectiveness of communications between them is key to ensuring the best results, in terms of decisions, details, quality, shared learning and customer satisfaction. For example:

- **Clear and accessible guidance for homeowners and builders on what roles need to be covered within a building project and by whom,** including the overall design of a project, the detailed specification, and the management of the work. A simple approach might be a checklist of who will do what at the start of a project, to avoid misunderstanding or omission.
- **Protocols for regular on-site communications** to develop solutions, and amend design and specification, to take account of issues that arise during the project. These need to be agreed and understood by all involved through ongoing dialogue.
- **Protocols for including the costs of time for such communications** for all the trades as well as designers, especially where a higher standard is expected (such as in a Passive House build) or where newer or different technologies are being installed (such as heat pumps).

- **Support from manufacturers and suppliers for sharing knowledge and understanding on energy retrofit tools and techniques,** through approaches such as two-way 'toolbox talks' and on-site briefings, as well as site-specific advice on specifications, to enable wider application of energy saving products.

Review the structure, cost-benefit and impact of private market accreditations

Private market-run accreditations without public sector endorsement can create confusion in the market and add cost to the customer and the tradesperson without ensuring quality. The time pressures resulting from the additional paperwork requirements may even contribute to driving down quality. Particular attention is needed to the risk of reducing the realisation of trigger-point opportunities by limiting the range of technologies that general building tradesman are able to deliver.

Accreditations for installing energy saving products should be streamlined and integrated within statutory regulation. Public information must clearly explain the status of different accreditations, so that customers can differentiate between what is essential and what is a desirable 'extra', and why.

Accreditation systems should be reviewed to ensure no overlap, minimal paperwork and adequate monitoring of the actual quality of work. Accreditation processes should encourage rather than discourage the ability of micro enterprises to offer multiple technologies.

Use Building Regulations to enable and ensure change, and refresh and re-invigorate Building Control so it can achieve its potential, integrating it with local Planning to ensure consistency

Building Control must be effectively resourced and authoritative, and this requires consistent application of credible Building Regulations. Any private provision of Building Control services must be carefully controlled to ensure a level playing field for projects.

The use of Building Regulations to move towards lower carbon and lower energy building is widely understood and accepted. The development of Building Regulations to ensure this should continue along an established path, in a planned and consistent way, following a clear and well-communicated long term plan, covering both new buildings and retrofit of existing buildings, and specifically aiming to increase the take-up of energy improvements within RMI. This will enable building trade companies and specialist installers to plan and invest accordingly in training and equipment.

There is a need for a more consistent and coherent approach by Planning and Building Control working together to avoid any contradictory messaging. Rebuilding and enhancing this joint capacity at local level would provide a local service that communicates, enables and polices good quality low carbon and low energy housing refurbishment, as well as new building.

The local knowledge embodied in Building Control could be more fully utilised, for example in the provision of advice and information services at local level. Building Control and Planning personnel need real practical experience on site as part of their training in order to be fully effective.

The provision of locally accessible advisory capacity could be further enhanced by the development of local databases of good practice examples of energy efficient renovation of period properties, highlighting opportunities to make energy improvements during RMI work. This could also be used by builders as a reference to show customers and encourage them to consider different options.

Introduction

This report documents research carried out during 2014-15 by Catrin Maby (Severn Wye Energy Agency) and Alice Owen (University of Leeds), with the support of the Sainsbury Family Charitable Trusts Climate Change Collaboration.

The aims of the research were to produce evidence, and develop policy and intervention recommendations, to identify how mainstream building and allied trades could help accelerate the low carbon retrofit of the UK's private housing stock, using deep, qualitative insights from the important but generally unreported group of building trade micro enterprises.

Background

WHAT WE MEAN BY 'RETROFIT'

The term 'retrofit' is used in this report to mean adding energy efficiency measures or renewable heat or power installations to an existing building, whether as a one-off measure, in combination with other works, or as part of a general refurbishment.

There are a range of technologies currently available to reduce the carbon emissions associated with energy consumption, as illustrated by the examples in Table 1.

RETROFIT ACTIVITY	EXAMPLE TECHNOLOGIES	HOW CARBON EMISSIONS ARE REDUCED
Energy efficiency through fabric	Cavity and solid wall insulation; loft, flat and sloping ceiling insulation; floor insulation; draught-proofing; energy efficient replacement doors and windows; replacement or secondary glazing	Reducing energy consumption
Energy efficiency through appliances or installed systems	Energy efficient lighting; energy efficient boiler and room heater replacements; voltage optimisers	Reducing energy consumption
Energy curtailment	Improved time, temperature and lighting controls; zoning of heating systems	Reducing energy consumption
Microgeneration of low carbon energy (heat)	Heat pumps; solar thermal; biomass boilers and stoves	Reducing non-renewable energy consumption
Microgeneration of renewable energy (electricity)	Photovoltaics; wind; micro-hydro	Displacing non-renewable energy generation

Table 1: Example retrofit technologies to reduce carbon emissions

INSTALLERS AND BUILDING TRADESPEOPLE

In order to differentiate between the specialist and mainstream industry in this report, we use the term 'installers' to refer to companies or sole traders who install specific energy efficiency or microgeneration technologies. For the general building trades engaged in repair, maintenance, refurbishment, renovation and improvement work, we use the term 'building tradespeople', abbreviated to 'tradespeople' where necessary to make the text more readable.

WHY RETROFIT MATTERS

Climate Change

Set against the context of international concern about the impacts of climate change, and engagement in global and EU policy debate and targets, the UK's 2008 Climate Change Act commits the nation to cutting our greenhouse gas emissions by at least 80% by 2050 and 34% by 2020, against 1990 levels (UK Government 2008). The 2014 Climate Change Committee report on progress towards these targets showed an 8% reduction in carbon emissions from buildings, but gave a red light to the 'traffic lights' assessment for key measures such as solid wall insulation and low carbon heat (CCC 2014). Progress was slowing as the policy framework was changed.

Achieving the statutory carbon reductions cannot be achieved by each sector making 80% savings. Some sectors are less able to reduce carbon emissions, or to do so cost-effectively. For example, a total shift away from fossil-fuel internal combustion engines for land transport, or substituting aviation fuel, requires larger shifts in technology and infrastructure than energy conservation measures of any kind, or the implementation of existing commercial technologies in buildings (Ekins et al 2003). This means that, in effect, all buildings need to be 'zero carbon' by 2050 (DECC 2011, Ekins et al 2013).

With home energy use accounting for 26.5% of final energy consumption in the UK in 2014 (DECC 2015a), improving the energy performance of our homes must be a core element in achieving carbon emission reduction targets. The UK has some of the oldest and most energy inefficient housing in Europe, with 15.67m (57%) of our 27.4m homes built before even a basic level of thermal insulation was introduced into Building Regulations in 1965, and only 3.68m (13%) built since 1991 (DECC 2013).

Although what 'zero carbon' means is still subject to some debate, the scale of the ambition to reduce carbon emissions from our homes is clear. Using the Standard Assessment Procedure (SAP)[1] and Energy Performance Certificate (EPC)[2] grading as an indicator for forward plans, to be zero carbon by 2050, almost all homes will need to be at the top of the 'A' band, with a SAP of around 100 (Boardman 2012). The enormity of the task ahead is highlighted by the fact that in 2013 the average SAP rating for all homes was only around 59, at the bottom of EPC band D (DECC 2015b).

The energy efficiency of new homes is controlled through the application of increasingly stringent Building Regulations, set nationally but deployed through local authorities. What Building Regulations for new buildings can achieve is limited by the fact that we are replacing buildings very slowly, with only

1 *The SAP is the methodology used by the UK Government to assess and compare the energy performance of dwellings. The higher the SAP, the more energy efficient the building.*

2 *EPCs are a measure of the level of energy efficiency of a home, with ratings from A to G, where A is the most and G the least energy efficient.*

around 160,000 new homes built each year and even fewer demolished (Palmer & Cooper 2013). It has been estimated that over 75% of the buildings we will be living in in 2050 have already been built (SDC 2006), highlighting the need to make significant improvements to the energy performance of existing buildings, and to accelerate the rate at which this is currently being achieved.

Even homes that have been built in the last few years will need further improvements to achieve 2050 climate targets: in 2013, new homes had an average SAP rating of 81, equivalent to the bottom of EPC band B (DECC 2015b).

The 2010 recast of the EU Energy Performance of Buildings Directive (European Commission 2010) required that by the end of 2020 all new buildings should be 'near zero energy buildings' (NZEBs). This is loosely defined as a building that has a very high energy performance, with the nearly zero or very low amount of energy required covered to a significant extent by energy from renewable sources, including that produced on-site or nearby. The UK had set its own target for all homes to be NZEBs by 2016 (DECC 2014a), and the UK national plan to increase the number of NZEBs says that 'by 2050, emissions from heating and powering our buildings will be virtually zero' (UK Government 2012). However, recent announcements indicating that this interim target will now be dropped (HM Treasury 2015) have yet to be replaced by an alternative timetable.

Security of Supply

The UK has been a net importer of energy since 2004. This has obvious implications both for the economy and for security of supply. Without the effective application of energy saving policies, dependency on energy imports is projected to continue to rise (DECC 2015a). A key feature of an energy efficient home is that it requires the purchase of less energy to provide what a household wants and needs in terms of thermal comfort and energy using equipment. The cumulative effect of reducing demand from homes helps to improve security of supply by reducing the amount of supply required.

Fuel poverty

Closely linked to this is the issue of fuel poverty. A fuel poor household in the UK is typically described as one which cannot afford to keep adequately warm at a reasonable cost (DTI 2001). It is not surprising that affordable warmth is seen as the major issue in this country, with space heating accounting for 62% of home energy use (Palmer & Cooper 2013). A more broadly applicable definition, however, might refer to the affordability of all energy services, with fuel poverty (access to *affordable* energy services) differentiated from energy poverty (access to *any* basic energy services). The latter tends to refer to electricity and clean cooking facilities (Atanasiu et al 2014).

The 2012 Hills Review for DECC recommended the adoption of a new indicator (known as the 'Low Income High Costs' indicator) of the extent of fuel poverty, such that households would be considered fuel poor if:

- They have required fuel costs that are above the median level, and:
- Were they to spend that amount they would be left with a residual income below the official poverty line.

This approach introduces a measure for the depth of fuel poverty, the 'fuel poverty gap', defined as the amount by which the assessed energy needs of fuel poor households exceed the threshold for reasonable costs (Hills 2012).

The Fuel Poverty Advisory Group for England's 12th Annual Report (2013-14) estimated that there were 2.3m fuel poor households in England alone, with a fuel poverty gap of more than £1 billion per year, or nearly £450 per household (DECC 2015c). The impacts on vulnerable households cannot be ignored – the Children's Society report, 'The Debt Trap – Show some Warmth' published in January this year, analysed the England Housing Survey and found that almost one third of families in England were affected, including 3.8 million children (Williams et al 2015).

An energy efficient home, or one fitted with effective microgeneration, requires the purchase of less energy to provide the energy services a household wants or needs. For a lower income household, improvements in energy efficiency may mean that they can afford these services where before they could not. This gives a rather different perspective to the 'rebound' effect to that for a better-off household.

WHY RETROFIT IS A CHALLENGE

There is a clear and simple logic to the direct link between improving the energy performance of buildings and reducing both carbon emissions and fuel poverty, in terms of both energy efficiency and the use of household level renewable heat and power to displace the need to buy so much energy. The question is how to achieve it in practice.

To date, both government programmes and commercial markets have tended to focus primarily on measures delivering the quickest financial returns, resulting in selective delivery of mainly single measures. The focus on cost benefit in energy efficiency led to significant and rapid uptake of measures such as cavity wall and loft insulation and replacement gas boilers, together with the distribution of low energy light bulbs. A similar focus on simple payback led to a huge expansion in the market for microgeneration, particularly photovoltaic panels, through the Feed-In Tariff. The measures that offer the best short-term cost benefit tend to be those that involve the least time and labour, and are typically those that require little additional building work or 'finishing'.

To achieve the significant improvements needed in the existing housing stock, however, will require a more comprehensive approach, which enables and incentivises the achievement of the full potential for carbon savings in existing homes (Rogers et al 2015). Walls are typically the area of highest heat loss from the home, and there are around 7m homes in the UK that cannot be 'cavity-filled' because they have solid walls (DECC 2014a), with only around 211,000 thought to have been insulated so far (Palmer and Cooper 2013). The complex and inter-related set of measures required will include insulation of solid walls in particular, but also of other building elements such as floors – as well as better management of ventilation heat loss, and low carbon heating and home generation technologies (Boardman 2005).

The Stroud District Target 2050 project carried out energy surveys of 248 local homes, which indicated potential average energy and carbon emission savings of 57-58% if all the applicable measures were to be applied, including thermal insulation, heating improvements and microgeneration. This study highlighted the range of thermal elements to be treated in older homes, with different wall and floor constructions as well as various roof configurations without lofts (Maby 2011).

Given the costs and disruption involved for homeowners, and the need to access finance for refurbishment, this will not happen overnight. With around 65% of UK homes owner-occupied (Palmer and Cooper 2013), a major challenge is that of motivating homeowners to invest in such improvements. An important contribution is likely to come from ensuring the realisation in practice of 'trigger-point' opportunities to incorporate energy improvements offered by general home repairs, maintenance and

improvements, which homeowners need or want for other reasons. The 'Countdown to Low Carbon Homes' project highlighted the importance of working with all elements of the retrofit supply chain and local intermediaries to achieve this potential, and developed a community hub model supporting homeowners through the whole retrofit journey (Charalambous et al 2014).

Other barriers are presented by the nearly 5m homes owned by private landlords (Palmer and Cooper, 2013), where the incentive offered by savings on energy bills is 'split', with the cost of building works generally covered by the landlord but the energy bills (and the benefits of any savings on these) going to the tenant.

There is a further aspect to this challenge. If we are to avoid creating a new set of problems, we need to know how to integrate retrofit technologies effectively into an existing buildings and building services, and to apply this knowledge consistently. With 5.71m homes built before 1918, (Palmer & Cooper 2013), our homes contain a wealth of architectural detail, with regional and local variation in design and materials. These variations are part of our cultural capital; their distinctiveness and character has to be maintained, and enhanced, as an essential part of sustainability, and we need to safeguard these forms of capital at the same time as reducing carbon emissions (Porritt 2007).

To future-proof these homes, and make it possible to keep them warm and comfortable while reducing the demand for energy supply and associated carbon emissions, is not a simple matter of applying a few standard measures. Attention must be given to the details of older buildings such as sloping ceilings, dormers and bays, and energy efficient replacements or secondary glazing solutions for a wide range of window types. This presents particular challenges in terms of retrofit, both to preserve historic and aesthetic character, and to avoid the introduction of new risks, for example in relation to damp and ventilation.

THE ROLE OF INSTALLERS AND BUILDING TRADES, AND WHY WE DID THIS RESEARCH

The people who actually deliver home energy improvements are building tradespeople and specialist installers, together with some DIY work. Unless the work is part of a project designed and/or managed by an architect, the responsibility falls almost entirely on them as regards the effective integration of energy improvements, and the quality of the detail.

Making energy improvements to homes represents what could be a very significant market for energy efficiency products and installations. The December 2013 update to the UK's Energy Efficiency Strategy indicated that in 2011/12 the UK's energy efficiency market accounted for around 136,000 jobs and sales of over £18 billion (DECC 2013).

The domestic sector is only a part of this, and in preparing to carry out this research we were conscious that an even more significant market is that of general home repairs, maintenance and improvements (RMI). RMI in total, across all buildings and structures, was an area of economic activity valued at approximately £28 billion (Killip 2012) in 2009 compared with energy efficiency spending, through the energy company obligation Carbon Emissions Reduction Target (CERT) scheme, of £800million in the same year. We have looked at the UK construction statistics data for 2011-13 and, using only a conservative set of categories of work which we can link directly to tradespeople working in retrofit, the value of RMI work (termed Repair & Maintenance or R&M in the UK's Construction Statistics) carried out by tradespeople in private housing, has been at least £11bn per annum from 2011 to 2013 (ONS 2012a, ONS 2013a, ONS 2014a).

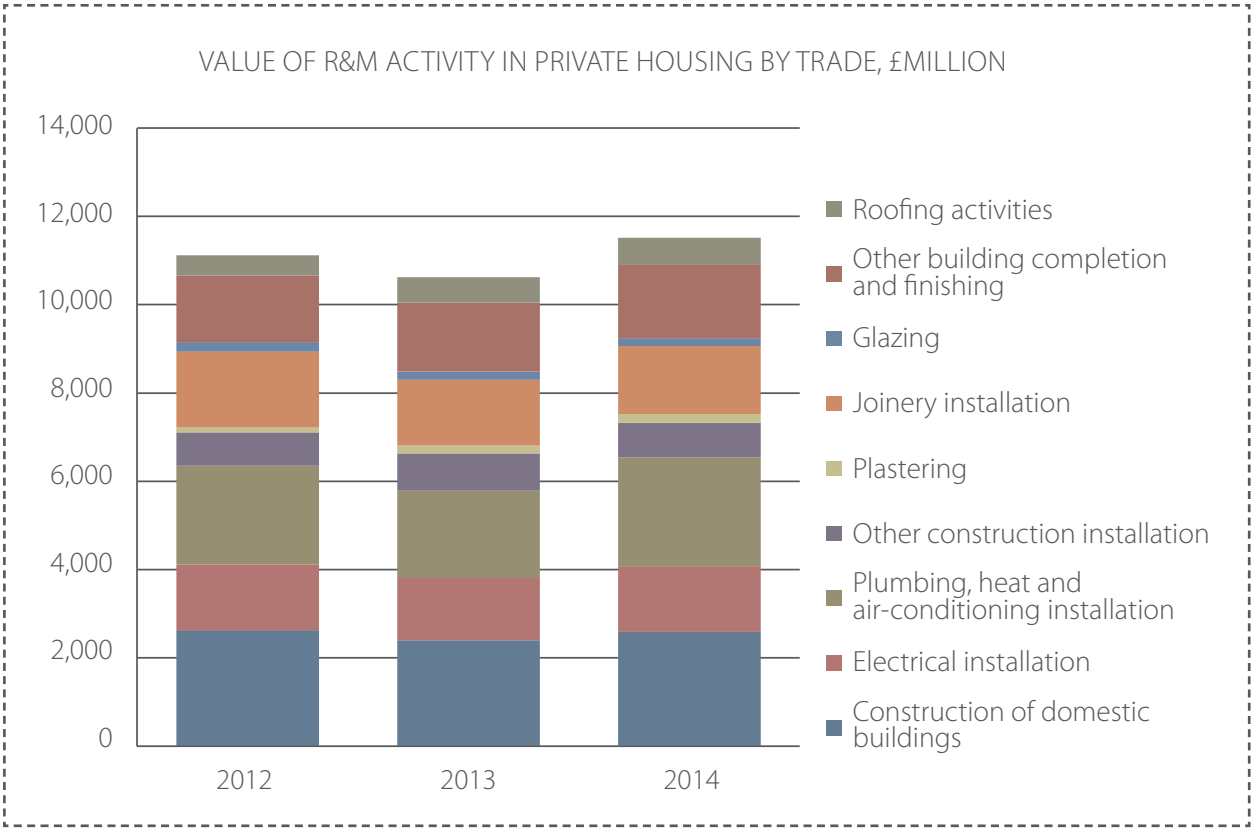


Figure 1: Value of R&M activity in private housing

A large proportion of RMI work is delivered by micro enterprises and sole-traders. Working on residential property is the main focus for 42 to 47% of small firms in the construction industry (ONS 2012b, ONS 2013b, ONS 2014b). It is difficult to separate out firms working on RMI from the broader category of firms working in construction, but the importance of small firms in the sector is clear. Around 330,000 people work in the 120,000 firms who employ 13 people or less in the residential property areas of the construction industry (ONS 2012b, ONS 2013b, ONS 2014b). Of these, over 75,000 are individuals working on their own in terms of running their business, although not necessarily in isolation in terms of delivering projects, as we explore below.

The RMI market would seem to offer massive potential for the inclusion of energy improvements to homes. The homeowner's need or wish for such works offers a 'route to market', and the associated costs and disruption may become relatively marginal when combined with relevant works. A further consideration is the opportunity to integrate the 'newer' energy efficiency and renewable energy technologies with the work of more experienced tradespeople.

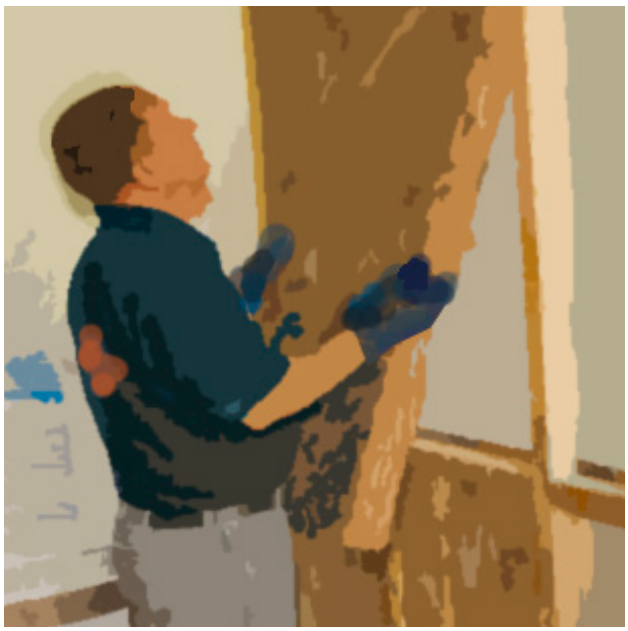
A starting point for this research was a recognition that, despite the vital importance of building trades micro enterprises in achieving low carbon retrofit, their views are rarely heard within policy debates. These micro enterprises usually fall outside of trade organisations and 'green-focussed' accreditation schemes and are mainly active at a local level. Little is reported about what drives their professional behaviours. As the first point of contact for many homeowners who want building work done, they have a great deal of potential to influence these customers, and a huge wealth of knowledge to bring to retrofit. They could be the frontline in communicating, selling and implementing energy improvements.

It is recognised that retrofitting the building stock with energy efficient or low carbon technologies is not the whole story; there is a behavioural as well as a technological component to this challenge. Changes in user behaviour after retrofitting energy improvements can mean that the energy saving potential of the measure applied is either not fully realised or is enhanced. The former is described as the 'rebound effect', where a household reacts to improved energy efficiency by purchasing more energy services (Dimitropoulos and Sorrell 2008).

This could be because they have more money to spend (income effect), or that they reallocate resources to energy services now that these give them better value for money (substitution effect). On the other hand, a consumer may build on having made their home more environmentally friendly by taking up other environmentally friendly behaviours (spill over effect). A range of factors affect whether these various effects occur and to what degree (Hertwich 2004).

Recent research has also shown that installers are important in behavioural as well as economic terms. Householders are influenced in what technology they adopt, and how they use it, by the advice they receive from installers, and how they experience the installation process (Owen et al. 2012, Owen 2013).

Reflecting this context – the imperative of a step change in the energy efficiency of existing homes, and the structure of the RMI market – this research aimed to fill a gap in knowledge by focussing particularly on the views and experience of micro enterprise building trades.



What we did

The research aimed to collect in-depth qualitative data from retrofit installers and building tradespeople on the issue of making energy improvements to existing homes.

We asked people about their working practices and their perspectives on retrofit in the construction industry. To understand how and why installers undertake the work they do, we asked about geographical range, influences and sources of information and knowledge. We were also interested in how tradespeople linked with each other, and with specialist installers.

The initial research questions identified were:

- What factors affect the implementation of low carbon retrofit through micro enterprises?
- What are the building tradepeople's own views of what drives their business activity and what is needed to change that activity?
- How do micro enterprises see their business activity changing? Where does this view come from?
- What are the barriers to overcome in shifting mainstream business practice so that it incorporates more energy improvements/low carbon measures?

There were 38 research participants, 33 of which were individual interviews and the remainder in two small discussion groups. Interviews were informal and held in a variety of locations to suit participants concerned.

The participants consisted of 20 general builders, 7 plumbers/heating engineers, 2 electricians, 2 carpenter/joiners, a roofer, a bricklayer, a painter/decorator, a solid wall insulation installer and 3 builder's merchants. The sample was drawn from several sources, the majority being local and neighbourhood contacts, deliberately chosen both in order to avoid a specialist bias, and to build a picture of local networking. This was balanced with a sample from professional networks, including the Association for Environmentally Conscious Buildings, the Centre for Refurbishment Excellence, and the Severn Wye Energy Agency 'Link to Energy' network of local installers.

The research focussed on tradespeople working mainly outside the big urban areas. The majority (25) of the research participants were drawn from the rural and market towns in the Welsh/English border areas of Gloucestershire, Herefordshire, and Monmouthshire. Of the remaining 13, 4 were based in towns in West Yorkshire, 3 in London, 1 in Surrey, 1 in Hertfordshire, 2 in Lancaster, 1 in Birmingham and 1 in Cornwall. The dynamics of communities, and how people identify installers and building trades to work with, may be at least partially different in cities, and this should be taken into account in reviewing the results.

The majority of the participants were either self-employed sole traders or had formed a company without any, or no other direct employees. 8 were in companies with more than one but less than 5 employees, and only 4 were in bigger companies: these were the three builders' merchants and a heating company.

Before setting out the themes that emerged from analysing all these conversations, the next section outlines some of the main themes that have already been researched so that the gap that our research fills is clear.

What previous research tells us

We undertook a brief review of existing research which touched on the role of installers in retrofit. Most of the research on retrofit focusses either on issues of the property and its fabric and technological options for retrofit – or on the user, the household and how they choose to retrofit, what retrofit is undertaken, and how they use their homes before and after retrofit.

RETROFIT AT SCALE – AND RETROFIT FOR INDIVIDUAL HOMES

The opportunities for retrofit have been explored at individual and area levels. Area retrofit is obviously appealing to policy makers since it offers the opportunity to achieve significant reductions in energy use. A major research project funded by the Engineering & Physical Sciences Research Council (EPSRC) – Retrofit2050 – looked at a range of retrofit activities in 5 UK cities (Cardiff, Birmingham, London, Edinburgh, and Newcastle) and identified transition pathways and conditions for change with a focus on governance and decision making (Barlow 2014). There is also a multifaceted and in-depth analysis of the low carbon zone, Hackbridge, in London (Deakin et al 2014). These analyses tend to focus on area-wide physical attributes, the morphology and hard infrastructure, leaving the 'soft' infrastructure of installers and advisers unexplored. The characteristics of an area affect which technologies are feasible, but the social or cultural attributes of that area decide which technologies move from 'possible' to 'installed' (Owen 2013). Whether or not there are builders and tradespeople in the area who are able to promote and install retrofit technologies will be one of those local factors.

The Green Deal, as a flagship policy instrument for retrofit, was evaluated in several area studies before being closed in July 2015, and the financing and assessment processes of the scheme were identified as significant barriers to uptake (Willey 2013, Marchand et al 2015). Investigating how homeowners experienced the required Green Deal Assessments provided data to help understand how they evaluated retrofit opportunities – indicating that energy efficiency measures were accepted as part of wider home improvements, rather than valued in isolation (Pettifor et al 2015). Investigating how the Green Deal Assessment was actually carried out revealed huge variations in the recommendations made by different assessors on the same property (DECC 2014b).

Combining 'Green Deal' thinking and an area-based approach, the Sustainable Housing Action Partnership's development of a 'Community Green Deal' brought a welcome focus on the supply chain to achieve energy efficiency improvements in existing homes, at scale (URBED 2010). This approach provides a helpful structure for the range of equipment and techniques that need to be brought together for effective area-based retrofit, although the very nature of 'at scale' delivery means that there remains a risk that the small construction-related business, not specifically focussed on energy retrofit, will not be included in, or affected by, the systemic changes proposed.

However, despite the appeal of large scale retrofit actions, the majority of renovation still happens on a home by home or even a room by room basis, over extended periods of time (Fawcett 2013). Individual homeowners' motivations in undertaking retrofit may not be well aligned with policy makers' desires for low carbon. The flurry of refurbishment that often accompanies moving into a new home is a potential key point for intervention, although the best way to realise that opportunity through the contractors who come into a home to undertake those tasks has not been fully mapped out (Energy Savings Trust 2011).

The reasons for renovation and installation are much more likely to be to do with increasing the utility of the home for the household, such as adding an extra room. Responding to fashion is an influence in the upgrading of kitchens and bathrooms – critical areas for determining energy use in the home (Maller and Horne 2011).

When considering individual household decisions to retrofit, installers do start to appear as an influence. Installers could be considered a constraint on retrofit options if they don't have the technical capacity to implement specific measures, such as the joiner who won't fit triple glazed windows, or because they don't have the knowledge to tailor available technologies to specific buildings (Risholt and Berker 2013). The installer's on-the-job problem solving during retrofit could contribute to the 'performance gap' between the energy performance calculated at design stage and what a building actually achieves in use (Gupta et al 2015). Other studies suggest that the tradespeople's softer skills in terms of reliability, client liaison and approach to work may be, from the homeowner's perspective, as much of a barrier as their technical abilities (Mallaband et al 2013). Different clients will expect and require different approaches from the tradesmen who come into their homes (Haines and Mitchell 2014), and responding appropriately to a client's expectation in order to deliver effective retrofit is more than a technical challenge for installers. Where homeowners have a specific low carbon agenda, the skills and capacity of the tradespeople they use, together with the capacity for trade and client to learn from each other, has proved an important factor in project success (Fawcett and Killip 2014).

The development of social practice theory has generated a new wave of studies examining how people live in their homes, and what opportunities and barriers this provides to retrofit and to energy efficiency more widely. Social practice theory puts the everyday use of the home at the centre of considerations and suggests that three elements: materials, meaning and skill all serve to create, and change, energy use (Shove 2009). In the specific case of self-identified 'green renovators' in Australia, one study suggests that the intentions to reduce household consumption and environmental impact are not effective because the ideas of an 'ideal home' and the incentives used by policy makers do not connect with how households use their homes on a day to day basis (Maller et al 2012).

While social practice theory is very powerful in helping us to see how energy use evolves, and becomes habitual, and potentially locked in, it does not help us to explore the role and influence of people who are not the occupiers of the home. Other people, like installers, are brought into the picture when it is widened to examine the retrofit process, rather than user practices. A recent UK project combined elements of different processes to conceptualise retrofit and found, among other things, that the decision making and design process for renovations including energy efficiency is a long process, and that while the costs of energy efficiency measures were not a barrier in themselves, higher costs would make the decision making process even longer, with a key feature being that installers or designers are engaged in an iterative process to develop the optimum solution for that household (Wilson et al 2013).

RETROFIT AS INNOVATION

Installers do feature in considerations of retrofit as a process of innovation. The classic description of innovation diffusion (Rogers 2003), while focussing on the decision making of the person who will use the innovation (the occupier), does recognise the role of intermediaries. However, intermediaries are cast as promoters of innovations, rather than people who evaluate which innovation is appropriate. They make further innovations through the process of innovation, and may influence how an innovation is used, although these are all roles that installers can play (Owen et al 2014). 'Intermediaries' is a term which

stretches far wider than the installer, with an emphasis on research on people who shape decision making in policy, and implementation at an area scale (Guy et al 2010). Usually, even when considering retrofit as innovation, the homeowner remains the focus, consistent with innovation diffusion theory; what drives a homeowner to consider renovation and how they select their options (Galvin and Sunikka-Blank 2014). However, even with the homeowner still clearly centre-focus, analysis of low carbon retrofit in Cambridge suggests that innovation arises from a creative and problem solving dialogue between homeowner and tradespeople, often in response to heritage or aesthetic considerations of the buildings (Galvin 2014).

Framing retrofit as a professional innovation rather than a social innovation yields interesting insights identifying the need for new professional roles which integrate different trades in order to achieve a coherent retrofit result (Janda and Killip 2013, Nosberger et al 2011). We have found only one other study which explores how construction SMEs specifically might contribute to innovations for low carbon outcomes and our own findings are consistent with this investigation (Killip 2013).

INSTALLER SKILLS AND ATTRIBUTES

The 'Build Up Skills Roadmap' prepared by the construction industry's four skills councils in order to ensure that the UK meets the EU's energy efficiency targets estimated that more than 250,000 tradespeople would need additional training in order for the UK to have the capacity to retrofit its buildings (SummitSkills 2013). The Roadmap focusses mainly on the technical skills that different trades will need in order to be able to specify, install and maintain the full range of retrofit measures required. There is an acknowledgement, however, that skills which are 'entrepreneurial bolt-ons' about customer communication, selling and developing a business in energy efficiency are also part of the picture. Similarly, PAS2030, the technical standard setting out the skills required to improve energy efficiency, a standard which underpinned Green Deal delivery expectations, also mentions the need for customer care and quality assurance skills as a minor element alongside technical competencies in a range of technologies (BSI 2014). For professionals and tradespeople who already have an interest in specific work areas, specific knowledge networks provide opportunities to develop skills and knowledge. Examples include the Association for Environmentally Conscious Building *(www.aecb.net*) and the Green Building Council (*www.ukgbc.org*) for building performance and the Centre for Refurbishment Excellence (*www.core-skills.com*) for retrofit processes more widely.

Technical capability may be the main focus of research and concern, but other aspects of the installer's skill base are being explored. Particularly innovative is the ethnographic work in the construction industry being carried out by the Innovative Construction Research Centre at the University of Reading. Their research has focussed on the complex pathways of skills and capacities that are brought onto construction sites and mediated by different individuals, particularly in the case of migrant workers (Pink et al 2010). In other research, the installer's role as a business or entrepreneur has recently been recognised though a study of the green building sector (Gibbs and O'Neill 2014).

These many skills and attributes are tied into four suggested areas of capacity for installers: their technical capacity, adaptive or problem solving capacity, their interpersonal skills, and their personal motivations in undertaking retrofit work (Owen et al 2014).

What we found out

The research was qualitative rather than quantitative. The conversations with tradespeople were informal and varied. In the following pages we have grouped the comments we heard around seven themes which came up repeatedly. The key points reported are those raised by the research participants, and the implications derived are those of the researchers.

LOCAL MATTERS

'I would say 85% would be in a 10 mile radius'

Working in a local area over a period of time gives a small building trades business an understanding of what is needed and what is acceptable in their communities. Working locally means that building tradespeople can develop distinctive solutions for distinctive local housing stock, and know the techniques that are successful with local materials and designs. Working on many jobs within a local area allows knowledge to be transferred easily from project to project. The local supply chain, and the networks of contractors who work together, are often how new ideas are tested and shared.

'I tend to go to areas that I've lived in and know people and built up customers'

As well as helping to deliver the most appropriate solutions, working locally is important to build reputation and trust, both with customers and with other trades. Reputation and trust are important for developing a stream of local work with good customers; expanding the business is typically less important than maintaining current levels of 'good' business.

Instead, a strong local reputation helps the micro enterprise in several ways: first, getting work through personal recommendation helps the tradesperson to vet customers and avoid potentially difficult customers and bad payers. This is vital when one very bad customer experience can bankrupt a micro enterprise; the costs of a single building project can be very high relative to annual turnover and these businesses may not have the opportunity to build up reserve capital to fall back on when cash flow problems arise. Secondly, a personal recommendation starts the tradesperson on a better footing with the customer, and helps to reduce the number of quotes they have to do to get work – as opposed to the 'one of three quotes' situation, which can be very time consuming for small businesses.

Thirdly, local reputation can put a business in a better position to get confirmed work early in the design process, and to influence the detail of the project. This will often increase the energy benefits of the project, allowing good practice and existing knowledge to be incorporated through recommending measures such as thermal insulation or more energy efficient lighting. We also found examples of tradespeople highlighting opportunities for the inclusion of microgeneration, such as photovoltaics when re-roofing, a solar-ready tank when replacing a hot water system (typically in combination with central heating), or a ground source heat pump as part of a major renovation on a suitable site. While for some tradespeople this was part of a wider interest and knowledge in environmentally-friendly solutions, for others this was more about simply being up-to-date with technology and offering a good service to the customer.

'We try to keep it down to half an hour'

Tradespeople themselves prefer to work as locally as possible, for a number of other reasons. Access to known suppliers and other trades to work with is an important practical point, and the time and cost of travel is a significant factor. Travelling to a different location for work makes it difficult to offer a price that is competitive with a business already based in that location.

'If it was stone masonry, I would travel further because the work is more specialist, whereas if it was general building it would be too competitive'

'No more than 20 miles now, because of the children'

The actual cost to a small business is important, but the opportunity cost when an individual has family or social responsibilities and activities is also a consideration which connects back to the motivations of these individuals – growing the business is not necessarily a top priority. A few of those we spoke to also mentioned the environmental impact of travelling a long way, and were conscious of the inherent contradiction in doing this to undertake 'green' work. However, longer journeys are made in exceptional cases, such as to carry out work for family or friends, or for more specialist work, which may be more interesting and tends to be better paid.

'They found us in the village newsletter and we did some work to the local pub, and from that the phone for about 3 weeks was inundated with 'can you come and service my boiler, can you come and repair this'...'

'Don't market myself at all, I prefer to get word of mouth jobs – people who like my work pass on my information to others'

Many of those we spoke to get most or all of their work through word of mouth recommendations. Advertising their business, if it's done, is highly localised, such as through parish newsletters or local free sheets. Advertising at this scale also helps with the visibility of these businesses, as does having a name and phone number on a van parked outside while work is undertaken, or having a board up outside projects. While most of the tradespeople who spoke about advertising their businesses preferred this highly localised identity and approach, there were also some who took pride in not advertising at all, and relying on their reputation to bring them the work. Carrying out work on a building that is well known in the community, such as the church, pub, village hall, sports centre or school, can cascade into other opportunities. General advertising carries the risk of being contacted by people who do not go ahead with work, of being stuck in the position of competitive quoting with no assurance of work, of working for a homeowner who is a habitual bad payer, or simply receiving too many calls to cope with.

'They trust me you see because if you work in the church you must be good'

'We don't advertise.... if your work is good enough you don't have to'

In addition, reliance on getting work through word of mouth recommendation means that building tradespeople working at local level place high value on quality, both of work and customer service.

Implications for policy

- Keeping work local has social, environmental and economic benefits, ticking all the boxes for a sustainable economy. RMI work (in rural areas at least) is characterised by micro businesses working at a very local level, getting their work through social and neighbourhood networks and personal recommendation, with benefits to the tradesperson as well as the customer in terms of avoidance of both time-wasting and other risks. National policy needs to take account of this thriving local business activity, and to build on it in developing policy for achieving improved energy performance of existing homes.
- The local nature of building trades' RMI activity indicates a good fit with local delivery of integrated energy efficiency schemes, including energy advice and assessments, and community scale awareness-raising and partnerships.
- A difficult or untrustworthy customer can pose a real risk to the micro enterprise. Consumer protection policy and guidance should match, and be consistent with, small business policy and guidance, so that both parties are protected and able to provide what the other needs.

LOCAL NETWORKS

'We are carpenter/joiners, but there is also a team of people of other trades that I will bring in and I'll coordinate the whole thing, plasterers, roofers, lead-workers and so on'

Closely linked to the highly localised nature of retrofit activity undertaken by the smallest firms, local networks are vital. These are not formally established networks, and are outside of the specific supplier relationships with installers that exist in some of trades and technologies. We identified four different types of informal networks which overlap but perform different functions for retrofit installers and tradespeople.

First, there are the local social networks which provide customers and build reputation, as outlined above.

'I work with a plumber who's brilliant and he knows his stuff, and then very often perhaps there's a brickie or a carpenter, and everybody knows each other...because back in the 70s or 80s there used to be one big company and they used to employ everybody, right up to the finishing and painters and decorators, and they all used to look after each other'

Second, there are local trade and knowledge networks between complementary trades: inter-trade networks. Many local tradespeople are either sole traders or working in very small businesses of two or three people – for example a general builder, a part time administrator/book-keeper, and an apprentice. Some of the micro enterprises we talked to had been part of disbanded SME building companies a few years ago, citing 2008 as the 'crash' year, since when there has not been the confidence to rebuild companies to that scale.

'They are all self-employed, they are there when I want them to be there'

'We have a little sort of almost cooperative thing going....there's a couple of us builders, specific carpenters when you are getting into the intricate stuff, plumbers, electricians, plasterers...and I guess a lot of people work in the same way...so I probably spend about 6 months of the year on average for myself and 6 months subcontracting.'

There are a lot of jobs which require more skills and time than an individual micro enterprise possesses, so the smallest firms tend to work in informal networks with other trades, enabling them to cover more major works. These networks provide flexibility and extra capacity, allowing an individual to borrow equipment or call on labour which is needed for a specific job. This is a low risk way of working.

Central to these networks is the general builder. The general builder typically knows enough to project manage the other trades and step in to help when necessary, but this varies a lot in practice. One of the reasons for the variation is that learning to be a general builder tends to be ad hoc rather than through a formal training or qualification, something we discuss further in relation to accreditation, below. Even where the general builder could do a task themselves, sometimes they bring in other tradespeople because they are quicker at their specialism, or because an accreditation is needed, whether this is a legal requirement (as in gas and electrical work), to streamline notifications to building control (as in glazing), or to enable access to guarantees or finance (as in some insulation measures and microgeneration). We noted that there was more day to day collaboration between the construction trades – carpenters, joiners, bricklayers, plasterers, roofers, than with more tightly regulated and highly technical trades such as electricians and plumbers.

'The bricklayer and carpenter goes together typically'

There are many variations on the possible patterns of networking, and some of the ones we noted are illustrated in Figure 2 below:

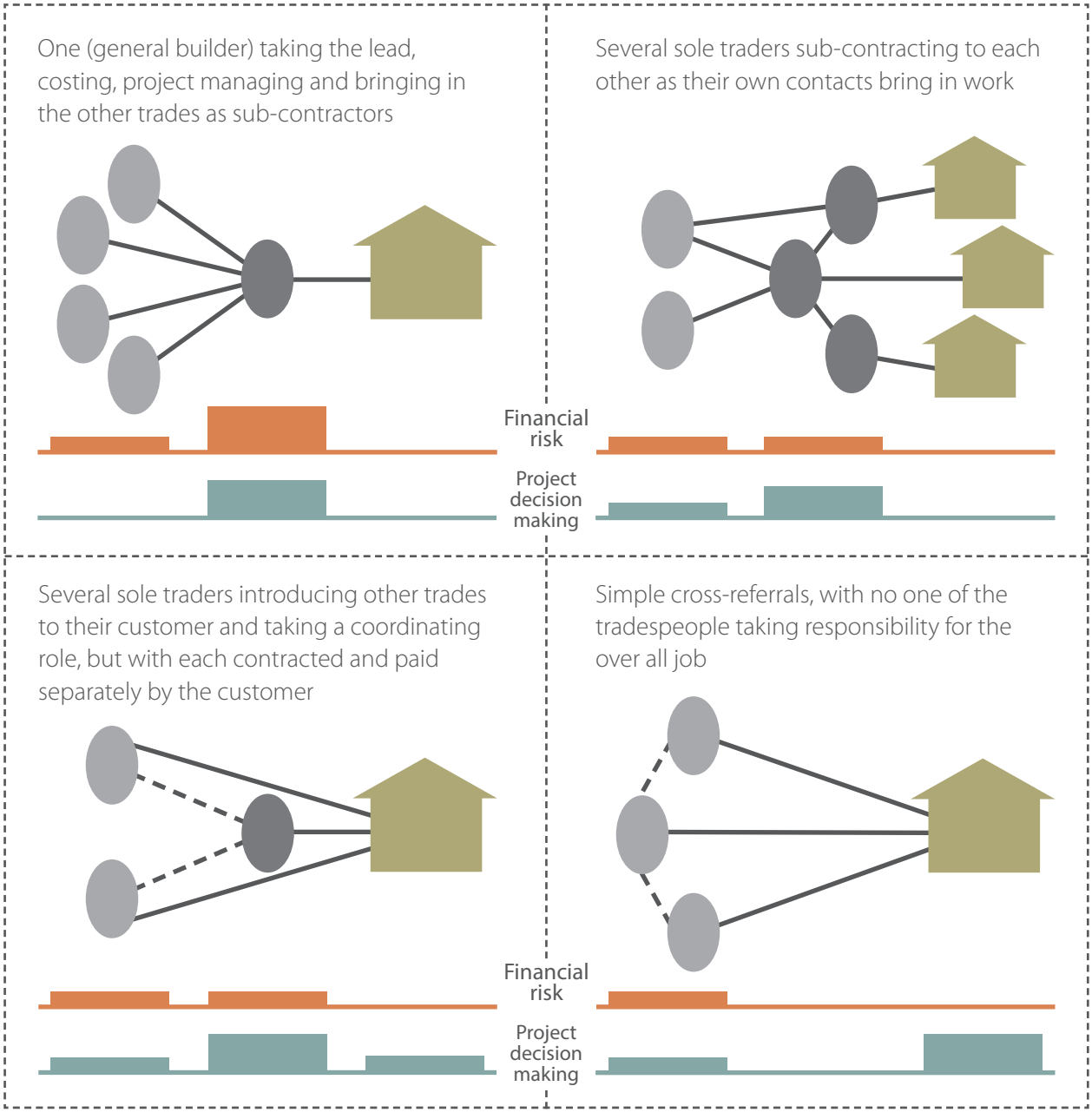


Figure 2: Informal local inter-trade networks

'You are only as good as your worst bloke'

Trust, built up over time, is vital to these inter-trade networks functioning well. Working with people you know well makes life easier because you know people's day rates, typical costs, quality of work and availability. As well as trusting someone to deliver the right quality of work, there's the commercial aspect that people who work together are less likely to undercut each other on price or go direct to each other's contacts for work.

'When you work with friends you don't have to constantly have these conversations, you know there is no chance of them muscling in on someone else's...'

Trust also allows tradespeople to talk to other trades that they know and respect when they are working out how to do a job with new features, such as a type of material or technology they haven't used before.

Third, there are networks of people working in similar trades in the same area. While this can be a route to accessing larger projects by increasing the capacity of the team brought onto a job, the learning that is shared in such networks is limited by concerns about competition for jobs locally.

And fourth, there are networks which grow out of the local supply chain. Builders' merchants, plumbers' merchants and electrical suppliers play a role here. Relationships with locally based suppliers can develop over long periods of time, with merchants providing a link to manufacturers and a local point of contact to discuss the details of requirements. They provide information on products rather than advice, and can be helpful in chasing manufacturers about problems with products, as well as offering credit facilities and simplified payment arrangements through provision of client accounts. The range and quantity of stocks held are dictated by demand, and the local merchant may be bypassed where close supply links are developed between manufacturer and installer, with potential knock-on effects in terms of limiting the technologies that the local RMI trades have (easy) access to.

Implications for policy

- Not all micro enterprises are planning for growth. The maintenance of a steady level of economic activity, underpinned by quality and local distinctiveness should be recognised in policy as a positive outcome.
- Effective economic development policy should also acknowledge the strength and resilience of the micro enterprise and the informal network as a positive response to economic insecurity.
- Information on new products and methods can be transferred between trades, with plumbers/heating engineers and electricians seen as particularly specialist in their fields.
- Networks are an important route for shared learning and influencing practice. In seeking routes to dissemination of information and innovation, policy needs to reflect and build on the reality of the business and social networks that operate at local level, rather than attempting to create (or impose) centralised structures.
- When developing policy which moves towards the deeper retrofit required to meet 'near zero energy buildings', understanding and working with the characteristics of these networks could enable and accelerate change.

INFLUENCING CUSTOMERS

'They are not waking up on Saturday morning thinking how am I going to solid wall insulate my house'

'If it's a self-build they do a lot of homework themselves'

'With a customer you just say well this is what you should have'

'I think it's very hard for people to see the correlation between the amount of insulation and how much is that going to save'

While there is a knowledgeable type of customer who researches and decides on the details of retrofit for themselves, in many cases, the tradesperson needs to suggest what and how things could be done. How receptive the customer is to these suggestions, and how ambitious the tradesperson is in their advice, varies with the situation and relationship. Having worked for the customer before, or being personally recommended, establishes a basic level of trust which puts the tradesperson in a stronger position to make recommendations. This is particularly important if the recommendations incur additional cost, perhaps because it's for a higher quality product or for something extra to the customer's original enquiry, for example additional thermal insulation within a general RMI job such as re-plastering or fitting a new kitchen.

'Definitely they are aware of the rising costs of electricity...all my customers are pushing towards LED lighting, more efficient lighting'

The tradespeople we spoke to understand the potential added value of energy efficiency measures in RMI work. They are aware that improving energy efficiency can save on running costs but are not always confident that they can convince the customer of this. Many tradespeople are also aware of a wide range of co-benefits of energy efficiency, as well as savings on energy bills. These include the general benefits of energy efficiency, such as the extra comfort and health benefits of staying warm and reducing damp as well as protecting the environment through lower energy use and carbon emissions. Some of those we spoke to referred to other specific benefits provided by particular retrofit technologies, such as energy efficient lighting producing less heat and improving fire safety, or underfloor heating allowing a household to get rid of radiators and improve the space and appearance of the home. Longer term benefits, such as lower levels of maintenance, or increasing the value of a property were also identified.

However, not all the tradespeople we spoke to were enthusiastic about all retrofit technologies. We heard about practical problems such as the difficulty in accessing wiring in the loft after it has been insulated, or the problem of damp where loft insulation has been installed with insufficient ventilation, or in connection with both cavity and solid wall insulation. We also heard about personal preferences, such as disliking the appearance of solar panels.

'You get retirees with plenty of dosh and they want to build their own house .....and to make it more efficient, and they tend to want to manage it themselves'

'People don't HAVE to insulate their walls. So all the clients are fairly aspirational..... got some money or think they know how to get some...have an aspiration to fulfil, none of it essential...'

The level of customer interest in different potential benefits can vary widely – which brings us to the issue of cost. We often heard that cost was a barrier, but investigating what this meant brought out a variety of ways in which cost was considered. The size of discrete, capital or upfront costs was not the only factor, and different customers might view costs quite differently. Some of the nuances of customer attitude to cost that tradespeople reported were:

- Worry about future running costs, and willingness to spend now to save later.
- Willingness to invest to make the home more comfortable.
- Aspirations about making the home environmentally friendly and willingness to invest heavily in this.

'Some people don't care because they've got enough money and they don't care about the bills'

…and on the other hand…..

- Some very well-off customers apparently unconcerned about running costs, and unconvinced about the value of spending money on energy efficiency.
- Older customers unwilling to spend on energy efficiency as they think they will not live long enough to get a return on their investment.
- Spend on energy improvements coming from a finite pot, and conflict with other wants and needs, such as a holiday.

'The reality is people have a finite amount of money'

There is a recognition that the whole house approach to retrofit is ideal and delivers the best outcomes in terms of reducing energy consumption and delivering other benefits. Customers often cannot afford to do everything at once, however, and a customer may only have one room or a particular element of the building fabric in their scope at present. Compromises need to be made in practice, to deliver what is possible on energy efficiency within this limited scope.

'When you talk 10 or 50 Watts you may as well be talking Chinese, but when you say the meter will spin 5 times faster with that one then they understand...'

In trying to communicate the potential benefits of retrofit, tradespeople identified the challenge of how to quantify the savings and benefits in a credible and consistent way. They are aware that being able to quantify savings against costs would help their case, but not how to access this information. There is general awareness of the existence of Energy Performance Certificates, and that these certificates can be useful in bringing attention to energy efficiency – but there is also the view that EPCs are of limited use, partly because they can be wrong, typically because the assessor has not collected data accurately, or the EPC assessment process does not allow detailed consideration of a particular property. Builders with experience of organisations such as CORE and AECB are aware of more detailed assessment products, such as an NHER assessment[3] using full SAP data sets, or the Parity Projects Home Energy Masterplan[4]. However, these tend to be more costly than a basic EPC. While paying for an energy assessment is seen by many as a barrier, it was also reported that driving down their price makes it impossible for them to be done properly, so damaging both the reputation and intrinsic value and usefulness of the assessment and accompanying report.

'They've really pushed down the price of certificates. He's probably doing eight a day, whereas to do it properly you can probably only do two a day'

'You mean to tell me that I'm going to a house, test its energy, put my name to a legal document that contractors and surveyors are going to read and I get paid £50? You're in cloud cuckoo land.'

3 *The National Home Energy Rating Scheme run by National Energy Services: www.nesltd.co.uk. The EPC is based on a reduced data input for the SAP assessment. An NHER assessment can be used as the basis for a tailor-made energy advice report, as in the Stroud Target 2050 project (Maby 2011).*

4 *Parity Projects have developed their own home energy report designed more specifically as an advisory tool for the consumer rather than an asset rating. www.parityprojects.com/households/home-energy-masterplan.*

'Because what the landlords say, and I hear it time after time, is 'I don't pay the bills – why should I worry?'

One particular variation on customer motivation which came up in these conversations, is the (already well known) issue of the split incentive between landlords and tenants. Tradespeople working for landlords across multiple properties recognised that landlords were generally unwilling to invest in energy efficiency and that owner occupiers were much more likely to want the added benefits of retrofit, such as comfort as well as lower bills.

'You give 'em a price and it includes TRVs and they say I don't want TRVs and you say well the law says you've got to'

Implications for policy

- A well-established tradesperson with a good reputation in their locality is less likely to have to compete on price, and is in a stronger position to influence the customer as regards including energy improvements within other works requested. These people are potential ambassadors for low carbon refurbishment, and an under-used resource in this regard.
- There are different types of customer, with different priorities. Supporting small businesses with the ability to evaluate customers, identify what motivates their decisions and match those to the multiple benefits of improved energy efficiency could ensure inclusion of energy improvements within other works.
- It could also be useful to support businesses in matching what they can offer to different types of customers, taking account of the role the customer intends to play and how involved they will be in the work, how knowledgeable they are, and how much they can spend. This is explored further in the conclusions.
- Tradespeople need support from national and local policy makers as higher standards of energy performance are implemented and quality is enforced – such as a clear and consistent message around increasing regulation over time, backed up by a long term plan.
- Both homeowners and building tradespeople would benefit from access to independent expert and practical advice at all stages of the retrofit journey. This would support tradespeople to influence customers to take up energy improvements, and would help to avoid customers being confused by contradictory advice from different contractors.
- Advice needs to include good quality, credible home energy assessments. While these will need to be subsidised for low income customers, they should also be realistically priced so that it is possible to deliver them accurately and professionally, and it would be helpful if information was to be made available to explain differences in price for more complex assessments. Where energy assessments are offered as a free or low cost service, any subsidy or private commercial interests involved should be made transparent.
- There is a need for accessible advice and information for both tradespeople and homeowners about how to deal with risks and potential problems around retrofit, such as loft access and damp.

'You can say, while you are there you could do this and this and this'

DESIGNING AND SPECIFYING RETROFIT

In large or commercial projects where there is an architect, a design team and so on, there is normally a clearly defined process to make sure that design objectives are implemented: this is set out for example in the RIBA 'Plan of Work' 2013[5]. For work on individual existing homes, there is no standard arrangement for how, when and who designs, specifies, implements and modifies building work. Homeowners embarking on works are generally unaware of this fact.

'I said you've got a few thermal bridging issues. And his (referring to the architect) words were 'well they won't pick it up will they', and I said well I'm sorry but I don't care whether building control pick it up, I've picked it up and I'm not building it'

Architect involvement may vary from a full design and project management role to, more usually, providing an outline design and not the detailed specification, or there may be no architect involvement at all. A competent and confident general builder may provide the entire design and specification, without recourse to an architect. This is rarely recognised in fees paid, appearing as part of the (unpaid) quotation work, or billed at a day rate which is typically much lower than that of an architect. Even where an architect has drawn up a detailed specification, some builders report mistakes and lack of clarity in the specification, and some construction details or problems may only become evident once work has begun, and so need to be resolved on site (particularly with older buildings). If this happens then the builder will typically lead on developing a solution, sometimes in consultation with the architect or the client.

'I do a lot of advising to clients ...before they buy a property...I advise them on extensions and renovations...I was trying to set it up as a company but I haven't had time'

Problems may arise in relation to gaps in delivery or communication where the expectations of the customer, architect and builder are not consistent with each other and not clearly set out or understood. In these situations the general builder, as the person on site with the customer, and typically the person with the broadest skills base, may at times be filling in the gaps ad hoc and without acknowledgement.

'People have got to live in these houses, and I fully support in principle what the listed people are trying to do, keep the heritage, but they put people's backs up by being so closed to very clever solutions'

An experienced general builder knows the value of using their expertise early on in a project and may be in a position to visit a house with a client when they are thinking of buying it, and to advise on what work could be done and what it might cost.

There is a perception that change in how things are done within an industry takes time, but happens in the end. It can be obstructed, however, by contradictory messages from authorities (such as Building Control and Planning) – supporting energy efficiency while also making it difficult to retrofit effectively – and this can create frustration, and even incredulity and cynicism. Planning restrictions placed on listed buildings or those in conservation areas are an example of such contradictions and can seem impractical and illogical. These designations can prevent energy efficiency improvements which have the potential to improve and not detract from aesthetic and historic character, as well as making the property more likely to be a home fit for the future. Examples included an insistence on preserving unattractive 1960s or '70s features in a seventeenth century cottage because they were installed at the date of listing, or refusing permission to replace 20th century windows in a Georgian house with custom made double glazed timber replacements.

5 *www.ribaplanofwork.com/PlanOfWork.aspx*

'You should be able to speak to building control and get information..... You can't just chat to someone...everyone is trying to cover their own backs. They will not say 'yes you can do that' just in case.'

Given the value placed on Building Regulations as a way of ensuring standards, there is confusion about why Building Control do not give more information and advice on how best to comply with requirements. A source of such advice would be welcomed by builders and homeowners alike.

The biggest battle I find is when people have come along and listed something in the 70s and said that's the way it is...'

The disruption and inconvenience to the household of getting building work done is raised as a barrier, together with an awareness that this means it is better to get as much done at the same time as possible, if you are facing disruption anyway. This is an argument for including energy efficiency work (such as insulation) in general RMI work, with the most disruptive work typically offering the greatest opportunity for the inclusion of energy efficiency improvements.

Implications for policy

'The trouble is with all the information you get now, they are trying to sell a product.'

- Builders as well as homeowners would benefit from access to expert and independent advice on energy retrofit, from a trusted source, at all stage of the process of getting building works done.
- There is a need for a more consistent and coherent approach from Planning (in controlling building development and alterations) and Building Control working together. Rebuilding and enhancing this capacity at local level would create a local service that communicates, enables and polices good quality low carbon, low energy housing refurbishment as well as new building.
- The re-invigorated Planning and Building Control service should include an advisory capacity. The development of local databases of good practice in energy efficient renovation of period and vernacular style properties, with technical details, enhancing the current Supplementary Planning Guidance system. This type of resource could also be used by builders to show customers, encouraging discussion of different options.

'From the builder's point of view, if you could have access to something you could take to the client....almost like a manual really, with half a dozen ideas, and say look we've got these options, this or this or this, not just going from memory all the time...'

'It's only if you are starting from scratch that you will get people interested in energy efficient, because they don't want the house ripped about'

- There is a need for clear and accessible guidance for homeowners and builders on what roles need to be covered within a building project and by whom.

MANAGING RISK, ENSURING QUALITY

'In a utopia you would not have it all run by these big businesses- there's always a vested interest... a lot of technologies could be a lot easier to access'

Some of the installers and tradespeople we spoke to were concerned about the risks to quality inherent in driving down prices and pushing for speed of delivery, while policy affecting the construction industry has stated aims of ensuring quality and consumer protection. This is seen as driven by forces out of the control of the small local contractor: government deadlines on financial incentives, and the commercial interests of the energy utilities and big contracting companies. Poor quality and problems can result from top-down commercial interests focussed on quantity, low price and high profit, and are not necessarily because of a lack of skills amongst building trade micro enterprises.

Another aspect of the commercial scale of different enterprises that was commented on by those we spoke to, was that tenders for the relatively large energy retrofit schemes run by (or endorsed by) some local authorities, tend to favour large corporations (big enough to sue). These large tenders then have many levels of sub-contracting and at the bottom of the pile the micro enterprise is forced to work for very little, and yet still blamed if problems arise in project delivery.

'one of the problems with our building trades is 99% is done on price and time, so the quicker you get it done, the more you earn.....well that's never going to be a recipe for quality is it? They don't build aeroplanes like that...'

Higher quality work tends to cost more money, with more expensive products and materials, and more and/or higher skilled labour. The building tradespeople we spoke to wanted to deliver quality work, and to be recognised for this, both in terms of professional status, and reasonable financial reward. They were not generally motivated by a drive towards large scale delivery or expansion, even with its potential for larger profit. Builders doing RMI work are aware that it cannot be rushed if you want to do it well.

'They hit another barrier which was that the builders on site didn't understand...it was a new language to them...'

'....it's all in the communication really – some of it gets quite complicated, for example EWI where it meets roof insulation....you have to draw pictures...'

Good collaboration and communication between all concerned (builder, other trades, architect and customer) are key to achieving that quality and to ensuring that design details are fully understood and followed through. Mistakes can occur because of a lack of experience of a particular technology, approach or detail. Once understood, this new knowledge can be transferred to future work on other projects. Air tightness detail is an example often cited.

'When you bring an architect on site, suddenly everything becomes slightly different, the customer acts in in a different way towards them....and in my experience the architect will rely on the guys on site to make everything work, because they don't know how to...'

In renovation work on older buildings, some details (or the extent of potential problems) will be unknown until the work is underway, so on-going communication, on-site experience and wider building skills are essential. The contribution of the builder to this kind of problem solving is not always acknowledged, and their relatively low status with the customer compared to that of an architect can be a source of frustration. It is difficult to assess costs accurately in advance when carrying out major works on older buildings, so if a firm quotation is required it has to be high enough to cover the worst scenario. For this reason offering to work on a day rate can benefit both the tradesperson (through less risk of under-costing) and the customer (by getting a cheaper job if all goes well).

'If they've had some training on a specific product that's the product that the contractor will tend to work with, across the board not just with insulation.'

Tradespeople place high value on reliability and durability of products, as they are the ones who are called back if there are problems. This is a good reason for sticking with a brand, manufacturer, product, or supplier. Great value is also placed on support and after-sales service from suppliers and merchants. Small building companies have found that some of the bigger suppliers don't have time for them when detailed support is needed, such as with solid wall insulation on traditional construction. Those suppliers that are willing to help, however, offer a valuable service with (free) training and site-specific advice – a couple of the companies specialising in environmentally friendly products were mentioned particularly in this regard. This enables tradespeople to use specific products with confidence.

'I have been back to repair boilers that have been installed by other people, on the cheaper side, and... they're spending a fortune putting them right'

'The branch I use is very helpful – if you've got a problem, you can ring them up and they sort it'

Very small building companies face particular financial challenges. There is no set standard way to pay for works, so the tradesperson faces significant financial risk if they pay for material and labour before being paid by the customer. This can be reduced by asking the customer for staged payments and to pay directly for materials. Running a business at less than the VAT threshold can be preferable as it means less complex accounting and not having to charge the customer VAT. However, a business which is not VAT-registered cannot reclaim VAT on materials.

'I went on training with suppliers and they've been really good'

Implications for policy

- Communications between architect, builder and other trades on site, and the customer are key. In practice, this time may be covered in the fees for the architect, but rarely for the tradespeople. Time for communication and project management needs to be built into costings, especially where work at a higher than typical current standard is expected (such as in a Passive House build) or where newer and conceptually different technologies are being installed (such as heat pumps). Guidance on communications procedures and techniques, and dissemination of these as standard practice, would be useful, such as using the 'toolbox talks' approach of on-site briefings. These are more commonly used in relation to health and safety, but can be beneficially extended to cover energy efficiency detailing, and to be more of a two way dialogue, where all parties can raise issues and suggest solutions.

- Running a business at less than the VAT threshold should not be seen as an indication of low quality or business instability, but taken at face value as simply a business with a small turnover. Businesses below the VAT threshold require specific policy attention, they are too important in low carbon building works to be ignored.

- There are potential benefits to customers and tradespeople to working on a day rate, with the customer paying directly for materials, rather than working to a fixed fee quoted for a complete job. A day rate offers the customer more transparency and potentially lower costs, as the tradesperson passes on any discounts on materials and foregoes a mark-up on these. It is less risky for the tradesperson in terms of cash flow and the danger of non or late payment by the customer. This way of working should also not be seen as unprofessional or of lower quality.

- Guidance for both businesses and homeowners on pricing options and payment arrangements could help avoid problems and misunderstanding.

- Skills and new approaches learned on one site are taken on to others, helping to develop the local market and build confidence in technologies through experience. This can also boost a business by raising the tradesperson's profile as someone who can do this kind of work.
- Suppliers of energy efficiency materials and products should be encouraged to provide training and pre- and after-sales services specifically for micro enterprises and for smaller projects. Cumulatively, these projects represent a significant area of commercial opportunity. This might, for example, be achieved through some kind of local or sub-regional clustering arrangement, to make it more cost-effective, perhaps facilitated by local authorities.

QUALIFICATIONS AND ACCREDITATIONS

Many, but not all, of those we spoke to, had trade-specific further education college and apprenticeship training. Real experience and working with skilled teachers or mentors is seen as the most valuable training. Qualifications are not always seen as essential in general construction trades, except where specific accreditations are legally required, such as for electrical or gas work.

'I done 5 years as an apprentice but I started work for my father... when he employed people he put me with someone, two years with one trade and then he put me with another one'

College courses are trade-specific and there is not a clear route to becoming a 'general builder', with the closest category being perhaps the role of site foreman. Some of those interviewed had trained initially as carpenter/joiners; others had done several separate trade qualifications over time; or worked for their father's building company and gained a wider knowledge base by working with different skilled people. Others had gained some of the necessary skills and knowledge through renovating their own homes. The lack of a standardised educational and training path to becoming a general builder has implications as regards the ability to take responsibility for the 'whole house', including its energy performance, and closely associated issues such as internal air quality and the movement of moisture within a building.

'People will pay a solicitor £120 for an hour and they will say it takes a long time to become a solicitor, and doctors will get £120,000 a year because it takes 7 years to qualify... as far as I can see it takes at least as long as that to become a true craftsman, but it's not recognised as a profession and something needs to change in my opinion...'

'No one seems to think that doing a job with your hands is a worthy thing, that you must be stupid, that it's something you do if you're thick'

Trade apprenticeships are much shorter than they used to be, and there is uncertainty about the implications for the skills that can be developed through current apprenticeships. While this may be in part due to a reduction in the need to develop specific manual skills, due to modern machinery, it raises concerns about the status of the building trades in society, which is already felt to be very low and could be reduced further by cutting back on training. A corollary to this low status is that builders are expected to charge very little money which does not reflect the importance of their work to people's lives, homes and the value of the property they work on.

In general, tradespeople working as sole traders or in very small companies tend to develop wider business and technical skills than in the more defined roles in big companies. Some take a lead in coordinating jobs with other trades involved and become general builders, able to plan, cost and coordinate complex building projects.

While the need for quality control is understood and accepted, the development of technology-specific accreditation processes beyond the basic qualifications runs the risk of setting a skills standard which needs to change and develop constantly in response to technology (and societal use of energy). Separate and costly accreditations for specific technologies can also reduce the ability of the tradesperson to offer a full range and choice appropriate to each situation. Requiring additional accreditations is seen as discriminating against the busy small business, the experienced and the self-taught. The shift towards accreditations that require a lot of additional paperwork is particularly burdensome for building trades micro enterprises, which can afford only limited administrative capacity. Implementing additional accreditations through commercial providers is seen as adding even more cost and overheads, with the money going to middle-men rather than to those carrying out the work. The cost of this, in time and fees, takes away from actual time to deliver quality work.

'Every avenue of a business has got a lot more administration to run with it'

'I'd cut the red tape, there are a lot of people out there that know what they ae doing already...make the availability of the right sorts of materials at a subsidised rate. Rather than giving cashbacks, reduce the costs of the materials in the first place'

'When my dad started with the Council in the 60s there was one man with a clipboard who gave 40 men their jobs for the day, and when he retired there were 40 men with clipboards and two men to go and do the work...supposedly that's progress and being more efficient...'

'I think it (referring to a membership label implying quality) allows people to get away with murder'

Membership of trade organisations that require fees tends to be viewed negatively and the fees are perceived by many as too high to be acceptable or offer value for most micro enterprises. This is not universal, however, with exceptions including those with a strong personal interest in ongoing learning, either generally or specifically in relation to the environment and sustainability.

Implications for policy

- Private, market-run accreditations need to be streamlined and managed very carefully to avoid creating new problems and barriers, creating confusion in the market and adding cost to the customer and the tradesperson without necessarily ensuring quality. The time pressures resulting from the additional paperwork requirements may even contribute to driving down quality in practice.
- Public information should clearly differentiate between accreditations that are legal requirements (such as Gas Safe), single national schemes supported by government such as the Microgeneration Certification Scheme, supplier schemes to ensure correct installation of their products, and other competitive market-driven schemes.
- Using accreditation to limit the range of technologies that general building tradesman are able to deliver reduces the potential to deliver carbon reductions through 'trigger point' opportunities. Accreditation schemes should aim to increase the number of people able to undertake high quality, low carbon home improvements.
- The status of the building trades as professions needs to be increased, acknowledging the skills of experienced tradespeople, but avoiding additional overheads and new 'middle men'.

REGULATIONS AND INCENTIVES

'Whenever you do a job, Building Regs are always involved, and if the Building Regs insist on a certain level of insulation, then the builder has to fit in with that and so does the customer, and anyone doing a quote will know that'

'It's great to have insight into that with the job I've just done...puts me ahead of my competitors'

'Refurbishment can be a big opportunity – it could be a load of work when you buy a house or a landlord buys a house and wants to let it, those seem like very good natural intervention points which I think should be incentivised more.'

Building Regulations set the minimum technical standards that building works must achieve, and are generally respected and vital to ensuring quality. Building Regulations are seen as an essential part of shifting towards lower carbon and more energy efficient building. The consistent 'direction of travel' of regulation is important; experience of low energy building is seen by some builders as putting them ahead of the game, knowing that it is coming in soon. Building Regulations also serve to drive the market for insulation (and potentially other products) from the merchant's point of view; they will stock what the Regulations require.

Tradespeople are frustrated that the resources for Building Control to support and enforce Building Regulations have been reduced; there is an associated risk to the reputation of the building industry by allowing those who are willing to cut corners to compete on price alone. Several of those we spoke to had knowledge of non-compliance by others that was not effectively policed. Builders also had to counter the customer perception that Building Regulations 'cover' energy efficiency and no more needs to be done. There can also be a perception amongst customers that current levels of insulation are very high, because it's so much more than in the past.

'....intervention simple and powerful like building regs – any home improvement that has planning permission would have to have....and you can crank that up over time'

'We are more regulated but it's not being enforced...it's not being checked or if it's checked and found out, it's not put right'

The people we spoke to felt strongly that the introduction of private Building Control Bodies has allowed inconsistency, undermining of the authority of Local Authority Building Control. Private building inspectors are considered to be more lax than Local Authority Officers, and thought to be used by developers who want to cut corners.

'obviously you have to match Building Regs, but I have always tried to go further than that, because in the past Building Regs haven't been up to much.'

The Building Control personnel who do the job best are the ones who have real practical experience, and builders we spoke to also preferred to deal with Planning Officers who had practical experience. There are risks in moving towards less experienced personnel, with a loss of expertise in the profession.

Complicating regulation or incentives could have a negative effect, because people may not understand how to comply, or be frightened off by the paperwork involved. In a similar vein, there is a perception that schemes like the Green Deal are not intended or designed for micro enterprises to participate in.

'We got to the point about 20 years ago where they got rid of most of the cowboys...and then they overcomplicated things... and now people are beginning to do things themselves and its actually reintroduced the problem'

This is confirmed by the dominance of bigger players in public procurement, and the use of measures (such as free boiler servicing or free energy assessments) to gain competitive advantage or access to customers in ways smaller businesses cannot afford.

'...just getting towards retirement now, they were builders who had maybe damaged a knee or something and they had years in the trade and they knew building,...but now you have young kids come out in a suit and tie and a brand new builder's hat... they have no experience of old buildings...they can't see a problem and work their way round it. If it isn't in a book they can't do it..'

Short term subsidies and financial incentives are destabilising to the industry, with the real potential for these schemes to be abused by those looking for a quick profit, creating an unsustainable dependence and a boom-bust industry. This subsidy-led industry is peripheral to the mainstream building industry and does not provide benefits to that mainstream. Financial incentives with centrally-imposed deadlines can result in poor quality work. For example, external wall insulation (EWI), applied in adverse weather conditions in order to ensure that it is completed by a scheme end date, will not perform as designed.

'They think they've got loads (of insulation), it's compared to 10 years ago when they put it in last time'

The consensus is that consistent, long term policy is needed to help companies plan and invest in the right training, skills development and equipment.

'What they could do is say everyone who has had an energy certificate done and hasn't carried out the recommendations will have a penalty on their Council Tax.'

' The most depressing thing I have heard for a long time was sticking on the Today programme and hearing that they were going to relax the rules...'

Implications for policy

- Building Control needs to be effectively resourced and authoritative, and this requires consistent application of Building Regulations. The role of the local authority in enforcement and advice should be strengthened, with the local knowledge base fully utilised and built upon.
- Building Control and Planning personnel need to have real practical experience of building work as part of their training and development.
- The use of Building Regulations to gradually move towards lower carbon and lower energy building is understood by building tradespeople and should be followed in a planned and consistent way.
- Any financial incentives and subsidies should be long term, well signalled and followed through to avoid creating dependence and instability.

Conclusions and recommendations

The aims of the research were to produce evidence, and develop policy and intervention recommendations, to identify how mainstream building and allied trades could help accelerate the low carbon retrofit of the UK's private housing stock, using deep, qualitative insights from the important but generally unreported group of building trade micro enterprises.

The fragmented nature of both the industry and its direct customers makes it a particularly difficult area to reach for national policy makers, but it need not be difficult to reach for policy. The scale of activity within this sector and its unique access to knowledge of, and decision making about, the buildings that constitute the private housing market, make it a vital area for policy and action towards achieving the challenging targets for reduction in carbon emissions, energy demand and fuel poverty.

In talking to building tradespeople about their work, a picture of a localised, knowledgeable and connected system has emerged. The components of that system are:

- The tradesperson
- The customer
- The tradesperson's trade network
- The supply chain
- The tradesperson's competitors
- Local social networks
- National policy priorities
- Local regulation and enforcement
- Training and knowledge networks
- Technologies

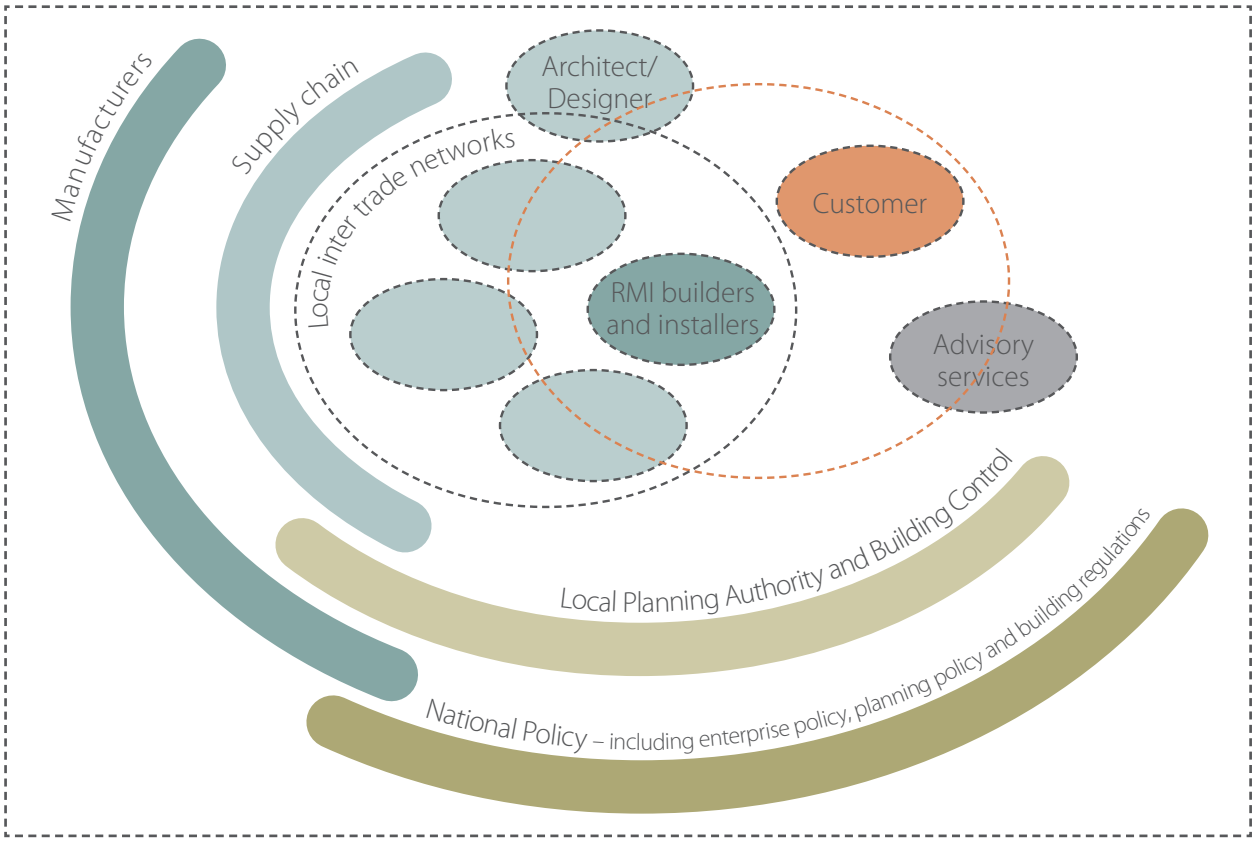


Figure 3: The home energy retrofit system

Each element of this system can limit the potential of RMI work to deliver low carbon homes, and each element can, under the right conditions, increase the potential of RMI work to deliver low carbon homes. Here we offer ideas for policy and practice, rooted in our research findings, to make sure that the system works effectively for a low carbon future.

Develop policy which supports localised action

Key to success in low carbon retrofit is recognising and understanding the local and small scale nature of the RMI construction industry. It is crucial that policy and practice go with the grain of the good practice that many are already undertaking, and builds upon the knowledge and skills that exist at local level. Keeping work local has social, environmental and economic benefits, ticking all the boxes for a sustainable economy.

Local informal networks are an important route for learning, including about new products and methods. These networks are routes to influencing practice particularly along the supply chain and between trades. The characteristics of networks make them a positive enabling factor in moving towards deeper retrofit. In seeking routes to disseminate information and innovation, policy needs to reflect and build on the reality of the business and social networks that operate at local level, rather than attempting to impose top-down structures.

Design programmes for energy efficiency in buildings to engage the existing, locally active, RMI industry in maximising the inclusion of energy improvements in general building works.

RMI work (in rural areas at least) is characterised by micro businesses working at a very local level, getting their work through social and neighbourhood networks and personal recommendation, with benefits to the tradesperson as well as the customer in terms of avoidance of time-wasting and other risks. The very local nature of building trades RMI activity indicates a good fit with local delivery of integrated energy efficiency schemes, including energy advice and assessments, and community-scale awareness raising and partnerships.

Match consumer protection with small business protection.

Not all (possibly very few) micro enterprises are planning for growth. Maintaining business activity at a local level is a positive outcome. Policy and guidance around consumer protection should be matched by, and be consistent with, policy and guidance for the small business, so that both parties are protected and enabled to provide what the other needs.

For example, there are potential benefits to customers and tradespeople to working on a day rate with the customer paying directly for materials, rather than to a fixed quote, and this should not be seen as an indication of an unprofessional approach. It offers the customer more transparency, in that the tradesperson passes on any discounts on materials, and foregoes a mark-up on these. It is less risky for the business in terms of cash flow and the danger of late (or non) payment by the customer. Similarly, running a business at less than the VAT threshold should not be seen as an indication of low quality or business instability, but taken at face value as simply a business with a small turnover, with overheads kept low by not adding complexity to administration.

Guidance for both businesses and homeowners on pricing options and payment arrangements could help avoid problems and misunderstanding.

Effective economic development policy must acknowledge the strength and resilience of the micro enterprise and the informal network as a positive response to economic insecurity.

Develop advice services that can provide independent, expert advice to both homeowners and builders to support them through all stages of the retrofit journey.

There is a need for new knowledge and exchange at all levels and amongst all key actors involved in potential retrofit work.

Builders as well as homeowners would benefit from access to expert, independent and practical advice from a trusted source, at all stages of the process of getting building works done. This would support tradespeople in being able to influence customers to take up energy improvements, and help to avoid customers being confused by contradictory advice from different contractors.

Advice provision should include good quality home energy assessments. While these will need to be subsidised for low income customers, they should also be realistically priced so that it is possible to deliver them accurately and professionally, with information made available to explain differences in price for more complex assessments. Public promotional activity should avoid devaluing energy assessments by suggesting they are 'free', unless public sector funding is envisaged; where energy assessments are offered as a free or low cost service, any subsidy or private commercial interests involved should be made transparent.

There is also a need for accessible information for tradespeople and homeowners about how to avoid risks and potential problems that may arise in relation to retrofit, such as loft access and damp.

Identify and support good practice for suppliers to enable small and micro enterprises to use their products: guarantees, training, site-specific and follow-up product support.

Suppliers of energy efficiency materials and products should be encouraged to develop the capability to provide training and pre- and after-sales services to micro enterprises and for smaller projects, not just for major developments. This might for example be arranged through some kind of local or sub-regional clustering arrangement, to make it more cost-effective, perhaps facilitated by local authorities.

Identify, support and disseminate good practice in communications within retrofit and RMI.

Both general RMI work and retrofitting energy improvements can involve a number of different people and roles, and the effectiveness of communications between them is key to ensuring the best results, in terms of decisions, details, quality, shared learning and customer satisfaction.

We have listed below some of the key areas for communication and some of the possible solutions that were identified in this research. The development of the detailed solutions should involve and be tested by those involved in the industry.

- **Clear and accessible guidance for homeowners and builders on what roles need to be covered within a building project and by whom,** including the overall design of a project, the detailed specification, and the management of the work. A simple approach might be a checklist of who will do what at the start of a project, to avoid misunderstanding or omission.

One aspect of this is that different types of customer may require some different responses and capabilities from the builder, in addition to their core building role, such as:

CUSTOMER CHARACTERISTICS	REQUIREMENTS FROM BUILDER
Employs architect	Follow drawings and liaise with architect on specification where needed
Informed client with time	Learn from client
Informed client with cash	Follow and interpret client's specification and discuss solutions where needed
Informed client with no cash or time	Understand and interpret what client wants, identify and communicate options, design and specify job, coordinate and project manage.
Ill-informed client	As above plus informing and 'educating' client
Disinterested/hands -off client	As above, plus encourage/influence best decisions

- **Protocols for regular on-site communications** to develop solutions, and amend design and specification, to take account of issues that arise during the project. These need to be agreed and understood by all involved, through ongoing dialogue.
- **Protocols for including the costs of time for such communications** for all the trades as well as designers, especially where a higher standard is expected (such as in a Passive House build) or where newer or less usual technologies are being installed (such as heat pumps).
- **Support from manufacturers and suppliers for sharing knowledge and understanding on energy retrofit tools and techniques,** through approaches such as two-way 'toolbox talks' and on-site briefings, as well as site-specific advice on specifications, to enable wider application of energy saving products.

Review the structure, cost-benefit and impact of private market accreditations.

Private market-run accreditations without public sector endorsement can create confusion in the market and add cost to the customer and the tradesperson without ensuring quality. The time pressures resulting from the additional paperwork requirements may even contribute to driving down quality. Particular attention is needed to the risk of reducing the realisation of trigger-point opportunities by limiting the range of technologies that general building tradesman are able to deliver.

Accreditations for installing energy saving products should be streamlined and integrated within statutory regulation. Public information must clearly explain the status of different accreditations, so that customers can differentiate between what is essential and what is a desirable 'extra', and why.

Accreditation systems should be reviewed to ensure no overlap, minimal paperwork and adequate monitoring of the actual quality of work. Accreditation processes should encourage rather than discourage the ability of micro enterprises to offer multiple technologies.

Use Building Regulations to enable and ensure change, and refresh and re-invigorate Building Control so it can achieve its potential, integrating it with local Planning to ensure consistency.

Building Control needs to be effectively resourced and authoritative, and this requires consistent application of credible Building Regulations. Any private provision of Building Control services must be carefully controlled to ensure a level playing field for projects.

The use of Building Regulations to move towards lower carbon and lower energy building is widely understood and accepted. The development of Building Regulations to ensure this should continue along an established path, in a planned and consistent way, following a clear and well-communicated long term plan, covering both new buildings and retrofit of existing buildings, and specifically aiming to increase the take-up of energy improvements within RMI. This will enable building trade companies and specialist installers to plan and invest accordingly in training and equipment.

There is a need for a more consistent and coherent approach by Planning and Building Control working together to avoid any contradictory messaging. Rebuilding and enhancing this joint capacity at local level would provide a local service that communicates, enables and polices good quality low carbon and low energy housing refurbishment as well as new building.

The local knowledge embodied in Building Control could be more fully utilised, for example in the provision of advice and information services at local level. Building Control and Planning personnel need to have real practical experience of building work as part of their training in order to be fully effective.

The provision of locally accessible advisory capacity could be further enhanced by the development of local databases of good practice examples of energy efficient renovation of period properties, with technical details, highlighting opportunities to make energy improvements during RMI work. This could also be used by builders as a reference to show customers and encourage them to consider different options.

LOW CARBON RETROFIT – A RECIPE FOR SUCCESS

In conclusion, our conversations with building tradespeople have revealed that making energy improvements to existing buildings depends on a highly complex system of interactions. We have developed some ideas around what the most effective components of such a system might be and present these in the diagram below.

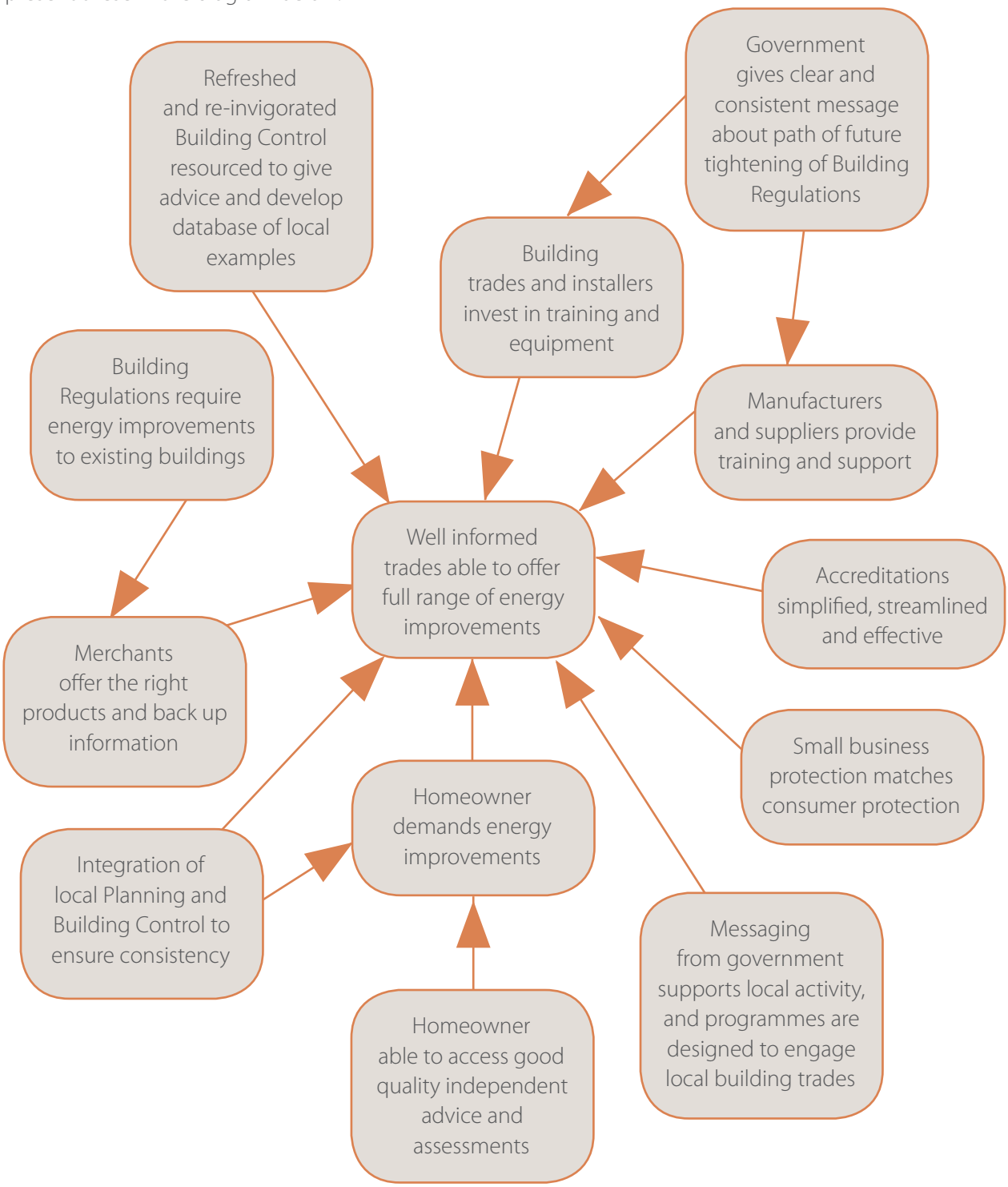


Figure 4: Low carbon retrofit – a recipe for success

SUMMARY OF RECOMMENDATIONS

- Develop policy which supports localised action.
- Design programmes for energy efficiency in buildings to engage the existing, locally active, RMI industry in maximising the inclusion of energy improvements in general building works.
- Match consumer protection with small business protection.
- Develop advice and information services that can provide independent, expert advice to both homeowners and builders to support them through all stages of the retrofit journey.
- Identify and support good practice for suppliers to enable small and micro enterprises to use their products: guarantees, training, site-specific product support and follow-up.
- Identify, support and disseminate good practice in communications within retrofit and RMI.
- Review the structure, cost-benefit and impact of private market accreditations.
- Use Building Regulations to enable and ensure change, and refresh and re-invigorate Building Control so it can achieve its potential, integrating it with local Planning to ensure consistency.

References

Atanasiu, B., Kontonasiou, E., and Mariottini, F., 2014. Alleviating Fuel Poverty in the EU. Brussels, Building Performance Institute Europe (BPIE).

Barlow, C., 2014. Retrofit alternatives in five UK cities. Salford, University of Salford.

BSI, 2014. PAS2030:2014 Edition 1. Improving the Energy Efficiency of Existing Buildings. specification for installation process, process management and service provision. London, BSI.

Boardman, B., 2005. The 40% House. Oxford, Environmental Change Institute.

Boardman, B., 2012. Achieving Zero – delivering future-friendly buildings. Oxford, Environmental Change Institute.

CCC, 2014. 2014 Annual Progress Report, Chapter 3 – Progress reducing emissions from buildings. London, Climate Change Committee.

Charalambous, A., Healy, A., Ioannidou, M., Maby, C., Panayiotou, G., Papagiannis, G. and Tampakis, D., 2014. Countdown to Low Carbon Homes: delivering community scale retrofit of home energy improvements. Gloucester, Severn Wye Energy Agency.

Deakin, M., Campbell, F., Reid, A. and Orsinger, J., 2014. The Mass Retrofitting of an Energy Efficient – Low Carbon Zone. London, Springer.

DECC, 2011. The Carbon Plan: Delivering our low carbon future. Presented to Parliament pursuant to Sections 12 and 14 of the Climate Change Act 2008. London, Department of Energy and Climate Change.

DECC, 2013. Energy Efficiency Strategy, 2013 update. London, Department of Energy and Climate Change.

DECC, 2014a. UK National Energy Efficiency Action Plan. London, Department of Energy and Climate Change.

DECC, 2014b. Green Deal Assessment Mystery Shopping Research. London, Department of Energy and Climate Change.

DECC, 2015a. Digest of United Kingdom Energy Statistic (DUKES), 2015. London, Department of Energy and Climate Change.

DECC, 2015b. Energy Efficiency Statistical Summary 2015. London, Energy Efficiency Deployment Office.

DECC, 2015c. Fuel Poverty Advisory Group 12th Annual Report. London, Department of Energy and Climate Change.

DTI, 2001. The UK Fuel Poverty Strategy. London, Department of Trade and Industry.

Dimitropoulos, J. and Sorrell, S., 2008. The Rebound Effect: microeconomic definitions, limitations and extensions. Ecological Economics Vol 65, Issue 3, 15.4.2008.

Ekins, P., Keppo, I., Skea, J., Strachan, N., Usher, W. & Anandarajah, G., 2013. The UK energy system in 2050: comparing Low Carbon, Resilient Scenarios. London, UKERC.

Energy Saving Trust, 2011. Trigger points: a convenient truth. London, EST.

European Commission, 2010. The Energy Performance of Buildings Directive 2010/31/EU (EPBD recast). Brussels, Official Journal of the European Union.

Fawcett, T., 2013. Exploring the time dimension of low carbon retrofit: owner-occupied housing. Building Research & Information, 42(4), 477-488.

Fawcett, T., and Killip, G. 2014. Anatomy of low carbon retrofits: evidence from owner-occupied Superhomes. Building Research & Information, 42(4), 434-445.

Galvin, R., 2014. Why German homeowners are reluctant to retrofit. Building Research & Information, 42(4), 398-408.

Galvin, R. and Sunikka-Blank, M., 2014. The UK homeowner-retrofitter as an innovator in a socio-technical system. Energy Policy, 74(0), 655-662.

Gibbs, D. and O'Neill, K. 2014. Rethinking sociotechnical transitions and green entrepreneurship: the potential for transformative change in the green building sector. Environment and Planning A, 46(5), 1088-1107.

Gupta, R. Gregg, M., Passmore, S. & Stevens, G. 2015. Intent and outcomes from the Retrofit for the Future programme: key lessons. Building Research & Information, 43(4), 435-451.

Guy, S., Marvin, S., Medd, W. and Moss, T eds., 2010. Shaping Urban Infrastructures – Intermediaries and the Governance of Socio-Technical Networks. London, Routledge

Haines, V. and Mitchell, V. 2014. A persona-based approach to domestic energy retrofit. Building Research & Information, 42(4), 462-476.

Hertwich, E.G., December 2004. Consumption and the Rebound Effect: An industrial Ecology Perspective. Journal of Industrial Ecology, Vol. 9, Issues 1-2, Winter-Spring 2005.

Hills J., 2012. Getting the Measure of Fuel Poverty: Final report of the Fuel Poverty Review. CASE Report 72, Centre for Analysis of Social Exclusion, London School of Economics and Political Science.

HM Treasury, July 2015. Fixing the Foundations: creating a more prosperous nation. CM9098, London, HM Treasury.

Janda, K. and Killip, G., 2013. Building Expertise: Renovation as Professional Innovation. In: Henn, R. L. and Hoffmann, A. J. eds. Constructing Green: the social structures of sustainability. 35-56.

Killip, G., 2012. Beyond the Green Deal: Market Transformation for low carbon housing refurbishment in the UK. Retrofit. Salford, University of Salford.

Killip, G. 2013. Products, practices and processes: exploring the innovation potential for low-carbon housing refurbishment among small and medium-sized enterprises (SMEs) in the UK construction industry. Energy Policy, 62, 522-530.

Maby, C., 2011. Target 2050 Homes: future-proofing homes in Stroud District and beyond. Gloucester, Severn Wye Energy Agency and Stroud District Council.

Mallaband, B., Haines, V. and Mitchell, V., 2013. Barriers to domestic retrofit: Learning from past home improvement experiences. In: Swan, W. and Brown, P. eds. Retrofitting the Built Environment. Chichester, Wiley Blackwell, 184 - 199.

Maller, C., Horne, R. and Dalton, T. 2012. Green Renovations: Intersections of Daily Routines, Housing Aspirations and Narratives of Environmental Sustainability. Housing, Theory & Society, 29(3), 255-275.

Maller, C. J. and Horne, R. E. 2011. Living Lightly: How does Climate Change Feature in Residential Home Improvements and What are the Implications for Policy? Urban Policy and Research, 29(1), 59-72.

Marchand, R. D., Koh, S. C. L. and Morris, J. C. 2015. Delivering energy efficiency and carbon reduction schemes in England: Lessons from Green Deal Pioneer Places. Energy Policy, 84, 96-106.

Nosberger, S., Killip, G. and Janda, K. B., Building Expertise: A system of professions approach to low carbon refurbishment in the UK and France. ed. ECEEE Summer Study: Energy Efficiency First: the foundation of a low carbon society, 2011 Belambra Presqu'île de Giens, France.

Office for National Statistics, 2012a. Construction statistics 2012 Table 2.8. London, ONS.

Office for National Statistics, 2012b. Construction statistics 2012 Table 3.4 reporting on figures to the end of Q3 2011. London, ONS.

Office for National Statistics, 2013a. Construction statistics 2013 Table 2.8. London, ONS.

Office for National Statistics, 2013b. Construction statistics 2013 Table 3.4 reporting on figures to the end of Q3 2012. London, ONS.

Office for National Statistics, 2014a. Construction statistics 2013 Table 2.8. London, ONS.

Office for National Statistics, 2014b. Construction statistics 2012 Table 3.4 reporting on figures to the end of Q3 2013. London, ONS.

Owen, A., 2013. Factors that affect the diffusion and impact of domestic 'green technology' and the role of 'place'. (PhD). Leeds, University of Leeds.

Owen, A., Mitchell, G. and Gouldson, A. 2014. Unseen influence – The role of low carbon retrofit advisers and installers in the adoption and use of domestic energy technology. Energy Policy, 73(0), 169-179.

Owen, A., Mitchell, G. and Unsworth, R. 2012. Reducing carbon, tackling fuel poverty: adoption and performance of air-source heat pumps in East Yorkshire, UK. Local Environment, 1-17.

Palmer, J., & Cooper, I., 2013. United Kingdom Housing Energy Fact File 2013. Cambridge Architectural Research, Cambridge Energy and Eclipse Research Consultants. London, Department of Energy and Climate Change.

Pettifor, H., Wilson, C. and Chryssochoidis, G., 2015. The appeal of the green deal: Empirical evidence for the influence of energy efficiency policy on renovating homeowners. Energy Policy, 79(0), 161-176.

Pink, S., Tutt, D., Dainty, A. and Gibb, A., 2010. Ethnographic methodologies for construction research: knowing, practice and interventions. Building Research & Information, 38(6), 647-659.

Porritt, J., 2007. Capitalism as if the World Matter. Abingdon, UK: Earthscan.

Risholt, B. and Berker, T. 2013. Success for energy efficient renovation of dwellings – Learning from private homeowners. Energy Policy, 61(0), 1022-1030.

Rogers, E. M., 2003. Diffusion of Innovations. 5th ed. New York, Free Press.

Rogers, J. G., Cooper, S. J. G., O'Grady, A., McManus, M. C., Howard, H. R. and Hammond, G. P., 2015. The 20% house – An integrated assessment of options for reducing net carbon emissions from existing UK houses. Applied Energy, 138(0), 108-120.

SDC, 2006. Stock Take: Delivering improvements in existing housing. London, Sustainable Development Commission.

Shove, E., 2009. How people use and 'misuse' buildings. In: ESRC/TSB ed. ESRC Policy briefing. Swindon, ESRC, 20-25.

SummitSkills, 2013. BUILD UP Skills – United Kingdom 2020 Skills Roadmap and Action Plan. London.

URBED, 2010. Community Green Deal. Birmingham.

UK Government, 2008. Climate Change Act. London, The Stationery Office.

UK Government, 2012. UK National Plan: Increasing the number of nearly zero energy buildings, Brussels, European Commission. Available at ec.europa.eu/energy/en/topics/energy-efficiency/buildings/nearly-zero-energy-buildings.

Willey, A., 2013. Futurefit: Lessons for the Green Deal from a retrofit large-scale project in UK social housing. In: Swan, W. and Brown, P. eds. Retrofitting the Built Environment. Chichester: Wiley Blackwell, 128 - 140.

Williams, N., Royston, S., Ayre, D., & Royston, S., 2015. The Debt Trap- Show Some Warmth: exposing the damaging impact of energy debt on children. London, The Children's Society.

Wilson, C., Chryssochoidis, G. and Pettifor, H., 2013. Understanding Homeowners' Renovation Decisions: Findings of the VERD Project. Norwich, UK Energy Research Centre.

Installer Power

CONTACTS FOR FURTHER INFORMATION

Catrin Maby cmaby@outlook.com

Alice Owen a.m.owen@leeds.ac.uk

asiantaeth ynni
SevernWye
energy agency

Severn Wye Energy Agency
Unit 15 Highnam Business Centre, Gloucester GL2 8DN
www.severnwye.org.uk Charity no. 1083812

UNIVERSITY OF LEEDS

Sustainability Research Institute, School of Earth and Environment
University of Leeds, Leeds LS2 9JT

The Climate Change Collaboration

Supported by the Sainsbury Family Charitable Trusts
Climate Change Collaboration