National Housing Maintenance Forum

Best Practice Guide

Fuel Saving Improvements

Andrew Burke and **Peter Rickaby**
Rickaby Thompson Associates

Foreword

***Shaun Aldis**, Director of Operations, Wolverhampton Homes, and NHMF Chair*

The provision of affordable housing is a central objective of most, if not all, social housing organisations. A key element of affordable housing is affordable warmth, which is becoming ever more important in this era of rising fuel prices and increasing fuel poverty. Improvements to reduce fuel use in existing homes (also known as 'retrofit') are not only critical to the protection of residents from the social impact of rising fuel prices, but also essential if the UK is to meet its statutory targets for reducing the greenhouse gas emissions associated with energy use and thus mitigating climate change. Housing organisations must therefore rise to the twin challenges of fuel poverty and climate change and embrace the integration of fuel saving improvements into their asset management strategies. Despite the paucity of support for this approach from Government policy there is no alternative – if housing organisations and housing professionals do not provide leadership towards homes fit for the twenty-first century then nobody else will.

This document provides comprehensive guidance on the integration of fuel saving measures into housing asset management strategies. It tackles the problem from the top – with guidance on how to persuade Governing Bodies to embrace fuel saving strategies, how to carry out the analysis that will support them and how to implement them; and from the bottom – explaining the risks associated with fuel saving improvements and how to mitigate them. The guidance has been prepared by two authors who have many years of practical, professional experience of their subject, supported by a panel of experts drawn from housing organisations, governmental organisations and specialist consultancies throughout the UK. It will be underpinned, in the months following publication, by a programme of training for asset managers, offered by the NHMF. I am therefore pleased to commend this guide to all NHMF members and indeed to all Governing Bodies of housing organisations, housing asset managers, technical surveyors, consultants, educational and continuing professional development establishments and installers of fuel-saving measures.

Wolverhampton
December 2015

Executive Summary

Drivers for Fuel Saving Home Improvements

Reducing the fuel used in the housing stock should be an integral and essential part of every social landlord's business plan. This guide focuses on fuel saving home improvements that will reduce residents' fuel bills and ensure homes continue to be affordable. The business plan should include a fuel saving strategy that goes beyond minimum statutory fuel poverty standards and is driven by the organisation's own objectives and business needs rather than chasing money from ever-changing and uncertain external funding schemes.

Developing a Fuel Saving Strategy – agreeing the need

A housing energy strategy, to be effective, should be fully supported by senior management with ownership or buy-in from across the organisation. The Governing Body must be persuaded of the business and regulatory drivers. Landlords need to understand their stock, know which are the least energy efficient homes and why, and what additional investment is required to improve them and the resulting benefits.

Establishing Fuel Saving Targets

To develop a comprehensive and effective fuel saving strategy a landlord needs an accurate knowledge of the energy performance of its housing stock. It needs to understand its stock's current energy performance, what standards might be technically attainable and affordable, the improvement options that would have to be implemented in order to meet proposed targets, and what they would cost. Housing stock profiles, which focus attention on the least energy efficient dwellings, where the return on investment in improvements is greatest, are useful tools for asset management and business planning.

Presenting the Fuel Saving Strategy to the Governing Body

The results of the detailed analysis to establish the proposed fuel saving targets should be presented to the Governing Body in social business terms and with quantified outcomes. Business risks arising from the current asset management programme should be identified, quantified and assessed. Good, up-to-date demographic information will be an important aspect of any assessment since pensioner households may be more at risk of fuel poverty if they are living in former family homes. Fuel saving targets and funding should be built into long-term business plans and budgets to support fuel saving improvements. A strong social business case is required to secure the necessary budgets to improve existing stock with the challenges on available finance and the pressure to build more new homes. The whole organisation, not just the Governing Body, should recognise the benefits of reducing fuel use and be committed to delivering it. A member of the Governing Body could be made responsible for championing the fuel saving strategy and ensuring delivery.

Funding Fuel Saving Improvements

Since UK public funding is limited, especially in England, housing organisations should plan to fund fuel saving measures as integral elements of their asset management programmes based on the organisation's business objectives. Social landlords should only apply for external funding where it supports the objectives of their strategy to reduce fuel use, and not change their objectives just to get funding, i.e. stick to their business plans.

Delivering Fuel Saving Improvements

An integrated approach to delivering fuel saving improvements, embracing both technical and organisational aspects, is usually more cost effective than implementing retrofit as a separate programme. The development and implementation of a fuel saving strategy should be approached as a cross-departmental project so that everyone in the organisation understands the overall aims and objectives and what needs to be done.

Managing Risk and Ensuring Quality

Improving the energy efficiency of existing housing is a risky business that needs to be understood and managed to ensure good quality results. Work that is intended to deliver fuel saving improvements is different from traditional maintenance and refurbishment work and carries technical risks that need to be managed. It involves the integration of new materials, products and systems using installation processes that are new to managed housing. To achieve significant reductions in fuel use, fuel cost and carbon dioxide emissions a range of improvement measures have to be installed in each house, either all at once or in coordinated stages according to a medium-term plan. This guide explains how risks can be managed in order to ensure successful outcomes, and describes a risk management methodology developed for a large-scale retrofit programme.

Introduction: Drivers for Fuel Saving Home Improvements

Reducing the fuel used in the housing stock should be an integral and essential part of every social landlord's business plan. This guide focuses on fuel saving home improvements rather than energy efficiency because these will reduce residents' fuel bills and ensure homes continue to be affordable. While energy efficiency is the focus of legislation and policy, it does not on its own guarantee the reduced fuel bills necessary for social housing.

This guide explains why the business plan should include a fuel saving strategy and how to make the business case to get the Governing Body[1], such as the Board, and senior management approval for a fuel saving strategy and targets. It is important to get agreement to the business case first because without it there is no mandate for developing the detailed strategy to reduce residents' fuel bills. Such an approach is driven by the organisation's own objectives and business needs rather than chasing money from ever-changing and uncertain external funding schemes.

All social landlords will need to review and 'stress test' their business plans in the light of the Government's announcements on welfare reform and energy efficiency policies in the 2015 Summer Budget and the Comprehensive Spending Review in November 2015. Those announcements, it is estimated, will reduce housing organisations' rental income by £3.9bn over the next 10 years and would limit the amount residents receive in housing benefits - see Chapter 3 for more detail. When carrying out their review, it is essential that landlords consider their strategy to reduce fuel use, either to revise the existing one or to agree one for the first time.

There will be very limited public funding for social landlords to carry out fuel saving improvements. Existing schemes, such as the Energy Company Obligation (ECO) will soon be exhausted because most energy companies have largely met their 2017 targets. Furthermore, social landlords are not eligible for the main fuel poverty schemes such as the Home Heating Cost Reduction Obligation (HHCRO/ Affordable Warmth) element of ECO or the new Warm Homes scheme in Northern Ireland. There is currently some funding for social landlords in Scotland and they have a mandatory standard to meet by 2020. Similarly in Wales funding for social landlords is linked to meeting the Welsh Housing Quality Standard. In both countries that funding includes ECO and so future funding will depend on how quickly the ECO fund is exhausted - see Chapter 1 for more detail.

Fuel poverty

All UK Governments have fuel poverty strategies and will be monitoring progress against different fuel poverty targets, particularly the LIHC indicator (low income high cost) that has superseded the 10% rule in England (see the discussion of fuel poverty below). The Fuel Poverty Strategy published by DECC in March 2015 is accompanied by the Fuel Poverty Regulations, which set a minimum energy efficiency target of EPC Band C by 2030, with interim milestones. These apply to all housing stock.

In Scotland and Wales, social landlords have to meet minimum energy efficiency standards set by Housing Regulators.

However, it is important to explain to the Governing Body that these minimum energy efficiency standards are inadequate to protect residents from fuel poverty because they are economic rather than performance based.

Falling fuel prices reduce the imperative to improve efficiency while rising prices quickly overtake low standards. The combination of reduced income for those on benefits with projected increases in fuel prices will require far more challenging energy efficiency

1 Governing Body is the generic term used throughout this guide to refer to strategic oversight of social landlords, such as by Boards, Cabinets, etc.

standards than the minima specified by Governments' current fuel poverty strategies and by housing regulators. See Chapter 2 for a more detailed analysis.

Social landlords should set their own agenda and determine their own objectives and priorities rather than confining their aspirations to statutory minimum standards. Having a long-term fuel saving strategy in their business plan is a necessary part of meeting their social purpose and demonstrating social responsibility. It will enable them to provide truly affordable homes that keep residents warm and healthy, as well as safeguarding income streams as a vital part of an overall active asset management strategy. It will also enable social landlords to play their part in reducing carbon dioxide emissions and meeting climate change targets.

Once the business plan includes a fuel saving strategy as an integral part of the asset management strategy, landlords are well set-up to bid for any funding that fits with their planned programme. This is in contrast to approaches where the asset management programme is changed to secure funding - see Chapter 4.

What are the drivers?

While the energy efficiency of social housing does not feature much in current policy and funding in England, there are strong regulatory, business and social drivers for landlords to reduce the amount of fuel used in their stock. Each organisation should assess how important each driver is when developing its business plan. The main drivers are set out below:

- **Asset value** (NPV) is an important aspect of any landlord's business plan because it is the basis on which loans are negotiated (i.e. for new development). A well-maintained, fuel-efficient stock will be attractive to residents because it compares well with fuel-efficient new homes. While the investment required to improve stock may not increase its NPV, it will ensure it continues to provide affordable homes for residents, safeguard income streams and demonstrate that social purpose is being achieved. However, before any investment is planned, the existing NPV should be assessed as part of wider portfolio management. Fuel saving improvements to homes should help to reduce turnover, repairs, arrears and voids and maintain a strong asset base.
- **Legislation**
  - Fuel Poverty – the Government's Fuel Poverty Strategy for England *Cutting the Cost of Keeping Warm*, which is based on the Hills definition of fuel poverty[2], includes a minimum Energy Performance Certificate (EPC) band C target for all fuel poor homes by 2030 and this is included in the Fuel Poverty (England) Regulations 2014. There are no exceptions for social housing. The strategy also includes interim milestones of band E by 2020 and band D by 2025. The Welsh, Northern Irish and Scottish Governments use the old definition of fuel poverty[3]; specific requirements set for social housing by Wales with its Housing Quality Standard define an energy performance of at least SAP 65 and Scotland sets minimum SAP scores of 60 – 69. It is likely that social landlords will be scrutinised by Government and by housing regulators on their progress to meeting statutory, although inadequate, fuel poverty targets.
  - Statutory carbon dioxide emissions targets – The Climate Change Act established a target for the UK to reduce its emissions by at least 80% from 1990 levels by 2050. Government expects housing, particularly social housing, to play a key role. It is

2 Low Income High Costs indicator – a household is fuel poor if it has higher than average fuel costs and income below the poverty line (or if meeting its fuel costs would push its remaining income below the poverty line).

3 A household is fuel poor if more than 10% income would have to be spent on fuel, to achieve reasonable comfort and provision of hot water.

probable that emissions reduction expectations for social housing will increase as the deadlines for this target approaches.

- **Maintaining affordable homes** – this involves assessing what total housing costs residents can afford, including rent, energy, other utilities and any service charges. Factors to consider include residents' incomes and how they will be affected by welfare reforms. Current rent arrears show whether there is already an affordability problem. To ensure homes remain affordable, total housing costs should be within an affordability target. This will not be the same for all residents and should be assessed by landlords based on detailed knowledge of their stock and their residents. To assess worst case scenarios, some landlords now use benefits income as the basis for affordability.
- **Business risks**
  Business risks come from a range of issues, such as:
  - Reduced rental income when residents are in fuel poverty, combined with welfare reform or increased void rates and longer void periods for energy inefficient stock.
  - Liabilities from poorly maintained properties, such as additional repairs to deal with condensation and mould. Complaints of condensation and mould can trigger environmental health enforcement action under HHSRS and serious detriment rulings by housing regulators, with all the associated reputational damage.
  - Climate change effects such as storms, floods or increased subsidence resulting in damage to assets. It can also affect residents through overheating, flooding or drought and could increase void rates.
- **Business benefits, value for money and cost effectiveness** can be demonstrated by quantifying what is being achieved with current expenditure and how much more could be achieved by a small additional investment to integrate fuel saving into the broader asset management strategy. Additional factors should also be assessed, such as:
  - Future maintenance costs, such as remedying condensation and mould growth, will be reduced when homes are made more affordable to heat, as will void rates and periods.
  - An integrated strategy that reduces both costs and resident disruption, when compared with a separate 'retrofit'[4] programme.
  - However, to ensure that future repair and maintenance work does not negate these improvements, some landlords have developed 'Green repairs', where training is provided for maintenance teams to ensure they are aware of the effects of leaving unsealed holes in the building fabric, etc.
- **Value for money and cost effectiveness** can more easily be demonstrated, using the HCA's Value for Money Standard, when fuel saving is integrated into the broader asset management strategy because this reduces both costs and resident disruption, when compared with a separate 'retrofit' programme. In comparison with other maintenance and improvement work fuel saving improvements directly benefit residents by reducing fuel bills, thus demonstrating social value for money. They also generate economic benefits for the community because typically they will: employ local labour, including SMEs; provide local employment and training; and increase local economic activity.

4 'Retrofit' has often been used to refer to energy efficiency improvements, too often associated with a funding scheme but retrofit (fitting something later) is only one way of improving stock. This guide uses the term fuel saving improvements because it is more generic, is not so closely tied to funding schemes and relates better to social landlords' improvement programmes.

- The **Health and wellbeing** of residents should be an important consideration for a social business, reflected in social responsibility strategies. Government fuel poverty strategies make reference to the health benefits of warmer homes and the need to reduce excess winter deaths attributed to living in fuel poverty. Severe health risks can be assessed using HHSRS. Some funding from local authorities and local clinical commissioning groups is currently available to scale up pilot projects examining the evidence for improved health from energy efficiency improvements. However, there are also business benefits from healthier tenants, such as more reliable income and potentially lower turnover (there is some anecdotal evidence of residents moving because of poor indoor air quality, dampness or cold). Indoor air quality is an important health factor, so adequate ventilation, too often neglected in fuel saving improvements, should be an integral aspect of all energy efficiency and fuel saving projects. It will also reduce the risk of condensation and mould, and the associated repair costs.
- **Climate change** poses business risks both to assets through storm and flood damage or increased subsidence and to residents through harsh winters combined with summer overheating and flooding or drought. A fuel saving strategy provides an opportunity to assess climate change risks and how to reduce them by means of adaptation measures. Where residents are on water meters, typically in water-scarce areas, there can also be economic benefits of considering water reduction measures as part of adaptation work.

Such drivers, when supported by quantified benefits, will be important for overcoming negative organisational perceptions, barriers and challenges to fuel saving improvements. This will be essential for convincing the Governing Body and senior management and for getting the mandate to make improving fuel saving an integral aspect of the business plan. It should also lead to a change in the organisation's culture.

For example, voids and maintenance contracts, or possibly 'standing orders' should include the work to be done to implement fuel saving when routine repairs and maintenance work are carried out, such as installing flow restrictors when replacing taps or LED lighting when luminaires need to be replaced.

It is important for organisations to appreciate the inadequacy of meeting only the minimum standards set by Government, particularly in relation to reducing fuel poverty. Experience with the Decent Homes programme illustrates the costs and disruption involved for landlords and residents to achieve a standard that included minimal energy performance improvement compared with today's standards, let alone tomorrow's. To avoid repeated improvement programmes organisations need to set ambitious fuel saving targets even though this will be challenging financially. Fuel saving targets may vary between landlords because for some their stock will be more difficult and expensive to improve than for others, but any targets should be challenging but realistic (higher than the statutory minima) to achieve the twin goals of reducing fuel poverty and reducing carbon dioxide emissions.

The rest of this guide explains how to get agreement for an ambitious and challenging fuel saving strategy and then how to deliver it.

Chapter 1: Developing a Fuel Saving Strategy – agreeing the need

'A housing energy strategy is an essential component of any housing organisation's corporate environmental sustainability strategy, and should be an integral part of its asset management strategy'[5]. To be effective, a housing energy strategy should be fully supported by senior management with ownership and buy-in from across the organisation.

One social landlord (as well as other landlords anecdotally) that has made the business decision to invest in high-levels of fuel saving in their stock have seen zero or reduced rent arrears, as well as fewer voids because tenants can afford their energy bills. Landlords also need to understand their stock so that they know which are the least energy efficient homes and why, and what investment is needed to improve them. Installing fuel saving measures can improve residents' health; it also generates economic benefits for the community because typically it will: employ local labour, including SMEs; provide local employment and training; and increase local economic activity. Evidence to help landlords estimate such benefits for their asset management programmes to strengthen the business case for fuel saving home improvements can be referenced in the UK Green Building Council's campaign document *A Housing Stock Fit for the Future*.

For those social landlords that have not developed a fuel saving strategy as part of their business plan, the Governing Body should be persuaded it needs to develop one. It is recommended that this should be approached in two stages, the first being an agreement to develop a fuel saving strategy and to provide a budget for the necessary analyses. The second stage (see Chapter 3) involves presenting the detailed results of this analysis to the Governing Body as a quantified fuel saving strategy so that appropriate targets can be incorporated into the business plan.

This chapter explains how to get the Governing Body's agreement to developing a fuel saving strategy that sets energy performance targets, such as minimum Standard Assessment Procedure (SAP) energy ratings.

It should start with identifying which of the business drivers listed in the Introduction above are most important for the organisation. Such drivers will need to compete with the pressure for housing associations to build more new homes. Additional investment for fuel saving improvements has to come from income rather than borrowing because this is focused on new homes. All social landlords will be committed to providing and maintaining affordable housing but, with the increasing cost of heat, power and water and other utility bills, housing that is truly affordable means more than subsidised (below market) rents. Providing truly affordable housing involves consideration of all housing related costs (i.e. rent, service charges, energy and utility bills) and assessing these costs against residents' incomes. Each landlord should identify what housing costs are affordable for its residents, but in the absence of specific income information a prudent approach would be to assess what is affordable for those on the *lowest* incomes. This is even more important in the light of the 2015 Summer Budget changes to benefits.

Regulation will be another important business driver, particularly in relation to fuel poverty. For example, social landlords in Scotland are required to meet the Energy Efficiency Standard for Social Housing (EESSH) by 2020. The EESSH website provides tools and guidance to landlords on what measures will be required for different property types and at different dates. It proposes typical energy performance targets such as minimum SAP scores (60 – 69, i.e. the upper part of EPC band D). These targets will supersede the energy targets and guidance in the Scottish Housing Quality Standard (SHQS) from 2015. The Standard aims to improve the energy efficiency of social housing, so as to reduce fuel consumption, fuel poverty and the emission of greenhouse gases. Meeting this standard will

5 JONES M, LUPTON M, KIELY J and RICKABY P A, (2011) *Managing the Assets*, National Housing Federation, London.

help to achieve the Climate Change (Scotland) Act 2009 target of reducing carbon dioxide emissions by 42 per cent by 2020 and 80 per cent by 2050. It will also help address fuel poverty levels in the social housing sector and help in achieving the Scottish Government's commitment to ensure that no-one in Scotland is in fuel poverty, as far as practicable, by 2016. Progress on meeting this standard will be monitored by the Scottish Housing Regulator.

Similarly in Wales, social landlords need to meet the Welsh Housing Quality Standard by 2020 which must be capable of being adequately heated at an affordable cost to the residents. This is defined by an energy performance of at least SAP 65 (which is EPC band D).

The Government's *Fuel Poverty Strategy for England March 2015* put energy efficiency and demand management at the heart of its energy and climate policy. The *Fuel Poverty (England) Regulations 2014* set a target of minimum EPC band C (i.e. SAP 69-80) for fuel poor households by the end of 2030 (as far as reasonably practical). The Strategy also sets interim milestones for 2020 (band E, SAP 39-54) and for 2025 (band D, SAP 55-68). The Government will monitor progress towards achieving its strategy across all housing stock - social housing stock is not exempt. While the Government suggests in the strategy that fuel poverty is not such a problem in social housing, official fuel poverty statistics show that one in ten social households are currently in fuel poverty. Landlords know how important fuel poverty is for their residents, something that will increase with proposed reductions to benefits and higher energy bills.

In Northern Ireland, following consultation in 2014 on the previous Fuel Poverty Strategy *Warmer Healthier Homes - a new Fuel Poverty Strategy for Northern Ireland* (2011), a new Affordable Warmth Scheme has been introduced. The Scheme is designed to address fuel poverty in the private sector i.e. the grants are only available to owner occupiers and private landlords. It funds insulation, air-tightness, window and heating improvements with grants up to £7,500, with an additional £1,000 for solid-walled properties.]

While the different fuel poverty regulations may be seen as a business driver, it is important to understand that each Government's own statutory fuel poverty standards are inadequate, with the rising costs of supplying energy and other utilities, to ensure affordable warmth in 2020.

For example, EPC Band C (SAP 70) just about delivered affordable warmth in 2012 but work for some landlords has demonstrated that a minimum of SAP 80 will be required by 2020. Consequently landlords should not simply aim to meet these minimum statutory targets by the deadline set out in the regulations. Better standards will be required to protect residents against fuel poverty, even in the short term. Even though substantial investment may be required for some stock, landlords need to consider setting fuel saving targets suitable for the longer term based on projected 2020 energy prices at least to ensure homes remain affordable. See Chapter 2 for detailed analysis.

To make the initial business case to the Governing Body, the Director with responsibility for asset management should establish how much the organisation is already committed to spend on its stock and provide a commentary on what will be achieved (i.e. establish a 'business as usual' base case). This will include reactive repairs, planned maintenance and cyclical maintenance programmes, which are designed solely to maintain the quality of properties, typically meeting the Home Standard in England (a standard that is generally seen as inadequate to safeguard against fuel poverty). Only the *improvement* programme is designed to raise the standard of the stock. One landlord uses essential, desired and aspirational in its appraisals when deciding how to scope out works to its non traditional stock which is known as PRADA (properties requiring a different approach).

Housing Management and Customer Services should be consulted about current rent arrears, void levels and periods, as well as the nature of customer complaints. This will provide an assessment of how the stock is performing for residents and help to identify potential problems, such as rent arrears increasing.

Such assessments should be correlated against the 30-year NPVs calculated on an organisation's stock. It will also help to predict future demands, such as increasing numbers of complaints about condensation and mould, or higher void levels because residents request transfers from cold and damp homes (i.e., poor energy performance). Input from Customer Services and Finance teams will identify the business challenges that welfare reform poses for the organisation's residents.

Much of this information should be available from existing KPIs that landlords monitor but the process of building the business case for the Governing Body will identify what other KPIs should be considered. For example, fuel poverty will be important and may require several KPIs, including the incidence of fuel poverty among residents and the energy performance of each property type (SAP or EPC band). Each Government has set its own indicators against which it will monitor the progress of its fuel poverty strategy. In England, the Strategy proposes a range of indicators (still to be fully defined) to monitor progress for different tenures against the national average. As well as measures of energy efficiency, these include numbers of off-gas homes, the use of renewable energy, households with children under 16 and the incidence of poor health.

The combination of committed stock maintenance expenditure together with current and future demands will provide the Governing Body with the business risks associated with not having a fuel saving strategy, including the possibility of HHSRS Category 1 failure for 'excess cold'. This is generally interpreted in practice as SAP 35 or lower. Governing Bodies should be aware that in the case of a Category 1 hazard, unless the landlord takes action as a matter of urgency, then the Local Authority can take action itself and recharge. This stage is essential to present senior management and the Governing Body with a vision of what the organisation could and should be doing. It should result in a mandate and budget to commission the detailed analysis required to develop an improvement strategy to reduce fuel use with aims, objectives, targets and standards.

Winning hearts and minds is essential, particularly when landlords are looking to cut back on expenditure.

Chapter 2: Establishing Fuel Saving Targets

Housing Stock Data

The ability of a housing organisation to develop a comprehensive and effective fuel saving (retrofit) strategy that incorporates appropriate targets is dependent on accurate knowledge of the energy performance of its housing stock. It is necessary to understand the current energy performance of the stock, what standards might be technically attainable and affordable, the improvement options that would have to be implemented in order to meet proposed targets, and what they would cost. Without this knowledge the organisation is working in the dark.

Most housing organisations hold some form of energy data about their housing stock. In many cases these are low-precision (also known as 'Level 0') Standard Assessment Procedure (SAP) energy rating data collected during housing stock condition surveys. Often these data have only been collected from a sample of dwellings, and have been copied ('cloned') to the records for other dwellings that are thought to be similar. Many housing organisations fail to record changes to their stock that would change the rating – usually for the better – making these data even less useful. The provenance of low precision energy data is often unclear, and their accuracy is frequently poor.

The longstanding requirement that landlords must make Energy Performance Certificates (EPCs) available when dwellings are offered for tenancy has resulted in more accurate Reduced Data SAP (RDSAP) energy rating data being collected by the Domestic Energy Assessors (DEAs) who carry out the assessments required for EPCs. Some housing organisations only procure the actual EPCs or the associated SAP energy ratings and A-G efficiency bands from their DEAs; others also collate the RDSAP data into their databases in order to have more accurate information about the energy efficiency of their dwellings. If the RDSAP data are collated by the housing organisation, then as the number of dwellings for which EPCs have been issued increases so do the scope and accuracy of the energy data. It is therefore important that housing organisations *always* obtain the underlying RDSAP energy rating data, and collate them into their housing stock databases, when they procure EPCs. At present some housing organisations hold RDSAP data for only about 20% of their stock, while others have data for 80%, but overall the proportion is steadily increasing. The more RDSAP data a housing organisation holds the more accurate its housing stock assessment and improvement option evaluation will be.

The demands placed on housing organisations' asset management data are continually changing but the approach to surveys and data collection has not kept pace. Recently, stock condition surveys have focussed on the state of repair of building elements with an emphasis on components with defined lives – windows and doors, kitchens, bathrooms, roofs, etc. Fuel saving investments, however, require a new level of information: surface areas of floors, walls, roofs and glazing, heat loss perimeters, installed ventilation, external wall finishes, verge and eaves overhangs, externally mounted utilities and rain water goods, porches, canopies, extensions, means of access, etc. Much of this can be drawn from RDSAP data but the approach to surveys and to wider information storage and management should reflect these new needs.

The current approach is often inefficient, involving multiple visits: a stock condition survey one year, an EPC a few years later, then a contractor being paid for a pre-work survey. Integrating information related to energy efficiency and fuel saving measures into stock condition surveys and databases should be a priority.

The Standard Assessment Procedure (SAP) energy rating

The SAP energy rating of a dwelling is based on the estimated annual fuel cost for heating, hot water and fixed lighting, per unit of floor area, under a standard occupancy pattern and heating regime. The SAP is expressed on a scale of 1 (very inefficient) to 100+ (very efficient). SAP incorporates a version of the Building Research Establishment Domestic Energy Model (BREDEM), which takes into account the thermal characteristics of the building fabric, the efficiency and responsiveness of the building services and the interactions between them, as well as the contributions of any renewable energy technologies. The procedure estimates annual fuel use, fuel costs and carbon dioxide emissions using weather data for a standard year, and national average fuel costs and carbon dioxide emissions factors. All SAP assessments assume that dwellings are located in the East Midlands.

The SAP standard occupancy pattern was derived from English House Condition Survey data during the 1990s and assumes that the number of occupants is related to the floor area (bigger dwellings have more occupants) and that the demand for hot water is related to the number of occupants. The demand for fixed lighting depends on the floor area, the area and orientation of glazed openings, and any external shading. It is assumed that on weekdays dwellings are unoccupied during the day, when all occupants are at work or at school, so they are only heated in the mornings and evenings; at weekends dwellings are assumed to be heated throughout the day. It can be argued that this results in under-estimation of fuel use, fuel costs and carbon dioxide emissions associated with energy use in social housing, because many homes are occupied and heated during the day (by parents with young children, or by other adults who are unemployed). However, another view is that low income households do not heat their homes to the standards assumed by SAP (21^{o}C in the living room, and between 18^{o}C and 21^{o}C in the rest of the house, during occupied periods), resulting in over-estimation of fuel use, fuel costs and carbon dioxide emissions. In practice these two effects seem to cancel out. Because of the variation between households (energy use has been shown to vary by a factor of five, between different households in identical dwellings) it is necessary to adopt some form of standard occupancy pattern for analytical purposes, and there is little or no evidence to support any alternative to SAP standard occupancy.

Overall, SAP provides a reasonably accurate prediction of the *average* fuel use, fuel costs and carbon dioxide emissions associated with a dwelling, accurate to about ±10%. SAP is *not* a good predictor of the fuel use, fuel costs or carbon dioxide emissions associated with an individual household occupying a home in a particular location.

Reduced Data SAP (RDSAP)

RDSAP is a 'cut down' version of the SAP energy rating in which 'least unlikely' default values are used to replace data items that are too difficult or time-consuming for energy surveyors to collect on site (e.g. ground floor insulation and window areas). This facilitates rapid and inexpensive energy surveys but reduces the accuracy of the predicted energy performance. However, an experienced SAP Assessor can convert RDSAP data to Full SAP data, to support detailed analysis of energy performance, and improvement option evaluation.

Low Precision (Level 0) SAP energy ratings

A Full SAP energy rating requires hundreds of items of data about the dwelling, and an RDSAP assessment requires almost as many. By contrast, low-precision energy ratings use only the eighteen items of data for houses (twenty for flats) to which the calculation is most sensitive. 'Least unlikely' default data are used for all other characteristics of the dwelling. This approach was developed to support the incorporation of energy data into stock condition surveys, and for calculating stock key performance indicators (KPIs). Consequently low precision energy ratings of individual dwellings are very inaccurate (the SAP energy rating is predicted to an accuracy of approximately ±10). However, when low precision energy ratings are calculated for a stock of dwellings (more than a hundred) then the errors cancel out (the energy performance of some dwellings is underestimated, but for other dwellings it is over-estimated), so that very accurate *average* ratings can be calculated (SAP ±1) Therefore low precision energy ratings should only be used for the purpose for which they are intended: the preparation of housing stock profiles and the calculation of stock-level KPIs: average SAP and average fuel use, fuel costs and carbon dioxide emissions. Low precision energy ratings of individual dwellings are very inaccurate and quoting them is essentially meaningless.

Measuring Energy Performance

The process of assessing the energy efficiency of a housing stock starts with calculation of the SAP energy ratings of all dwellings, using data at the best level of precision that is available. Often this means combining data at different levels of precision.

In practice, in order to make reasonably accurate assessments, it is usually necessary to use not only the housing stock condition database but also other databases such as the rental database (which will reveal the number of bedrooms, from which numbers of rooms can be derived) and the gas safety database (which will reveal which dwellings have gas-fired heating systems, and often the types of boilers installed). Once the SAP assessments have been made and recorded in the database, housing stock profiles can be prepared and stock-level key performance indicators (KPIs) can be calculated.

Housing Stock Profiles

Housing stock profiles are bar charts showing the distribution of performance indicators such as average and minimum SAP energy ratings, and average and maximum fuel costs and carbon dioxide emissions across the stock. Figures 3.1 to 3.3 show housing stock profiles (of SAP, fuel costs and carbon dioxide emissions) for a UK housing association. The associated KPIs derived from the assessments and profiles (and calculated under SAP standard occupancy) are shown in Table 3.1. It should be noted that the *shape* of each profile is often as informative as the numerical KPIs such as stock averages. Housing stock profiles are useful tools, both for asset management and for presenting information to Boards and regulators. They focus attention on the least energy efficient dwellings (at the left hand side of each profile) where the return on investment in improvements is greatest. If profiles and KPIs are updated regularly (at least annually) they can be used to track the progress of an improvement strategy: the bars will move to the right and the KPIs will improve. Multiple years can be plotted on a single chart to illustrate progress. Under various Governments' fuel poverty strategies housing organisations may be monitored on their progress in reducing fuel poverty and such charts and KPIs will enable them to present strong evidence of progress.

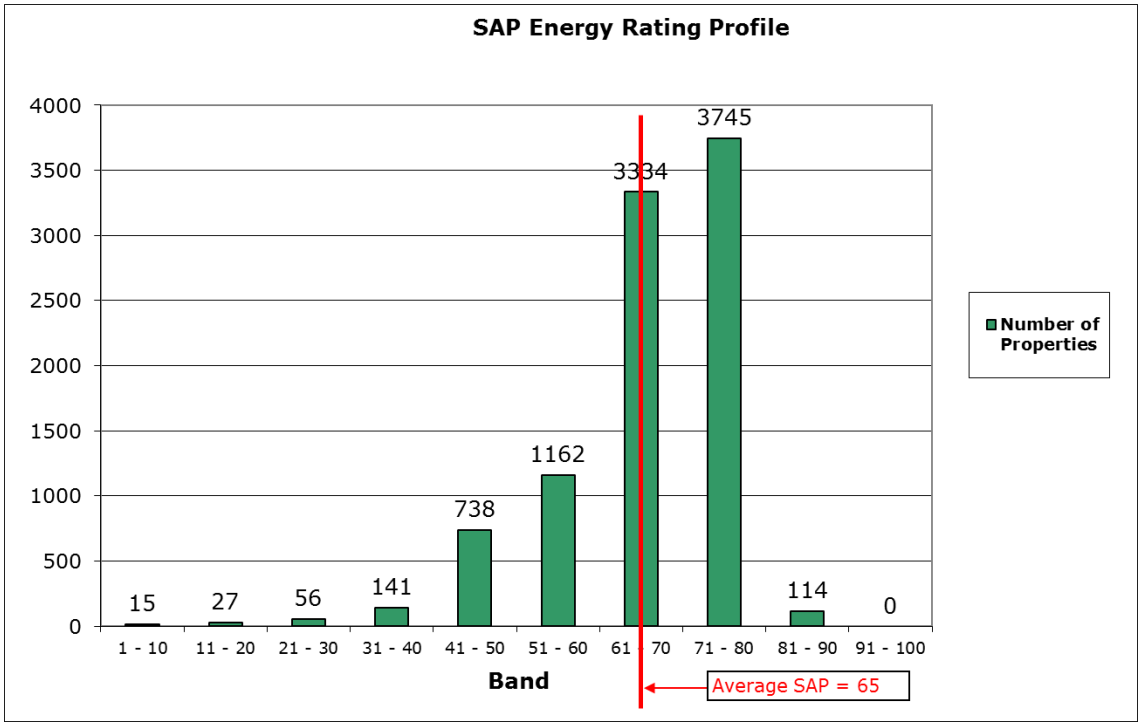

Figure 3.1 A SAP energy rating profile for a housing association's stock

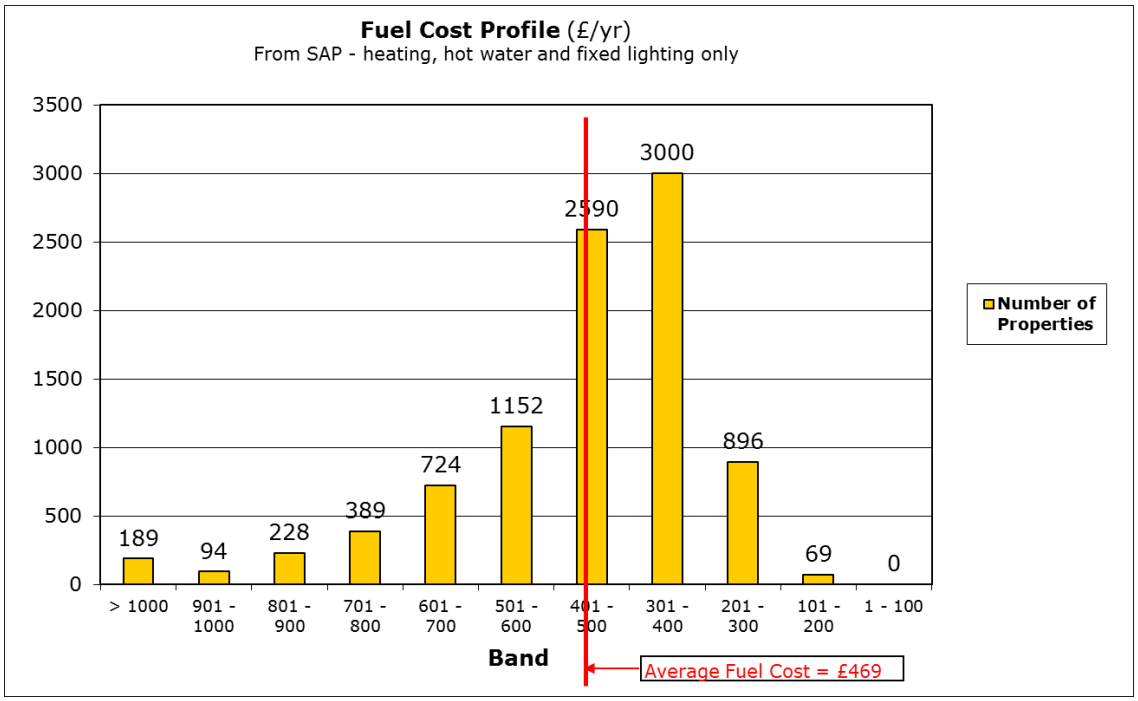

Figure 3.2 A fuel cost profile for a housing association's stock

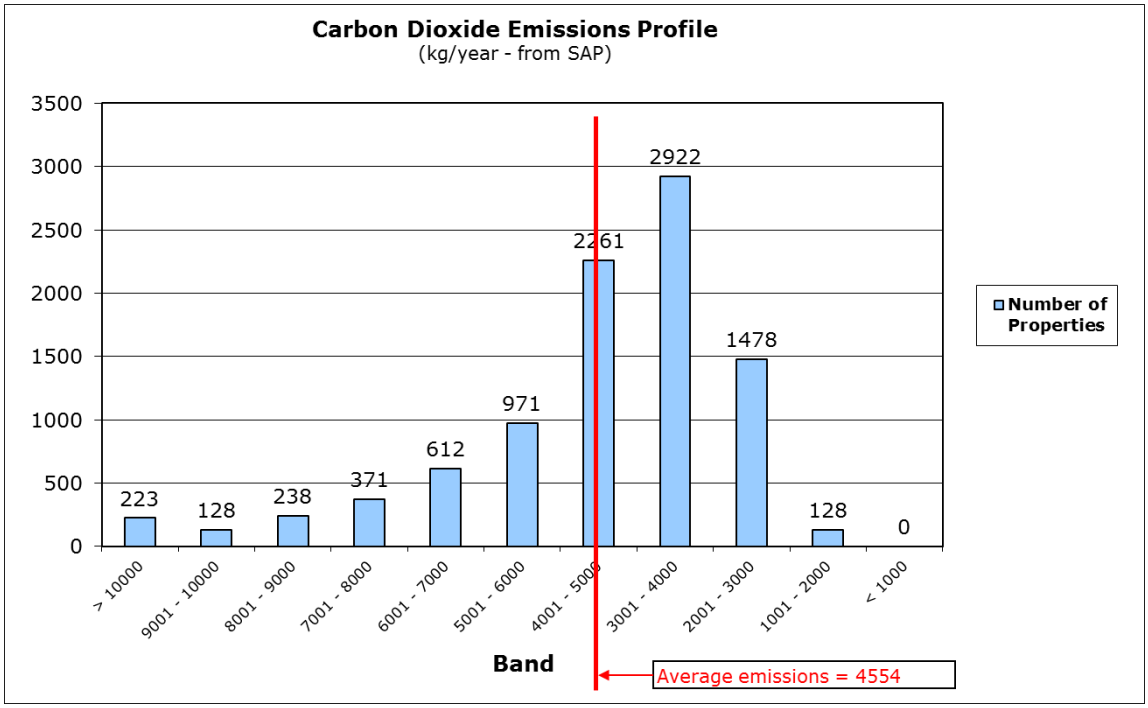

Figure 3.3 A carbon dioxide emissions profile for a housing association's stock

Key Performance Indicator	Value
Average SAP	65 (band D)
Minimum SAP	<10 (15 dwellings)
Average annual fuel cost	£469/yr
Maximum annual fuel cost	>£1000/yr (189 dwellings)
Average carbon dioxide emissions	4,554 kg/yr
Maximum carbon dioxide emissions	>10,000 kg/yr (223 dwellings)

Table 3.1 Key performance indicators for a housing association's stock

Setting Improvement Targets

Housing stock profiles and KPIs also provide an initial indication of what might be realistic improvement targets, expressed in terms of KPIs. For example, Figure 3.1 shows that the adoption of a target to raise the minimum SAP energy rating to 60 would involve improvement of 2139 dwellings, but raising the minimum SAP to 80 (a more realistic affordable warmth standard) would be much more challenging, requiring improvement of 9218 dwellings altogether – most of the stock! Similarly, Figure 3.3 shows that reducing the maximum carbon dioxide emissions to less than 5 tonnes per year would involve the improvement of 2543 dwellings, but reducing it to 2 tonnes per year (more consistent with climate change targets) would involve improvement of 9204 dwellings. In both cases the dwellings to be improved can be identified from the database containing the assessment results. The database can also be used to establish other values such as the total carbon dioxide emissions associated with energy use in the stock (to which a percentage reduction target might be applied).

However, identifying and evaluating appropriate improvement (retrofit) standards is not straightforward. There are often overlapping objectives: delivering affordable warmth (to reduce fuel poverty); reducing overall energy use; and reducing the carbon dioxide

emissions associated with energy use (to help mitigate climate change). In addition some landlords monitor minimum SAP energy ratings to assess HHSRS Category 1 risks. Housing organisations should be clear how all these objectives are prioritised, because without clear priorities it is difficult to define an optimum set of fuel saving improvements for any dwelling. Quite often standards are reduced to SAP energy ratings or EPC bands, but the SAP is based on fuel costs so measures that improve the SAP may not necessarily reduce emissions, and vice versa. EPC bands provide only a very crude measure of performance.

Affordable warmth standards designed to help eliminate fuel poverty are complicated by changes in the definition of fuel poverty (the definition used in England is different from those used by the devolved administrations), by changes in fuel tariffs and by changes in benefit levels. There is little point in investing in improvements that would deliver affordable warmth to residents today if by the end of the investment programme fuel costs will have risen by more than household incomes, so that the poorest residents remain in or return to fuel poverty. Northern Ireland saw its fuel poverty decrease between 2001 and 2004 due to energy efficiency improvements but then increase after 2005 when fuel prices increased sharply, some households fell back into fuel poverty and other households entered fuel poverty for the first time.

It is therefore necessary to consider both fuel cost and 'worst case' income scenarios, with horizons at ten, twenty or even thirty years, and to set energy efficiency standards with an eye to the future. Some housing organisations have considered a minimum SAP energy rating of 80 as a proxy affordable warmth standard for investment programmes that may not be completed until the end of the next decade or beyond.

Emissions Reduction Targets

Setting carbon dioxide emissions reduction targets is equally difficult. The *Retrofit for the Future* programme run by the Technology Strategy Board (now Innovate UK), involving eighty-six one-off 'low carbon' retrofit projects across the UK, showed that the cost of reducing emissions by 80% is of the order of £85,000 per dwelling. Even if economies of scale could reduce this to £50,000 per dwelling, it would still be unaffordable for most housing organisations. Fortunately there are reasons for believing that it will only be necessary to reduce emissions by between 50% and 60%, and that the balance of the 80% reduction required by our statutory national target will come from the supply side ('decarbonisation' of the electricity supply), from replacement of some of the worst performing dwellings with much more efficient new homes, and from 'offsetting' by local renewable energy schemes. Both the *Retrofit for the Future* programme and assessments of many dwelling types across a range of housing stocks suggest that reducing emissions by between 50% and 60% is much more affordable – of the order of £25,000 per dwelling on average (although the range of costs is wide). Therefore some housing organisations have been considering the implications of reducing the carbon dioxide emissions associated with energy use in their stocks by at least 50%.

Dwelling Type Analyses

Once a housing stock energy assessment has been completed, in order to explore the implications of possible energy efficiency standards in more detail, attention should turn to individual dwellings. The SAP energy rating data should be repetitively sorted by the variables to which energy performance is most sensitive: age, built form, construction type, heating system type and fuel, etc. This process will expose the thermally distinct *dwelling types* in the stock – usually around twenty of them, and every dwelling in the stock will be of one of the types.

In practice the sorting process should be extended to take account of other characteristics (e.g. pre-fabricated construction) and of information that may not be included in low-precision data (e.g. the position of a flat in a block – ground, mid or top floor, middle or corner of block; or whether a house is a mid- or end-terrace unit). The number of dwelling types arrived at will be a compromise – too few will not adequately represent the stock, but too many will require excessive analytical resource. Typically, the stock is reasonably well represented by between twenty-five and thirty-five dwelling types. In order that the energy performance of each type can be assessed in detail (using Full SAP) it is important that there are RDSAP data (i.e. data from an EPC assessment) available for at least one representative example of each dwelling type. *Google Streetview* is a useful tool for checking that the proposed representative dwellings are indeed good examples of their types. Once this has been confirmed a Full SAP data set can be assembled for each dwelling type.

Performance Assessment and Improvement Option Evaluation

Analysis of each representative dwelling using Full SAP will calculate an indicative SAP energy rating and estimate annual fuel use, fuel costs and carbon dioxide emissions for each dwelling type. This provides a 'base case' for the evaluation of improvement options and identification of 'packages' of measures that will bring the performance of each dwelling type to the proposed standards (e.g. minimum SAP 80 and/or 50% reduction of carbon dioxide emissions). Each improvement measure or package should be evaluated in terms of its capital cost and the effect its implementation will have on fuel use, fuel bills and carbon dioxide emissions. This information will support the calculation of simple payback periods for each improvement option or package, or of more sophisticated investment indicators such as carbon cost effectiveness[6] or net present value (NPV).

To support this process, good knowledge of the capital costs of improvement measures is needed, in the form of rates that can be applied to the areas of walls, floors, roofs, windows, etc. in the SAP data files. Housing organisations should therefore develop databases of improvement costs, based on the M3NHF schedule of rates and/or their own recent experience. Some consultancies also maintain their own databases of improvement costs, differentiated by geographical regions, etc. It is important when assembling improvement cost data to adopt a consistent approach to contractors' preliminary costs, overheads, profit and VAT. Some housing organisations prefer total improvement costs to be used, others use only net costs for comparison.

When evaluating improvement options to identify appropriate packages of measures it is important to assume a 'fabric first' approach in which building fabric improvements (insulation and air tightness) are installed first, followed by improvements in the efficiency of building services (including installing heat pumps in off-gas network locations) and then finally by the installation of renewable energy technologies (e.g. solar water heating, solar photovoltaic systems) to 'top up' the performance of the dwelling to the required standard. This is because building fabric improvements are the most cost effective and long-lived measures; building services improvements are often equally cost effective but have much shorter service lives (typically the improved building fabric will outlast three heating systems); and renewable energy systems are expensive, short-lived and constrained by the available roof space. In practice the fabric first approach will usually be modified by the local factors, including the housing organisation's own experience and consequent preferences for particular measures.

6 Carbon cost effectiveness is the whole-life cost of a measure or package (i.e. its capital cost minus the lifetime fuel cost savings that it delivers) divided by the associated lifetime carbon dioxide emissions savings; carbon cost effectiveness is expressed in £/tCO_2, and may be negative – indicating that the measure saves more over its life than it costs to install.

Improvement Plans for Dwelling Types

The outcome of the improvement option evaluation is the definition of a medium-term improvement plan for each dwelling type. These plans will identify the preferred package of improvement options for meeting each of the proposed retrofit standards. They should also include: the estimated capital cost of each package; its effect on the SAP energy rating; the associated reduction of annual fuel use, fuel bills and carbon dioxide emissions; and an appropriate cost effectiveness indicator such as simple payback, capital cost per tonne of carbon saved per year, carbon cost effectiveness or net present value. Medium term improvement plans can be prepared for any proposed energy, affordable warmth or emissions reduction target, but the analysis is time consuming and expensive, so in practice usually only two or three prioritised standards are investigated. The objective is not to provide a prescription for improvement of each dwelling type but to illustrate the technical and financial implications, for the asset management programme, of standards that the Board might be asked to adopt or that might be imposed on the housing organisation by regulators or Government. The evaluation work will also illustrate the relative effects of various improvement measures on different dwelling types, and how those measures contribute to improving the SAP energy ratings.

The Whole-Stock Programme

The next stage of the assessment process is to scale-up the analyses to the level of the whole stock, by multiplying the capital cost of each improvement package, and the associated fuel use, fuel cost and carbon dioxide emissions savings, by the number of dwellings of that type, in each case. This estimates the total cost of bringing the whole of the housing stock to each of the standards, as well as the total reduction in fuel use, the total fuel cost savings to residents and the total reduction in emissions. All of these figures can be broken down by dwelling types, or by measures. The total improvement cost is usually an eye-watering number that becomes more palatable when it is divided by the number of years over which the improvement programme is to be delivered. In order to illustrate the scale of the challenge the required annual investment can then be compared with the current rate of investment, and with what the organisation must spend just to ‘stand still’ (e.g. under *Decent Homes*). Projected housing stock profiles and KPIs, after improvement to each standard, can also be prepared.

Assessing External Funding Potential

The final stage of the assessment process is to consider the scope for external funding from schemes such as the Energy Company Obligation (ECO), the Feed in Tariff (FiT) or the Renewable Heat Incentive (RHI), as well as private finance options such as energy performance contracting. ‘Do it yourself pay as you save’ (DIY PAYS) schemes, in which improvements are paid for by borrowing against predicted fuel cost savings, are sometimes also considered. There are many funding schemes, at both national and European levels, each scheme has its own rules, and most schemes are politically volatile and short-lived. Therefore it is not possible to estimate the scope for external funding over a thirty-year asset management programme, but it is possible to estimate what the schemes available at the time of the analysis could contribute, as an indicator of external funding *potential*. This is done by applying the rules of each scheme to each of the eligible improvements in each package, and calculating how much funding each scheme might contribute. The results are rarely encouraging, leading inevitably to the conclusion that housing improvement to appropriate standards will require significant internal investment by landlords.

However, defining medium-term improvement plans and assessing the potential for external funding does help housing organisations to be well prepared with ‘shovel ready’ proposals,

either when short-term funding becomes available or when there is an opportunity to bid for longer-term funding (e.g. from the EU).

Once the stock assessment and improvement option evaluation have been completed, and the results have been summarised, the implications for the asset management strategy should be considered (see Chapter 3). Different energy standards will have different overall costs, and require different patterns of investment. The required investment should be considered alongside the investment required in broader housing management activity, such as cyclical maintenance, other types of improvements (e.g. new kitchens and bathrooms) and maintaining the *Decent Homes* standard.

Housing improvement programmes are often driven by the objective of alleviating fuel poverty. Estimates of fuel use and of the fuel cost savings arising from proposed improvements are useful for assessing the extent to which those improvements will help to deliver affordable warmth. Fuel poverty is the result of the combination of a low-income household with an inefficient dwelling. Different households have different levels of income, so a particular type of household (e.g. a single parent or a pensioner couple) may be fuel poor in one type of dwelling (whether it has been improved or not) but not in another type.]

It can be useful to create an 'affordable warmth matrix', i.e. a tool in which household types (with known 'worst case' benefit incomes) are tabulated against dwelling types. The national definition of fuel poverty[7] can then be used to calculate whether each type of household (with worst case income) would be in fuel poverty in each dwelling type. Affordable warmth matrices can be prepared using fuel costs for unimproved or improved dwellings, and with fuel costs and benefits inflated in accordance with official projections for future years (possibly as far as 2025). Such matrices can be used to investigate the likely effects of proposed improvement programmes on fuel poverty across the stock, as well as to identify 'excluded combinations' of household types and dwelling types (especially prior to improvement). This information can be used to prioritise improvements and to support the development of allocation and transfer policies, as well as the specification of new developments.

7 In England, fuel poverty is defined as occurring when a household has unavoidable fuel costs that are higher than the national average and its residual income after paying those costs would place it below the poverty line (which is 60% of median household income after housing costs). In Wales, Scotland and Northern Ireland a household is deemed to be in fuel poverty if its unavoidable fuel costs exceed ten percent of its disposable income.

Chapter 3: Presenting the Fuel Saving Strategy to the Governing Body

Having undertaken the detailed analysis to establish the proposed fuel saving targets (see Chapter 2), it is essential that the results are presented to the Governing Body in social business terms with quantified outcomes.

This should build on the information that secured their initial agreement, starting with a review of what is already in the business plan i.e. the current asset management programme's planned expenditure and what it is intended to achieve. An assessment of how the stock is performing should draw on the detailed analysis above, in addition to housing management and customer services data, including KPI data and NPVs.

Stock KPIs should be related to:

- the business plan, such as income generated;
- energy performance, such as average and minimum SAP energy ratings and average and maximum carbon dioxide emissions;
- residents' experience, such as the incidence of fuel poverty, the number of reactive repairs, rent arrears and void levels.

Business risks arising from the current asset management programme should be identified, quantified and assessed. For example, is the incidence of fuel poverty or are rent arrears increasing and why? Future business risks should be considered using scenarios, such as different rates of increase of domestic fuel prices based on Government predictions, and how they might impact on rent arrears.

The Government's 2015 Summer Budget announced that rents in social housing in England will be reduced by 1% per year for four years from April 2016 and will apply to both social and affordable rent. The Government suggests that this will result in a 12% reduction in average rents by 2020/21, compared to current forecasts. Housing associations' business plans are based on the existing ten-year rent settlement but the National Housing Federation estimates that a reduction of 1% each year for the next four years would reduce social landlords' rental income by £3.9bn. As a result, future rental income will be less than had been included in business plans.

The Budget also announced a raft of measures designed to lower the annual welfare budget in England, which will be phased in over three years. The bulk of the savings are to be found through a freeze to working-age benefits. Some households, including working families, will face significant reductions in their income. Proposals directly related to Housing Benefit include new Universal Credit claimants aged 18-21 no longer automatically being entitled to claim and the family premium being removed from new claimants and new children. A new Household Benefit cap of £20,000 (£23,000 in London) is proposed. Rent will no longer be paid direct to landlords for benefit claimants. These changes will put pressure on income recovery for social landlords and are likely to result in increased rent arrears.

Reduced rental income will be compounded by the probability of rent arrears increasing because of the new benefit caps. Furthermore, operating costs are likely to rise with the introduction of the National Living Wage and the 'Right to Buy' policy. An assessment should be made of how big these reductions are likely to be, and they should be factored into future business planning and risk assessment. Other factors that could affect rental income include rising energy and utility bills, as well as increasing service charges.

Accurate, up-to-date demographic information will be an important aspect of this assessment because the welfare reform changes do not affect pensioner households as much as others. However, they may be more at risk of fuel poverty if they are living in former family homes

with poor energy performance that will be relatively more expensive to improve in a way that will protect pensioners from fuel poverty. Where this demographic and stock analysis shows that pensioner households cannot be protected from fuel poverty because of the type of property they are living in, consideration of how best to house older and vulnerable residents should inform both the asset management and development strategies. This analysis should be included in any presentation to the Governing Body.]

The proposed strategy to reduce fuel use and associated targets can then be presented in terms of how business risks could be reduced and what outcomes could be achieved, such as improved EPCs or SAP energy ratings or reduced incidence of fuel poverty. The additional costs of delivering the proposed fuel saving strategy as part of the asset management programme are often marginal compared with the current retrofit approach. The cost of fuel saving measures should be presented against the total current asset management budget so that the proposed additional costs can be seen in perspective. A sensitivity analysis of any proposed additional expenditure needs to be modelled in the overall business plan to assess any effects on interest cover, cash flow deficit, and net debt per unit. Most of these items are connected with loan covenants which cannot be exceeded.

An assessment could be presented, based on current Government policy, as to what funding might be available for measures to reduce fuel use but external funding should not drive the strategy. It is essential that the fuel saving targets and funding are built into long-term business plans and budgets so that they will always support fuel saving improvements. A strong social business case will be required to secure the necessary budgets to improve existing stock with the challenges on available finance and the pressure to build more new homes.

It should also be possible to identify the cost savings from strategically integrating the measures to reduce fuel use into the asset management programme as opposed to carrying out the improvements as a separate retrofit programme. The costs of installing external wall insulation during a window replacement programme or external decoration would be significantly reduced because there would be no need for additional scaffolding. However, varying existing contracts in such a way would need to be carefully considered, for example, the scaffolding would need to be erected earlier to allow time for external wall insulation to be completed. External insulation and other fuel saving improvements are specialist work (see Chapter 6) and so the capabilities of the existing contractor and the capacity to vary the existing contract to include the necessary specialist expertise need to be assessed. A further factor to be considered is any need to consult leaseholders about the proposed improvements. These criteria, and any other enabling works required for energy efficiency works, should be included when cyclical maintenance and planned works contracts are re-tendered.

The stock analysis should identify how measures to reduce fuel use could best be integrated into the asset management strategy, i.e. identifying what work is already planned (e.g. boiler or window replacements) and what the marginal costs are of enhancing specifications and adding other fuel saving improvements. This would demonstrate how short, medium and long-term (whole-house) energy performance targets could be achieved most economically and efficiently. The business benefits of this approach can be presented in terms of value for money and also reduced disruption for residents since the measures to reduce fuel use would be installed as parts of integrated contracts.

However, it will be important to keep this under review, in order to exploit opportunities to meet targets as circumstances change and funding opportunities become available.

[The Governing Body should be made aware that a flexible approach will be required and should provide Asset Management and Investment Directors with the necessary autonomy so that opportunities and/or funding are not missed. Any changes to the programme should

be carefully considered to assess whether the costs and disruption are worthwhile. There have been examples of landlords bringing forward work to capitalise on short-term funding opportunities but these have not been as financially beneficial as expected.

While funding regimes and incentives have appeared attractive, they may not be a reliable basis for delivering measures to reduce fuel use. Many had short, uncertain timescales and frequent policy changes implemented at short-notice. This experience showed the risks of an over-reliance on funding schemes i.e. basing fuel saving strategies on external funding ('chasing the money') rather than on assessed business needs. The strategy to reduce fuel use should be based on what is right for the business and the residents, with external funding considered when it helps achieve the agreed objectives and does not distract the organisation in an unintended direction.

However, with an agreed strategy, funding opportunities and incentives can be assessed as to whether they will help to deliver the planned fuel saving improvements. To utilise such funding and incentives, it is essential that improvement projects are sufficiently developed, with quantified outcomes, that they can be implemented quickly to meet funding timeframes and before funding budgets are exhausted or the policy changes.

For a strategy to reduce fuel use to work, the whole organisation, not just the Governing Body, should be able to see the benefits of and be committed to delivering it. It may be appropriate for a Governing Body member to be made responsible for championing the strategy and ensuring sufficient senior management ownership to deliver it. Furthermore, all residents (leaseholders as well as tenants) need to be engaged and convinced so that they agree to the work and participate willingly. Some landlords have integrated energy advice and third party support agencies, such as Citizens Advice Bureau, when engaging residents and keeping them on board, particularly around things like tariff switching. Others have found residents' awareness of the benefits of more energy efficient homes has resulted in positive responses to fuel saving improvements, even when costs and disruption are involved. Housing management and customer services teams, together with third party support agencies, have key roles in working with residents to support and facilitate the delivery of improvements and making sure the benefits are realised. They should also promote behaviour change by providing fuel saving advice to residents during and after improvements so that they benefit by having homes they can afford to heat.

Chapter 4: Funding Fuel Saving Improvements

The best way to fund measures to reduce fuel use is through planned improvement programmes based on the organisation's business objectives because external funding schemes have not been reliable. They have often been short-lived or too bureaucratic to suit the larger and longer term projects planned by social landlords. Once the Governing Body has approved the strategy to reduce fuel use and provided a budget, implementation plans can be developed as part of the annual business planning cycle. When measures to reduce fuel use in the next business year have been confirmed and projects developed sufficiently, it is then an appropriate point at which to review the scope for short-term external funding to assist financing.

Since government subsidy is limited, especially in England, organisations should not expect more than a small proportion of their fuel saving work to be externally funded. EU funding is still available but most programmes (see below) have very long lead-times and require large collaborative bids co-ordinated by local authorities, Local Enterprise Partnerships (LEPs) or central government. Consequently any investigation of EU funding needs to consider the potential to collaborate with other organisations and, at times, partners in other EU member states. It will require longer term planning than the annual business plan cycle. It is well suited to partnership working (see below).

The current situation for Government funding in each country is reviewed below, together with other funding opportunities, such as European sources and private finance.

Implementation plans should start with a review of the asset management programme to identify opportunities to incorporate measures to reduce fuel use as part of planned works (e.g. cyclical, planned maintenance or any outstanding *Decent Homes* work) and what additional budget would be required for each year (detailed planning and delivery is covered in Chapter 5). Some landlords are examining whether it is sustainable or good social value for money to replace components that are still performing satisfactorily when they reach an academic end of service life, in order to meet the guidelines of component accounting or the Decent Home Standard[8], when that investment could instead be used to fund fuel saving measures. Adopting a more flexible approach would allow organisations to manage and improve their stock as responsible social businesses.

Importantly projects should be developed sufficiently so that they could be implemented quickly if new short-term funding opportunities and incentives are launched. This would include assessing whether the work can be done without any EU procurement exercises, informing residents of possible plans and quantifying the outcomes (typically required when applying for external funding). An established programme of well-developed projects can also prove attractive to private investors looking for predictable rates of return on their investments, such as renewable energy incentives. An ideal situation would be to have fuel saving improvement projects ready to go (or 'shovel-ready') so that they could be initiated at short notice rather than trying to develop projects when new short-term funding is announced or to respond to private investment opportunities.

In England, social landlords are largely excluded from Government fuel poverty funding and so the EU is likely to be the main source of public finance. EU funding may be channelled through local authorities or LEPs. There will also be limited funding from the Energy Company Obligation (ECO) scheme because most energy suppliers have met their 2017 targets apart from those for the Carbon Saving Community Obligation and its rural sub-target. However, private finance is available, such as through energy performance contracts or for the installation of renewable energy.

[8] Now incorporated into the Home Standard in the Regulatory Framework

In Wales, the main source of Government funding for social landlords is the Arbed scheme, which is designed to fund area-based energy efficiency measures. This programme, part funded by the European Regional Development Fund (ERDF), supports Welsh Government commitments to mitigate climate change, help eradicate fuel poverty and boost economic development and regeneration in Wales. Arbed is now in its second phase (started May 2012).]

Additional funding is available for the Welsh Housing Quality Standard.

In Scotland, grant funding for social landlords to meet the Energy Efficiency Standard for Social Housing (EESSH) is largely provided through ECO but this is only guaranteed until March 2017 and, as in England, could be exhausted earlier. The Scottish Government lists a fuller range of other funding. A review is planned in 2017 that will assess progress towards meeting the 2020 milestone, which is being monitored by the Scottish Housing Regulator. The review will consider setting longer-term milestones in line with the requirements of the 2050 Climate Change target of an 80% reduction in carbon emissions against the 1990 baseline. It will also take account of changes in technology which may offer additional measures to improve energy efficiency in housing.

In Northern Ireland, the new Affordable Warmth Scheme offers an increased grant limit of £7,500 (or £10,000 for solid-walled properties). A list of eligible measures – ranging from Insulation/Ventilation/Draughtproofing through Heating (for homes without central heating) and windows to solid wall insulation – is categorised in terms of priority to maximise fuel savings. However, this scheme is only available to owner occupiers and private rented sector, and residents must have income less than £20,000.

Other Funding Sources

European funding

Social landlords could continue to benefit from EU funding associated with Europe 2020 goals of smart, sustainable and inclusive growth. For example, the European Structural and Investment Fund (ESIF) provides an opportunity to promote investment in green jobs, green firms and sustainable living. The top priorities of this programme are innovation, support for SMEs, low carbon, skills, employment and social inclusion. The National Housing Federation has published a list of areas in England where ESIF is available and guidance on how to access it and LEP funding (see below). Within the total European Regional Development Fund (ERDF) allocation 20% is dedicated to investment supporting the shift towards a low-carbon economy in all sectors; this could equate to approximately £62.5m of funding over seven years. It can support energy efficiency and the use of renewable energy in the housing sector, without upper limits or tenure restrictions.

ERDF can be used to fund energy efficiency in housing across the EU (with 50% matched funding). It requires the Managing Authority in each Region to prioritise energy efficiency in housing in their forward plans. To date, the Managing Authority in Northern Ireland has not done this but Managing Authorities in Scotland, Wales and some of the English Regions have done this and have made ERDF funding available for this purpose. Indeed a number of mainland European countries are also using ERDF funds for this purpose. European funding is competitive and there is usually a need for match-funding. Housing Europe publishes Guidance on EU Funds.

In addition to grant-based programmes there are other European initiatives to help social landlords finance energy efficiency improvements. For example, the European Energy Efficiency Fund (EEEF) is an innovative public-private partnership dedicated to mitigating climate change through energy efficiency measures and using renewable energy in member states. It focuses on financing energy efficiency and small-scale renewable energy,

targeting municipal, local and regional authorities and public and private entities acting on behalf of those authorities.

There is also funding being made available by the European Investment Bank (EIB) to finance energy efficiency improvements; the majority of this funding is debt finance but there is some grant finance. The Housing Finance Corporation (THFC) collates and aggregates bids from housing organisations for submission to the EIB. Below are examples of how EIB finance has been used in London.

Local authority schemes

London Green Fund used £12m grant finance enhanced by a £400m EIB loan facility managed by The Housing Finance Corporation (THFC) for the Greener Social Housing Urban Development Fund. It also provides for the London Energy Efficiency Fund using £100m debt finance procured by EIB.

London RE:NEW is another London-wide home energy efficiency retrofit programme capitalised by EIB funding via the Greater London Authority with the objectives of reducing carbon dioxide emissions and energy bills in London's homes. RE:NEW works with London's boroughs, social housing providers and private landlords. RE:NEW does assist with retrofit funding, but mostly provides free or subsidised technical support including opportunity analysis, assistance with the development of strategies, programme optimisation, a procurement framework which is freely available to social housing providers, retrofit risk management and a set of technical support tools and services.

Local Enterprise Partnerships (LEP)

LEPs are partnerships between businesses in local areas and local authorities. Each LEP has two key priorities: to increase jobs and promote economic growth. Locally, they set their own targets, which can include actions on planning, housing and other infrastructure priorities. There could be scope for LEP funding of energy improvement and asset management projects where these create new jobs and promote local economic growth. There are 39 LEPs across England.

Renewable energy installations

As part of its carbon reduction plan, the Government has incentivised the use of renewable energy. The Feed-in Tariff (FIT) was designed to promote the uptake of small-scale renewable and low-carbon electricity generation technologies, such as PV. Following consultation, the Government has confirmed the new tariffs and cost control measures from 2016. There have been similar cuts to the Renewable Obligation Commitments (ROCs) in Northern Ireland. The Renewable Heat Incentive (RHI), is designed to promote greater use

of renewable energy for space and water heating. There are two schemes: Domestic RHI for individual houses and Non-Domestic RHI for communal systems. Where two or more heat pumps are run of a single ground loop, they are eligible for non-domestic RHI; this is a better rate than the domestic RHI, though the subsidy is payable for the loop rather than for each heat pump installation. Even though the Government has reduced incentives for new installations, existing income streams are guaranteed (and in some cases index-linked) and landlords already in receipt of this income have used it to help fund other energy efficiency improvements.

Renewable energy installations, even with reduced tariffs, should still be considered because they can make a significant contribution to meeting realistic fuel saving targets that will reduce carbon dioxide emissions, provide affordable warmth and improve SAP energy ratings. However, roof-space is limited, and renewable energy systems are expensive, so domestic renewable technologies only make sense as part of a 'fabric first' approach in which demand is first reduced by insulation, air tightness, efficient building services and responsive controls. Furthermore, all homes benefit from a 'fabric first' approach, while only those with the right orientation, sufficient roof area and no overshadowing can benefit from renewable energy installations.

Private finance is available for renewable energy projects. For example some renewable heating suppliers offer asset finance arrangements based on operating expenditure to install renewable heating that enable landlords to obtain RHI income while not affecting existing borrowing arrangements. This is due to the fact that security for the finance is limited to the assets only (e.g. a renewable heating system) and not land or property. Some social landlords have adopted 'rent a roof' solar PV schemes, often funded by private investment, which reduce residents' electricity bills by the provision of 'free' electricity generated by the panels and used directly by the household. Also some landlords have extensive solar PV programmes based on the twin benefits of free electricity for residents and the FIT income helping to repay capital costs or being used to finance energy efficiency improvements to other stock.

Health

Some social landlords have received healthcare funding to demonstrate the improved health benefits possible from improving home energy efficiency, such as Gentoo's Boiler on prescription and the Oldham Warm Homes scheme. The Government's *Fuel Poverty Strategy for England March 2015* anticipates health funding being used for energy efficiency improvements because of proven health benefits. Landlords with good information on resident demographics, such as vulnerable households and the incidence of poor health among their residents will be better placed to bid for such funding.

Partnerships

Establishing partnerships can improve opportunities for financing. Examples are housing associations collaborating with local authorities on area-based schemes or social landlords providing community-based energy efficiency improvements to all tenures. Partnerships are being developed with health professionals to improve health outcomes by using public health budgets to fund energy efficiency improvements as preventive measures. EU funding often requires collaboration with other member states. Partnerships increase the size and impact of improvement projects and provide economies of scale, making them more attractive to private finance. However, some funds are restricted to geographic areas, which can limit partnerships for social landlords with stock in many local authorities.

Energy Performance Contracting

Energiesprong ('Energy leap') is a concept developed in the Netherlands where it has been used it to support the retrofitting of 110,000 homes. It is essentially an Energy Performance

Contract based on a thirty-year energy cost guarantee. Fuel saving improvement work is funded by a loan repaid by the income from roof-mounted PV and by residents continuing to pay the same energy bills even though much less energy will be used. Energiesprong is being piloted in UK, with the National Energy Foundation acting as the secretariat for a market development team called Energiesprong UK.

Private finance

With interest rates at an all-time low, investors are looking for alternative low-risk options to provide better rates of return than currently available. Private investment is being used to finance renewable energy (large and small scale) and fuel saving [energy efficiency] projects. To be considered, such projects must have quantified energy performance outcomes against which finance risks and returns on investment can be assessed. Private finance can come in the form of energy performance contracts, such as Energiesprong (see above) that have the potential to finance significant energy efficiency projects and can be structured to use operating expenditure (Opex) and so not affect existing borrowing arrangements. Some leading housing associations are examining how improvements to the building fabric might be capitalised – particularly external wall insulation (EWI), which it can be argued extends the service life of the building (which in accountancy terms has already lapsed in many cases). For example, some system builds, non-traditional and curtain-wall clad homes are far beyond their theoretical life span (e.g. HAPM manual figures). Adding EWI can add at least twenty-five years in warranty terms (Ofgem states thirty-six years for calculating lifetime carbon dioxide emissions savings, but a longer life might be expected if it is installed correctly) and so improve NPV beyond 100% of the cost of the EWI works.

Innovate UK

Innovate UK is the new name for the Technology Strategy Board. It is the UK's innovation agency that funds, supports and connects innovative businesses to accelerate sustainable economic growth. Funding (normally match-funded grants) is allocated via a competitive application process. These grants are intended to assist with the development and demonstration of innovative technologies or techniques. Previously funded building-related programmes are now completed or in implementation or monitoring and evaluation phases. Innovate UK publishes details of current funding competitions.]

Charitable funding

Some social landlords have obtained Big Lottery funding but applications for substantial funding are complex. While most of its funding programmes are not designed to support measures to reduce fuel use, some have sustainability and environmental objectives. Others could help fund projects where they provide social benefits, such as community engagement, improving health and development opportunities. One programme (currently closed) matched funds from the European Social Fund for projects across England tackling poverty and promoting social inclusion. It is also working with the Cabinet Office to support the development of more innovative approaches to improving social outcomes in England.

Ashden is a charity that champions and supports the leaders in sustainable energy, including social landlords, to accelerate the transition to a low-carbon world.

Identifying and assessing funding opportunities

The important thing is that social landlords should only apply for external funding where it supports the objectives of their strategy to reduce fuel use, and that they don't change their objectives just to get funding, i.e. they stick to their business plans. However, this has to be balanced by flexibility about how to achieve business plan objectives i.e. presenting a fuel saving project to explain how it will create training and employment opportunities, and help the organisation to gain experience, if external funding was available for these objectives.

Since funding opportunities change, it is important that social landlords sign up to electronic newsletters, bulletins and alerts to be aware of current and future funding, as well as case studies on innovative private finance arrangements.

Chapter 5: Delivering Fuel Saving Improvements

Introduction

Once strategic fuel saving (retrofit) aims and standards have been adopted by a housing organisation at Board level, and a budget has been agreed, it is necessary to integrate the delivery of fuel saving improvements with broader housing management and improvement activity. An integrated approach to delivering fuel saving improvements, embracing both technical and organisational aspects, is likely to be more cost effective than implementing retrofit as a separate programme.

Work that is intended to deliver fuel saving improvements is different from traditional maintenance and refurbishment work, because fuel saving improvements are associated with quantified performance standards, involve the use of new assessment processes, new materials and products, new building services and new installation techniques, and carry technical risks (see Chapter 6). Most parts of the organisation, and most of the people in it, are likely to be affected by these changes, in one way or another. Consequently, placing the responsibility for fuel saving solely with an 'energy officer' or 'sustainability team' or even with the asset management team, is rarely effective, because the corporate focus will then be too narrow, and insufficiently resourced. It is essential that the development and implementation of fuel saving strategy is approached as a cross-departmental project that informs, involves and engages everyone whose work will be affected. This approach will promote an 'energy efficiency culture' that helps everyone in the organisation understand what the overall aims and objectives are, what needs to be done, and how their own work and their colleagues' work will inevitably change in response.

Energy Work Group

The most effective mechanism for developing and implementing a fuel saving strategy is to establish a cross departmental 'Energy Work Group' including Governing Body members and residents' representatives (not forgetting leaseholders). Typically, Energy Work Groups are chaired at Director level and include representatives of the departments responsible for finance and investment, asset management and improvement, repairs and maintenance, housing management, staff training, corporate communications and front-line customer care (i.e. local estate managers, call centre staff, welfare benefits officers, etc.). Members of the Energy Work Group should be responsible not only for the collective development of the energy efficiency strategy but also for its implementation. Representatives should report regularly to the Group about progress with implementation in their own teams, and the Energy Work Group itself should report regularly to the Board or an appropriate committee of the Board.

Key Action Areas

Each housing organisation's fuel saving strategy will be different, but the most effective ones usually embrace seven key action areas:

- Fuel saving policy
- Stock assessment
- Affordable warmth
- Staff motivation and training
- Resident guidance and support
- Integration of fuel saving work with broader asset management activity
- Securing external funding

Each of these key action areas is dealt with in turn, below.

Fuel Saving Policy

The Fuel Saving Policy should be a formal statement of the organisation's fuel saving aims and objectives, and how it will meet them. It should be prepared by the Energy Work Group, formally approved and adopted by the Board, circulated to staff and published (at least in summary form). The policy statement should include aims, objectives, targets, standards and a review process.

Aims should provide a succinct summary of what the organisation aspires to achieve with respect to fuel saving and energy efficiency. They are usually expressed in terms of affordable warmth (e.g. reducing residents' fuel costs and reducing the social impact of rising costs for energy services) and/or contributing to national climate change targets by reducing the carbon dioxide emissions associated with energy use in the housing stock.

Objectives should be medium-term, measurable, expressed in terms of the whole housing stock or the whole organisation, and relate to each of the other six key action areas, listed above, as well as to other aspects of the asset management strategy. Thus there should be objectives for stock assessment, affordable warmth, staff motivation and training, resident guidance, integration of fuel saving work with broader housing management activity and securing funding. A robust and comprehensive fuel saving strategy will usually include between thirty and fifty measurable objectives, to be achieved within defined timescales: two, three, five, eight or even ten years, as appropriate. Some objectives may be adopted as KPIs. Some strategies include tabular summaries of the objectives, as appendices, in which deadlines, delivery responsibilities, budgets and costs are defined.

Targets should be annual, and identify the retrofit or fuel saving work that will be carried out, and to which dwellings, in each year. Establishing annual targets is part of the process of integrating fuel saving work with broader housing repair, maintenance and improvement activity, as part of the annual planning and budgeting cycle.

Standards should be explicit, measurable performance standards that all fuel saving work will be required to meet, and should be underpinned by consistent and robust technical specifications. They can be expressed in terms of minimum SAP energy ratings (or increments in ratings), affordable warmth (e.g. maximum fuel costs for different dwelling types), maximum carbon dioxide emissions, or third-party energy or environmental standards (e.g. EnerPHit or BREEAM Domestic Refurbishment). Standards can also be applied to staff training (minimum qualifications for staff in energy-related roles) and to guidance (e.g. adherence to the *Code of Practice for Energy Advice*).

Some housing organisations also adopt energy performance standards for their new developments, to supplement or enhance external standards such as Building Regulations, the Home Quality Mark, etc. More controversially, some organisations set energy performance standards for stock that is acquired from other landlords, and require acquisition projects to include budgeting for improving acquired stock to meet them.

Every fuel saving strategy should include a process for regular review. Reviews should cover progress towards the objectives, recommendations for adjustment of the objectives in the light of progress and funding, recommendation of targets for the coming year, and recommendations for the adjustment of standards, if necessary. All Energy Work Group members should contribute to reviews, on behalf of their own departments or teams, and formal reports of reviews should be submitted to the Board or an appropriate committee at least annually.

Affordable Warmth

Alleviating fuel poverty by improving the availability of affordable warmth is at the heart of most fuel saving strategies, and is usually formalised in the aims, objectives, targets and

standards. However, the pace of improvement programmes is usually constrained by resources, and therefore relatively slow, and there is often a need to deal quickly with more immediate fuel poverty problems. Therefore strategies should include:

- Processes for identifying households that are in fuel poverty, or at risk, and in particular for identifying individuals who are at risk of health problems due to the presence of condensation or mould in their home, or at risk of potentially fatal hypothermia[9]. Landlords should be aware that such a situation could amount to a category 1 hazard under the Housing Health and Safety Rating System (HHSRS).
- Processes for prioritising improvements to the homes of residents who are at risk, both as part of the annual planning and target setting cycle and as an immediate response to urgent cases; it may be necessary to allocate a small, dedicated 'top sliced' fuel poverty budget to fund urgent improvements.
- Processes for assisting at-risk households with advice about how to keep warm at the least cost, how to use their heating and hot water systems efficiently, how to ensure that they are on the most economical fuel tariff, and how to switch fuel suppliers, if appropriate.

Staff Motivation and Training

In most housing organisations, responsibility for implementing a complex and detailed fuel saving strategy will be spread across several departments and many individuals. It is therefore important that everyone is well motivated and empowered to play their part, and that when staff are dealing with residents everyone should 'sing the same tune'. Policy aims and objectives should be communicated to all staff, with detailed information about what is expected of each department and individual. Corporate communications media such as email bulletins, staff newsletters and team briefings should be used for this purpose. Appropriate objectives should be included in individuals' professional development plans and reviewed during appraisal sessions.

Staff training need should be assessed to determine whether the organisation has the knowledge and skills required to deliver the fuel saving strategy. Where gaps are identified, training should be provided, and appropriate content should be included in induction training for new staff.

A 'best practice' energy training programme should include four types of training:

- Energy awareness training, including a policy awareness element, for all front-line staff, housing managers and residents' representatives.
- Technical training for all in-house and consultant surveyors, so that they can collect and/or check the RDSAP energy rating data for dwellings that they visit and monitor / quality assess any installation.
- Technical training for energy assessors and data analysts, covering the SAP energy rating and the procedures for preparing stock profiles, calculating KPIs, assessing the energy performance of individual dwellings and evaluating improvement options.
- Training for staff who will be procuring fuel saving improvement work, involving materials, products, process and skills that are new or different from those with which the organisation is familiar.

9 Governments' fuel poverty strategies suggest using health outcomes as a metric for monitoring progress.

It is important that training programmes are implemented before resident guidance programmes (see below), so that staff are equipped to answer residents' questions when their awareness of fuel saving issues has been raised by the delivery of advice.

Resident Guidance

There is little point in improving the energy efficiency of residents' homes if they are not motivated to use them in energy efficient ways, or don't know how to do so. It has been shown that the predicted fuel savings associated with retrofit projects are rarely realised unless the installation of fuel saving measures is accompanied by advice. Where improvements are installed without advice, often only half of the anticipated fuel cost savings are achieved. And remember, half of the predicted savings can be realised by delivering advice without any improvements!

Therefore fuel saving strategy should include an energy advice programme for residents. A 'best practice' advice programme should have three components:

- Basic energy awareness training delivered to all residents via newsletters, email bulletins, websites, leaflets in welcome packs, etc., and face-to-face by front-line staff.
- Responsive energy advice for residents who report problems with energy use, fuel costs, heating or ventilation; this advice can often be delivered by front-line staff (e.g. in call centres) or by trained residents (e.g. 'green champions') but they should be able to refer difficult problems to others with greater expertise. Some housing organisations run a 'Green Doctor' energy advice support service for residents.]
- System-specific training about their heating, hot water and ventilation systems for new residents, for those who transfer between dwellings and for those who have new systems installed in their homes under the retrofit programme.

Integration of Fuel Saving with Broader Housing Management Activity

The most cost effective way to install fuel saving measures is to integrate the work with broader housing management activity: with repairs and maintenance, and with other planned improvements including *Decent Homes* work (and the Scottish and Welsh equivalents). This allows the organisation to take advantage of established procurement processes and existing framework contracts. However, care should be taken to ensure that the scope of existing arrangements is adequate.

Fuel saving improvements require new and often unfamiliar materials, products and systems, and new installation techniques, so new specifications may have to be prepared with the assistance of specialist consultants. Existing contractors may not have the skills, experience or qualifications required to install unfamiliar measures such as solid wall insulation, floor insulation or renewable energy technologies, and may have to engage suitably qualified and experienced specialist installers as sub-contractors. Alternatively, new contracts may have to be let, or existing arrangements modified at the time of renewal.

Well-planned integration of fuel saving measures with broader housing improvement work brings both cost savings and technical benefits. For example, if scaffolding can be used for more than one purpose (e.g. repairing the roof, installing solar PV, installing solid wall insulation and replacing windows) the overall cost of the package will be significantly lower than if measures are installed separately at different times, and there will be much less disruption of residents. Well-planned integration also avoids waste, for example internal wall insulation can be fitted behind new kitchen units, to avoid having to modify them or replace them again when the rest of the walls are insulated later; and new hot water cylinders can be fitted with twin-coil heat exchangers, so that they need not be replaced when solar water heating is installed later. Integration can also facilitate future opportunities, for example re-

roofing work can include extending the eaves and verges, to allow for the later installation of external wall insulation.

Most housing organisations' asset management systems define service lives for individual components such as fittings and finishes, over which the investment made in them is amortised. It is very difficult to write-off an element such as a kitchen fitting, a floor finish or a replacement window before the end of its planned service life. Consequently it may not be acceptable to replace kitchen fittings when internal wall insulation is installed, to replace windows when external wall insulation is installed, or to replace floor finishes when floor insulation is installed. Thus carrying out general improvements and installing fuel saving measures at the same time can deliver significant savings. Matching the lives of elements such as windows and external wall insulation will permit the next replacement to be simultaneous, and eliminate the need to damage one in order to replace the other, and make-good.

A well-integrated fuel saving strategy typically includes three types of delivery programme:

- An *opportunist* programme, which delivers some fuel saving measures alongside repair and maintenance work, in order to minimise the on-costs that would otherwise be associated with multiple visits to the same dwellings. For example, many organisations combine fuel saving improvements such as additional insulation with the repairs and maintenance that are carried out on 'void' dwellings, between tenancies.
- An *integrated* programme, as described above, in which fuel saving work is planned and delivered alongside other improvements, in order to minimise overhead costs, maximise asset lifetimes, achieve economies of scale, keep future opportunities open and avoid multiple disruption of residents.
- A *dedicated* fuel saving programme, with its own 'top-sliced' budget, for urgent installation of measures in dwellings with very poor energy performance but for which comprehensive improvements are not planned for some time, or in dwellings where the household is in severe fuel poverty or there are vulnerable individuals at risk of hypothermia.

In practice, these three types of programme are complementary. Housing organisations should seek to implement all of them in parallel in order to achieve their fuel saving and affordable warmth objectives quickly and cost effectively.

Procurement

Finally, procurement of fuel saving work offers opportunities for economies. Volumes of materials, products and systems are often low, especially during the early years of a programme or when funding is limited, but there are opportunities for housing organisations to work together in 'procurement clubs' in order to increase volumes and secure economies of scale; several of these are included in the HCA Procurement Efficiency Initiative (PEI). Cooperative procurement also allows specification, tendering and assessment costs to be shared. Several procurement organisations in the housing sector now operate 'retrofit frameworks' focused on cost effective procurement of retrofit materials, products and systems against technically sound specifications.]

The RE:NEW (described above) Procurement Frameworks are freely available to all social landlords. Another example is Surefire, a procurement framework hosted by Walsall Housing Group in association with the Sustainable Housing Action Partnership (SHAP).

Securing Funding

Fuel saving improvement strategies cannot rely solely on external funding, because funding programmes are usually short-lived and politically volatile, and often constrained by complex

eligibility criteria. Funding is nearly always allocated on the basis of competitive applications.

However, even limited external funding can provide a valuable supplement to internal budgets by accelerating the pace of delivery, so housing organisations should maintain awareness of available and forthcoming external funding opportunities and ensure that resources are available to support the preparation of applications. In some larger organisations it may be appropriate to employ a dedicated member of staff or a consultant to monitor external funding opportunities, prepare applications and negotiate with funding bodies. Many programmes require applications to be supported by technical analyses that demonstrate and quantify the eligibility of the work that is proposed for funding.

Housing organisations that have assessed their stock, identified dwelling types, prepared medium-term fuel saving improvement plans (see Chapter 2) and integrated them into their broader improvement strategies will be better placed to secure external funding than those that have not done that work. This is because they will know what improvement measures are required, where they are required and how much they are likely to cost – so 'shovel ready' improvement projects can quickly be assembled to form the basis of funding applications. It will also be easier for well-prepared organisations to integrate funding for individual measures into more comprehensive improvement packages.]

Opportunities for EU funding usually require the formation of local consortia, or of international consortia including partners from other EU nations. Assembling such consortia and preparing an application for funding often involves significant work, and may require a dedicated member of staff. EU funding is frequently over-subscribed, and applications are usually dealt with in two stages, extending the application process over many months, so these programmes are only suited to substantial projects that justify the required investment of time.

The Housing Energy Management Matrix

The Housing Energy Management Matrix is a graphical tool that is used by some housing organisations to measure the quality and effectiveness of their fuel saving strategies, and track progress. Activity under each key action area above is scored on a five-point (0 to 4) scale, using a series of standard questions, where 0 represents no action and 4 represents action consistent with best practice. The matrix provides a 'profile' of the organisation's strategy, identifying the stronger and weaker points. Regular plots (usually associated with formal reviews of the strategy) can be used to illustrate progress over the timescale of the strategy objectives. Figure 5.1 shows 'baseline' and 'proposed' plots on the Housing Energy Management Matrix for an Arm's Length Management Organisation (ALMO). The plots illustrate the ALMO's strategy to move from an average position (levels 1 to 3) towards a best practice position (level 4) over three years.

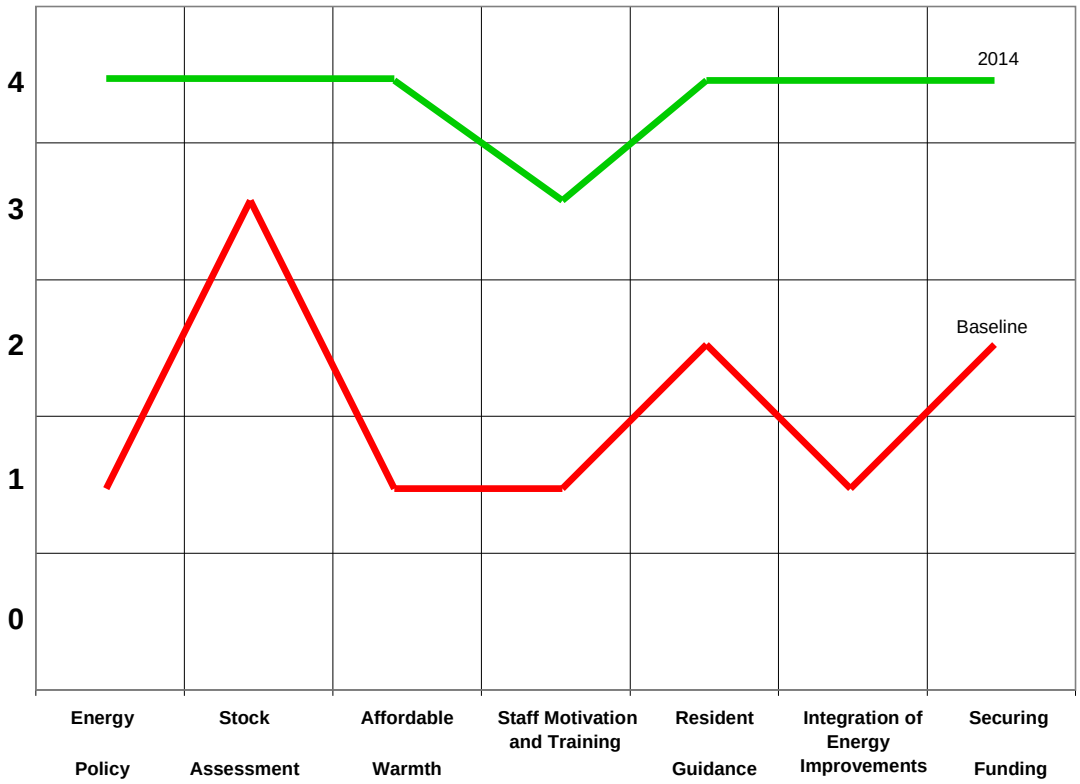

Figure 5.1 An ALMO's baseline (2011) and projected (2014) profiles on the Housing Energy Management Matrix, showing planned progress over three years.

Further Guidance

Jones M, Lupton M, Kiely J and Rickaby P A (2011) *Managing the Assets: a guide for housing associations,* second edition, National Housing Federation, London.

Rickaby P A *et al* (2011) *Low Carbon Domestic Retrofit*, Institute for Sustainability, London; twelve business opportunity guides:

1 Rickaby P A *Introduction to the Low Carbon Domestic Retrofit Guides*
2 Smith R *Surveying and Assessing Dwellings for Low Carbon Retrofit*
3 Mellor A and Wedlake N *Planning Low Carbon Retrofit Projects*
4 Smith L and Owen S *Funding and Procurement for Low Carbon Retrofit*
5 Prewett R *Managing Low carbon Retrofit Projects*
6 Elton M and Turrent D *Improving the Building Fabric*
7 Willoughby J *Improving the Building Services*
8 Griffiths N *Green Retrofit: Materials, Waste, Water and Maintenance*
9 Junemann S and Rafferty L *Living in a Low Carbon Home*
10 Moore S and Warren L *Identifying Opportunities and Promoting Low Carbon Retrofit*
11 Rickaby P A, Owen S and Smith L *Promotion Programmes for Low Carbon Retrofit*
12 Rafferty L and Warren L *Skills, Training and Accreditation for Low carbon Retrofit*

Chapter 6: Managing Risk and Ensuring Quality

Introduction

Improving the energy efficiency of existing housing is a risky business. It involves the integration of new materials, products and systems using installation processes that are new to managed housing. To achieve significant reductions in fuel use, fuel cost and carbon dioxide emissions a range of improvement measures have to be installed in each house, either all at once or in coordinated stages according to a medium-term plan. The measures include improvements to the building fabric (insulation and air-tightness), the building services (ventilation, space heating, water heating and lighting) and the addition of renewable energy technologies (usually solar thermal and solar photovoltaic systems). All of these measures interact – for example insulation and air tightness measures reduce air infiltration and air leakage, creating a critical requirement for better deliberate ventilation; and they reduce heat losses, resulting in a need for smaller heating appliances with more responsive controls as well as increasing the risk of overheating in warm weather. The fact that the measures are usually installed while the dwelling is occupied introduces more interactions, and more risk. Therefore this chapter addresses three questions:

- Why do energy efficiency improvement projects rarely deliver the predicted reductions in fuel bills and emissions, and what contributes to the so-called 'performance gap'?
- What are the risks of building-in defects, and how can we mitigate those risks?
- What are the key points to watch out for, at each stage of the process?

Research from the eighty-six projects in the *Retrofit for the Future* programme run by the Technology Strategy Board (now Innovate UK), and other, subsequent projects, have helped us to understand the interactions between measures, the risks that arise from them, and how to manage them. Good practice guidance has become available[10], and risk management tools have been developed to help housing organisations to identify and mitigate risks, and to ensure that their fuel saving programmes deliver quality work[11]. It is important that housing organisations understand and manage risks, because the consequences of not doing so are serious, including:

- poor energy performance (i.e. fuel cost savings significantly less than predicted, leaving residents with high fuel bills);
- condensation, mould growth and the deterioration of finishes, fabric and structure;
- overheating in warm weather;
- diminished resident satisfaction (and increased complaints);
- erosion of asset value and resources; and
- loss of reputation and undermining of the commitment to fuel saving.

In order to manage risks it is first necessary to understand the fuel saving improvement process, then to introduce risk mitigation techniques based on documented good practice standards and procedures.

10 See for example RICKABY P A, WILLOUGHBY J and McLAREN-WEBB C (2014) *An Introduction to Low Carbon Domestic Refurbishment,* Construction Product Association | RIBA Publishing, second edition, London; and the Institute for Sustainability's online suite of twelve *Low Carbon Domestic Retrofit Guides* (see Chapter 5).

11 Amongst these are the online 'Guidance Wheel' developed by the Sustainable Traditional Building Alliance (STBA) for the retrofit of older, traditionally constructed buildings, and the suite of risk management tools developed for the London RE:NEW retrofit programme by Six Cylinder Ltd, Rickaby Thompson Associates Ltd and ArchiMetrics Ltd.

The Retrofit Process

Figure 6.1 shows the process followed in many publicly funded fuel saving programmes such as the Energy Company Obligation (ECO) and the now-defunct Green Deal Home Improvement Fund. It is simple: the dwelling is assessed and appropriate improvement measures are identified; a design is prepared; improvement measures are installed; and the improved dwelling is occupied with the new systems, etc., in place and in operation. Theoretically, installation quality is governed by a Publicly Available Specification (PAS 2030), which sets standards for the training of installers and the processes they use.

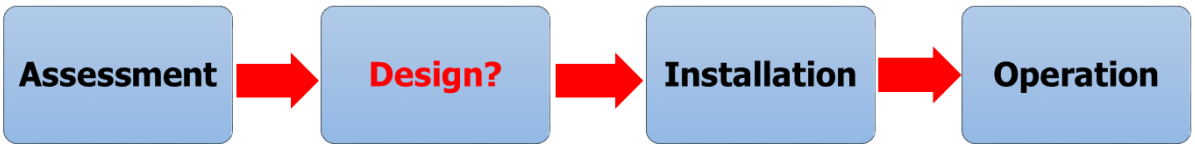

Figure 6.1 A simple representation of the retrofit process

Unfortunately almost every project that has followed this process has failed to deliver the improvements in energy performance predicted at the assessment stage – in many cases by significant margins. Some projects have also suffered from technical defects such as condensation. To understand why this has happened it is necessary to examine where the process goes wrong.

Where Do Fuel Saving Improvements Go Wrong?

One problem is that the design stage of the process is rarely present (which is why it is shown in red with a '?' in the 'Design' box in Figure 6.1). Although PAS 2030 requires the installers of measures to work to documented designs, most processes implemented in large-scale, funded programmes (e.g. ECO) do not include a design or specification stage; instead they move straight from an assessment that identifies *potentially appropriate* improvement measures to installation of those measures, with very little either generic or site-specific consideration of how those measures interact or how they should be installed.

The reason why the omission of the design stage of the process is critical is that the three places where improvements often fail are all places where design input, attention to detail with drawings, is critical. They are:

- At the corners, junctions and edges where building elements meet, and around openings, where continuity of insulation and of the air barrier are critical to minimising thermal bridging and to eliminating air infiltration and air leakage.
- At the interfaces between the building fabric and the building services, where heating and ventilation systems and their controls must be matched to heat loss and air permeability.
- At the interfaces between systems and people, where commissioning, handover, control, and maintenance are critical to achieving the intended performance.

This is also the reason why PAS 2030 is not fit for purpose, and should not be relied on by housing organisations as an assurance of quality. PAS 2030 specifies that installers should be certified according to measure-specific training schemes established by industry before the importance of whole-house improvement was recognised. Its focus is on improving individual elements of the dwelling by installing individual measures, but not on the junctions between them; and on installing systems correctly, but not on the interfaces between those systems and the building fabric or the people who will use and maintain them. PAS 2030 includes a separate annex specifying training and certification requirements for the installation of each individual measure or system, but has almost nothing to say about the

corners, junctions, edges and interfaces that are the places where problems occur. Thus it preserves the fragmentation of the industry rather than promoting a robust, integrated approach.

An Improved Process

In practice, many housing organisations developed their own procedures for assuring the quality of improvement work during the *Decent Homes* and other programmes and subsequently when installing measures funded by the CERT, CESP and ECO programmes. These procedures include assessing dwellings, consulting residents, designing and specifying improvements, engaging contractors via framework contracts and inspecting work to check compliance with designs and specifications. Housing organisations should build on this valuable experience when venturing into fuel saving improvements.

A robust process for medium- and large-scale fuel saving programmes is shown in Figure 6.2.

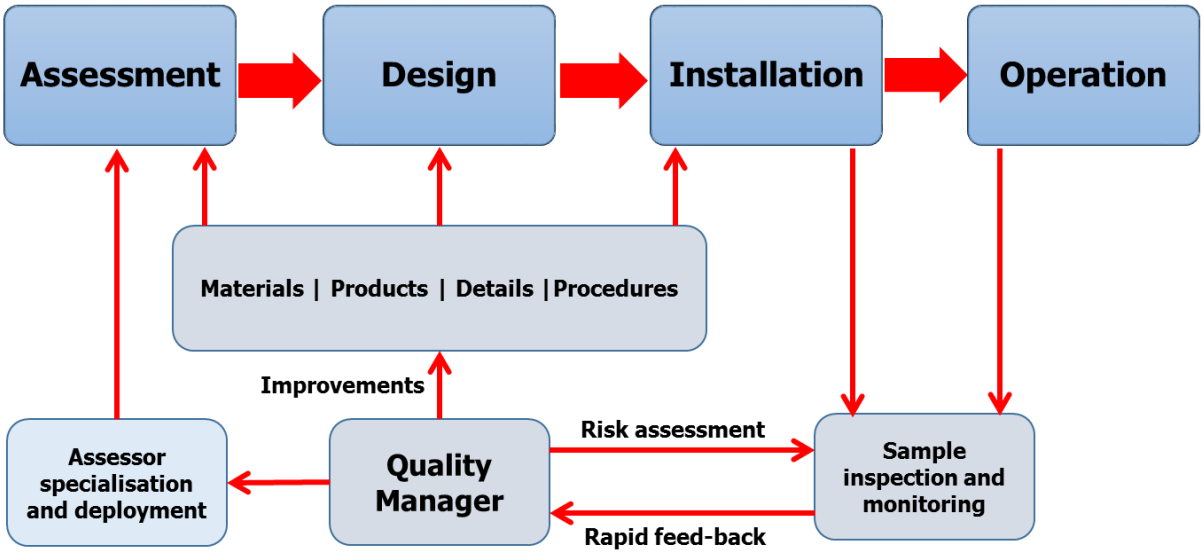

Figure 6.2 A robust process for medium- and large-scale fuel saving programmes, incorporating risk management and quality assurance.

Figure 6.2 has two key features. First, there is a library of materials, products construction details and documented procedures (for assessment, design, installation and quality assurance) that are used throughout the process. These are based on experience and good practice guidance, and because delivering improvements is a learning process they are subject to change, under the control of the Quality Manager. There is considerable scope for housing organisations to share their fuel saving improvement libraries with each other, possibly via the NHMF, or to develop them collaboratively through common procurement processes. There is also scope for framework contractors to contribute to them. However, it should be noted that many designs and procedures may be stock-specific.

The second key feature is the Quality Manager, who might be a senior programme manager, an experienced project manager, an in-house technical surveyor or architect, or a small team of such people. Irrespective of background it is also preferable that the lead Quality Manager is a Retrofit Coordinator, i.e. an individual who holds the Diploma in Retrofit

(Retrofit Coordinator)[12] or has completed the forthcoming NHMF Retrofit Asset Manager training[13].

The Quality Manager or Quality Management Team should have five responsibilities:

- Ensuring that dwellings are properly assessed prior to measures being designed, specified and installed. The assessment process should be more than a simple SAP energy rating assessment carried out by a Domestic Energy Assessor: it should embrace all relevant aspects of the dwelling, including its current performance, its construction type and state of repair, planning constraints, design constraints, cost considerations and a technical risk assessment. Specialist assessors should be deployed to 'vulnerable' dwellings (i.e. those built before 1920, which may have vapour permeable construction) and to dwellings where the installation of high-risk measures (e.g. solid wall insulation, communal heating or whole house mechanical ventilation with heat recovery) is anticipated.
- Maintaining the library of materials, products, construction details and procedures. Inevitably, the library will continually change as the scope of the improvement programme develops, and in the light of experience. There should be rapid feed-back from inspections and from monitoring and evaluation work to ensure that elements that prove problematic are quickly improved or replaced, before further defective installations are completed. Updates should be subject to a strict change management procedure and communicated clearly to users (i.e. assessors, designers, specifiers and installers).
- Operating an inspection process, involving inspections of work both during and after the installation of measures. Inspections are expensive, and there is unlikely to be sufficient resource to inspect the installation of every measure in every dwelling. Technical risk assessments should therefore be used to target inspection resources on the highest risks, i.e. where problems are most likely to occur, with the greatest impact. Elsewhere, good quality improvement work will rely on well-trained site supervisors.
- Operating a sample monitoring regime, involving both basic energy performance monitoring and simple post occupancy evaluation (i.e. proforma interviews with residents) to ensure that the fuel saving programme delivers what residents have been promised. More elaborate and expensive energy performance monitoring, post construction reviews and detailed post occupancy evaluation may be appropriate in some cases, especially where complex or high-risk whole-dwelling fuel saving improvement has been carried out. The monitoring regime is critical to the continuous improvement of the overall retrofit process.
- Finally, collaborating with housing managers to investigate residents' complaints, rectify problems and feed experience back to the library.

How to Ensure Successful Improvement

Key actions for managing risk and ensuring successful improvement, listed in the order of the stages described above, include:

- Build risk management and quality assurance processes into the overall programme. Employ specialists, including architects with fuel saving improvement experience and at least one Retrofit Coordinator.

12 Gaining the Diploma in Retrofit (Retrofit Coordinator) qualification involves eight days of training and passing an examination. The training course and examination are offered in several UK locations. The training can also be delivered in-house.

13 The NHMF Retrofit Asset Manager training is designed to complement this guidance, and will be offered by the NHMF from early 2016, on both an open-access and an in-house basis.

- Don't under-resource assessment: match assessors' skills to buildings and anticipated measures. Recognise that vulnerable buildings may require specialist attention.
- Identify appropriate improvement measures to suit the residents, the buildings and the local contexts. Spend time understanding residents' constraints. Beware of over-optimistic performance predictions (especially if work will be funded by fuel cost savings and residents are currently under-heating their homes).
- When evaluating improvement options, adopt a 'fabric first' approach: first improve the insulation and air tightness of the building envelope, in order to reduce heat loss; then improve the building services, to increase efficiency; finally, add appropriate renewable energy systems to 'top up' performance to the required standard.
- Establish an air-tightness and ventilation strategy to ensure good internal air quality, control moisture and reduce the risk of condensation and mould growth. Recognise that in most dwellings deliberate ventilation will need to be improved if insulation is added or the dwelling is made more air-tight.
- Specify the materials and products to be used. Design the construction details at all junctions, corners and edges of building elements. Maintain the integrity of the insulated envelope and the continuity of the air-barrier.
- Match the type and capacity of heating and ventilation systems to the reduced heat loss and air permeability respectively. Keep controls as simple as possible, and readily accessible.
- Ensure that ventilation systems include provision for fresh air inlet as well as for stale air extraction. Recognise that mechanical ventilation with heat recovery (MVHR) will not work effectively if the air permeability of the building envelope is more than 3 m^3/m^2hr @ 50 Pa. MVHR is also very difficult to install properly in existing buildings. Ensure access is provided for filter cleaning or replacement.
- Incorporate measures to reduce overheating, including external shading, reduction of internal gains (by installing very energy efficient lamps and appliances) and provision for secure night-time ventilation in summer. Ensure that any ventilation system with heat recovery includes summer by-pass of the heat exchanger.
- Avoid using separate installers for each improvement measure: use multi-skilled installation teams or require installers to cooperate. Ensure that installers are properly briefed by means of 'toolbox talks' – especially about air tightness.
- Procure the design, not a contractor's or installer's interpretation of it. Implement change management control to eliminate inappropriate substitutions of materials or products. Do not allow installer design unless it is pre-documented and approved by the designer.
- Undertake pre-completion testing (pressure testing and thermography); target sample testing and inspections using risk assessments. Provide rapid feedback to facilitate remedial work, and improvements in designs and specifications.
- Commission all building systems together at the same time, not separately, in accordance with a pre-agreed process, and obtain commissioning certificates.
- Adopt a robust handover process: explain what has been installed and how to use it by means of verbal briefings, supplemented by graphic instructions and follow-up visits by trained resident advisors.
- Provide residents with advice about the use of controls. Explain how risks of condensation and of overheating can be managed. Explain the consequences of disabling ventilation systems. Promote behaviour that will reduce fuel costs.

- Brief the maintenance team, providing comprehensive descriptions of the systems, components, controls and service requirements: they are as important as the residents!
- Undertake post-construction reviews, post occupancy evaluation and monitoring to confirm performance, internal air quality and user acceptability. Target monitoring using risk assessments and focus on the highest risks. Provide rapid feedback to the quality assurance team so that materials, products, details and processes can be improved.

Case Study: Risk Management in the London RE:NEW Programme

The Greater London Authority (GLA) RE:NEW programme provides a wide range of support services for local authorities', housing associations' and private landlords' fuel saving projects in London. The programme aims to: promote and support retrofit at scale; overcome barriers to retrofit; reduce carbon dioxide emissions associated with energy use; and reduce London residents' fuel costs and fuel poverty. RE:NEW is funded by the GLA and the European Investment Bank, and administered for the GLA by CAPITA.

Many housing organisations see technical risks as a barrier to fuel saving improvements. Helping housing organisations to manage technical risk removes that barrier as well as improving the quality of the work carried out. Therefore consultants[14] working for CAPITA's RE:NEW support team have developed a suite of risk management techniques and tools to define and mitigate the inherent technical risk associated with most individual retrofit measures and, crucially, with combinations of measures. These tools include a risk management process, a triage matrix, a detailed assessment procedure, a set of risk management tools, and a range of risk management support options. The risk management process, tools and support options are illustrated in Figure 6.3.

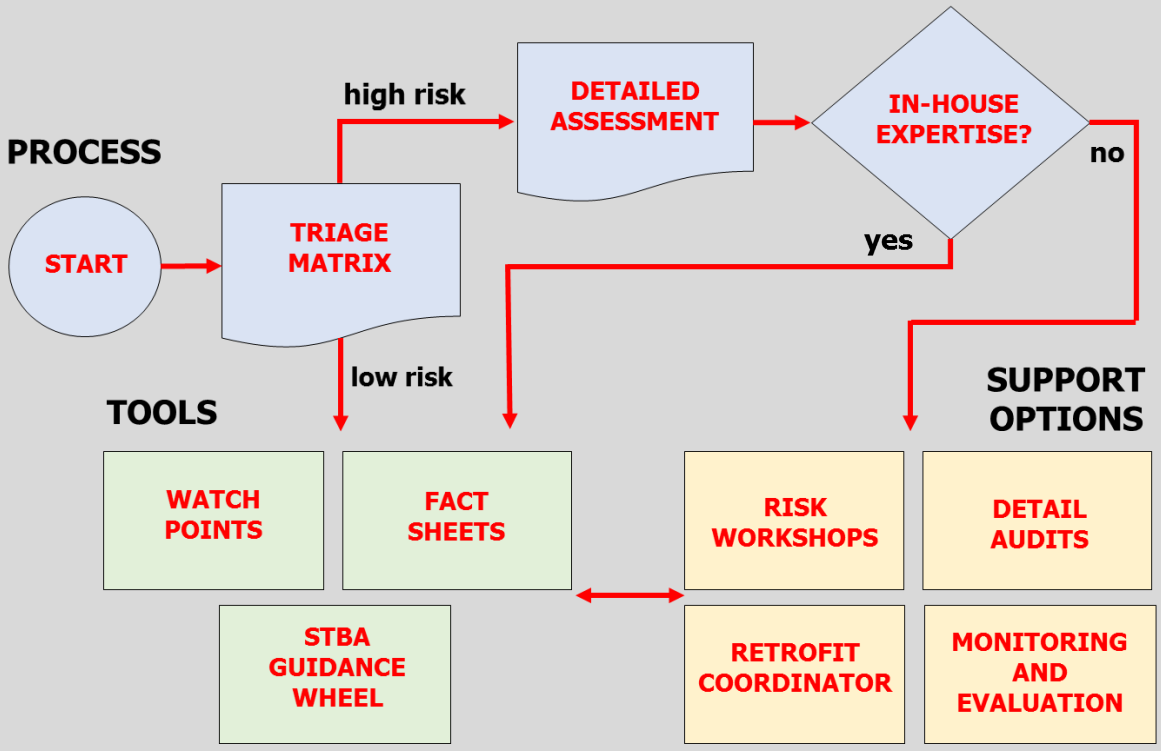

Figure 6.3 The GLA RE:NEW retrofit risk management process, tools and support options (Diagram courtesy of the CAPITA RE:NEW support team)

[14] Six Cylinder Ltd, ArchiMetrics Ltd and Rickaby Thompson Associates Ltd.

Projects that are proposed for support from RE:NEW are first assessed with the triage matrix. The matrix is used to calculate a risk score that is determined by the inherent risk associated with the individual fuel saving measures proposed and the risk associated with each combination of measures. Risks are scored on a scale of 0 (no risk) to 3 (high risk). For example, a project combining communal heating (inherent risk 3) with external wall insulation (inherent risk 2) attracts a score of 3 for the combination of measures (because EWI can exacerbate overheating caused by communal heating) so the total score is 8, which is then divided by 2 (the number of measures) to give an overall risk score of 4, which is high.

If a project is assessed as *low risk*, the risk management tools are made available to the project team. These consist of Watch Points, detailed technical Fact Sheets, and the Guidance Wheel published by the Sustainable Traditional Buildings Alliance (STBA – see www.responsible-retrofit.org/wheel/), which is itself a source of extensive technical references. Lists of watch points are available for each stage of the retrofit process (assessment, design, installation and commissioning, handover and operation) and for the following topics:

- Floor insulation
- Cavity wall insulation
- Solid wall insulation
- Loft and roof insulation
- Windows and external doors
- Draught-proofing and air-tightness
- Ventilation
- Heating
- Heat pumps
- Water heating
- Solar water heating

The Fact Sheets cover the following topics:

- Interstitial condensation
- Surface condensation and mould
- Air leakage and ventilation
- Thermal bridging
- Water ingress
- Overheating

If a project is assessed by using the triage matrix as *high risk*, a further assessment is made, using a detailed questionnaire, to establish whether the project team (i.e. the designers and specifiers, and the contractors and installers) has appropriate experience and expertise, and whether appropriate risk mitigation is included in the project plan. If this is the case then the overall risk score is reduced, and the project team is again referred to the risk management tools.

If the project team is assessed as not having appropriate experience, or not applying appropriate risk mitigation, then the project team is offered one or more of the support options. These consist of

- Risk workshops involving the whole project team and covering general retrofit risk management and/or the risks associated with specific fuel saving measures.
- Support from a qualified Retrofit Coordinator, potentially including design and specification assistance, ventilation assessments and strategies, moisture management strategies, auditing of details for thermal bridging and air tightness, and support for the installation, commissioning and handover processes.
- Monitoring and evaluation, including sample quality assurance inspections and testing, and rapid feedback to improve the overall project process as it proceeds.

The approach adopted by the RE:NEW support team and its consultants is that risk management in large scale retrofit projects requires a systematic approach spanning from strategy to detail, and a range of consistent and transparent assessment and support tools. Every project is different, requiring different packages of fuel saving measures, and some measures are inherently riskier than others (both individually and in combination). The skills and experience of retrofit teams also vary. Risk management activity should therefore be tailored to suit projects, even though there will be recurring themes such as moisture management, ventilation, air tightness and thermal bridging. Demonstrating robust risk mitigation is important to protect occupants, to protect the buildings, to protect investment and to provide everyone with confidence in fuel saving programmes.

The risk management tools developed for the London RE:NEW programme are to be made available nationally by the RE:NEW support team and the consultants who developed them.

Acknowledgements

This guidance has been prepared for the National Housing Maintenance Forum by **Andrew Burke** and **Peter Rickaby**, of Rickaby Thompson Associates.

The authors wish to acknowledge the assistance provided by members of the NHMF's panel of expert readers, who significantly improved the scope, focus and accuracy of the guidance by providing detailed and constructive comments on the proposed structure and the early drafts.

Shaun Aldis, *Wolverhampton Homes*
Paul Allen, *Merthyr Valleys Homes Ltd | Cartrefi Cymoedd Merthyr Cyf*
Richard Baines, *EBC Management Services Ltd and Black Country HA*
Liz Circuit, *M^3 Housing Limited*
Pauline Graham, *Islington and Shoreditch HA*
Karl Linder, *Viridian Homes*
Alison Mathias, *Homes & Communities Agency*
David Pierpoint, *Centre of Refurbishment Excellence*
Noel Rice, *Northern Ireland Housing Executive*
David Shewan, *Parity Projects*
Luke Smith, *National Energy Foundation*
Bill Taylor, *Taylor Armitt Consulting*
Alexandra Willey, *Affinity Sutton*

Examples of housing stock profiles and housing stock KPIs have been included courtesy of Viridian Housing. The example of a completed Housing Energy Management Matrix has been included courtesy of South Essex Homes. Information about the RE:NEW programme, and the case study of risk management in the London RE:NEW programme have been included courtesy of CAPITA and the Mayor of London.