building opportunities for business

living in a low carbon home

LOW CARBON DOMESTIC RETROFIT

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Sebastian Junemann and Linn Rafferty

Institute for Sustainability

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9.1 Introduction

This guide considers the needs of residents who live in low carbon homes. It also covers the role of energy advice in helping residents in less efficient housing reduce their carbon emissions. The emphasis is on:

- how important behaviour is in ensuring that energy and carbon dioxide emissions reductions are realised
- the importance of energy advice, how to engage residents with this advice and what should be covered
- the need to design with users in mind and the importance of effective control systems so that residents can manage their energy use.

Generally, residents should be expected to benefit in several ways from low carbon retrofit:

- lower fuel bills
- warmer, more comfortable homes
- in some cases, improvements to their health
- knowing they have reduced their home's impact on the environment.

Evidence from post-occupancy research into low carbon homes suggests that it is common for residents to fail to enjoy the full benefits of a retrofitted home. When the studies show that the technology has been fitted and commissioned correctly, the conclusion is that this mismatch is caused by how the residents use the home.

It is important for retrofit practitioners to manage these factors; they can lead to opportunities including:

- delivering retrofits that result in the highest long-term levels of customer satisfaction
- commercial opportunities arising from the role of energy advice within low carbon retrofit
- avoiding commercial and reputational risk and promoting recommendations for further work
- managing the expectations of residents.

To elaborate on this last point, many residents will naturally expect that they will automatically enjoy energy savings as a result of the retrofit works. If they don't realise the savings, they may blame the contractor for failing to do the work correctly, rather than recognising that they are not using their home effectively. Similarly, if the resident is left with a home that they do not understand (due to ineffective controls or poor handover) or is unsuitable for their lifestyle they will probably be dissatisfied with the work. Ensuring that residents are able to use the homes and systems is crucial to the success of retrofit and, with energy prices increasing every year, the need for quality energy advice has never been greater.

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Business Opportunity

Providing post-installation advice as part of a wider improvement scheme, eg for a social landlord, an energy company funded community scheme such as CESP, or a Green Deal Provider.

9.2 The importance of occupant behaviour

How carbon dioxide emission reductions are predicted

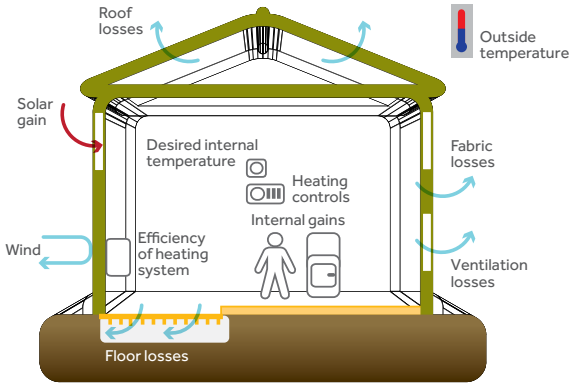
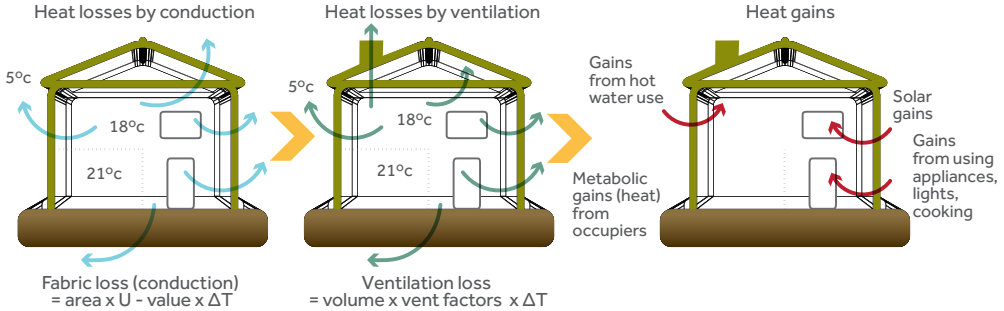


Figure 9.1 The BREDEM model.

The achievable carbon dioxide emissions reductions from housing are generally calculated using a model known as BREDEM – the Building Research Establishment Domestic Energy Model (see Figures 9.1 and 9.2).

The BREDEM calculation of home energy consumption

1 Calculate the energy requirement (heat demand) of the home



ΔT = temperature difference between the inside and outside of the home.
The home's heat losses vary with size of ΔT (thermostat setting, local climate) and on how long ΔT lasts (heating times)

The home's heat gains vary with the number of occupants

When BREDEM is used to produce estimated savings for an unknown occupier, ΔT, heating times and number of occupants are all unknown. A set of standard assumptions, called standard occupancy, is used instead.

2 Calculate the total amount of energy used

3 Calculate the energy used for hot water and fixed lighting

Effect of the fuel used and the efficiency of the heating system(s)

Energy needs for use of hot water and lighting are based on number of occupants

The actual heating system efficiency and fuel are input

Number of occupants estimated from floor area

Figure 9.2 The BREDEM calculation process.

Because residents differ significantly in how they use energy in their homes, this model makes assumptions representing *average* users. Typically, energy use by different households in identical, adjacent houses can vary by a factor of five. If the resident, having installed an improvement, uses the home very differently from the way assumed by BREDEM, the predicted fuel cost savings may not be achieved. In some cases, savings will be lower, while in others they may be greater. This is because the predictions overestimate energy use for light users of energy, but underestimate them for heavy users.

How carbon dioxide emission reductions are predicted

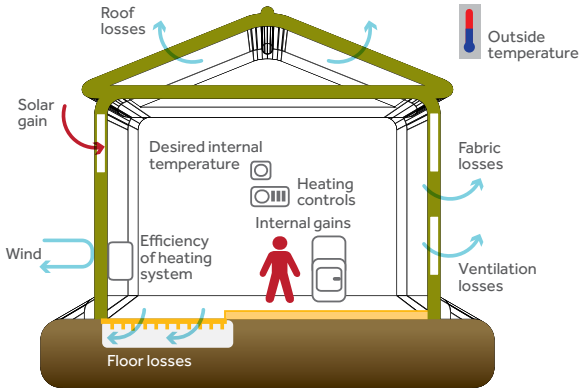
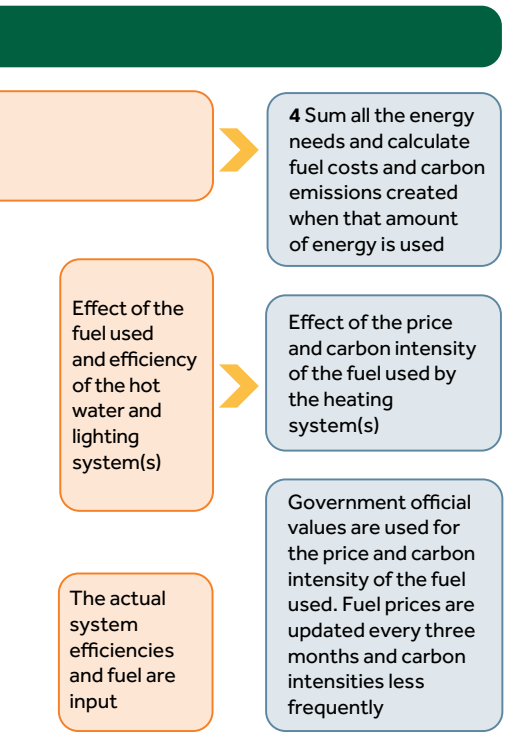


Figure 9.3 The role of the occupant is important.

It is critically important that whenever energy efficiency improvements are made to a home, energy advice should always be part of the project.



Here are some things that residents may do that prevent predicted savings being achieved in practice. Although energy advisors cannot always influence them, it is useful to know what they are:

Under-occupation of the home: BREDEM bases a number of assumptions, such as hot water use, on the floor area and assumes that the property is not under-occupied. It also assumes that the occupier heats all of the home.

Comfort taking: Household preference for lower temperatures and/or shorter heating times: sometimes, but not always, this is due to users self-regulating their access to energy because they cannot afford to pay for it (ie they are in fuel poverty). Where this is the case, improvements to the dwelling may lead to "comfort taking", where the resident spends the same amount on fuel as before the improvement but enjoys a better standard of comfort for the same cost. Even where fuel poverty is not an issue, residents may not achieve the predicted savings due to comfort taking, either deliberate or accidental.

Figure 9.4.1 Hot water cylinder.

BREDEM only allows for a single hot water system (except for electric immersion heater back-up to a solid fuel central heating system). Where the main hot water provision is from an indirect cylinder, with the heat provided by the main central heating boiler, the secondary electric immersion heater is not taken into account. The resident may use this in summer instead of the gas boiler, mistakenly thinking that this will reduce their costs.

Figure 9.4.2 A wireless room thermostat.

As it is not fixed to the wall, this wireless room thermostat is convenient because it is easily installed without the disruption of wiring it in – but this can become a disadvantage if it cannot be found, or is left in a drawer, as was found to have happened when this home was surveyed.

Not using the installed heating controls correctly: This can be because the controls have not been designed with residents in mind, or because they have not been shown how to use them, or perhaps they are just not interested. For more about controls see Section 9.4.

Using the "wrong" heating system: The heating system that the householder uses is not what BREDEM predicted. This can happen where more than one heating system, or hot water system, is present in the property. The latest version of BREDEM allows for two main heating systems and one secondary system, with assumptions about their relative use that may not match their actual use. The resident may sometimes use an inefficient secondary heater rather than use their gas boiler, thinking that this will cost them less.

9.3 Energy advice

What is energy advice?

According to the Energy Advice Providers Group's *Code of Practice for Energy Advice* (see page 11) energy advice is defined as "specific to individuals and their circumstances, and aims to improve energy efficiency and achieve affordable warmth." To avoid giving inappropriate advice, the advisor should reflect what is actually present in the home, ideally by basing it on an energy survey of the home (see Guide 2).

Energy advice can be delivered via a variety of channels (online, by telephone or face to face) and in one of two formats (verbal or written). Research has shown that to be effective, advice should be bespoke rather than generic and delivered via a combination of written and verbal communication. Leaflets or non-interactive websites are not bespoke to the client, so they provide information only, not advice.

The benefits of energy advice

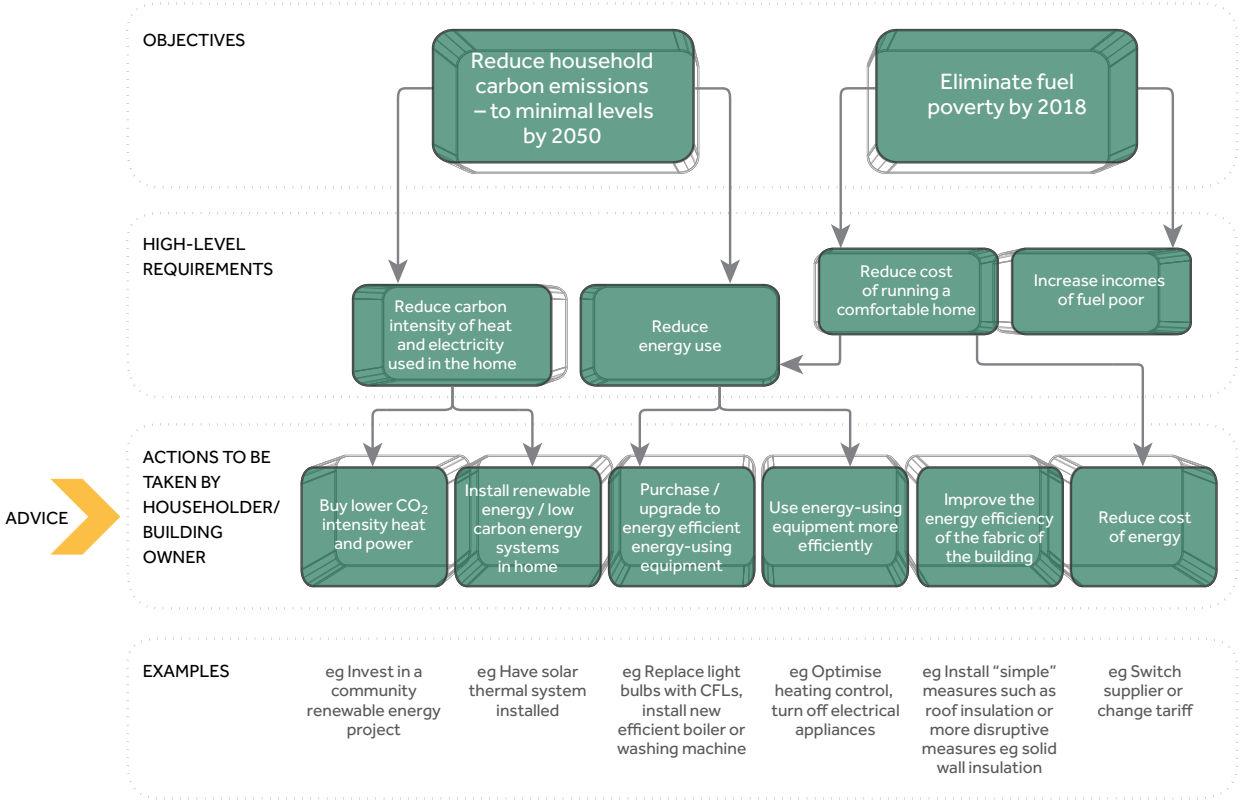


Figure 9.5 The objectives and role of energy advice.

Business Opportunity

All the benefits of energy advice outlined in this section suggest possible markets for a freelance energy advisor, if an appropriate marketing strategy is available.

Some of the results of giving home energy advice are easy to see. Figure 9.5 shows some examples of visible changes that energy advice can promote, and how they contribute to the Government's objectives of achieving their 2050 carbon emissions reduction targets, and their intention to remove fuel poverty, see DECC (2011a). To promote a business providing energy advice, though, the energy advisor needs to be able to demonstrate to potential clients that they will benefit from receiving that advice.

The obvious benefit to residents is that their fuel bills will reduce, and a promise of saving money is known to be a good motivator. A study undertaken by the Energy Advice Providers Group of the Energy Efficiency Partnership for Homes (published as *Energy Conscious Behaviour Saves Money* (2005)) estimated the financial savings from adopting more energy conscious behaviour; unlike installing energy efficiency measures, these savings generally come at no up-front cost to the resident. However, reducing fuel bills is not relevant to everyone (eg teenage children who do not pay the bill; residents with sufficient income, who are not concerned about the bill) and it may be necessary to "sell the sizzle, not the sausage" (see Guide 10). Here are some pointers to some of the other benefits to residents of receiving energy advice.

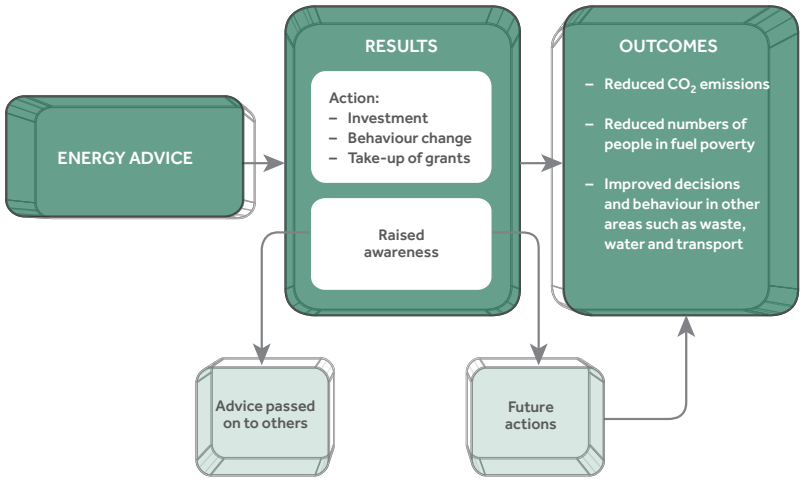


Figure 9.6 Energy advice results and outcomes.
(Adapted from Energy Advice in Europe 2007)

Empowerment and sustainability: With the trend in energy prices ever upwards, many residents feel that their fuel bills are out of control. Good energy advice can give back to residents the feeling that they are in control of their energy bills: this is often referred to as empowerment. For some residents, being in control of their energy use brings with it a further "feel-good factor". That is, they are also controlling their carbon dioxide emissions and therefore contributing to tackling climate change. The residents' raised awareness level can impact on their wider community, as the message that energy advice is a good thing is passed on by word of mouth.

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Business Opportunities

Providing pre-installation advice in return for commission from an installer, eg partnering with a heating engineer.

Providing pre-installation advice as part of a wider improvement scheme, eg for a social landlord or as part of a community scheme funded by an energy company or social housing providers.

Providing pre-installation advice as part of a fuel poverty reduction scheme, eg for a national charity (but note that financial rewards are unlikely to be high unless the contractor is managing the scheme).

Figure 9.7 Solar PV.

Figure 9.8 A blocked flue? (Source: Carl Harvey of My Home Survey Ltd)

Financial reward and community credentials: Residents who have previously had no interest in the energy performance of their home can be inspired to take much more notice of their energy systems – even to the extent of agreeing to install solar PV. There are schemes available that offer a free installation, with the PV owner receiving the Feed in Tariff (FiT), and the resident receiving the free electricity it generates (see Guide A). For able-to-pay households, improvements like PV can be promoted as an investment or as a visible indicator of green credentials.

A healthier home: Unfortunately, residents do not always enjoy excellent living conditions. A visit from a home energy advisor can alert the resident to problems they were not aware of. Where a resident is experiencing difficulties with condensation, which is at best unsightly and ultimately can cause damage to both property and health, the resident can be helped to understand how they are worsening the problem by their behaviour.

Why and when energy advice is needed

Energy advice is needed before carrying out any energy efficiency improvement to a home for many reasons. Critically, it is often needed to encourage residents to make, or agree to, improvements to their homes. Advice can be particularly effective if it is provided at a time when residents are thinking of carrying out other home improvements. It is not just residents who may need energy advice, their landlords may also need it, and advice is also useful after the work is complete.

Figure 9.9 *Energy Advice: A Good Investment*. (Source: Energy Savings Trust)

In other cases, for example where improvements to housing stock are being made by a social landlord, the decision to install measures has already been made. However, the provision of some energy advice at the outset will still benefit both parties. For the landlord, willing tenants mean that the process of the installation work will be eased. After the work is complete, residents are likely to realise the benefits.

In both examples, a major contribution from the energy advisor is to encourage the resident to want to have the measures installed. The ability to encourage a resident to say "yes, please go ahead, where do I sign" is extremely useful!

Good energy advice does not only relate to installing energy efficiency improvements. In a number of situations, especially when advising a private tenant, there will be limited opportunity for installation of physical improvements. In this situation, an energy advisor can help the resident to make best use of the energy-using systems that are already present in their home. Advice on dealing with fuel debt may also be provided.

Figure 9.10 Advice on saving energy when cooking, washing etc. (Source: Energy Efficiency Partnership for Homes [EEPH])

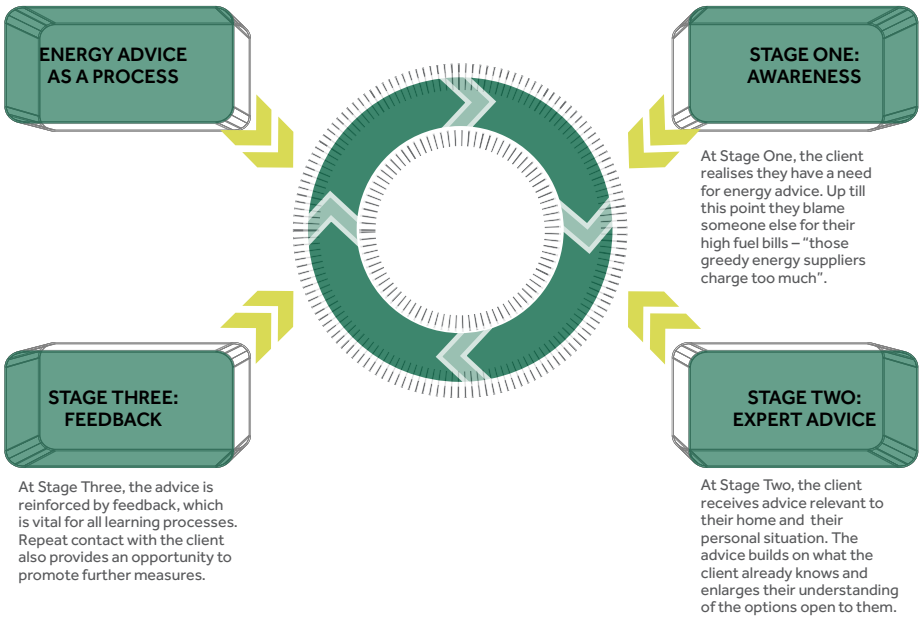

Figure 9.11 Energy advice as a process.

Residents vary in how well engaged they are with energy efficiency, climate change, and green issues in general. They will range from people who do not recognise that they need any advice to clients who already know quite a lot and need specific advice, probably of a more technical nature. There will also be people who believe they know exactly what they need and are now ready to take action and they will need some support to enable them to take this next step. In the standard work on the subject, BOARDMAN & DARBY (2000), the customer journey from knowing nothing about home energy efficiency to becoming fully aware is described in three stages: awareness, expert advice and feedback as shown in Figure 9.11.

Ways of categorising different levels of energy advice	
Level 0: All marketing and information that raises awareness of the need for action	Behaviour change programme
Level 1: Generalised information on how to take action	
Level 2: General advice specific to the home in question – without home visit	
Level 3: Detailed advice specific to home in question – involving home visit	
Level 4: Level 3 plus support to implement actions	

Figure 9.12 Levels of advice.
(Adapted from Severn Wye Energy Agency 2009)

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As not all people are looking for the same thing from energy advice, it can be delivered in a number of ways and at various levels (see Figure 9.12).

Research has shown that behavioural advice is most effective when it is delivered face to face in the resident's home. This type of advice also benefits from being delivered more than once; for example, via a follow-up visit after any work has been completed. The same study also found that the most effective advice for encouraging the installation of measures was a combination of written advice and verbal or telephone contact – either one of them, on their own, was less effective.

Type of advice	Best for	Risks
Written advice tailored to client's needs. Examples include: Advice via an online interactive survey Remotely provided Energy Performance Certificate (no interaction between DEA and client)	Encouragement to install measures	If it is too generic or looks like a leaflet, it may not be recognised as advice. More recent studies into the effectiveness of Energy Performance Certificates have also found that the energy advice they contain is not always seen. See Consumer Focus (2011) and www.nher.co.uk/news/can-we-seize opportunity and Guide 2
Verbal advice – on the phone	Awareness raising	Recipient may believe that no further advice is needed
Verbal advice – face to face at an event or in an advice centre	Awareness raising	Recipient may believe that no further advice is needed
Verbal advice in the client's own home	Operational and behaviour change advice; essential for correct use of controls	Expensive to provide Without written back-up, verbal advice may be soon forgotten
Combination of written and verbal advice	Installing measures, operational advice and behaviour change advice; performs better than either advice type on its own	Giving inappropriate advice, eg to install measures which are already in place, undermines the credibility of other advice given at the same time. Data on the home's current energy performance must be obtained before giving advice to the client, ideally by conducting an energy survey. See Guide 2

Table 9.1 Lessons from research on home energy advice.

Figure 9.13 A trigger point for improvement?

A recent report from the Energy Saving Trust, *Trigger Points – A Convenient Truth: Promoting Energy Efficiency in the Home,* discusses the opportunity to take advantage of trigger points – that is, times when residents could be most receptive to advice on installing home energy efficiency improvements. According to this report, when they are already having work done on their homes, nearly nine in ten residents would be prepared to stretch their home improvement budgets by an average of 10% in order to include some energy saving measures. The important thing is to be there, on the spot, giving advice at the right time to take advantage of this opportunity – due to the timing, this type of advice is often referred to as opportunistic. Although advice that has been requested by the resident is generally most effective at encouraging action, studies have shown that good opportunistic advice can be almost as effective.

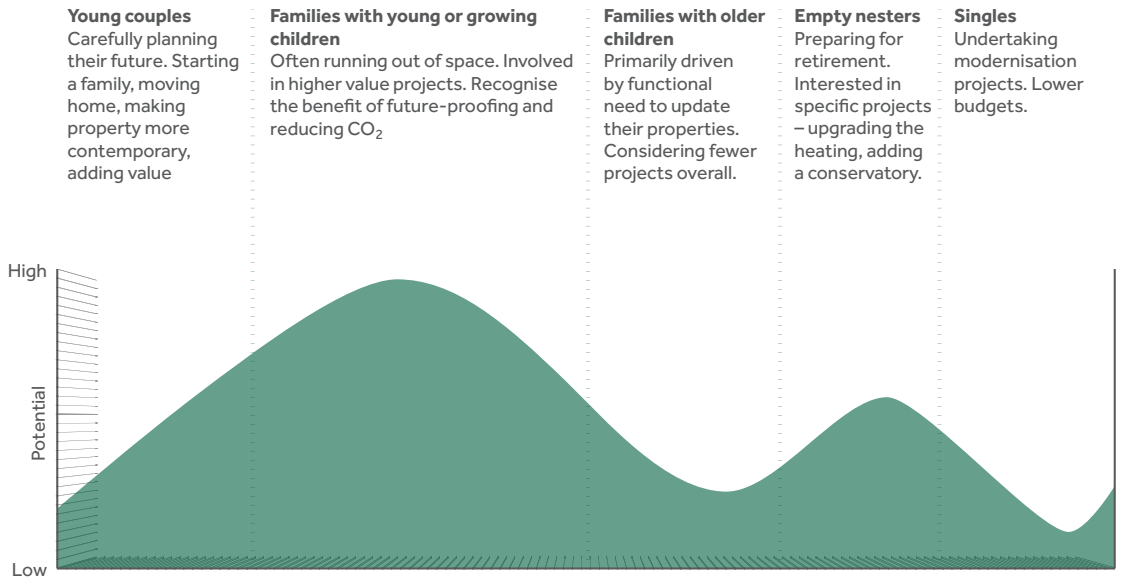

Figure 9.14 Trigger point potential.

Renovating a property, or just a single room, is an obvious trigger point when energy advice can be given. However, there are others, including:

- having a new heating system installed, where the cost of adding insulation may be relatively small
- querying a high fuel bill, when action to reduce energy consumption would mean smaller bills in the future
- moving into a new home, when there is a desire to put one's own stamp on the new property
- starting or expanding a family, when there can be a need for more space
- when the family has grown up and left, and the "empty nesters" have more time and money on their hands
- retirement, when residents generally have more time, but less money, available. This means there is an incentive to reduce heating bills, alongside sufficient time to plan the work.

For more discussion of this, see EST (2011a).

Who receives the advice?

Tenure is highly relevant to the provision of energy advice; not all residents are in a position to act on advice to install physical energy efficiency improvements. However, in all tenures the potential is there to give energy advice on behavioural changes to save energy. Landlords may also benefit from advice on how to access funds for energy efficiency improvements (see Guide 4). The business opportunities listed here are discussed further in Guide 3.

Figure 9.15 Advice to landlords.

Energy advice – the details

The primary purpose of energy advice is to encourage residents to install energy efficiency improvements but there are other benefits that result from the resident's increased awareness of how they relate to energy.

Business Opportunities

All these trigger points provide a possible business model for a freelance energy advisor, if an appropriate marketing strategy is available.

Providing advice to landlords on possible energy efficiency improvements and the financial support available to install them.

Providing advice to tenants on reducing energy costs by adopting more efficient behaviour – in this case, the client is generally a social landlord.

Providing advice on possible energy efficiency improvements to housing stocks – in this case, the client is generally a social landlord. Some private landlords with large stocks may become potential clients in future, especially if the Green Deal is made attractive to them.

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Figure 9.16 A cavity masonry wall that has been filled.

Encouragement to improve the home

To be effective, advice about improvements should not be confined to any one area. For example, advisors should not give advice about insulating a property without also looking at the heating system. In fact, there are opportunities to give much wider advice, even when responding to a very specific request, such as how to set a heating programmer. The resident may welcome the chance to spend more time with their advisor, looking into other energy performance factors relevant to them and their home. They are likely to view this as getting the best out of the time they spend with the advisor, thus adding value to the visit. For more discussion of the retrofit options that may be recommended see Guide 6 and Guide 7.

The Code of Practice for Domestic Energy Advice provides a description of current best practice in energy advice provision (see www.goodenergyadvice.org.uk). According to this code, advice given in the home must be based on individual circumstances and be able to cover at least the following:

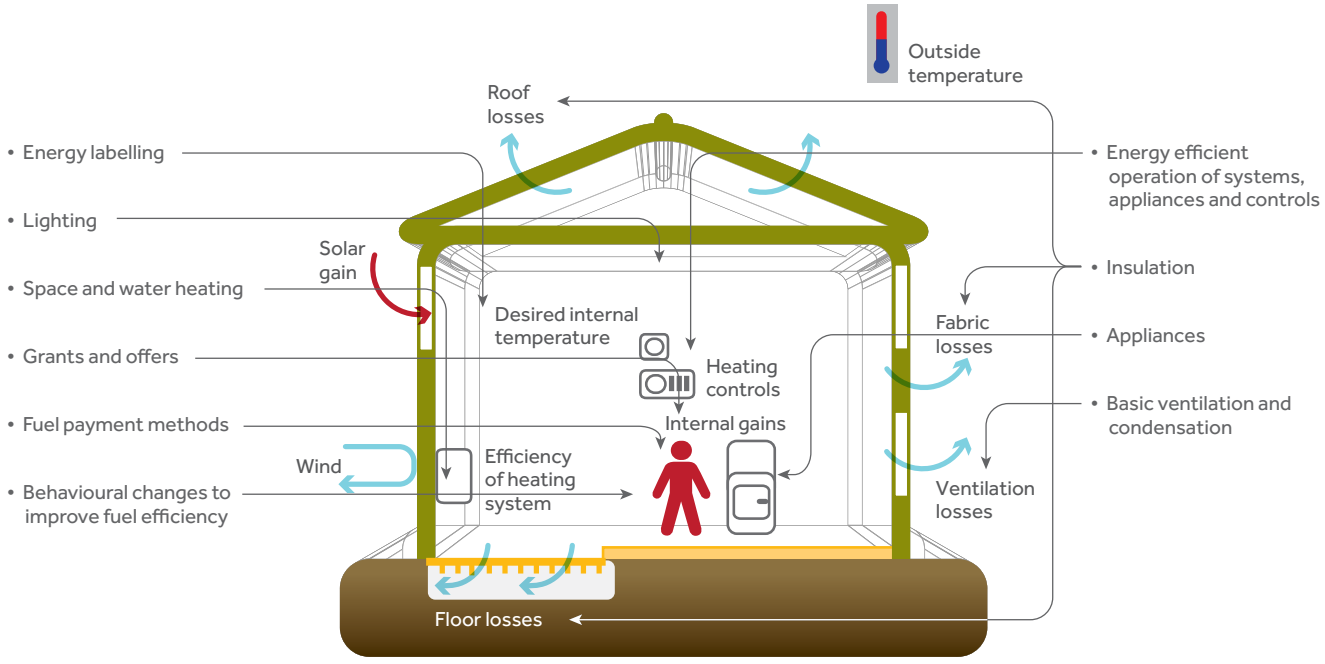

Figure 9.17 BREDEM diagram showing targets for energy advice.

Under the Green Deal, prior to giving energy advice to the resident, the advisor will carry out a full energy survey of the home using a standard procedure (see Guide 2). This is to ensure that appropriate advice is given on the physical measures to install. The advisor will also propose a Green Deal Plan, ie the measures that will be installed using Green Deal finance – see Guide 3, Guide 4 and Guide A. Advisors need to be aware of financial support to residents for installing improvement measures, see Guide 4 and Guide A.

Operational advice

The aim of operational advice is to influence how the resident operates the energy-using appliances and systems in their home so that they use less energy. For residents, this usually means suggestions about operating specific appliances and systems, plus how to read meters (including smart meters and display units) and utility bills. No matter how energy efficient the property is, residents can normally reduce their bills even further by using their installed systems and appliances more efficiently. An energy advisor will generally be expected to be able to give advice on a variety of appliances and systems.

Operational advice

Cold appliances (fridges and freezers) – because these are always on, the amount of energy they use can be quite high. Knowing how to use them effectively will make small but useful savings.

Cooking appliances – there are savings to be made from using an oven more productively, or using a microwave instead of the oven for some tasks.

Wet appliances (washers, dryers and dishwashers) – anything that uses electricity to heat water will be a relatively high user of energy, and knowing how to use these effectively will make some savings.

Consumer electronics (eg set top boxes, TVs, electronic games); residents may not be aware that they are still using energy when they are on standby.

Domestic ICT (eg laptops, printers, mobile phone chargers) – residents may not be aware that they are still using energy when they are left on – printers are particularly heavy users.

Heating systems – for example savings can be made by not using an expensive, inefficient secondary heater instead of more efficient central heating, and closing off a conservatory in cold weather instead of heating it.

Heating controls – where they are installed but not used, they may as well not be present. Some residents believe it is cheaper to leave the heating on all day when they are out, rather than use the central heating programmer. Controls that are not easy to understand are often unused. See Section 9.4.

Hot water systems – the resident may have alternative systems available; when choosing between an electric shower, or a bath using hot water from an efficient gas central heating boiler, do they consider the cost of each?

Fuel meters and bills

Energy supply meters are designed with the supplier in mind, not the resident, and the energy advisor should help residents to overcome this. When meter reading becomes a habit, the resident's actual energy use is immediately visible to them and this usually leads to energy savings. With a record of past energy use, residents become more aware of their consumption patterns, allowing them to note changes due to altered behaviour, new systems, suppliers or tariffs.

Advisors have to be familiar with all types of supply meter, including oil gauges in rural areas; the newly available "smart meters" and meters associated with microgeneration. They also help residents read and understand their energy bills.

Figure 9.18 Electricity meters.

Reducing condensation

Behaviour such as drying clothes outdoors and putting lids on pans will reduce condensation as well as saving energy.

Achievable savings

Operational advice for residents is also referred to as behavioural advice. Research has shown that this type of advice can achieve financial savings of up to £150 a year, which was achieved by residents who followed advice relating to cooking, lighting, heating and other suggestions.

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Figure 9.19 A "smart" meter.

Figure 9.20 A "smart" meter display.

What you paid - thank you

Payment from your bank account 22 Nov 2010 £15.54

Total payments £15.54

Electricity you've used this period

Meter number: E3MFC42127

2 Nov 10 - actual 63749 We read your meter

9 Dec 10 - estimated 63855 Estimated

106.00 kWh used over 36 days (estimated)

First 52 kWh x 22.765p £11.84

Next 54 kWh x 9.879p £5.33

Cost of electricity used this period £17.17

10 Dec 10 - estimated 63855 Estimated at price change

1 Feb 11 - actual 64011 We read your meter

106.00 kWh used over 54 days (actual)

First 107 kWh x 21.769p £23.29

Next 49 kWh x 9.877p £4.74

Cost of electricity used this period £28.03

Total cost of electricity used £45.20

One unit of electricity used = 1 kilowatt hour (kWh)

Your discounts

Dual Fuel £0.81cr

Prompt Pay £1.77cr

Total discounts £2.58cr

To get a large print, talking or braille bill or to join our Home Energy Care register call 0800 072 8625 (Textphone 18001 0800 072 8625)

Electricity Payment Slip British Gas

£ 44.96

Figure 9.21 An electricity bill.

Smart meters generally come with a separate display unit that displays information on the energy being used in the home. These units can also indicate costs and carbon dioxide emissions arising from that energy use. Because they provide a strong visual indication of the cost of energy use, they give instant feedback when an appliance with high energy use is switched on. This feedback allows the resident to be more aware of their own energy use, and motivated to reduce it. One advantage of smart meters is that residents need never receive an estimated bill again.

The Government has recently published its Smart Metering Implementation Programme – see DECC (2011b). There is more information about smart meters on the *Which?* website.

It is not surprising that residents do not always bother to read their bills, as they can appear complex and difficult to understand. Without help from an energy advisor, residents can get into difficulty, especially where they are on a monthly payment budget account and the supplier has estimated their payment inaccurately. Energy advisors need to know how to interpret bills from different energy suppliers, for both gas and electricity, and to help a variety of residents to learn how to do it themselves.

Once residents understand how to read their bills, it can be helpful to compare a resident's current bills with standard values that are typical of similar homes. Residents' bills may be compared with: estimates from a recent Energy Performance Certificate; estimates published by Sutherland Tables (see www.sutherlandtables.co.uk); online sites where residents upload their own consumption (see www.imeasure.org.uk); or bills for other local households, by joining a local energy club.

Lifestyle advice: encouraging behaviour changes that reduce condensation

Poorly insulated homes suffer from low internal surface temperatures, which can lead to condensation when warm moist air inside the dwelling comes into contact with the cold surfaces. Condensation can be an unsightly and even an unhealthy problem. Living in a home affected by severe condensation that has resulted in mould growth has been linked to health problems such as asthma.

Indoor environment

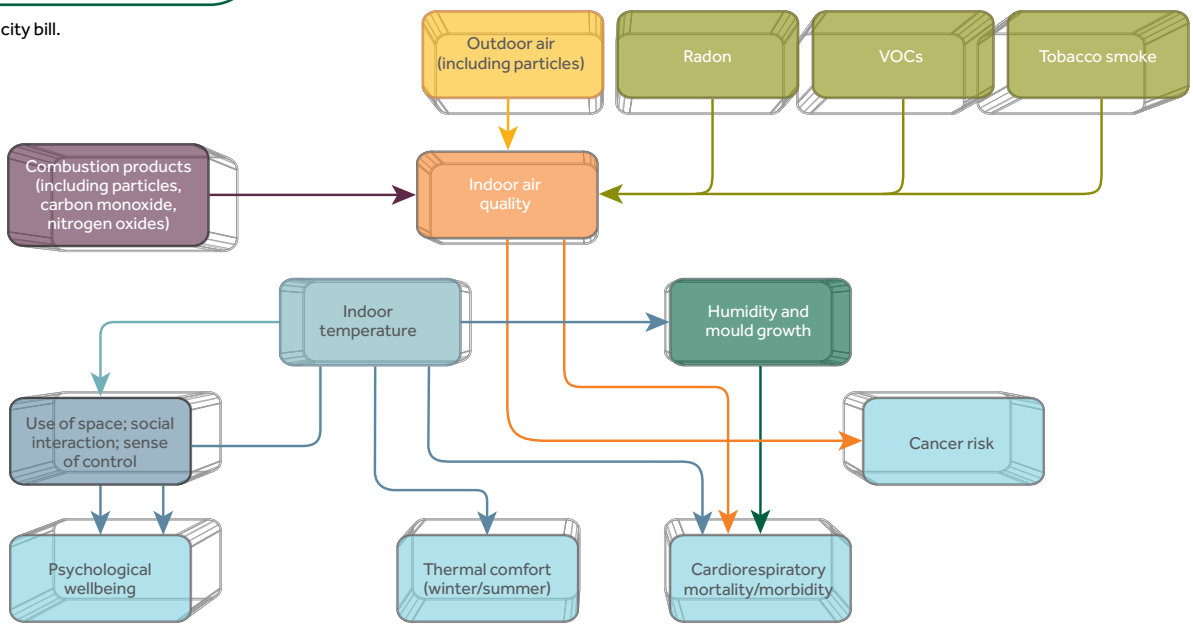

Figure 9.22 Housing and health.

Condensation affects residents' health in many ways. Even when less severe, it can cause damage to decorations and the constant need to mop up can be distressing. Energy advisors can help residents cope with homes that are prone to condensation by advising them how to avoid creating the conditions that promote it.

Figure 9.23 Preventing condensation.

Figure 9.23 shows the three main ways to avoid condensation. Of these, the first and second are within the control of all residents but, for a number of reasons, the third may not be. Residents may not be able to afford to heat their home adequately or install insulation or their landlord may not be willing to insulate.

Lifestyle advice for residents of low carbon homes is covered in Section 9.5 of this guide.

Interpersonal skills and training needs

At present, the provision of Home Energy Advice is poorly regulated. There is no standard minimum qualification for a Home Energy Advisor, and the term is used loosely, sometimes meaning little more than an energy supplier's salesman. This is changing, especially for the Green Deal, where the energy advisor will need to take specific training and become accredited for the work. A good energy advice training course should help you practise the interpersonal skills you need to give operational advice and to help residents make lifestyle changes that can reduce condensation. Less obviously, these skills are also needed when giving advice on physical improvement measures, since the most effective advice takes account of the resident's personal circumstances and lifestyle. For more information on training and accreditation see Guide B.

9.4 The importance of appropriate design and controls

Designing with users in mind

Retrofit design and installation should meet the needs of current and future residents of the home. Design and installation practice should always focus on the end-user – meeting all regulations as well as meeting the residents' needs. It is worth considering the various different tenures that may have an impact on a retrofit provider's ability to engage with the end-user and how they may wish to approach each tenure type.

Business Opportunities

Providing energy advice on behalf of an energy company to their customers. This will include advice on adopting more efficient behaviour, coupled with the promotion of energy efficiency improvement measures offered by the energy company.

Under the new Energy Company Obligation (ECO), energy companies are likely to want to form partnerships with organisations that can provide access to the less able-to-pay sector. As well as providing advice, you would be expected to encourage these clients to participate in the energy company's ECO scheme.

Advisors may also offer services to manage the installation of planned measures (see Guide 5).

Providing post-installation advice following the installation of a smart meter, eg for a social landlord or as part of a scheme funded by an energy company.

Providing lifestyle advice intended to help residents avoid condensation, possibly as part of a health improvement scheme or similar.

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Tenure	Is the customer the end-user?	Suggestions
Owner-occupier	Yes	Arguably the easiest situation in terms of coming to design for the users' needs. At the outset, discuss the requirements of the client in terms of how they will use the home afterwards and, crucially, involve them at each stage throughout the process.
Private rented	No	A more difficult situation, as dealings will be primarily with the landlord who makes the decisions and ultimately pays for the work. However, most landlords are keen to see that their tenants' needs are met by the property and that the dwelling is desirable for tenants to live in. A good approach would be one where the three parties – the contractor, the tenant(s) and the landlord – agree how best to meet the needs of the resident as well as future tenants. In the event that the property is vacant (or void) during the works, the landlord should still have a good idea of the needs of the future tenant and be able to advise accordingly.
Social rented	No	Again, retrofit providers will be dealing primarily with the landlord. However, social landlords will typically have a larger number of properties in their portfolio than private landlords and will likely be approaching retrofit as part of a works programme. Individual, in-depth consultation with the resident is, therefore, often not a practical arrangement.

Table 9.3 Retrofit suggestions for various tenure types.

Control systems

A modern, low carbon home can feature a range of different systems for heating, hot water and ventilation, all of which require effective control.

Basic traditional controls	
	**Description** Carry out a function over the whole dwelling.
	Examples Heating timers/programmers, boiler controls, central main circuit breaker (MCB).
	Benefits Allow standard, simple, uniform control across the home. Generally easy to understand.
	Drawbacks Do not allow for sophisticated management of systems including balancing outputs from different technologies and delivering different climate control for different parts of the home (which is most efficient).
	When to use With simple systems where uniform performance across the dwelling is appropriate or desired (eg hot water set point, setting system on/off times).

Table 9.4 Basic traditional domestic heating controls.

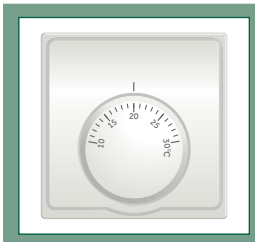
Localised zoned controls	
	**Description** Carry out an independent function for a single room, single output (eg radiator) or a central interface that allows a user to manage the climates of different "zones".
	Examples Room thermostats, thermostatic radiator valves (TRVs), wireless central controls.
	Benefits Allow the user to adjust the settings of individual rooms to meet their different needs. Deliver higher savings than basic controls.
	Drawbacks Depending on the setup and size of property can lead to an excessive number of controls that the resident fails to engage with. Require more education of the resident to ensure best usage.
	When to use Required under latest Building Regulations, and should be used to allow the resident to set different climatic conditions for the main living space and the rest of the home.

Table 9.5 Localised zone controls.

Integrated whole house systems	
	
Description	Carry out multiple functions across a range of technologies, integrating and balancing to manage the whole house services at once.
Examples	Building management systems, wireless smart control systems.
Benefits	Help to integrate various technologies that are being used to do the same job (eg solar thermal and a gas boiler to heat water). Consolidate control points into one central interface. Some models also integrate with lighting and home entertainment systems and can be operated remotely via smartphone.
Drawbacks	Can be seen as complicated for some users. Many interfaces utilise touchscreens and feature several options which could put off users (see Table 9.7). Often an expensive or "premium" option.
When to use	When fitting multiple technologies requiring balancing and integration. For clients seeking a high level of technical engagement with their systems.

Table 9.6 Integrated whole-house control systems.

For a resident to fully enjoy the benefits of a low carbon home, they must understand and engage with the control systems that manage their heating and power systems. However, to be effective control systems must be accessible and intuitive. The following sections look at some of the things to consider when selecting the controls for a retrofit project.

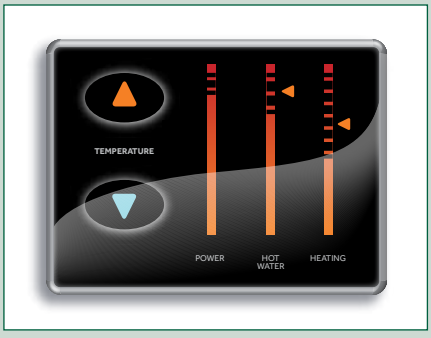
Depth of control	Simple control
	
Benefits	
Allows sophisticated control to maximise performance. Could encourage "tech savvy" residents to engage more deeply with energy saving.	Easy to understand for day-to-day use. Able to engage a broader range of people to enable efficient system use.
Drawbacks	
Could be seen as too complicated. May lead to inefficient use of system and user frustration.	Less likely to achieve absolute maximum performance through user customisation.
BEST FOR	
Those who enjoy gadgets and technology.	Most residents, particularly those less interested in technology.

Table 9.7 Depth of control versus simplicity.

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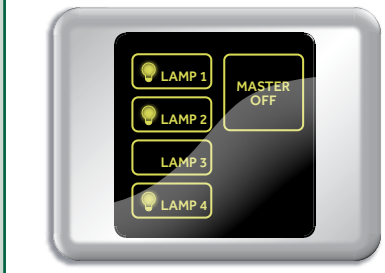
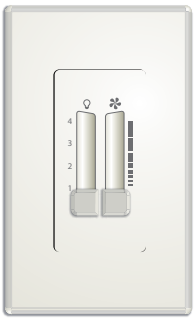
Text	Symbols
	
Benefits	
Potential to convey control information in unambiguous terms.	Convey information about functionality quickly and effectively. Do not require user to be able to read English.
Drawbacks	
Assumes the resident can read English. Can make a control unit look intimidating if there is a lot of text.	Certain functions cannot be effectively conveyed without a reference sheet.
BEST FOR	
Situations where symbols are ineffective or confusing.	Most situations where functionality can be reliably conveyed.

Table 9.8 Text versus symbols.

Procuring controls

The first opportunity to consider with control systems is when procuring the technology to be installed. This stage is vital as with many low carbon technologies the technology defines the control system that can be installed. Therefore, if the available control system is unintelligible or otherwise unsuitable for use, it is important to consider whether the technology is fit for purpose.

For example, a highly performing heat pump, which can only be operated by a confusing, unintuitive set of unlabelled buttons with obscure functions is unlikely to be well understood and operated effectively by most residents. Thus selecting technology based purely on cost and performance specifications does not guarantee a satisfied customer and a highly performing unit.

Siting controls

After choosing the best controls, deciding where to install them is also a crucial step in delivering the best retrofit for customers. Here are some examples of practices to follow and those to avoid when siting controls:

DO **Site controls in the location relevant to their area of control** – eg if the main zone of the heating system is the living room, put the room thermostat in a prominent place in the living room. Similarly, controls for a window or blind should be beside the relevant window.

DO **Site controls near the entrance to their relevant location** – if a user is expected to activate the control upon entering or leaving the room, beside the doorway is an intuitive place (for the user) to site it.

DON'T **Site important controls in a cupboard or secluded location** – while it is tempting to install a heating timer beside a cylinder in a closed cupboard, this can lead to the user being less engaged with the controls and failing to operate the system efficiently. Worse, such cupboards are often used for storage, leading to controls being obstructed by household clutter. A better place for such controls is in a main living space.

DON'T **Site controls in places likely to be obscured by furniture** – this is difficult to assess as residents will use their homes in different ways. However, if possible, observe the way the room was used before the works – it is likely that the resident will want to maintain the same arrangement. Otherwise, try to anticipate the way the space is likely to be used and avoid, for example, positioning ventilation controls in a living room alcove that would be ideal for a bookcase.

9.5 Lifestyle changes for residents of low carbon homes

Introduction

To ensure that the greatest energy efficiency is enjoyed and that the home remains comfortable and well maintained, certain lifestyle changes may be necessary for residents of low carbon homes. It is important to be aware of these when designing a whole-house solution and, later on, when preparing to hand over the retrofitted home.

Ventilation for airtight homes

Many retrofitted properties are made to be more airtight to help retain heat and are, therefore, designed to need lower levels of primary heating. Such homes are typically fitted with mechanical ventilation (often with heat recovery) to keep the air within the home fresh. To ensure that the home performs effectively, residents should ensure that they:

DO Rely on the mechanical ventilation to keep the air in the home fresh.

DO Use heating controls to regulate temperature within the dwelling.

DO Keep the mechanical ventilation on at all times.

DON'T Open windows in winter to ventilate unless absolutely necessary.

DON'T Open windows to regulate temperature in winter.

DON'T Dry clothes indoors unless unavoidable.*

*This can be problematic, particularly for properties with no garden or access to a tumble drier. Drying clothes forces a great deal of water into the air which could lead to condensation and strain the ventilation system. Consult the technical specification of the ventilation system to see whether the proposed system can manage such user behaviour and advise the resident accordingly. See Guide 7 for more discussion of ventilation systems for homes.

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Summer and winter

Getting the most out of a low carbon home requires residents to change their behaviours with the seasons. Figure 9.24 details some key tips for managing the home during the hottest and coldest months of the year:

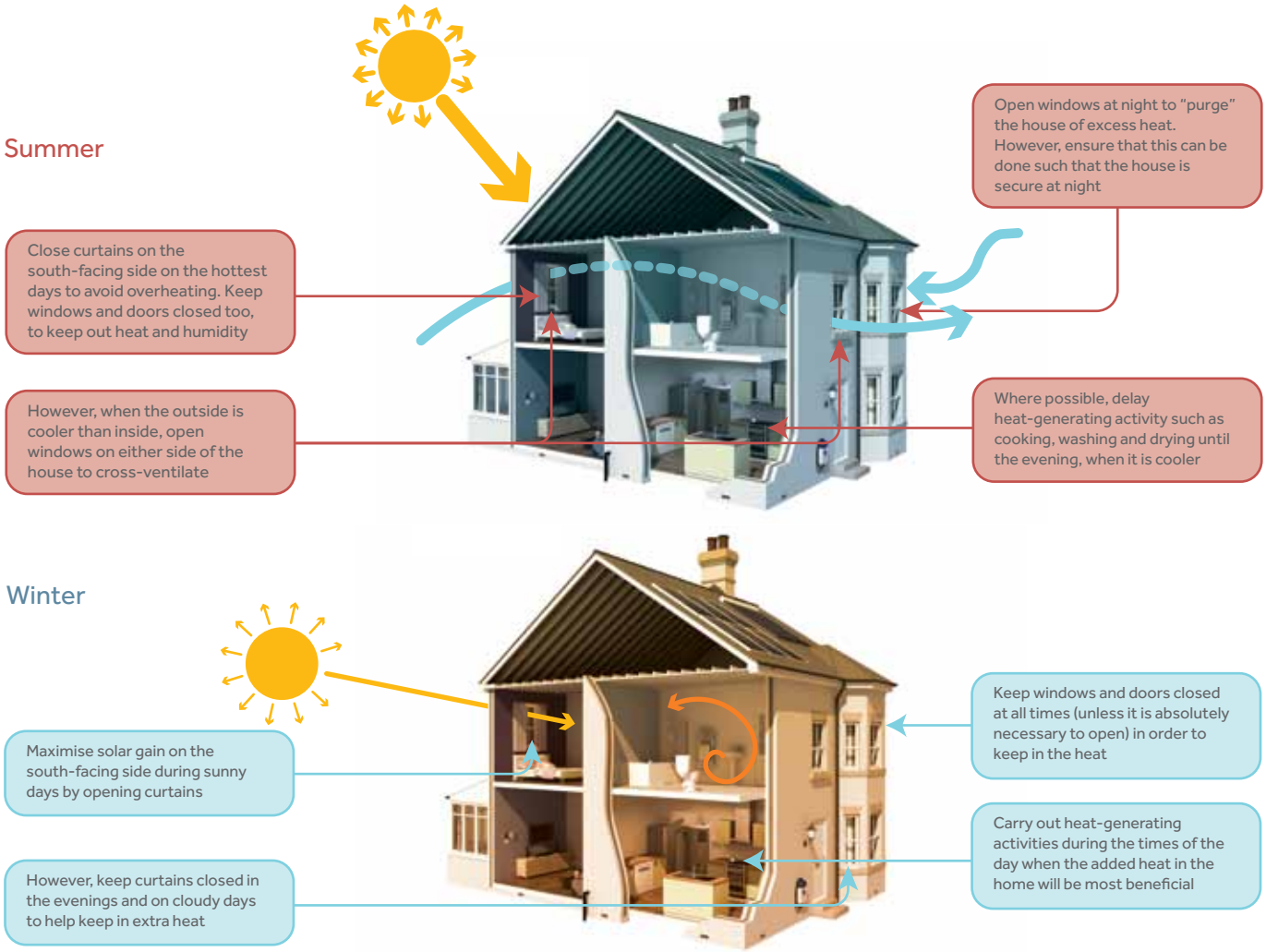

Figure 9.24 Summer and winter operation of a low carbon home.

Further information on keeping warm in winter and cool in summer can be found online, for example, from the Energy Saving Trust or care2.com (see references).

9.6 Summary of business opportunities

This section summarises the business opportunities identified in this guide.

The importance of occupant behaviour

Providing post-installation advice as part of a wider improvement scheme, eg for a social landlord, an energy company funded community scheme such as CESP, or a Green Deal Provider.

Energy advice

Providing pre-installation advice in return for commission from an installer, eg partnering with a heating engineer, or as part of a wider improvement scheme for a social landlord or led by an energy company.

Giving pre-installation advice as part of a fuel poverty reduction scheme, eg for a national charity (but note that financial rewards are unlikely to be high unless the contractor is managing the scheme).

Triggers

All the situations identified in the section on triggers provide a possible business model for a freelance energy advisor, if an appropriate marketing strategy is available.

Who receives the advice?

Providing advice on possible energy efficiency improvements, and specifically on the financial support to install them available to landlords – in this case the client may be a private or a social landlord.

Providing advice to tenants on reducing energy costs by adopting more efficient behaviour – in this case, the client is generally a social landlord.

Providing advice on possible energy efficiency improvements to housing stocks – in this case, the client is generally a social landlord. Some private landlords with large stocks may become potential clients in future, especially if the Green Deal is made attractive to them.

Encouragement to improve the home

Providing energy advice on behalf of an energy company to their customers. This will commonly include advice on adopting more efficient behaviour, coupled with the promotion of energy efficiency improvement measures offered by the energy company.

Under the new Energy Company Obligation (ECO) energy companies are likely to want to form partnerships with organisations that can provide access to the less able-to-pay sector. As well as providing advice, you would be expected to encourage these clients to participate in the energy company's ECO scheme.

Advisors may also offer to manage the installation of planned measures (see Guide 5).

Operational advice

Providing post-installation advice following the installation of a smart meter, eg for a social landlord or as part of a scheme funded by an energy company.

Providing lifestyle advice intended to help residents avoid condensation, possibly as part of a health improvement scheme or similar.

Appropriate design and controls

Designing with the occupant in mind: at every stage of the retrofit process, a focus on the end-user is crucial to a positive customer experience, and a positive customer experience is crucial to helping your business grow through customer recommendations and reputation.

Effective control systems

Specifying retrofits incorporating effective and appropriate controls should: enable customers to easily and intuitively engage with their systems; help customers achieve a level of control that fits with their needs and lifestyles; and enable customers to enjoy the greatest levels of energy savings through effective management of their low carbon home's energy systems.

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Lifestyle changes for residents of low carbon homes

Ensuring you are aware of the lifestyle changes required of residents in completed retrofits ensures that you are best placed to advise them at the design stage and later at handover about how to get the most out of their home.

By ensuring that these messages are effectively understood and conveyed, you can ensure that residents are enjoying the benefits of a low carbon home with minimal chance of unintended problems – such problems that could be perceived as a fault with the installation or your service to the customer.

9.7 Next steps

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Key links

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Sutherland Tables: **www.sutherlandtables.co.uk**

UK Public Health Association Housing Health and Fuel Poverty Forum: **www.warmerhealthyhomes.org.uk**

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Lei Ouyang (Lime Creative)

Proofreading

Rachael Oakley (Byline Publishing)
Catherine Anderson (Byline Publishing)

Technical Support

Kathryn Derby (Rickaby Thompson Associates)

Institute for Sustainability

Contact information:

info@instituteforsustainability.org.uk
www.instituteforsustainability.org.uk

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