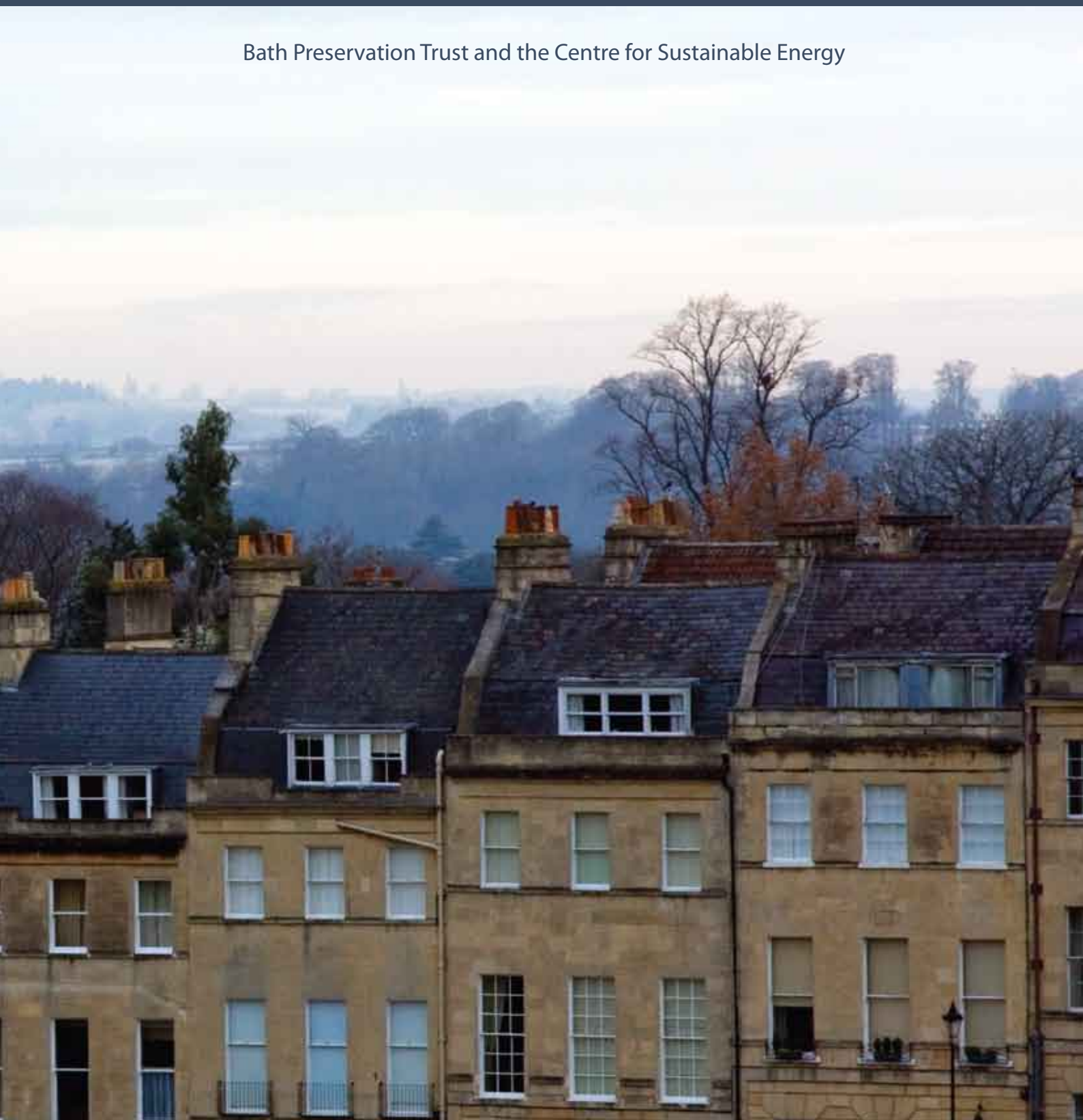
Warmer Bath

A guide to improving the energy efficiency of traditional homes in the city of Bath

Bath Preservation Trust and the Centre for Sustainable Energy



Centre for Sustainable Energy

BATH PRESERVATION TRUST

Warmer Bath: A guide to improving the energy efficiency of traditional homes in the city of Bath

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Foreword

This guidance is the final product of the Low Carbon Bath project, a collaboration between the Bath Preservation Trust and Bristol's Centre for Sustainable Energy. The project was funded by the government's Department for Communities and Local Government.

The project began with a series of workshops and a public meeting which explored local attitudes to preserving the historic environment of Bath and tackling climate change. Workshops were run for people with a strong interest in heritage, people involved in local green groups, building professionals and school pupils.

The workshops made clear that local people are determined both to preserve the character of historic Bath and to make the city fit for a low carbon future. This guidance is a response to this challenge. It has been designed for all owners and occupants of traditional homes in Bath (homes of solid wall construction, typically built before 1919). Thirty per cent of the homes in Bath are of traditional construction but these homes are responsible for about 40% of domestic carbon emissions in the city

The draft Core Strategy published by Bath and North East Somerset Council includes a commitment to developing a local policy on the retrofit of traditional buildings. We welcome this commitment and hope that this guide will assist in the development of the policy. In particular, we present the results of an online survey conducted in early 2011 which sought local views on improving the energy efficiency of listed buildings in Bath. This provides valuable evidence of local attitudes to this important long-term issue for Bath and its residents .

We would like to thank everyone who contributed to this project: the participants in the workshops and public meeting, the respondents to the survey, and the many individuals who advised on the development of the guidance, especially Bill Gething, John Willoughby and Philip Haile.

We would also like to thank the people who welcomed us to their homes in Bath and let us take the many photographs which illustrate this guide.

A note on survey methodology

The survey was conducted between January 13th and February 14th 2011. The link to the survey was published in the Bath Chronicle and sent to the individuals who participated in our workshops, who were encouraged to forward it to others. It was also published on the Bath Preservation Trust website, Bath Watchdog website and in the Centre for Sustainable Energy e-newsletter. Members of Transition Bath and other local groups were encouraged to forward the link to their members.

A total of 246 people responded to the survey. Of these, 158 respondents who said they lived in BA1 or BA2 postal areas completed the survey. The results from this subgroup are reported in this document. The views of the 53 respondents within this subgroup who live in listed buildings in Bath are also reported.

The heat losses through this elegant sash window in the heart of Bath are reduced not only by the shutters (when they are closed) but also by the secondary glazing which sits neatly and discreetly within the window architrave (see page 28)

1. Bath: past, present and future

Bath is one of the most celebrated cities in the world. The beauty of the architecture, clarity of the town planning and consistency of the urban landscape combine to create an exceptional public environment. This environment is an asset which the people of Bath, and the people of the world, are keen to protect.

The special qualities of Bath are appreciated by everyone regardless of age or special interest. At the workshops organised to inform the development of this guidance, participants told us what they valued in the built environment of Bath (see overleaf). Despite their diverse interests, participants' views were remarkably consistent. When asked "How important is it to you to preserve the historic environment of Bath?", 98% said this was important to them.

However, local people also recognise that Bath is part of a changing world, a world in which the problems of climate change and fossil fuel shortages are likely to worsen as the century progresses. They do not wish to sit back and ignore these problems. There is a clear consensus that the fossil-fuel dependent society that we currently take for granted has to change. Among the workshop participants, 91% said that reducing carbon emissions was personally important to them.

The preservation of the built environment of Bath and the creation of a sustainable future for the city need not be in conflict. There are many ways of improving the fabric and use of traditional buildings in Bath without radically changing their appearance or their historic fabric. For example, the renovation and draught-proofing of sash windows significantly reduces heat losses and the use of shutters helps to keep the heat in during the dark evenings of winter, just as the original builders intended.

If, however, we are to plan for a truly low carbon future – the national target is for an 80% reduction in carbon dioxide emissions by 2050 – we will have to go beyond traditional approaches to conserving energy. And this may involve more substantial changes to the buildings of Bath. Some, such as double glazing, can be achieved with minimal visual impact if appropriate materials and products are used. Other measures, such as wall insulation and solar panels, are potentially more disruptive to the look of the city. The challenge is to find the right balance between preservation and change for the many traditional buildings in Bath. 'Re-use' has always been a good environmental maxim, and keeping old buildings in use instead of building new ones is a good example of this, not least because all the energy that went into building them is valued for another generation. But this does not justify leaving buildings exactly as they are. If we want to sustain the traditional buildings of Bath for another two centuries, we must look beyond the energy standards of their Georgian and Victorian builders.

These issues are most acute for listed buildings in Bath, for which listed building consent has to be sought for any changes to the fabric of the building. Currently, the options for conserving energy within these buildings are limited and, as a result, many people in Bath have to cope with homes that are cold and expensive to heat. In our survey, 43% of the respondents who live in listed buildings in Bath said their homes are much colder than they wanted them to be in the winter, compared to only 11% of those who live in unlisted buildings.

Every change to a listed building is always assessed on its individual merits, a principle which provides an exceptional degree of protection for the historic buildings of Bath. However this principle should not inhibit the development of policy on energy improvements. Ultimately, the listed houses of Bath are homes and if they are uninhabitable because the heating costs are too high – one of our survey respondents described struggling to get his indoor temperature above 15C even with the heating on – they become a liability rather than an asset. We must be more innovative in improving these buildings without sacrificing their contribution to the heritage value of the city.

Over the coming decades, energy security will be an ever-pressing issue in Britain, as in the rest of the world. Increasing global demand for fossil fuels, matched by tightening supplies, will inevitably lead to escalating

What local people value in the built environment of Bath

The quality and integrity of the historic city as a whole

The beauty of the buildings, the elegance of the streetscapes and the clarity of the town planning

The consistency, harmony and homogeneity of the architecture, streets and roofscapes

The consistency of the materials and colour palette (Bath stone, slate, wrought iron) and the sensitivity of Bath stone to the changing light across the day

The variety within the uniformity – of periods (Medieval, Georgian and Victorian buildings), street plans (terraces, squares, circuses, crescents), buildings and building details

The grand set pieces of urban architecture

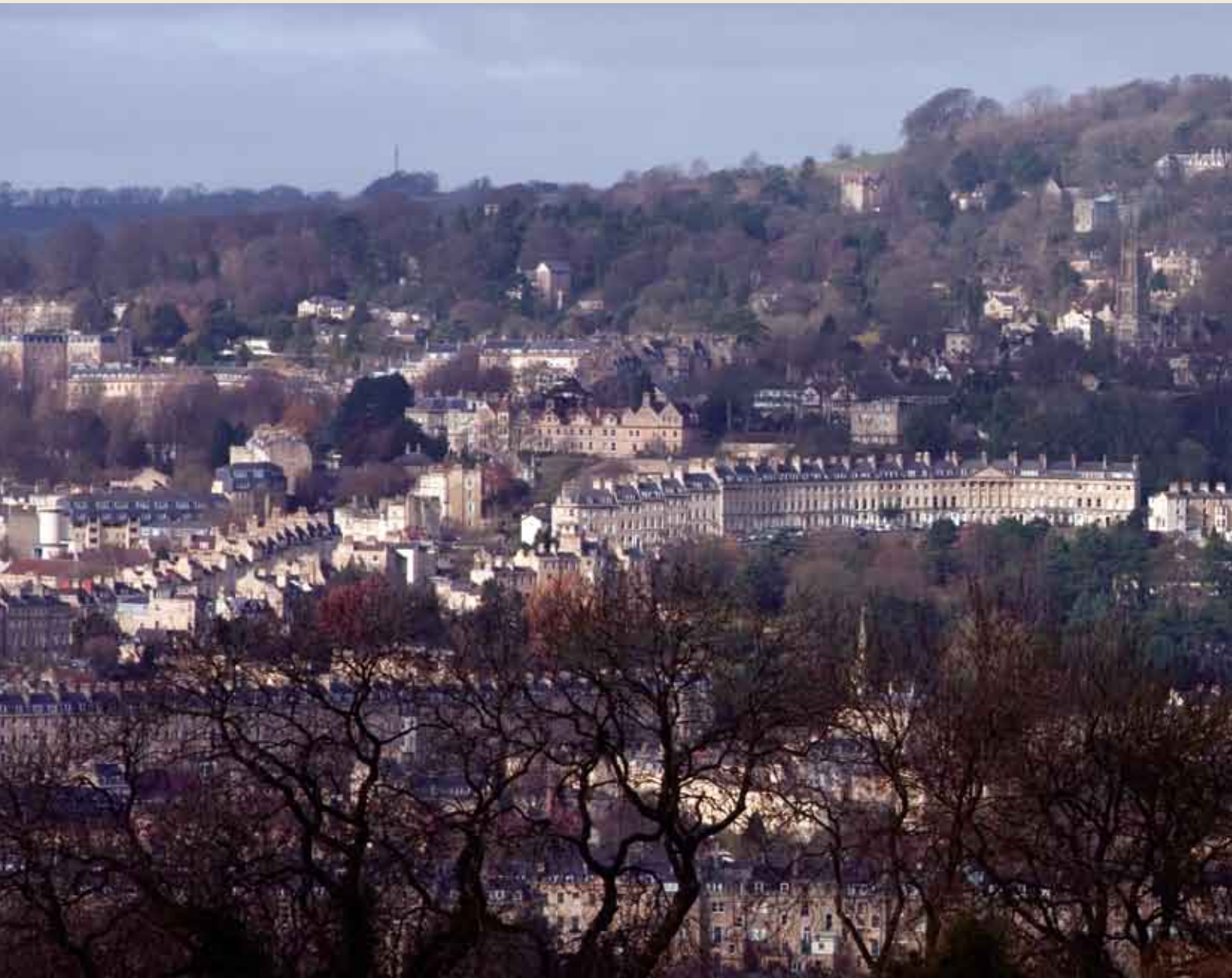
The richness and quality of the building details and street details

The eccentricities and oddities of the buildings and streets: niches, alleyways, hidden courtyards

The scale and proportion of the buildings and the close relationship of the buildings to the spaces between them, which they define and frame

The quality of the original craftsmanship and the evidence of long-term care of the building fabric

The visibility and readability of the history of the city in its buildings and streets



The human scale of the city; a city that can be traversed easily on foot or bicycle and which provides easy access to the surrounding countryside

The relationship between the city and the countryside, including the views out of the city towards the surrounding hills and the views over the city from those hills

The relationship between the built environment and its immediate topography: streets following contours, hills exploited to enable views, buildings and roofscapes made visible by the rising profile of the city

The green spaces within the city, including downs, parks and squares, and the corridors across the city (river, canal, cycle paths)

The river, albeit under-exploited

The industrial heritage

The integration of a living, working city within a protected historic environment

The lively public spaces and streetscapes

The strong community and rich cultural life

The robustness and adaptability of the traditional (especially Georgian) buildings and their long history of reuse

The city's World Heritage Status

prices and more cold homes. Improving the energy performance of our homes today is the best way of preparing for this future.

This document is designed for owners and inhabitants of all traditional buildings in Bath, not just listed buildings (see below). The scope for improving the energy performance of unlisted buildings is much greater than for listed buildings but there are still some planning constraints to consider. This document provides basic guidance on these constraints but it is always worth checking with the Council's planning department if you are unsure of how current policy applies to your property.

The practical guidance in Chapter 4 describes many different interventions from draught-proofing to installing solar panels. However, the improvement of a traditional building – or indeed any building – should always be approached holistically. This means thinking through the full range of possible interventions, considering their combined impacts and working out the most appropriate and cost-effective action plan for the individual building. Chapters 2 and 3 provide some guidance about the issues to think about when making such an assessment for your home.

The traditional buildings of Bath: key types

Georgian townhouses

These terraced townhouses are characterised by Palladian, classical and neoclassical elevations, ranging from palace fronted set pieces, grand streets, architectural sequences and sweeping crescents to simple artisan housing.

The houses are typically constructed from rubble stone, faced with honey coloured Bath ashlar on the primary frontage or street elevation, though many simpler houses are constructed from six inch ashlar without rubble backing. Rear facades are rubble stone, many of which were originally rendered with lime stucco to resemble ashlar.

Houses are normally three storeys with basement and attic. The basement is usually at ground level to avoid excavation and to be dry. Where there are differences in ground level there may be a sub-basement. In front of the house there is an area at basement level separating the house from the street and bridged to reach the entrance. Under the street itself are vaults that belong to individual houses.

The roof is normally a double mansard with an 'M' shape behind the parapet and central valley.

The early 18th century windows have two sashes, each with three by three panes (9 over 9) and 'ovolo' glazing bar profiles. By the 1730s the sash became divided with the three pane wide, two pane high sash (6 over 6) and thinner glazing bars. Four patterns of glazing bars are common in Bath: ovolo, astragal and hollow, keel and lamb's tongue.

By the mid 19th century, window sills were lowered and plate glass inserted to single sashes. Whether or not these windows should be returned to their original appearance is a conservation dilemma.

The use of Bath stone (ashlar or rubble) quarried locally provides uniformity and cohesiveness. Other prevalent traditional materials in the Bath palette include painted cast and wrought iron, lead, natural slates (stone, Welsh, Westmoreland Green, and Delabole), pennant paving, setts, clay double Roman Bridgewater pantiles, cream or red terracotta chimney pots, lime render, timber sash windows, and glass. Lias limestone and ornately patterned brick are less common.

Buildings are characterised by architectural finesse: 'icing on the cake' details which provide an exhibition of ornamental stonework (volutes, columns, capitals, pediments, ramped cornices) and details such as incised street names, delicate wrought iron, and elaborate door knockers.

Internal features of interest include the layout, principal floor 'piano nobile', interior wall surfaces to imply parts of the classical order using joinery mouldings, ornamental plaster work and decorative chimney pieces.

Nineteenth century villas

Nineteenth century villas on the fringes of the Georgian city, developed from the Greek Revival and the ideas of the Picturesque movement, are primarily Italianate in style, although some examples are in the Gothic Revival or castellated style. Key characteristics of the 19th century villa include asymmetrical plan, a varied roofline, emphasised large overhanging eaves, and ideally a corner tower. Bath villas are generally detached or semi-detached substantial properties built within a generous garden. Fundamental to the villa style is the setting

Two atttractive traditional buildings in Bath. Both employ the same materials and palette. But only one is listed.

of the building, and its absorption into its landscape as following the ideas of the Picturesque. As such the view of the building in its setting, alongside the views that can be seen from the building, are essential to the understanding and significance of the villa.

Bath villas generally have emphasis placed upon two of the facades, depending on where it is situated. For example the villas on the north side of Bathwick Hill place design emphasis on the south and west elevations.

As well as a tower, Bath villas frequently have roof terraces and balconies designed to offer occupants specific views of the city or surrounding landscape.

Nineteenth and early twentieth century terraces

These modest two-storey terraced houses were built in areas around growing industries along the river, such as Oldfield Park and Twerton. They are built of natural Bath stone with natural slate or clay tile roofs. Some nineteenth century housing is a mixture of ornately patterned brick, Bath stone and less commonly white lias limestone.

2. Deciding what to do

Where should you start? The answer to this question depends on many things including your budget, the history and character of the building you live in and the current condition of your home. Perhaps the best place to start thinking about these issues is the energy hierarchy. This recommends that you think first about low impact, low cost, energy-saving options and think last about the high impact, high cost, energy-generating options. In the middle there are many possibilities but the key question is always the same: *is there something simpler, less invasive and more cost-effective that I can do first?*

The energy hierarchy

First, reduce your need for energy

This is the simplest and least disruptive level of action but it typically involves some behaviour change which not everyone is willing to do. For example, you could:

- Wear a jumper in the winter and turn the heating down
- Have quick showers instead of long baths (install a high quality aerating shower if necessary)
- Use a clothes airer or washing line and keep the tumble dryer turned off
- Store food in a larder or cool room (if you have one) and keep a smaller fridge
- Turn off the radiators in any room you rarely or never use and shut the door

Second, stop throwing energy away

This is where the big opportunities lie. There is plenty that can be done at zero cost:

- Learn to use your heating controls properly so the heating isn't on when you don't need it
- Close your curtains or shutters in the winter whenever practicable
- Don't boil a kettle full of water for one cup of tea
- Turn appliances off at the wall socket when you don't need them
- Close doors within your home to protect the heat in the rooms where you spend most of your time

For relatively little cost, the following will all deliver significant energy savings:

- Install low energy lighting
- Put an insulating jacket (or two) on your hot water cylinder
- Draught-strip your doors, windows and floors and install chimney balloons
- Line your curtains with thermal interlining or install thermal blinds
- Install seasonal secondary glazing
- Install thermostatic radiator valves so that you can maintain different rooms at different temperatures
- Insulate your loft
- Install energy efficient appliances when your current appliances need replacing

The following options are costly but effective:

- Reinstate your missing shutters
- Insulate your ground floor
- Install an energy efficient boiler
- Upgrade your windows with permanent secondary glazing or new double glazing

This leaves the most expensive and disruptive option:

- Install wall insulation (interior or exterior)

Third, switch to low carbon or renewable energy

The options are limited in a sheltered city such as Bath but you could:

- Install solar thermal (hot water) panels
- Install solar photovoltaic (electric) panels
- Install a wood burner, if you have a good source of fuel
- Install a ground source heat pump

This list is only a basic guide. However it demonstrates

the importance of taking seriously the full range of relatively straightforward energy saving measures before you start spending serious money on more disruptive measures or renewable technology. There are however, other things that come into the equation. If you are planning other home improvements or a full-scale renovation, your priority should be to ensure that you take every opportunity to integrate energy-efficiency measures into your plans.

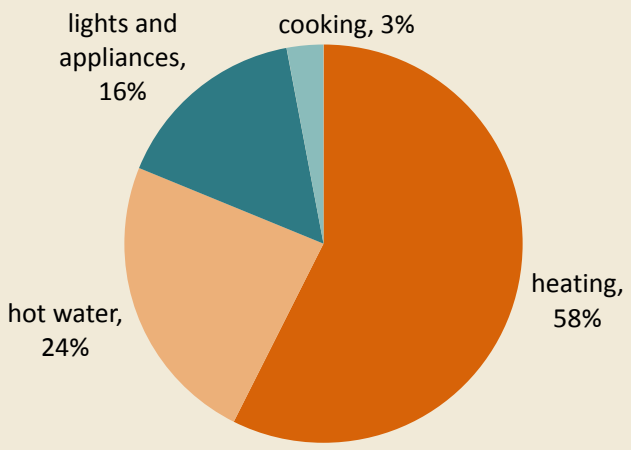
Energy, money and carbon

Most of the energy we burn in our homes is devoted to heating: nearly three fifths in an average home (Figure 1) and considerably more in an unimproved traditional home. This is why energy efficiency measures such as installing draught-proofing and loft insulation can make such a big difference to energy consumption and costs. Heating water accounts for around a quarter of energy consumption, though this is very dependent on the size of the household and how carefully water is used. Lights, appliances and cooking account for less than one fifth of domestic energy consumption.

As the cost of the energy you use depends on the price of the fuel, the relatively thin 'lights and appliances' slice of the energy pie can turn into a much bigger slice of your annual energy bills because electricity is so much more expensive than gas. If you use electricity for heating as well as power, you will be very familiar with its high cost.

Electricity is also more 'carbon intensive' than gas. Compared to burning gas at home, using electricity generates nearly three times the quantity of greenhouse gases. This is because the generation of electricity in distant power stations is so inefficient. Over half the energy is lost in the generation process as waste heat and even more is lost in the transmission of the electricity.

Figure 1. Domestic energy consumption: average UK home (Department of Energy and Climate Change, 2010)



You can buy electricity on a 'green' tariff or from an exclusive supplier of renewable electricity such as Good Energy (www.goodenergy.co.uk) or Ecotricity (www.ecotricity.co.uk). This is easy to do as no physical changes have to be made to the wires that provide your electricity. In fact, you will continue to use exactly the same electricity as you did before but the company will use your payments to put renewable electricity into the Grid to match the amount of electricity you consume.

Even if you are buying from a green supplier, you should do everything you can to reduce your consumption. Renewable electricity is a scarce and precious resource. If you waste it, you will prevent others from using it and force them to use electricity made in coal, gas and nuclear power stations. As long as renewable energy remains scarce (the forseeable future), we should use it with as much care as possible.

Costs and benefits

Your decisions about what to do ought to be informed by a broad assessment of the costs and benefits of action. However, there is no 'magic formula' for doing this because many of the possible costs and benefits cannot be directly compared. Assessing the relative importance of each of the following is ultimately a matter of judgement:

Costs

- Financial costs: capital and installation
- Visual impacts (e.g. solar panels)•
- Fabric impacts (e.g. loss or damage to original features and other historic fabric)
- Impacts on home (e.g. loss of room space due to internal insulation)

Benefits

- Increased warmth and comfort
- Reduced running costs
- Reduced carbon emissions
- Improved quality of life
- Increased resilience to future fuel price rises

Table 1 gives an overview, for a selection of measures, of three key issues: cost, carbon cost effectiveness and disruption. The carbon cost effectiveness is the capital cost of the measure less the fuel cost savings that it will deliver, per tonne of carbon dioxide emission saved, during the lifetime of the measure. Note how poorly the energy generating options perform on this measure compared to the energy saving options.

This table, which is ordered by carbon cost-effectiveness, presents the options in a slightly different order to the energy hierarchy (page 11). This is partly because the energy hierarchy takes some account of the potential impacts of the measures on the look and fabric of traditional buildings in Bath. Although Table 1 has a 'disruption' measure, this is an indication of the

disruption to your home during installation and not of the lasting impacts on the building. This is why external wall insulation, which has a huge impact on the look of a building, is shown as being less disruptive than floor insulation, which is likely to be invisible when complete, because you can continue life inside the home without too much trouble while external wall insulation is being installed.

One way to obtain an overview of the financial costs and savings of different options for improving your property is to use the t-zero website (www.tzero.org.uk), developed by the Association for the Conservation of Energy with partners in the building industry. This site allows you to specify the size and construction of your house and then calculates the cost, savings and carbon savings of a wide variety of improvement options. However, be aware that there are various measures which are not included on this website which we pay considerable attention to in this guide, including secondary glazing, window and shutter renovation, thermal blinds and floor insulation.

Table 1 does not take account of any grants or other government schemes that might help you to reduce your capital costs. Currently there are generous government schemes available for some renewable energy systems. Grants are also available for some types of energy efficiency improvements, though not to all households. Call the Energy Saving Trust helpine to find out exactly what you may be entitled to (see page 71).

Monitoring progress

If you live in an unimproved traditional home in Bath, you will have lots of scope for cutting your energy consumption, bills and carbon emissions. However, before embarking on a programme of improvements, it's worth recording your current energy use so that you can see how much you save.

Bills

The first place to look is your energy bills (if you have kept them) as these will give you a historic record of your energy use. If you have a prepayment meter, you should receive regular statements which record your payments and energy consumption.

Most of us, if we look at our bills at all, look only at the bottom line. But this is no good for recording energy use because cost varies not only with how much we use but also with the price of energy. You need to look at the actual energy figures, recorded in kilowatt-hours (kWh), but ignore any figures with an E (for estimated reading) beside them.

Table 1. The cost, carbon cost-effectiveness and disruption during installation of a selection of home energy improvement measures. Adapted from the Construction Product Association's *Low Carbon Domestic Refurbishment Guide* with permission of the author (see www.constructionproducts.org.uk for more details)

Measure	Cost	Carbon cost-effectiveness	Disruption
Low energy lights	£	☺☺☺☺☺	✸
Draught-proofing	£	☺☺☺☺☺	✸✸✸
Loft insulation	££	☺☺☺☺☺	✸✸
Floor insulation	££	☺☺☺☺☺	✸✸✸✸✸
Internal wall insulation	££££	☺☺☺☺☺	✸✸✸✸✸
External wall insulation	£££££	☺☺☺☺	✸✸✸
Upgrading heating controls	££	☺☺☺	✸✸
Replacement gas boiler	£££	☺☺	✸✸✸
Low energy appliances	£££	☺☺	✸
Replacement windows/doors	££££	☺☺	✸✸✸
Wood pellet boiler	££££	☺☺	✸✸✸✸
Solar hot water panel	£££	☺	✸✸
Micro wind turbine	£££	☺	✸✸
1 kW solar electric panel	££££	☺	✸✸
Air source heat pump	££££	☺	✸✸✸✸
Ground source heat pump	£££££	☺	✸✸✸✸

Key

£	up to £100
££	£100 - £1,000
£££	£1,000 - £5,000
££££	£5,000 - £10,000
£££££	over £10,000
☺☺☺☺☺	pays for itself
☺☺☺☺	< £10/tonne CO2
☺☺☺	£10-£100/tonne CO2
☺☺	£100-£500/tonne CO2
☺	> £500/tonne CO2
✸	you will hardly notice
✸✸	briefly intrusive
✸✸✸	takes longer but you can live with it
✸✸✸✸	very disruptive with installers everywhere
✸✸✸✸✸	you may have to move out

Energy use, especially the fuel we use for heating, is also dependent on the season. So ideally you want bills that will give you a measure of your energy consumption over at least one year. Of course, some winters are colder than others, so year-on-year comparisons are not straightforward. Although you can also adjust for temperature this is probably beyond the enthusiasm of most of us.

Energy feedback monitors

You can get a more immediate indication of your energy use if you install a real-time energy display in your home, though at present these are only available for electricity. The display can be placed anywhere in the home and gives a reading of the amount of energy you are using. When you switch lights or appliances on and off, you can see the immediate effect on your electricity consumption.

Most of the displays on the market will keep track of how much electricity you have used over the past day, week, month or even year. So, over time, you can keep a reasonably accurate record of how much electricity you use each month. This ought to be fairly stable, unless you use electricity for heating or cooling.

Often the installation of one these displays leads to immediate energy savings because people are shocked to find out how much electricity certain appliances actually consume. If you don't know how much power your television, kettle and electric shower consume, this is a great way to find out. Table 2 gives some typical power ratings of domestic appliances. Remember, however, that how much energy you burn over the course of a day depends on how long the appliance is switched on for as well as how much electricity it draws (the power rating). This is reflected in the units of energy on your utility bills: kilowatt-hours (kWh). For example, one kWh of energy is consumed when an appliance with a power rating of one kilowatt (one thousands Watts) is on for one hour, or when a 500W appliance is on for two hours.

Energy feedback monitors can be borrowed free of charge from Bath Central, Keynsham and Midsomer Norton Libraries. If you want to use one for longer than the three week hire period, they can be bought from electrical stores and online, with prices ranging from £20 to £100. They are sometimes provided free by energy companies, so it may be worth giving your provider a call.

Energy auditing

Whenever a house is sold or let to a new tenant, an Energy Performance Certificate must be obtained. This certificate shows the overall energy efficiency of the

There is a wide variety of real-time energy displays on the market. They can also be borrowed from libraries in the Bath area

Table 2. Typical power ratings of domestic appliances. Remember that the amount of energy you consume and pay for depends both on the power rating and on the time the appliance is on and operating at full power.

Appliance	Typical power rating
Electric shower	9000W
Electric oven	4000W
Tumble dryer	4000W
Kettle	3000W
Vacuum cleaner	1200W
Microwave oven	800W
Television	150W
Laptop computer	50W
Low energy light bulb	11W
Radio	3W

dwelling on an A to G rating in the same manner as the familiar labels for fridges and other white goods. The average for the UK housing stock is an E rating. Unimproved traditional homes in Bath are likely to be F or G rated, though a mid-terrace house may achieve an E rating.

You can obtain an Energy Performance Certificate at any time if you are willing to pay for a Domestic Energy Assessor to undertake the necessary survey. As well as the rating, you will also be given an indication of the range of measures that you could undertake to improve the energy efficiency of your home. The cost of obtaining a certificate will depend on the size of your home, but prices start below £100. To find contact details of accredited Domestic Energy Assessors, check the online register at www.epcregister.com.

Although a Domestic Energy Assessor will visit your home and conduct a survey, their recommendations for improvement are produced using a standard software package applicable to all houses. If you are thinking of undertaking substantial improvements to your home, you should ideally seek more detailed, tailored advice from a professional who understands the performance of traditional buildings.

Working together

In Britain, energy has traditionally been the concern of end-users, including households and companies; generation and supply companies; and the government. There has not been much activity in between. But this is now changing: local authorities are playing a more important role in shaping energy policy and community organisations are becoming more active in promoting both energy efficiency and local, sustainable energy supplies.

There are great benefits to be gained from working together to promote a sustainable energy future for Bath. These include:

Reducing costs. Collective purchasing is always cheaper. The price of everything from draught-strip to double-glazing will fall for a bulk order.

Sharing experience, knowledge and skills. Applying standard guidance to real homes is always tricky, especially when those homes are as idiosyncratic as the traditional houses of Bath. Sharing knowledge and experience is an invaluable way of gaining the confidence to take action. Transition Bath (www.transitionbath.org) promotes such collective action in the city.

Comparing outcomes. If you keep a regular record of your energy consumption and compare it to those of others who are also trying to improve their homes and reduce their carbon, you will in time get a better sense of where and how to make a difference. There are websites that are designed to enable this by recording and comparing regular meter readings and sharing tips (e.g. www.imeasure.org.uk and www.thecarbonaccount.com).

Expanding your options. Although a great deal can be done at the level of the individual dwelling to save energy, the options for low carbon or renewable energy supply are limited, especially in a city such as Bath. But if you work with your neighbours, or your community, there are more possibilities. These include larger installations, such as hydro-electric power on the Avon, and more efficient systems, such as district heating (providing piped heat to a neighbourhood). You will also have more financial and human resources to plan and lobby for local low carbon projects. Community-owned renewable energy projects have the potential to provide long-term funding for wider improvement projects for the city. For more details of the options see www.planlocal.org.uk.

The Core Strategy of Bath and North East Somerset Council's new Local Development Framework includes a high level commitment *to encourage and support the increased generation and use of renewable and low carbon energy, including through the delivery of community led schemes* (see page 68).

Sustaining or enhancing the integrity of the city. The homogeneity of Bath is one of its strengths, but this is easily undermined by changes to individual buildings that are not done with due regard to the consistency of the streetscape and the city. If you work with your neighbours, you can potentially define and design improvements that will protect the quality of the streetscape and potentially restore consistency where it has been lost. For example, if a terrace or street of houses has seen a multitude of window replacements over the years, a joint approach to the specification and installation of timber slim-profile double-glazing could restore the original look of the street as well as improving the energy performance of the dwellings.

The River Avon: an endlessly renewable source of untapped energy?

3. The risks of change

In the modern world, we expect a lot from our homes. At the very least, we want shelter, warmth, comfort, light, power, hot and cold water, efficient drainage and decent air quality. The first inhabitants of Bath were just as interested in the quality of their domestic environment but their expectations were undoubtedly different: a home warmed throughout to 20°C would have been unthinkable to Georgian families.

Central heating is just one of many changes we have made to the traditional homes of Bath. We also enjoy bathrooms and showers, gas ovens, tumble dryers, electric lights and digital television. On the whole, the buildings themselves have coped rather well with these changes. They have proved to be robust.

We must, however, take care when planning further changes. Major energy efficiency improvements can have unwanted, and potentially serious, consequences if they are not thought through. Modern interventions need to take account of how old buildings work.

Passive and active design

A well-designed building can provide warmth and comfort without running up huge energy bills and carbon emissions. This is called 'passive' design and is exemplified in modern house-building by the Passive House movement: homes that are so well insulated that they need little more than the rays of the sun and the energy produced by the occupants to stay warm in the winter (see www.passivehouse.com). The opposite extreme is a house that relies on lots of technology – 'active' systems – to provide warmth, cooling and fresh air.

The traditional buildings of Bath combine passive and active features. A glance at the roofscape of Bath makes plain the dependence of the city's traditional homes on active heating systems. The forest of chimney pots may no longer be occluded by the smoke of a thousand open fires but a fossil fuel – gas instead of coal – is still burnt in abundance within the houses below. In the eighteenth

The chimneys of Georgian Bath are idle now but they (and the fireplaces below) were key to the design of the Palladian city

century, the builders of Georgian Bath were quick to exploit the rapidly expanding coal supply, turning their backs on the thermally efficient designs of earlier builders (thick walls, small windows, thatched roofs) in favour of buildings that were elegant before they were warm. John Wood put it succinctly in 1742:

> *In the Progress of these Improvements Thatch'd Coverings were exchang'd to such as were Tiled; low and obscure Lights were turn'd into elegant Sash-Windows; the Houses were rais'd to five and more Stories in Height; and every one was lavish in Ornaments to adorn the Outsides of them, even to Profuseness.*

But passive design was not forgotten. A tall sash window with integrated shutters provides both abundant natural light and, if it faces the sun, valuable heat – as long as the shutters are closed to keep the heat in once the sun has passed. Masonry walls and basements keep interiors cool in the heat of the summer, assisted by the natural ventilation created by sash windows and chimneys. Terraced houses warm each other and have the lowest exposure to the cold of any low-rise building type. A plaster finish on interior walls smothers all the tiny cracks in the masonry through which cold air can penetrate a home.

Perhaps the least obvious but most important passive feature of old buildings is how they cope with moisture and water vapour. All buildings have to cope with moisture: rain from above, striking walls as well as roofs; rising damp from below; and, from within, water vapour from washing, cooking and our very own breathing. Modern homes are designed to repel moisture. Roofs and exterior walls shed the rain, damp proof courses prevent ground moisture from getting into the fabric of the building, and the water vapour produced within homes is removed either through draughts or through mechanical ventilation such as extractor fans. However, condensation is a common problem within modern buildings where ventilation is inadequate.

In one key respect, the traditional homes of Bath deal with moisture in exactly the same way as modern homes: little has changed in the design of roofs in the last 300 years. But the solid walls of these homes behave quite differently to modern walls because they are moisture-permeable: they absorb rather than repel moisture. The permeability of solid walls in Bath varies, depending on the materials used. For example, Bath stone from one quarry may be more or less permeable than stone from another. But, regardless of the specific materials used, the builders assumed that moisture-permeability was not a fundamental problem.

This is not a recipe for damp disaster. For just as these walls absorb moisture, so they sweat it out again. In the

The traditional walls of Bath absorb rain and water vapour but will usually sweat out moisture just as readily

warmth of the summer, the walls dry out, assisted by the movement of air within the home. The draughtiness of traditional buildings helps to keep them dry. When this balance is maintained, the moisture within walls rarely becomes a problem for the inhabitants or the building fabric.

What happens, then, if we make changes to these buildings such that they no longer work in this way? In the worst cases, the results can be disastrous. For example, if you seal the external face of a traditional wall with an impermeable, cement-based render, any moisture inside the wall will be trapped. In time, this can eventually lead to the render cracking and failing. But this result is easily avoided by the use of more appropriate materials. If you use a moisture-permeable lime render, as many of the builders of Georgian Bath did, the moisture will be drawn out of the wall by the action of the sun and wind without causing problems. Similarly, you should use a limewash or moisture-permeable paint when painting a lime-rendered wall.

Identifying and addressing risks

There are always risks in making changes to buildings. But this should not put you off. The question you should ask before undertaking any energy efficiency improvement is simply: *What are the risks and how can they be minimised?* With good design and careful installation, the risks created by moisture and water vapour can be addressed.

For example, draught-proofing will decrease the uncontrolled movement of air that carries water vapour and toxins from your home. This may not cause problems if the building is very draughty to begin with as improvements will reduce, but not eliminate, air movement. If necessary, however, you can complement the removal of uncontrolled air infiltration with the addition of controlled ventilation in places where moisture is generated, such as bathrooms and kitchens (see page 40). This will reduce the humidity inside your home and with it the risks of condensation, moulds and dust mite proliferation (dust mites like warm, humid conditions).

If you install insulation in your loft or beneath your floorboards, it is vital that the cold space in your roof or subfloor remains ventilated to clear the condensation which will now be more common and which may damage joists and rafters. This is a standard and essential part of the design of such insulation retrofits (see pages 41-42).

The most challenging issue is solid wall insulation which should never be installed without a detailed assessment of existing damp problems and the risks of increased condensation within the wall. There are different professional opinions about how to manage these risks but the basic principles are to a) reduce the risk of moisture getting in to the wall, and b) ensure that if moisture does get in, it does not get trapped. Trapped moisture will increase the rate of heat loss through the wall, encourage mould growth and potentially damage the fabric of the building, especially timbers such as joists that are buried in the wall. For more information on these risks and how they can be managed, see the guidance on solid wall insulation (see page 43).

In general, it is good practice to use moisture-permeable materials when renovating or improving traditional buildings. These include natural insulation materials, lime or earth based plasters and lime mortars (for suppliers, see page 74). But this is not a 'golden rule'. It is possible to use impermeable materials such as synthetic insulation as long as the risks of condensation and damp are properly addressed (see case study, page 45).

The differences between traditional and modern construction are important but they can be overstated. In practice, the way in which any traditional building works will always depend not only on its original construction but also on its history and use. For example, many buildings in Bath have had damp courses injected into their walls and, over the years, many houses have accumulated layers of impermeable emulsion paint.

If you live in a traditional house in Bath, its moisture-permeable design may have been long compromised without obvious ill effects. This should not, however, make you complacent: significant changes such as installing wall insulation (of any kind) could turn a minor damp problem into a major one. If you want to enjoy the benefits of making such radical improvements to your home, your first step should be to seek professional advice to identify and address such risks.

4. Practical guidance

This chapter describes the many changes that can be made to traditional homes in Bath to help reduce energy use, improve warmth in the winter and cut carbon emissions.

Some changes are simple and cost nothing, such as ensuring your boiler's heating controller does not turn the heating on when you do not need it. Some are complex and expensive, such as installing solar panels. In between there is a wide variety of options, each with its own costs and benefits. The following topics are covered in this chapter:

- Windows
- Artificial light
- Draught-proofing
- Ventilation
- Insulation
- Appliances
- Heating systems
- Solar energy

Some changes need planning permission, others do not. For those that do not, you may still need to consider Building Regulations and get approval from the Council's Building Control officers. If you live in a listed building, you will need to get listed building consent for some (but not all) of the changes described in this chapter. The guidance indicates where listed building consent and/or planning permission may or may not be needed. However the Council's conservation officers will treat every building on its own merits, so you may find that a change that is acceptable in one building is not approved for another.

The results of our own survey on options for improving local policy on listed buildings are included alongside the guidance about current practice. We hope that the evidence we have obtained contributes to the development of more flexible policy for listed buildings in Bath. However, for now (May 2011), these options for listed buildings remain future possibilities, not current practice.

If you are in any doubt about whether or not planning permission or listed building consent is required for a change you plan to make, seek advice from the Council first. A guide to applying for planning permission and listed building consent is included in Chapter 5.

Definitions

The results of the survey employ the following terms:

historic - a building or building component dating from before the second world war. A window, for example, may be historic even if it is not original, such as a Victorian replacement of a Georgian window.

modern - a building or building component dating from after 1945.

significant - a building component which has special archaeological, architectural, artistic or historic value.

crown glass - this is the glass used in most original Georgian windows, much of which has been lost. *Crown-effect* glass is modern glass designed to have the appearance of crown glass.

*primary and secondary facade*s - A mid-terraced house in Bath only has one primary facade: the front. However, end-terrace or detached houses may have other facades which have the same visual status as the front facade. Secondary facades are the backs and other walls of buildings which are not finished to the same standard as the primary facades (though they may still be visually prominent within the city).

A draught-proofed sash window with thermal blind and curtains looks out over Bath. The garden shed sports a solar panel

Windows

Traditional windows do a great job of bringing daylight into our homes but are rather less brilliant when it comes to keeping the heat in. Although the simplest ways of reducing heat loss involve a sacrifice of daylight, there are also ways of improving the thermal performance of the windows of Bath's traditional homes without making them darker.

Daylight

Daylight brings to our interiors not only illumination but also warmth and delight, a fact that the builders of the eighteenth century were quick to exploit in the distinctive form of the tall sash window. The Victorians developed this design further, bringing yet more daylight into their principal rooms by lowering the sills and using large panes of plate glass instead of small panes divided by glazing bars. Consequently most of the traditional buildings of Bath enjoy good daylight.

If any of your rooms seem dark during the day, do your best to maximise the daylight before you turn the lights on. If you paint internal window sills and window reveals white and use light-coloured finishes on the walls and floors, you will reflect daylight deep into a room and help to illuminate the parts of the room furthest from the windows. This is a relatively easy way to brighten a gloomy room. White became the colour of choice in Bath for this reason, and now off-white is the predominant colour. You should also ensure that your curtains or blinds do not hang in front of the glazing of the windows when they are fully drawn.

Hallways and staircases need to be properly illuminated to be safe but are sometimes the darkest spaces in traditional houses. A roof window may be an option here. Because they face the sky, roof windows provide around three times as much natural light than an ordinary window of equivalent size. However, before installing a roof window, consider the effect of the installation on the building and streetscape. Roof windows are a fairly common sight in Bath but if you live in a street with a particularly consistent look to its roofs, the addition of a roof window could be disruptive. In these circumstances, install the roof window on a valley or back roof rather than on a street-facing roof if at all possible.

White surfaces, bright finishes and splayed window reveals all help to reflect daylight into the room

Heat losses

Windows lose heat both directly through the thin fabric of the glass and through the draughts that whistle through the gaps between the window and its frame. On average, 10% of heat losses are through windows but this figure is likely to be much higher in many traditional terraced houses in Bath which have large windows and no exposed side walls.

Heat losses through traditional windows can be reduced in the following ways:

- Protecting windows with shutters, curtains and blinds
- Renovating and draught-proofing windows
- Installing seasonal or integrated secondary glazing
- Installing double glazing

Replacing windows with new double-glazed units is often presented as the standard upgrade for old windows but this is not necessarily the best option. If you live in a house that has its original windows still in place, you may not want to lose them. If you renovate and draught-proof the windows, install seasonal secondary glazing in the winter months and always close your shutters and curtains, you will keep the heat in just as well at much lower cost.

However, in many traditional houses in Bath the original windows have long disappeared through decay, war damage or previous upgrades. In these circumstances, installing high quality timber double glazing which is sympathetic to the design of the house may be an attractive option.

As so much heat is lost through windows, the best option is always to combine measures. If you do install double glazing, don't forget to close your shutters and curtains when the light falls.

The heat loss through these elegant sash windows in Great Pulteney Street is reduced by the use of shutters and curtains (but only when they are closed)

Shutters

The Georgians loved their windows but felt the heat losses through them as keenly as we do. Their response was to install shutters, a method that remains an excellent means of reducing heat losses in traditional buildings today (though of little value if you are using the room during daylight hours). Closing shutters on an ordinary single-glazed window will cut the heat loss through it by over 50%. Shutters are also valuable in protecting privacy, reducing noise pollution and enhancing security.

If your home has original shutters, make the most of them. Close them as soon as the light falls or earlier if you are not using the room. Shutters take a bit of effort to use well on a daily basis but their adaptability is their strength – you can open and close them as your needs and the light conditions change across the day and the season.

If your shutters have been neglected or painted into their casements, consider bringing them back to life. Their repair and restoration will reduce your heat losses and enhance the character and value of your home. You may need professional help from a carpenter to achieve this. You need to be sure that they operate smoothly and fit snugly.

The reinstatement of shutters that have long since disappeared from your home is inevitably a more expensive process. If you do make this investment, ensure that your new shutters are built to keep the heat in as well as the noise out. Specify tongue and groove junctions between the panels so that the shutters close tightly without gaps to let the draughts through. However even the best shutters cannot keep out the draughts altogether so it is best to draught-proof your windows as well.

To keep the heat in effectively, blinds need to be made of a reasonably heavy material and fit snugly against the window frame.

Curtains and blinds

Like shutters, curtains and blinds can play an important role in keeping the heat in as well as protecting privacy. However their effectiveness depends on the materials used and how well they protect the window.

Heavy curtains will reduce heat losses through a window by around 40%. As far as possible, they should be hung with no gaps around them through which draughts can flow. This is difficult to achieve completely but avoid obvious gaps such as the one between the bottom of curtains and a window sill or floor. Hang the curtains over the sill or ensure the hem of the curtains rests on the sill or floor. Thermal interlining can be added to curtains in order to maximise their insulating effect.

Blinds can be just as effective as curtains, or more so, if they are fitted tightly against or within the window frame. If you want to keep the heat in, avoid blinds with holes in them such as thin fabric or venetian blinds. Insulating blinds with a reflective surface facing outwards can reduce heat losses by over 50%.

Renovating and draught-proofing windows

You may be losing as much heat through the gaps around your windows as you are through the fabric of the window itself. Cutting out these draughts is a relatively straight-forward way of reducing heat losses and improving your comfort within the room.

Many traditional timber windows are draughty and difficult to operate because of the effects of wear and tear over the years, including warping due to moisture movement and the accumulated impact of repainting jobs. If your windows do not fit very well, or are difficult to use, consider having them professionally renovated. Draught-strip can then be fully integrated into the windows as part of the renovation.

Even if your windows do not need renovation, the most effective and discreet draught-proofing systems are those which are professionally installed and integrated into the fabric of the windows. There are, however, DIY options available at lower cost.

Draught-strip comes in many shapes and sizes, so it's important to find the right strip for each job (see page 35). Ideally, you want draught-strip that is the same colour as your window, sits discreetly on or within the frame or on the window itself and provides an effective seal when the window is closed. For casement windows, compression or brush strips can be used at the junction of the window panes or where the edge of the window closes against its frame. For sash windows, brush strips are usually installed around the window and at the horizontal junction of the two panes (see case study opposite).

Case study: draught proofing traditional sash windows

This magnificent Grade II listed house in a village near Bath has never been easy to heat. The many mullioned sash windows have always been a particular problem.

In 2010 the owners embarked on a comprehensive renovation and draught-stripping programme. Each window was, in turn, removed, renovated by a professional joiner and fully draught-proofed before being re-fitted. Although the job took some time, the results has been worth the wait: a much more comfortable and noticably quieter interior.

Even the most well-made and well-preserved Victorian sash windows lose a lot of heat through draughts, especially at weak points such as the junction of the two sashes. Draught-strip closes all these gaps.

The owners are thorough in closing their shutters and curtains at night but appreciate the substantial change the draught-proofing has made.

The work was undertaken by Bath Restoration Ltd (www.restorebath.org).

A the raised lower sash with the junction brush protruding from the upper edge

B when the sash is lowered, this brush seals the junction tight

C the brush on the bottom of the lower sash

D the closed sash hides the brushes on both the bottom edge and the sides

Secondary glazing

The installation of secondary glazing inside your existing windows is an effective way of reducing heat losses in the winter. Unlike shutters and curtains, which are usually open during the daytime, this method is effective 24 hours a day. In the traditional buildings of Bath, the installation of secondary glazing is sometimes preferable to complete window replacement because of the historic importance of the existing windows. Secondary glazing can reduce heat losses through the window by over 50% and will all but eliminate the draughts through your windows. Noise from outside will also be dramatically reduced.

Although secondary glazing preserves the existing windows, it is vital to ensure that there is no visual conflict between the original and secondary glazing. This can happen if the secondary windows have glazing bars that do not align with those of the original windows. Secondary glazing is usually designed with a minimum of glazing bars to avoid this problem.

If you have shutters, you need to ensure that the addition of secondary glazing does not obstruct their use. This typically requires installation within the architrave between the closed shutters and the existing window.

Temporary options

Secondary glazing can be installed on either a temporary (seasonal) or permanent basis. The temporary options tend to be a lot cheaper. The cheapest option of all is a proprietary film, available from DIY stores, that is stretched across the window architrave at the beginning of winter. With the aid of a hair-dryer, this film tightens and sets fast. You have no access to the window but your draughts are completely removed. The film is torn down in spring and replaced anew the following winter.

Another seasonal approach is to use sheets of acrylic plastic, cut to size, with a magnetic edge. These are held in place by discreet plastic carrying strips that are stuck to the window frames using double-sided tape which can be easily removed if need be. Come winter, the plastic sheet is simply held up to the window and locks into place against another magnetic band on the carrying strip (see case study). As with the cling-film, you no longer have access to the window during the winter months, though the sheet can be taken down temporarily if need be.

Secondary glazing of this kind can be almost invisible if installed with care and is entirely reversible. Furthermore, as the carrying strips sit within the window architraves, there is no conflict with shutters which can still be used as normal. It is an extremely low cost way of cutting out draughts and reducing heat losses in the winter.

Integrated secondary glazing

Secondary glazing can also be installed on a semi-permanent, integrated basis. Although this is more expensive, as it effectively involves the specification of a new set of interior made-to-measure windows, it is much more durable than the temporary, seasonal options and will also be more effective in cutting heat losses. Ideally, use timber, slim-profile double-glazing (see below) for the secondary unit as this will dramatically reduce your heat losses. If you do, adopt the specification outlined below for low emissivity coatings, gas-fill and warm edge details.

If secondary glazing is to stay in place throughout the year, it must be openable to allow summer access to the original windows. This is normally achieved by dividing the window into two panels and allowing one panel to open. The glazing bar between the two panels should align with the centre bar of the original window. In the winter, it is best to keep the secondary glazing fully closed to minimise heat losses and reduce the risk of condensation on the primary window.

Double glazing

Many people prefer double glazing to secondary glazing because the end result is simpler and easier to use. Arguably good quality double glazing also looks better, at least from the inside. Like secondary glazing, new double glazed windows will reduce heat losses through the window by over 50% and will all but eliminate the draughts.

The downside is the loss of the existing windows. However even this can now be avoided, at a cost. The following range of options is now available, starting with the least expensive:

- uPVC double-glazed replacement windows
- standard timber double-glazed replacement windows
- slim-profile timber double-glazed replacement windows
- slim-profile double-glazed panes installed in original windows

Plastic double glazing is not recommended. In fact, it is actively discouraged! If you are replacing timber windows, timber is the obvious choice for the replacement. In all traditional buildings in Bath, timber windows will be more in keeping with the building – and probably the street – and with proper maintenance they are likely to last much longer than plastic windows. Timber windows in Bath have survived for over two centuries.

Timber is also an environmentally-friendly material which locks up carbon for generations, whereas plastic windows are made from non-renewable petroleum products and generate environmental pollution during their manufacture and disposal. The very best ecological choice is a window made from timber from a forest that is certified as being well-managed (look for Forest Stewardship Council certification).

There are many different designs of timber double-glazed window to choose from. Ideally, you should match the glazing pattern of the original windows as far as possible, especially for prominent street-facing windows. If your windows are not original, this may be a good opportunity to return the windows to their original pattern. For example, traditional sash windows in the Georgian buildings of Bath usually have six small panes (or 'lights') in each sash, separated by narrow glazing bars. In many traditional buildings these have been replaced with single panes of glass, interrupting the rhythm of the glazing pattern across the facade of the building and the street.

Most double glazing has a deep gap (up to 24mm) between the two panes of glass. However this requires deeper glazing bars than those of traditional windows. Slim-profile double glazing has a much smaller gap between the panes, typically 3-6mm deep. Although this is slightly less effective in reducing heat losses, it allows the exact dimensions of the original glazing bars to be retained. However, new slim-profile double-glazed timber windows are likely to weigh more than the single-glazed windows they are replacing. If this is the case, and you have sash windows, you may need to replace the weights as well the windows.

Slim-profile double glazing is also used for the replacement of individual lights in sash windows. This is not straightforward, as the sashes have to be removed and taken to a workshop for the panes to be replaced, but it ensures that the original windows are preserved for another generation. It is even possible to specify glass for the outer panes that has the appearance of traditional crown glass. The Sash Window Consultancy, based in Bath, offers this service (see page 74). However some original windows in Bath may have such narrow glazing bars that even this option may not be practical.

For any double glazing, specify the following:

- a low-e (low emissivity) coating facing outwards on the inner pane, to reduce radiative heat losses;
- a gas fill (argon or ideally krypton) between the panes, to reduce convective heat losses between the panes;
- a 'warm edge' (the material between the panes), to reduce conductive heat losses.

Planning and building control

Listed buildings

If you live in a listed building, you must seek listed building consent if you want to install a roof window. This is because roof windows can damage historic building fabric, if the roof is original, or change the character and appearance of the building, particularly if the window is installed on a visible roof. Proposals that demonstrate limited impact on 'significance' – the architectural, historic, artistic, archaeological or evidential interest of the building – would normally be granted consent.

Timber slim-profile double glazing is hard to spot. It is ideal for most traditional homes in Bath.

You will need to obtain listed building consent to reinstate missing shutters but this is likely to be approved as long as the reinstatement is sympathetic to the design and materials of the window.

Done well, draught-strip ought to be all but invisible when installed on traditional windows. Nonetheless, listed building consent is normally required for any draught proofing which has a visual or physical impact on the window. For most listed buildings it is likely that an application for discreet means of draught-proofing will be treated favourably. However, consent may not be granted for historic windows in highly sensitive locations. Like-for-like renovations or minor alterations to parting beads to improve the fit of a window do not normally require consent.

Temporary, seasonal solutions to secondary glazing do not need listed building consent because they do not result in any permanent change to the character of the building, are easily reversed and have no impact on the fabric of the original window.

The introduction of integrated, fixed secondary glazing does need listed building consent. To improve your chances of gaining this consent:

- ensure that the proposed secondary glazing will not interfere with the use of shutters, if you have them
- ensure that the design is as discreet as possible and has minimum visual impact on the existing window, including careful alignment of glazing bars
- ensure that any distinctive architectural details of the existing architrave are not disguised by the frame of the secondary glazing
- minimise the number of permanent fixings required to secure the new frame

Case study: seasonal secondary glazing in a Grade I Georgian house in Bath

All the windows in this house in the centre of Bath have lightweight plastic secondary glazing installed in the winter. In the spring, when the house no longer needs heating, the panels are removed in order to open the windows.

The glazing is extremely discreet and has minimal visual impact from the inside and none from the outside. The panels are held in place by simple L-shaped plastic carrying strips that sit within the window architraves. This does not interfere with the shutters which are used every day.

The windows themselves were renovated by a joiner when the current owners first bought the house. Basic draught-proofing was also added at this time.

This combination of measures, plus curtains, means that despite the original single-glazed windows still being in place, this is one of the warmest and most draught-free traditional homes in Bath.

To install this cheap and effective secondary glazing, follow the following steps:

1. Prepare the existing window beads. Fix any faults, and sand and repaint if the surfaces are not smooth.

2. Buy enough carrying strip to provide for all your windows. You will need L-shaped strip for the staff bead to carry the edges of the windows. However, for larger windows you may need two secondary panes rather than one. At the point where they meet, such as the mid-point of a double sash, you will need a T-shaped strip to carry the upper edge of the bottom pane and the lower edge of the top pane.

3. Cut the strip to size and line the face against which the window will sit with self-adhesive magnetic strip. Use a white strip so that it does not stand out against the window frame (assuming this is also white).

4. Ensure strips and beads are clean and install all the carrying strip on the beads using double-sided tape.

5. With the carrying strips in place, carefully measure up the size of every new secondary pane. These should then be ordered as made-to-measure items.

6. When the plastic panes arive, carefully attach self-adhesive magnetic strip to the edges. To make a neat finish, a 20mm white steel tape can be run around the perimeter of the perspex to hide the back of the sticky magnetic tape. This metal strip can then be painted the colour of the window woodwork if necessary.

The pane of secondary glazing on the inside of this window is barely noticeable. It sits within the window architrave against a carrying strip that is the same colour as the architrave and window.

7. You can now put the windows in place by dropping them into the carriers that you have already installed. The Perspex will attract some dirt when first fitted as it is initially electrostatically charged but this charge will go when it is next cleaned.

8. A special tool can be used to grip the plastic panes when you want to remove them in the spring.

Suppliers

L-shaped plastic carrying strip (20mm x20mm x3mm): MKM Extrusions (www.mkmplastics.com); code no. A20203W; 25 3metre lengths will be enough for 10 average windows.

Double-sided clear very high bond tape: Tapes Direct (www.tapes-direct.co.uk); a single 19mm x 0.25mm x 33metre roll will be enough for 5 average windows.

Magnetic secondary glazing kit comprising white steel tape and white backed TESA magnetic tape: Magnetik (www.magnetik.co.uk); 2 rolls will be enough for 4-5 average windows.

Made-to-measure Perspex cast clear sheeting: The Plastic Shop (www.theplasticshop.co.uk); 3mm or 4mm thick according to how rigid and efficient you want the secondary glazing (in this case study 3mm panes were used where there were two sections, 4mm panes were used for single large panes).

You will also need a litre bottle of isopropyl alcohol or Halfords glass cleaner to clean all the surfaces prior to applying any of the sticky tapes.

Suction pads: Coopers of Stortford (www.coopersofstortford.co.uk)

Above: two panes of secondary glazing are used for this double sash window. Top and bottom: the corners of the secondary glazing can be seen, held in place by the L-shaped carrying strip that adheres to the bead of the original window. Middle: a T-shaped carrying stip stuck to the top of the front sash holds the top edge of the bottom pane and the bottom edge of the top pane. Left: this window, being removed, has only one undivided secondary pane.

Timber double glazing is generally only permitted in listed buildings in Bath where the window being replaced is itself a modern replacement. Conservation officers will usually specify timber slim-profile double glazing with glazing bars matching the original window design. However, double glazing may not be approved even for a replacement window if there is a perceived detrimental impact on the significance of the building or the character of the street.

Many of the original windows of the listed buildings of Bath have been replaced over time, often with inappropriate plastic, metal and poorly specified timber windows. If you inherit such windows, conservation officers are likely to support your efforts to improve the building by installing more suitable replica windows (unless the inappropriate windows were originally installed by you).

If you have good quality modern replica windows which are single-glazed, you may get consent to have their individual lights replaced with slim-profile double-glazing. You are unlikely to obtain consent to use this method with original windows.

Timber slim-profile double-glazing in the 20th century extension to St John's Hospital

Other traditional buildings

Replacement windows are usually a 'permitted development' for unlisted houses in the World Heritage Site provided that the materials are 'similar in appearance to those used in the construction of the exterior'.

Roof windows can be installed provided that the work does not extend above the highest part of the roof. Planning permission is required for any roof window that would extend beyond the plane of the roof slope of the property's principal, road-facing, elevation. Low profile roof windows which sit flush with the roof are a good choice as they limit the visual impact of the windows.

Planning permission is also required for clear glazed windows in 'side walls or side roof slopes'. This is a 'permitted development' if obscured glass is used. Seek advice if you are not sure if your roof meets this description.

Building regulations

Replacing windows in dwellings is exempt from Building Regulation approval provided the installation is carried out by an installer registered with FENSA Ltd, BM Trada Certification Ltd, the British Standards Institution, CERTASS Ltd or Network VEKA Ltd for work of this kind. If this work is carried out by an installer not registered with one of these organisations then a Building Regulation application should be submitted.

Replacement windows should have a U-value of no worse than 1.6 W/m^{2}K (a U-value is a measure of the rate of energy loss, in Watts, through a material – the lower the U-value, the better). Where meeting these requirements would adversely affect the character of the building any replacement windows should meet a centre pane U-value of 1.2W/m^{2}K or alternatively the single glazing should have a layer of secondary glazing installed behind.

If the proposed work is only to replace a pane of glass in the existing frame, rather than to replace the entire window, Building Regulation approval is not required.

You need to obtain Building Regulations approval from the Council's Building Control department if you want to install a roof window and this involves the cutting of roof rafters or ceiling joists.

PRESSING FOR CHANGE

Local views on improving windows in listed buildings in Bath

The following results describe the extent to which Bath residents who responded to our online survey agreed with the given policy options for listed buildings. *These results do not describe current Council policy*.

Secondary glazing

A majority of Bath respondents supported the use of secondary glazing in listed buildings in the city, even where this has an impact on historic fabric.

59% The use of secondary glazing should be permitted in all listed buildings in Bath.

37% The use of secondary glazing should be permitted in any listed building in Bath where there is no permanent impact on historic fabric.

4% None of the above.

Among respondents who live in listed buildings in Bath, 57% supported the first of these options.

Bath Preservation Trust position

The Trust supports the use of secondary glazing in listed buildings in Bath where this has no permanent impact on historic fabric.

Double glazing (replacement windows)

Seventy-one percent of Bath respondents supported a more permissive policy on the use of timber slim-profile double-glazed windows in the listed buildings in the city, though some wish to continue to protect significant historic windows on principal facades.

42% The replacement of windows with timber slim-profile double-glazing should be permitted in all listed buildings in Bath.

29% The replacement of windows with timber slim-profile double-glazing should be permitted in all listed buildings in Bath except for significant historic windows on principal facades.

24% The replacement of windows with timber slim-profile double-glazing should be permitted in all listed buildings in Bath where the window being replaced is itself a modern window or the original window is beyond repair.

6% None of the above.*

Among respondents who live in listed buildings in Bath, 34% supported the universal use of slim-profile double-glazing in listed buildings in Bath and a further 34% supported this position except for significant historic windows on principal facades.

Bath Preservation Trust position

The Trust supports the replacement of windows with timber slim-profile double-glazing in listed buildings in Bath except for significant historic windows on principal facades.

Double-glazing: replacement panes in existing windows

A majority of Bath respondents supported the replacement of the individual panes of windows of listed buildings with double-glazed panes, with crown-effect glass used for the outer pane where historic crown glass will be lost.

56% The replacement of individual glass panes in significant windows with slim-profile double-glazing should be permitted for all listed buildings in Bath, with crown-effect glass used for the outer pane where historic crown glass will be lost.

38% The replacement of individual glass panes in significant windows with slim-profile double-glazing should be permitted for any listed building in Bath where historic crown glass will not be lost.

3% The replacement of individual glass panes in significant windows with slim-profile double-glazing should not be permitted in any listed building in Bath.

3% None of the above.

Among residents who live in listed buildings, 53% support the first of these options.

Bath Preservation Trust position

The Trust supports the replacement of individual glass panes in significant windows with slim-profile double-glazing in all listed buildings in Bath except where historic crown glass is still in place.

* Results do not always sum to 100% due to rounding.

Artificial light

The efforts of the Georgians and Victorians to bring daylight into their homes were in part a response to the poverty of the artificial light available to them. Oil lamps, candles and open fires were the only choices for the residents of Bath until the introduction of gas light in the nineteenth century and eventually electric light after World War I. Since then we have become used to living in brightly lit interiors and have, arguably, become lazy in our use of artificial light because of its very abundance. Reducing the energy we use to light our homes is therefore a matter not only of the technology we use but also the care we take in designing and using interior lighting.

Lighting design

The interior of a traditional home in Bath will not necessarily look at its best if it is comprehensively and consistently lit. Shadows can be as important as the lighting itself in defining the quality of an illuminated interior. There are only a few places within the home that must be brightly lit, such as desks and kitchen surfaces.

Lighting designers typically divide interior lights into three categories: task, feature and ambient lighting. Task lighting is trained on areas where specific activities are undertaken, such as food preparation or reading. Feature lighting is used either as a feature in itself or to illuminate features in a room which give it special character, such as pictures or architectural details. Ambient lighting provides the necessary background lighting to enable people to move around the room freely.

Every room does not need all three types of lighting. These categories are simply a guide to help you think about your use of lighting and to consider whether you could get a better result for less light. The most important time to think about this is during a major renovation. If you don't specify this carefully, you risk ending up with the standard approach in modern renovations: banks of ceiling recessed downlighters smothering the room with flat, energy-guzzling light.

Low energy lighting

The tungsten filament electric bulb has changed little since its invention by Thomas Edison over 100 years ago. It is notoriously inefficient because most of the electricity

A central ceiling lamp provides limited ambient light. However the goal of comprehensive illumination should perhaps be resisted: 'Our ancestors, forced to live in dark rooms, presently came to discover beauty in shadows, ultimately to guide shadows towards beauty's ends.' (Junichiro Tanizaki, In Praise of Shadows)

Compact fluorescent bulbs come in all shapes and sizes including ceiling-recessed downlighters

used to power it turns into heat not light. These bulbs are being phased out within the European Union but they remain popular because of the warmth of their light. In contrast, fluorescent tubes have a reputation for producing a cold blue light which is not attractive in domestic interiors. Happily, the lighting industry has responded to these problems and it is now possible to buy low energy bulbs that produce a warm light.

Although low energy bulbs are often more expensive than old-fashioned tungsten bulbs, they last a great deal longer and use less power so are cheaper over their lifetime.

There are three types of low energy lighting suitable for homes: fluorescent tubes, compact fluorescent bulbs and light-emitting diodes (LEDs). All three consume far less energy than traditional incandescent bulbs. For example, a 60W incandescent bulb can be replaced by a 11W compact fluorescent bulb and a 40W halogen downlighter can be replaced by a 3W LED. Fluorescent tubes are usually only used in kitchens and bathrooms or for feature lighting where the source can be concealed.

Early compact fluorescents gained a reputation for ugliness due to their egg-whisk appearance but today the tube is usually disguised by an opaque bulb-shaped sheath. Consequently compact fluorescent bulbs look little different from traditional incandescent bulbs. Furthermore it is possible to buy miniature compact fluorescent bulbs including replacements for candle bulbs and ceiling downlighters. Different brands and types of compact fluorescent bulbs have different qualities. In particular, some have a warmer light than others and some take time to reach full brightness. So be prepared for a switch from incandescent bulbs to compact fluorescent bulbs to involve some change in the quality of the light. A little experimentation with different brands may be worthwhile before a complete refit.

You cannot control an ordinary compact fluorescent bulb with a dimmer switch as they are not designed to dim and so will simply turn off. However special compact fluorescent bulbs are available which can be used in these circuits.

The reputation of LEDs has also suffered from the poor quality of early lamps which tended to produce a blue light. These problems have now been overcome and you can now buy 'warm white' LED bulbs and down-lighters. Their light is not quite as warm as the compact fluorescent 'warm white' bulbs but they come on instantly and can be dimmed in the same way as traditional incandescent bulbs. If you want to compare the 'warmth' of the light of different bulbs before buying them, compare the 'colour temperature' specified on the packaging. A lower colour temperature means a warmer light.

LED lamps are made from collections of small diodes grouped together. However, like modern compact fluorescent bulbs, these are designed to look like traditional bulbs and fittings.

If you are replacing your existing bulbs with low energy bulbs, pay attention to the voltage required, especially for ceiling recessed downlighters. Some halogen downlighters run on mains voltage (240V) and can be replaced directly by miniature compact fluorescent GU10 bulbs. Others run off hidden transformers at 12V, for which LED replacements are available if you don't want to take out the transformers.

Planning and building control

Listed buildings

Listed building consent is not usually needed to change light fittings as these are not considered to be fixtures of a building. However you may need consent if you want to bury new wiring in original plasterwork, if you have historic fittings such as chandeliers or if the existing fittings form part of the designed decoration of the interior.

Building regulations

Changing light fittings or bulbs does not require Building Regulation approval. If you want to install a new circuit or fixed cabling, the work should be carried out by a person registered on a Part-P registration scheme which allows them to self-certify the work. The organisations running these registration schemes are Ascertiva Group Ltd (NICEIC), Benchmark Certification Ltd, BSI, Building Engineering Services Competence Accreditation Ltd, ECA Certification Ltd and NAPIT Registration Ltd.

Draught-proofing

Old houses are famous for their draughts. They come from all directions – under the door and through the key hole, through the gaps in the windows, up through the skirting boards and floor boards and even through ceiling-recessed light fittings. As well as causing significant heat losses, draughts also intensify our discomfort. The movement of cold air over our skin in winter is uncomfortable, regardless of the room temperature.

The builders of the Georgian and Victorian eras were well aware of the discomfort produced by draughts. Homes that are draughty today may not have been quite so draughty when first built. The passage of time will open up fine cracks in the fabric of any building. Nonetheless the reliance on open fires for heating required a substantial flow of air into the building to maintain air quality and feed the flames. Draught-proofing is an invention of the modern, centrally-heated era.

Whether or not you still have an open fire, your home still needs to be properly ventilated. You need ventilation to provide fresh air and remove water vapour and toxins such as tobacco smoke. It is therefore helpful to distinguish between uncontrolled infiltration, which creates the uncomfortable draughts, and controlled ventilation which ideally provides just the right amount of fresh air without the discomfort of draughts. If you are thorough in your draught-proofing, you will dramatically reduce the uncontrolled infiltration of cold air but you may need to improve your controlled ventilation (see page 40). This might seem a bit perverse but greater control over air movement means lower heat losses and greater comfort. In practice, however, your efforts to draught-proof may still leave plenty of hidden holes for air to get through so extra ventilation may not be needed.

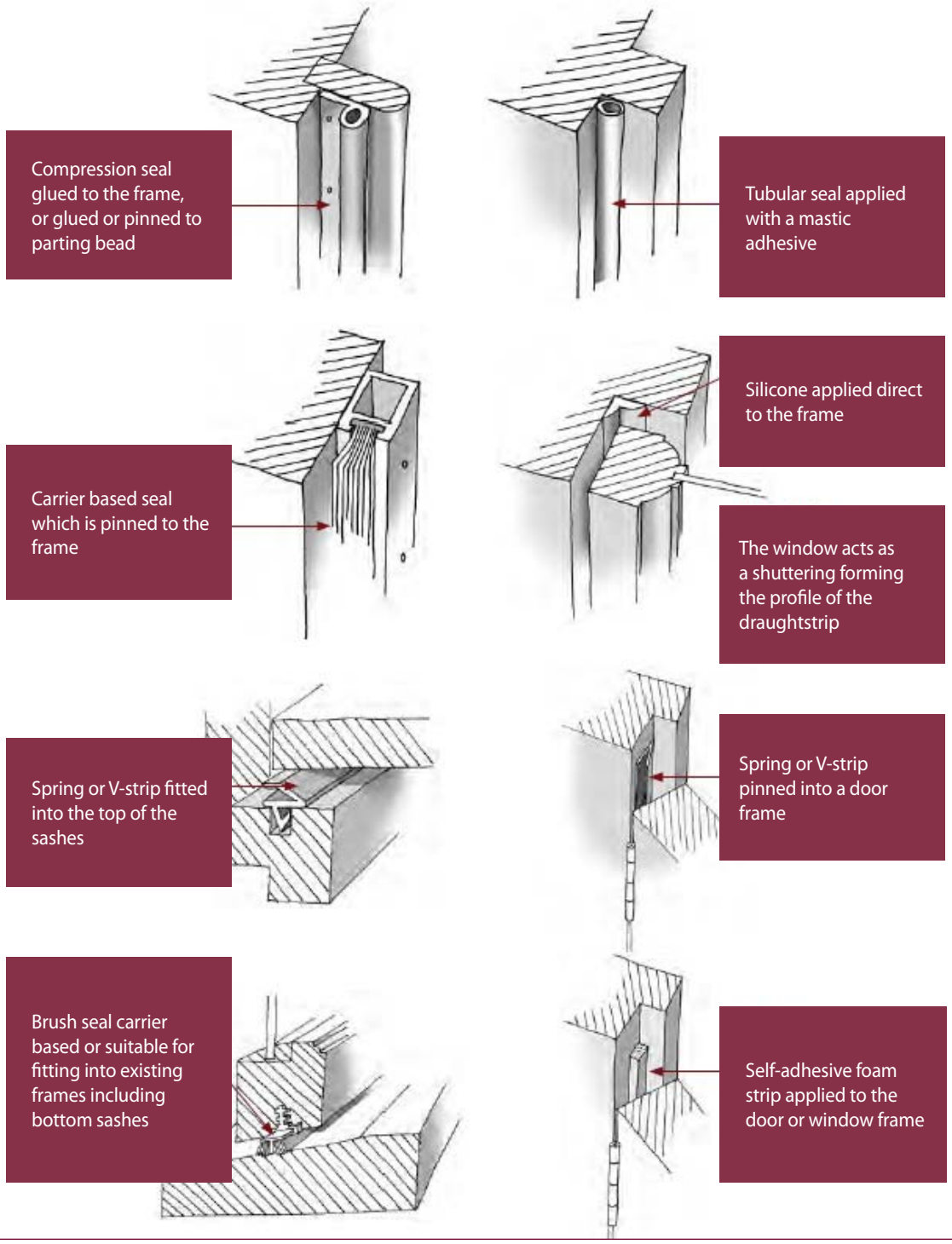
A simple brush draught-strip faces outward on the closing edge of the front door to this Georgian house in Bath. When this closes against the doorstop, the brush compresses and seals the gap. It is so discreet it is hard to spot.

Windows and doors

You may be losing as much heat through the gaps around your windows as you are through the fabric of the window itself. Cutting out these draughts is a relatively simple way to improve your comfort within the room. This issue is introduced in the section on window renovation on page 24.

Draught-strip comes in many shapes and sizes, so it's important to find the right strip for each job (see drawing below). Ideally, you want draught-strip that is the same colour as your window, sits discreetly on or within the frame or on the window itself and provides an effective seal when the window is closed. For casement windows, compression or brush strips can be used at the junction of the windows or where the edge of the window closes against its frame. For sash windows,

Examples of draught-proofing products for different junctions (drawing courtesy of Changeworks)



brush strips are usually effective around the window and at the horizontal junction of the two panes (see case study on page 25).

A great deal of cold air is also admitted, and a great deal of warm air lost, through front and back doors. If your home has a draught lobby – an inner door to protect the house when the front door is open – take care to close the inner door before you open the outer door (and vice versa). Draught-proofing products for doors include compression and brush seals for the edges, key hole caps and letter box covers.

Chimneys, flues and service penetrations

Warm air rises, so an unused chimney provides a simple mechanism for drawing warm air out of your home. The most effective way to prevent this is to board up the fireplace altogether. This was common practice in the eighteenth century in the summer months, when the fire was not being used, in order to reduce unwanted draughts and prevent soot entering the room. Chimney boards were designed to fit the fireplace and were often painted to mimic a view of the open fireplace, typically with a vase of flowers standing in the hearth. This method can still be used today for unused fireplaces (and artists can still be found who specialise in painting them). To be effective the board must sit tightly within the fireplace.

If you do not want to board your fireplace, either close the metal damper that seals the flue or install a chimney balloon. Chimney balloons are a proprietary product designed to be inflated within the chimney. When fully inflated they still let a small amount of air pass which prevents damp building up in the chimney. If necessary, they can be removed in summer to increase natural ventilation for cooling.

The cables and pipes that penetrate the walls of your home can cause major draughts if the junctions are not properly sealed. This is often the case in traditional homes where pipes and cables have been fitted in the twentieth century without due care. A mastic sealant is usually all that is needed to seal these gaps, though this may not be an easy job if the services are hidden or difficult to access.

Floors, skirting boards and ceilings

Timber ground floors were first raised off the ground in the eighteenth century to prevent the timbers rotting through contact with damp ground. The space beneath the floor is ventilated via airbricks in order to keep moisture levels low but this inevitably means that the floor itself is exposed to the external air, increasing heat losses and creating cold draughts. Cold air comes up through the edges of the floors and under the skirting boards or through the gaps between the floor boards.

If you insulate your ground floor (see page 42) you will dramatically reduce heat losses but it is still important to draught-proof the floor as gaps will remain in the insulation through which cold air can flow, undoing the good work of the insulation. If you lift the floorboards to install the insulation, you can cover the joists with a breather membrane which will hold the insulation but also act as a draught excluder (see illustration on page 42). It should be taped up behind the skirting boards before they are put back. If you are unable or unwilling to install insulation because of potential damage to your floor boards, draught-proofing is essential to reduce heat losses and draughts.

The intermediate floors of traditional homes in Bath are constructed of timber with the joists buried in the solid walls. These floors may also be a source of draughts because the void within the floor is exposed to a thin solid wall with no interior finish, unlike the plasterwork in the rooms themselves which plays an important role in stopping air infiltration. There are typically lots of fine gaps in these walls, especially in the mortar joints, through which cold air can infiltrate the floor void. Consequently draught-proofing of upper floors and the ceilings below them is also worthwhile.

Most of the timber floors of the traditional buildings of Bath were constructed by simply butting the boards up against each other and nailing them to the joists below. The movement of these floorboards over the subsequent decades inevitably opened up the gaps between them, letting the draughts through. However, in some cases, tongue and groove edge joints were used with the nail head hidden within the joint. These floors are less prone to draughts, except at the edges, because of the overlapping joints.

The simplest way to draught-proof a suspended timber floor is to cover the whole thing up with hardboard, insulating underlay and carpet. However you should first draught-strip the junction of the skirting board and the floor using a sealant or plugging it with a compression strip. Similarly, plug the gaps round service pipes such as central heating pipes that pop up through the floors to supply radiators.

If you want to keep your timber floor finish exposed, you also need to plug all the gaps between the floor boards. This can be done in a variety of ways. Holes and gaps should be repaired with small timber patches; smaller holes and cracks can be repaired with proprietary filler or with compression strips designed to be squeezed between the boards. Wide gaps between boards can be repaired with thin strips of softwood glued into the gap.

If cold air is penetrating your upper floor voids or your roof space, it will also find its way through the gaps in ceiling roses and ceiling-recessed lights. These gaps should be sealed as carefully as possible.

The Georgians used chimney boards to minimise draughts and soot when the fire was not in use. This example, dating from between 1710 and 1740, includes the elegant trompe l'oeil of a vase placed in the empty fireplace. Image courtesy of the Victoria and Albert Museum.

Planning and building control

Listed buildings
Done well, draught-strip ought to be all but invisible when installed on traditional windows. Nonetheless, listed building consent is normally required for any draught-proofing which has a visual or physical impact on the window. For most listed buildings it is likely that an application for a discreet means of draught-proofing will be treated favourably. However consent may not be granted for historic windows in highly sensitive locations. Like-for-like renovations or minor alterations to parting beads to improve the fit of a window do not normally require consent.

Some of the changes to doors, such as key hole and letter-box caps and brush seals on the bottom edge may be visible but their impact is minor. Again, because of the impact on the fabric, listed building consent is usually required.

You will need listed building consent to permanently board up any fireplace but you do not need listed building consent to install chimney balloons.

Listed building consent is needed to draught-proof floors, skirting boards and ceilings using the methods described above. To improve your chances of getting consent, the work should be substantially reversible and have little or no impact on historic fabric such as floorboards, skirting boards, architraves and decorative plasterwork. Adequate means of ventilation should be demonstrated.

Other traditional buildings
All forms of draught-proofing are permitted in unlisted buildings.

Buildings regulations
Building Regulation approval is not required for draught-proofing of any kind.

PRESSING FOR CHANGE

Local views on draught-proofing listed buildings in Bath

The following results describe the extent to which Bath residents who responded to our online survey agreed with the given policy options for listed buildings. *These results do not describe current Council policy*.

Windows and doors

Two thirds of Bath respondents supported the universal use of draught-proofing in the windows and doors of listed buildings in the city.

69% The draught-proofing of windows and doors should be permitted in all listed buildings in Bath.

31% The draught-proofing of windows and doors should be permitted in all listed buildings in Bath except where there is an impact on historic fabric.

Among respondents who live in listed buildings in Bath, 70% supported the universal use of draught-proofing in the windows and doors of listed buildings in Bath.

Bath Preservation Trust position
The Trust supports the universal use of draught-proofing in the windows and doors of listed buildings in Bath. Professional installation and the use of discreet products are encouraged.

Floors, skirting boards and ceilings

Three quarters of Bath respondents supported the universal use of draught-proofing in the floors, skirting boards and ceilings of listed buildings in the city.

76% The use of discreet draught-proofing in floors, skirting boards and ceilings should be permitted in all listed buildings in Bath.

24% The use of discreet draught-proofing in floors, skirting boards and ceilings should be permitted in all listed buildings in Bath except where there is an impact on historic fabric.

Among respondents who live in listed buildings in Bath, 74% supported the use of draught-proofing in the floors, skirting boards and ceilings of all listed buildings in Bath.

Bath Preservation Trust position
The Trust supports the universal use of draught-proofing in the floors, skirting boards and ceilings of listed buildings in Bath. Professional installation and the use of discreet products are encouraged.

Ventilation

Ventilation is a major issue in the design of new homes. Modern houses are designed to be air-tight in order to reduce the heat losses caused by draughts. Following the maxim 'build tight, ventilate right', air for ventilation is provided in the winter by small trickle vents in the windows. Mechanical ventilation is sometimes used if a house is built to a very high standard of air-tightness. The traditional homes of Bath are not air-tight. Quite the opposite: they are often draughty and lose a lot of heat because warm air can so easily escape through all the gaps and cracks in the building fabric. This is why draught-proofing is such an effective way of in reducing heat losses in traditional homes (see page 34). Nonetheless, even after draught-proofing, a Georgian or Victorian home may have a higher rate of cold air infiltration than a home built to modern building standards.

Modern lifestyles create a lot of moisture indoors thanks to all our cooking, cleaning, clothes drying, showering and bathing. Despite the draughtiness of traditional homes, many people still actively ventilate rooms by opening windows or using extractor fans in order to reduce the risk of indoor condensation and mould. If you need to do so, consider the more energy efficient ways of doing this.

Natural ventilation

Natural ventilation relies on the natural movement of air rather than electric fans. It is useful in the summer for cooling: windows left open will encourage air flow through a home and open chimneys will draw warm air out of the building. Natural ventilation is usually inappropriate in the winter because so much heated air is lost. You may need a low background air flow to supply a heating appliance but even this is not necessary if the appliance has a balanced flue (i.e. the flue draws in air as well as letting fumes out).

Natural ventilation remains important in unheated parts of your home where there is a risk of condensation such as loft spaces or underneath suspended timber floors. If you insulate your loft or your floor, make sure that you do not block up the gaps at the eaves in the loft or the air bricks beneath the floor as these keep the loft and subfloor dry.

Mechanical ventilation

Mechanical ventilation is usually only needed where water vapour or pollutants are produced such as kitchens and bathrooms. In kitchens, extractors are often

Case study: well-ventilated sun space

This renovated and restored 1823 Bath house boasts an unheated triple-glazed sunspace that the owner uses with care to maintain comfortable conditions in the house itself. Three opening windows at the lower level, and three in the roof, control the flow of air.

In the summer, as it warms up, both sets of windows are opened to create a steady movement of air through the sunspace. The door to the main house is opened and warm air is drawn out of the house, maintaining a pleasant ambient temperature throughout the building.

In winter the sunspace is closed off from the house on all but the warmest days. The unheated space helps to insulate the house because the temperature in the sunspace stays well above the external temperature.

There should always be a division between a conservatory or sunspace and the house it is attached to in order to control the heat flows between them. A conservatory that is not divided from the main living space will drain the heat from the house in the winter.

In the summer the temperature in a conservatory can quickly become uncomfortable, at worst leading to the installation of air-conditioning. In this example, the masonry walls on three sides help to moderate the swings in temperature by absorbing heat over the course of the day and releasing it at night.

incorporated into cooker hoods and can be controlled manually so that they are only on when fumes are being produced. There should be a baffle in the hood to ensure that the there are no draughts when the extractor is not operational.

If you install an extractor fan in a bathroom, kitchen or utility room to remove water vapour, ensure that the fan is controlled by a humidistat, i.e. a sensor that is triggered when the humidity in the room gets too high. This ensures that the extractor does not run when it is not needed.

If you have been *very* thorough in your draught-proofing and feel you need to improve the air quality in your home without pushing your energy losses back up again, you could consider installing a heat-recovery ventilation unit. This sits within the wall and provides a low level of background ventilation, transferring the heat from the outgoing air to the fresh air being drawn in. These systems run at a low power so the electricity consumption is less than the heat saved.

Planning and building control

Listed buildings
Listed building consent is required to install an outlet for an extractor fan or heat-recovery ventilation system in an external wall because of the visual impact and the potential damage to historic fabric. To improve your chances of gaining consent:

- specify a discreet outlet and paint the outlet the same colour as the wall
- if possible, install the system and outlet on a lower floor of the building
- if possible, offer to remove other services from the wall if they are not needed
- alternatively, put the exhaust through a vertical flue in a roof that cannot be seen.

Other traditional buildings
Ventilation systems of all kinds are permitted in unlisted buildings.

Buildings regulations
Any electrical work carried out in kitchens or rooms with a bath, shower or sauna should only be done by an installer registered with one of the self-certification schemes described on page 32 (artificial light).

PRESSING FOR CHANGE

Local views on ventilation of listed buildings in Bath

The following results describe the extent to which Bath residents who responded to our online survey agreed with the given policy options for listed buildings. *These results do not describe current Council policy*.

Three quarters of Bath respondents supported the installation of ventilation outlets on the secondary facades of listed buildings in the city, regardless of visual impact. A majority also supported their use on primary facades where there is no practical route to a secondary facade.

11% The installation of ventilation outlets should be permitted on all facades of all listed buildings in Bath.

44% The installation of ventilation outlets should be permitted on secondary facades of all listed buildings in Bath. Outlets should only be permitted on primary facades where there is no practical route to the rear facade.

19% The installation of ventilation outlets should be permitted on secondary facades of all listed buildings in Bath.

26% The installation of ventilation outlets should be permitted on secondary facades of any listed building in Bath where this does not have a significant visual impact

1% None of the above.

Among respondents who live in listed buildings in Bath, three quarters (74%) supported the installation of ventilation outlets on the secondary facades of listed buildings in the city, regardless of visual impact.

Bath Preservation Trust position

The Trust supports the installation of ventilation outlets on the secondary facades of all listed buildings in Bath. Outlets should be discreet and painted to match the colour of the external wall.

Insulation

The traditional homes of Bath were built without thermal insulation. The only original insulation is stuffed between the floorboards to reduce the transmission of noise between floors. The builders of Bath assumed that winter warmth would be provided by roaring fires; their focus was on the generation, not the conservation, of heat. Only now, in the twenty-first century, have these priorities been reversed.

In any building, most of the heat escapes through the walls, roof and floor. Insulation does not stop the heat loss but it does slow it down dramatically. Although traditional Bath stone walls provide some protection against the cold, they are by no means 'warm walls'. Heat passes through a 300mm limestone wall at about six times the speed it flows through a modern wall built to current building standards. Even when they perform at their very best, traditional homes are cold by modern standards.

Some parts of traditional homes are, however, a great deal easier to insulate than others. Your walls may make up the greatest area of the exposed skin of your home but the difficulty, cost and risks of insulating solid walls pushes them to the bottom of the priority list for insulation. The loft is the place to start, closely followed by your ground floor.

Loft insulation

Insulating your loft is a highly cost-effective way of reducing your heat losses as about a quarter of all heat losses in an unimproved building are through the roof (though a good deal less in a five storey Georgian house). It is also a relatively straightforward job in a traditional building if the loft space is accessible.

Many of the traditional homes of Bath do not, however, have loft spaces. Mansard roofs are not so straightforward to insulate. If you have a mansard roof or a room in the roof, you can install rigid board insulation in the manner of internal wall insulation (see page 44). Alternatively, if your mansard roof is in need of renovation, or you have a loft that you want to convert to a room, use this opportunity to combine roof renewal with comprehensive insulation both between and in front of the sloping rafters.

If you do have a loft and there is already some insulation up there, it probably is not enough. The recommended minimum depth is 270mm of mineral wool, fibreglass or sheep's wool insulation. Topping up your insulation, or replacing it if it is old, poorly installed or damp, will make a noticeable difference to your heat losses. Ideally, lay insulation both between and across the rafters (if rigid board insulation is used for the latter, the space is more easily used for storage once the job is complete).

Many people install loft insulation themselves. Rolling out insulation between the joists of a loft is a relatively straightforward job. However there are tricky details which you need to get right, and which may justify a professional job. There are two things to pay attention to: maintaining ventilation to the roof space and ensuring that there are no gaps which allow the heat to get past the insulation.

Above the insulation, your loft will be cold in the winter. Consequently, any water vapour that gets into the roof space is likely to condense. If the roof space is not ventilated, this moisture will linger and lead to potentially serious problems of mould and rot in the roofing timbers. It is therefore essential that the air above the insulation is ventilated to the outside. The simplest way to achieve this is to leave a gap at the eaves – if you have them. Georgian houses with parapet roofs do not have open eaves and in such cases you may have to install special roof tiles with integrated ventilation holes. If you have open eaves but the thickness of the insulation blocks them up, install ventilation panels between the insulation and the rafters (rafter trays or eaves ventilators) to maintain the air flow from the eaves.

Covering up the entire floor area of the loft is not always easy. If you have a loft hatch, this must be insulated and have an effective draught-seal. You may need to install a new loft hatch to achieve this. If you have a water tank in your loft, the insulation must be taken up and over it (if you go under it, the water will freeze in the winter). Any exposed pipework must also be insulated. Avoid installing ceiling-recessed downlighters in top rooms but, if there are any penetrations in the ceiling below

Sheep's wool insulation laid between the joists of a loft space in a late Georgian house on Bathwick Hill

the loft for lights and cables, these must be carefully sealed to prevent warm air escaping into the roof. Cables should run on the cold side of the insulation to prevent overheating.

Floor insulation

Most of the traditional buildings of Bath have suspended timber floors. These are relatively easy to insulate without affecting the look of the floor. Solid floors, such as flagstones, present more of a technical challenge.

Suspended timber floors

If your ground floor is of suspended timber construction, you will be losing heat in the winter through the fabric of the floor while being chilled by the draughts that whistle though the gaps in the boards. Usually suspended timber floors are ventilated to the outside to remove any moisture and prevent timber joists rotting, which means that the void under the floor can get very cold in the winter. Insulation will reduce the fabric heat loss but will not necessarily stop up the draughts, so draught-proofing should be undertaken at the same time. Insulation is installed between the floor joists either from above or below.

In some houses in Bath it is possible to reach the underside of a suspended timber floor through a vault, cellar or crawl space without taking the floor boards up. This makes it possible to insulate the floor without the risk of damaging the boards. If you do not have access to the subfloor space, you need to assess the quality of your floorboards and consider whether any damage from lifting is acceptable. If you feel it is not, you should focus on draught-stripping (see page 34) and consider laying a carpet with an insulating underlay over the floor. However, with the help of an experienced carpenter, even high quality, long-established floor boards can be lifted and relaid with minimum risk.

Insulating a suspended timber floor from above: the breather membrane provides excellent draught-proofing as well as support for the insulation

Whether you are able to install insulation from below or from above, it is important to keep the remaining void below the insulation ventilated. This space will be even colder once the insulation has been installed, so condensation of moisture will be more likely. If the void or basement is not currently ventilated and is at all damp, you should seek professional advice about how to ventilate the space.

The best way to insulate from below is to push flexible, moisture permeable insulation such as sheep's wool into the gaps between the joists, pin a breather membrane (e.g. Tyvek) under the insulation to hold it in place and then install a breather board (such as a wood fibreboard) to complete the job and provide a new ceiling to the basement room. However this basement space will be outside the insulation and so will be cold. You will need to treat the door to this room as an external door and draught-strip it to keep the cold out of the rest of the house.

If you are insulating from above, lay the breather membrane over the joists, tape up the junctions and tape the membrane to the wall where the skirting boards will be reinstated (use the proprietary tape supplied with the breather membrane). This provides good draught-proofing as well as a strong support for the insulation which can now be laid in the channels between the joists.

Solid floors

Solid floors are difficult to insulate if you want to retain the finish and height of the existing floor. If you have beautiful flagstones, these can be carefully lifted, the subfloor dug out, a damp-proof membrane or new concrete slab laid, insulation and a screed installed, and the flagstones put back. However this is a difficult and expensive job.

The alternative is to build a new floor on top of the existing floor. This will also preserve the existing floor finish, which may be important in a listed building, but of course you will no longer be able to see it. The usual approach is to lay rigid boards of insulation on top of a damp-proof membrane with plywood or chipboard on top. However this can add well over 100mm to your floor height and require adjustments not only to doors but skirting boards, kitchen units, radiators, bathroom fittings and sockets. You may be able to avoid some of these problems by using a thinner layer of high performance insulation such as 40mm of phenolic board or 30mm of aerogel.

Many of the rubble-stone rear facades of the Georgian houses of Bath were originally rendered. External insulation could be used in such instances to return the facades to something closer to their original appearance.

If insulation is installed over your existing floor, you must be thorough and take a comprehensive approach. Otherwise you will face trip hazards where the floor level changes and there will be cold spots where the insulation ends which will be liable to condensation. Whatever approach you take, you should seek professional advice to ensure that any damp problems are addressed rather than exacerbated.

Carpets and underlay

Carpets and underlay provide basic thermal insulation as well as helping to reduce draughts through suspended timber floors. Ideally, use natural, moisture-permeable materials such as wool, sisal and hemp for both the carpet and the underlay. This prevents any moisture beneath the carpet, either in a solid floor or from within the void of a timber floor, getting trapped.

Wall insulation

If there is one material that defines the distinctive character of Bath it is undoubtedly the warm oolitic limestone that we know as Bath stone. The legacy of its use by generations of builders is an urban environment of remarkable homogeneity and integrity, despite many changes in architectural styles over the centuries.

The walls of the traditional houses of Bath are all solid, consisting variously of dressed stone, rubble stone, brick, render and even timber. The only possible exceptions are post-war reconstructions which employ twentieth century building techniques such as cavity wall construction. As long as they are not exposed to driving rain, cavity walls are relatively easy to insulate because the cavity can be filled with an insulating material. Solid walls, on the other hand, are difficult to insulate because the insulation has to be installed on either the inside or the outside face of the wall and a new wall finish put on top. This is both technically complex and, in Bath, aesthetically challenging. No-one wants to pebble-dash the Royal Crescent.

Despite its problems, wall insulation is definitely worth considering, not least because 35% of heat loss is through the walls of an average unimproved home (though the share of heat loss is probably lower in the many terraced houses of Bath because their design reduces the number of walls that are exposed to the outside). You basically have a choice between exterior or interior insulation. Each has its pros and cons: exterior insulation does a better job and is less disruptive during installation but has a major impact on how a building looks; interior insulation preserves the outward form of the building but radically changes the interior and is technically more problematic. Both tend to be expensive and disruptive to install.

There are some well-known risks involved in the installation of solid wall insulation in traditional buildings. These arise because the walls of Georgian and Victorian buildings are, to some extent, 'moisture-permeable' (see page 18). Unlike modern buildings, which are designed to keep moisture out of their walls, traditional walls work by absorbing moisture and

then drying out through the action of the sun and the movement of internal air.

If you install wall insulation over the surface of a traditional wall, you will compromise its ability to sweat out any moisture within it. Moisture trapped within a wall will increase heat losses across the wall, encourage mould growth and potentially cause damage to timbers within the walls such as the ends of floor joists. These risks can be minimised with good design, appropriate materials and adequate ventilation. However, this is a complex issue and a careful assessment of the risks of damp within your walls must be made first. If you are considering installing wall insulation, seek professional advice.

Exterior wall insulation

Of the two wall insulation options, exterior insulation is the most effective and the least risky, as long as a comprehensive approach is taken. This is because the entire wall can be covered up so there are fewer routes for the heat to escape. However the job is complex and expensive. The wall has to be built out and a new wall finish created. Everything on the outside of the building has to be replaced or adjusted: window reveals and sills, door architraves, roof overhangs, decorative features, gutters and downpipes, soil and vent pipes and other services.

Although exterior insulation is obviously not appropriate for the prominent facades of the buildings of Bath, there are many secondary facades that are either hidden or of little importance to the character of the city. Furthermore, some of the rear facades of Georgian buildings in Bath were originally rendered, so the installation of a new rendered facade might actually be in keeping with the building's history.

When installing exterior insulation on top of a traditional wall, it is important to preserve the permeability of the wall by using a moisture-permeable insulation and finish. This ensures that any moisture within the wall does not get trapped. This is especially important for the outside face of the wall because of the high risk of rainwater getting into the wall and the importance of the action of the sun in drying out the wall.

Interior wall insulation

Like exterior wall insulation, the installation of interior wall insulation typically involves building out the wall, creating a new wall finish and making adjustments to all the windows, doors and features affected. In many of the traditional buildings of Bath, the list of important features that could be affected is considerable and includes panelling, dados, skirting boards, cornices, plaster work and reveals around architraves. Internal wall insulation is unlikely to be viable if important historic features are in place.

The installation of internal insulation is a complex process, best done as part of a major renovation. However, this depends on how much insulation you want to install and how much room space you are willing to lose.

The thinnest interior wall insulation is a proprietary product, Sempatap, which can be installed with relatively little impact on existing features as it is only 10mm thick. It is effectively a thermal wall-paper. Although thin, it cuts heat losses, raises the wall surface temperature and so makes a room feel warmer. It is relatively inexpensive and easy to install.

If you want to achieve more meaningful reductions in your heat losses, you will have to build out the wall and make adjustments to all the wall details including window reveals, architraves and mouldings. You can build out either by fixing an insulating board directly to the wall or, for deeper insulation, building out the wall with timber battens, infilling with insulation and boarding over. Either way, a plaster finish completes the job and helps to make the wall airtight.

The big problem with interior wall insulation is 'cold bridging'. This happens at all the points where the insulation stops and the heat can get round the edges such as the junctions with windows, floors and ceilings and around sockets which have been cut into the insulation. It can also happen at a junction with an internal wall unless the insulation is taken round the corner for at least a couple of feet. At all these points, heat and water vapour escape, the temperature drops and the risk of condensation increases. This can lead to long-term problems, especially if the condensation is hidden, for example within a floor void between ground and first floor. These risks can be reduced, for example by treating timbers that could be affected, installing insulation in floor voids, and keeping indoor humidity low through controlled ventilation (see case study opposite). However, given the risks involved, you should seek professional advice to work out the best approach. Great care is needed in detailing all the joins and junctions of the insulation with the existing building fabric.

Most internal insulation jobs in traditional buildings use synthetic insulation materials that are impermeable to moisture. They focus on keeping moisture out of the walls, including using a vapour barrier on the inside of the plasterboard. Most of the products on the market, such as insulation-backed plasterboard, are made with impermeable insulation. This approach is reasonable, given the problems that can arise when moisture does get into a wall, and is supported by English Heritage*. Nonetheless, there is a case for using natural moisture-permeable materials for internal insulation as well as external insulation. If condensation does occur in your wall after the insulation has been installed, moisture-permeable materials will allow the moisture to escape to the inside of the building. We do not yet know enough about how traditional buildings perform with solid wall insulation to give the final word on this issue.

Case study: interior wall insulation

The best time to undertake energy efficiency improvements is during a major renovation as this makes a truly holistic approach possible. When this attractive Victorian house in the centre of Bath was bought by its current owners, they decided to embark on just such a comprehensive approach, integrating improvements in the living space with radical improvements in energy performance. These improvements included new timber triple-glazed windows at the rear, low energy lights and appliances throughout and a solar thermal panel on the back roof. But the most striking aspect of the project was the use of insulation. The aim was nothing less than to wrap the entire house up in an insulating blanket.

At the top of the house, the loft space was converted to a room and insulation installed between and over the rafters. At the bottom of the house, a new solid floor was laid with a thick layer of insulation between the concrete slab and the floor screed. That left the walls which, given the quality of the exterior stonework, could only be insulated from the inside.

The material chosen was rigid phenolic board. This is a high performance synthetic insulation which is often used for wall insulation and supplied with plasterboard already in place on one side. Because it is such a good insulant, less depth is needed than other materials, which is an obvious benefit if you do not want to lose too much of the room space. The use of this 110mm wall insulation improved the thermal resistance of the wall by a factor of ten, resulting in a wall with lower thermal conductivity than a wall built to modern building regulations.

Phenolic board is not, however, moisture permeable. The house no longer functions as a traditional 'breathing' building (i.e. with fabric that can both absorb and release moisture and water vapour). But nor is the house a cold and draughty Victorian home that is expensive to heat. A trade-off has been made and the risks of condensation within the (now cold) original walls have been addressed as best they can.

The insulation was taken below the floorboards and between the joists, to reduce the risk of the floor junctions becoming 'cold bridges', and the ends of the joists were damp-proofed. Similarly the insulation was extended back from the exterior walls along the party walls to reduce heat losses through these walls. At all window and door junctions, the detailing of the insulation has been thorough to ensure that the blanket is as comprehensive as possible. And indoor humidity is kept low with careful ventilation.

Although not a listed building, the house has character and this was respected. The insulation may have pushed the wall out (centre left) but the mouldings were restored (bottom) and the final result is arguably as good as new (centre right).

PRESSING FOR CHANGE

Local views on insulation in listed buildings in Bath

The following results describe the extent to which Bath residents who responded to our online survey agreed with the given policy options for listed buildings. *These results do not describe current Council policy*.

Insulating suspended timber floors

Two thirds of Bath respondents supported the use of insulation beneath the suspended timber floors of listed buildings in the city.

66% The installation of ground floor insulation under suspended timber floors should be permitted in all listed buildings in Bath.

31% The installation of ground floor insulation under suspended timber floors should be permitted in all listed buildings in Bath except where significant historic floorboards have to be removed and reinstated.

3% The installation of ground floor insulation under suspended timber floors should not be permitted in any listed building Bath where this involves the removal and reinstatement of floorboards.

1% None of the above.

Among respondents who live in listed buildings in Bath, 66% supported the use of insulation beneath suspended timber floors of listed buildings in Bath.

Bath Preservation Trust position

The Trust supports the installation of ground floor insulation under suspended timber floors in the listed buildings of Bath except where significant historic floorboards have to be lifted.

Insulating solid floors

A majority of Bath respondents supported the use of insulation beneath the solid floors of listed buildings in the city.

56% The installation of insulation under solid floors should be permitted in all listed building in Bath.

39% The installation of insulation under solid floors should be permitted in all listed building in Bath except where significant historic floors have to be lifted.

3% The installation of insulation under solid floors should not be permitted in any listed building in Bath.

2% None of the above.

Among respondents who live in listed buildings in Bath, 57% supported the installation of insulation under solid floors in all listed building in Bath.

Bath Preservation Trust position

The Trust supports the installation of ground floor insulation under solid floors in the listed buildings of Bath except where significant historic floors are in place.

Solid wall insulation: external

Although most Bath residents want to protect the front facades of listed buildings in the city, a majority support the use of external insulation on secondary facades, at least where the wall is already rendered or has a history of being rendered.

15% The installation of external solid wall insulation should be permitted on all facades of all listed buildings in Bath.

26% The installation of external solid wall insulation should be permitted on the secondary facades of all listed buildings in Bath.

28% The installation of external solid wall insulation should be permitted on the secondary facades of all listed buildings in Bath where the wall is rendered or where there is evidence that the wall was once rendered.

26% The installation of external solid wall insulation should not be permitted on listed buildings in Bath.

4% None of the above.

Among residents who live in listed buildings in Bath, 57% supported the use of external insulation on secondary facades, though 21% felt this is only acceptable where the wall is already rendered or has a history of being rendered.

Bath Preservation Trust position

The Trust only supports the installation of external solid wall insulation in listed buildings in Bath on secondary facades which are, or have been, rendered.

Solid wall insulation: internal

The great majority (87%) of Bath respondents supported the use of internal wall insulation in the city's listed buildings on walls which have no important historic features, including 27% who supported the use of insulation on all internal walls.

27% The installation of internal solid wall insulation should be permitted in all listed buildings in Bath.

60% The installation of internal solid wall insulation

should be permitted in any listed building in Bath where the wall has no important historic features.

10% The installation of internal solid wall insulation should not be permitted in listed buildings in Bath.

4% None of the above.

Among respondents who live in listed buildings in Bath, 85% supported the use of internal wall insulation in the city's listed buildings on walls which have no important historic features, including 28% who supported the use of insulation on all internal walls.

Bath Preservation Trust position

The Trust supports the installation of internal solid wall insulation in listed buildings in Bath as long as there is no impact on important historic features.

Reflective panels for radiators

Even if wall insulation is out of the question in your home, consider installing reflective panels behind your radiators. These reflect the heat back into your room and prevent the walls from soaking up the heat. This is especially important for radiators that are attached to the inside of exterior walls. Radiator panels are cheap, effective and easy to install. They can be bought from major DIY stores or online.

Planning and building control

Listed buildings

Loft insulation can be installed in listed buildings without consent as long as the insulation is in no way adhesive and can be removed without any damage to the building fabric. Tile vents do not require consent if the character of the listed building is unaltered.

If you have a suspended timber floor and you can only insulate your ground floor from above, you will need listed building consent to take the floorboards up. If your floorboards and skirting boards are original and of historic interest, you may not get consent. If you have solid floors, you will need listed building consent if you want to add insulation over or under the floors. If the floors are original, you may be more likely to gain consent if you add insulation over the floor, minimising impacts on the original fabric.

Both the exterior and interior walls define the character of listed buildings so you must seek listed building consent for any project involving wall insulation. Exterior wall insulation is likely to be refused as it is considered to be too damaging to the character and integrity of the building. However, you could make a case if the wall is, or has been, rendered and you plan to finish the new wall surface in a comparable lime render.

Interior wall insulation is likely to be refused if it compromises the proportions of a room or affects historic features such as mouldings. However, many listed buildings in Bath have seen major changes to their interior fabric and proportions over their history. Where this has happened, there may be opportunities for renovation and renewal which could potentially include the installation of wall insulation.

You do not need listed building consent to install reflective panels behind your radiators.

Other traditional buildings

If you live in an unlisted building in the World Heritage Site, you do not need planning permission to install insulation unless you are insulating the outside of the building. To improve your chances of getting permission for exterior wall insulation, use a finish which is appropriate for the traditional construction and sympathetic to the surrounding houses and street. A lime render finish painted the colour of Bath stone may be suitable. If you can afford to, you could even clad the new wall in Bath stone.

Building regulations

Building Regulation approval is not required for the installation of insulation in a roof space.

The installation of insulation on an external wall, or on or under a floor which is exposed to either the ground or the outside air, will require Building Regulation approval if the area to be renovated is greater than 50% of the surface of that individual element. Certain classes of traditional buildings maybe exempt from the energy efficiency requirements of the regulations or special considerations may apply which permit a lesser standard of insulation to be acceptable.

* English Heritage: *Energy Efficiency in Historic Buildings: Insulating solid walls*, 2010.

Appliances

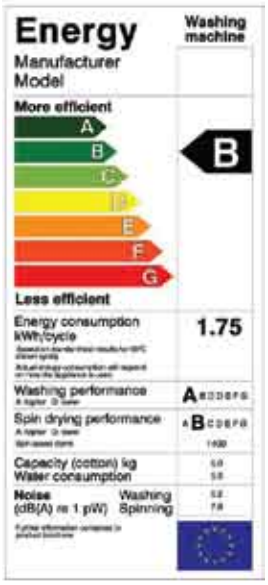
The Georgian and Victorian households of Bath managed quite well without washing machines, televisions, fridges and tumble dryers. Today, however, most of us manage quite well without domestic servants. Modern appliances have played an important role in transforming our lives and our society and few of us are willing to go without them altogether.

Happily, a great deal of effort has been spent improving the energy efficiency of the appliances we use in our homes. For example, an energy-efficient fridge bought today will use less than a quarter of the electricity of a fridge of the same size bought 20 years ago. Unhappily, our collective domestic energy consumption has not declined because we keep buying more (and bigger) appliances. If we are to genuinely reduce the energy our appliances consume, we need to consider the size and range of the appliances we use as well as their energy labels. However energy labels are a good place to start.

Energy labels

The European Union's 'A to G' energy label is displayed on all fridges and freezers, washing machines, electric tumble dryers, dishwashers, electric ovens, air conditioners, lamps and light bulbs. However, despite appearances, an A-rating is no longer the most energy efficient choice for some appliances. For fridges, freezers, washing machines and dishwashers, the A to G scale has been replaced by a scale which runs from A++ to C. So an 'A' rating is actually a middle rating.

The Energy Saving Trust label (right) and the EU label (left). Check the energy consumption per cycle as well as the rating.



The Energy Saving Trust also runs a labelling scheme in Britain which awards the blue 'energy efficiency recommended' label to the most efficient appliances. This is usually the easiest way of spotting an energy efficient product, though it is awarded to a slightly different range of products: fridges and freezers, washing machines and tumble dryers, dishwashers, computers and printers, digital radios, televisions, set-top boxes and lighting.

Cold appliances

Cold appliances have replaced cool rooms – larders – as our principal means of preserving food. However many traditional homes in Bath still boast such cool spaces including cellars and vaults. Although these spaces are not always convenient as everyday food stores, they can help keep the size of fridges to a minimum if used as supplementary storage spaces.

The size of your fridge or freezer is just as important (if not more so) than its energy rating. This is because the energy rating takes no account of size. A big A++ rated

The use of this cool Bath vault to store food keeps the fridge size to a minimum

fridge may be more efficient than a small A rated fridge but it will probably use more electricity simply because it has more volume to cool. Greater energy efficiency means little if you end up consuming more energy. The most important comparison to make when shopping for fridges or freezers is between the annual power consumption of the appliances. This is included on the energy label and is given in units of energy (kWh). For a low energy fridge, look for an annual consumption of less than 150kWh.

Wet appliances

Hand-operated washing machines and modern mangles are available but they are for the dedicated few. Most of us are happy to replace wash day with a modern washing machine. However this dependence can quickly lead to overuse. How many of the garments pushed every week without a thought into the washing machines of Bath are genuinely dirty? Reducing the energy consumption of washing machines involves not only buying an 'energy efficiency recommended' machine and running cool washes (a wash at 40°C will use less than half the energy of a 90°C wash) but also using the machine less.

The principal energy demand of the modern wash day is not the washing machine but the tumble dryer. The typical energy consumption of an A-rated washing machine is about 0.6 kWh per cycle at 40°C.

A Victorian clothes airer helps to keep the energy-guzzling tumble dryer turned off.

By comparison, an A-rated tumble dryer will use 2kWh per cycle or more. Fortunately, there are still viable traditional alternatives to this energy-hungry machine: washing lines and clothes airers. There are few houses in Bath which do not have room for a ceiling mounted clothes airer.

There are also traditional alternatives to dishwashers that remain viable. However, if you do stick to hand washing, take care not to waste hot water. If you run every dish under a hot tap, you will probably use more energy than a modern water-efficient dishwasher. If you do use a dishwasher, scrape off the worst food but don't rinse before the wash as this is the most energy hungry option of all.

Electronic equipment

Our enthusiasm for electronic devices is eating up all the savings that have been made from the improved energy efficiency of fridges and other white goods. Our homes are filling up with televisions, computers, games consoles, audio equipment, mobile phones, tablets and other electronic kit. Some of this kit now uses less energy than it used to. Lightweight laptop computers, for example, use a great deal less energy than desk-top computers. But in other areas, the change has been for the worse. In particular, televisions keep getting bigger and bigger, so although their energy efficiency has improved, the amount of energy they burn keeps increasing. Disregarding size, the most efficient television technology is a flat screen backlit with LEDs.

Some electronic appliances are eligible for the blue 'energy efficiency recommended' label (see above). However, as with fridges, the key issue is the size of the appliance and its power rating (in Watts). The power rating – the rate of energy consumption – provides the best point of comparison when making choices between electronic goods.

Compared to the growth in the range and size of electronic appliances, the stand-by issue is relatively minor. Nonetheless, it is worth addressing. Bear in mind that many appliances will only stop burning electricity when they are turned off at the wall socket, even if the little red light has faded. Phone chargers left plugged in but not switched off at the wall will also continue to burn energy even when the phone itself is not attached. Basically, anything that requires a transformer to turn mains voltage into low voltage will continue to consume power if the transformer itself is not isolated from the mains.

Heating systems

All the Georgian and Victorian homes of Bath were built with one heating system in mind: open fires. One of the most distinctive features of the famous urban landscape of Bath is the mass of chimney pots, held high above the roof tops on the sturdy party walls of the terraces below. These chimney pots, and the chimneys and fireplaces beneath them, are a key component of the design of traditional houses, yet today they are rarely used. In the modern era of gas-fired central heating we can enjoy warm interiors without the penalty of coal-fired particulate pollution clogging our lungs and spoiling the view.

Modern gas boilers are over 90% efficient, a great improvement on open fires which send around 80% of their heat straight up the chimney. If you have an old boiler, an upgrade will make a significant difference to your heating bills. However you also need to make sure that the boiler is providing heat in the right place at the right time. This involves either using your heating controls more effectively or improving them.

There is also the option of switching your heat source to a different fuel. This is likely to be attractive if you currently heat your home with electricity as this is the most expensive of all fuels. Gas is both cheaper and cleaner than electricity (see page 12). However wood burners and boilers may also be attractive if you have access to a reliable source of sustainable wood fuel.

A thermostatic radiator valve will turn off the flow of heat to the radiator when the room temperature reaches the set level.

Controlling heating

The builders of Bath may have assumed that there would be plenty of coal available to heat their new homes (and plenty of domestic staff to shovel it) but they also recognised the preciousness of the heat that the coal delivered. As heating an entire house to a comfortable temperature was out of the question, they ensured that individual rooms could be heated adequately as and when they were needed. The modular plan of Georgian and Victorian houses, a plan which is still taken for granted in the design of many new homes, allowed inhabitants to close the doors on cold halls and unused rooms and keep the heat where it was needed. Typically there were always at least two doors between the front door and the main fire place to ensure that the cold air was buffered when people entered and left the homes.

Despite the triumph of central heating in the twentieth century, many households in traditional buildings continue to exploit the modular form to keep their heating bills down. This may involve turning the central heating off or down and heating individual rooms with room heaters such as gas fires. Alternatively radiators may be turned off or down in certain rooms for certain parts of the day. However, such practice may evolve through trial and error and may still be inefficient. If you want to make the best use of your heating system, consider all of the following:

Do you need to heat your entire house? If you don't, but you have central heating and you don't want to be running around turning fires and radiators on and off, install thermostatic radiator valves on all your radiators except the ones in the room where your central heating thermostat/controller is located. You can set these to room-specific temperatures and they will maintain the rooms they are in at the given temperature. They are especially useful for setting relatively low temperatures in bedrooms and hallways.

Are you using the best room heaters? If you do use room heaters either to supplement your central heating or as an alternative to central heating, avoid using electric fires and heaters if at all possible. For the same amount of money and carbon, you will get 2-3 times as much heat from a gas fire.

Do you understand your thermostat? We are all familiar with thermostats but they are often misunderstood. The thermostat sets the temperature that the room should be at, so it ought to be set at the desired temperature

and left alone to do the work of turning the boiler on and off as needed. It is tempting to turn a thermostat up if a room feels cold but if the temperature of the room where the thermostat is located is below the point set on the thermostat this will make no difference – the heating system should already be on and putting heat into the room. Turning your thermostat up by only one degree can increase your heating bills by 8%.

Many households, however, want to vary the temperature in the home across the day: warmer first thing and in the evening and cooler at night or during the day if the house is not occupied. This is the purpose of a programmable thermostat or central heating controller. Which leads to the next question:

Do you know how to use your central heating controller? These little boxes on the wall are notoriously badly designed. As a result, households often have the heating on for longer than they need simply because they find programming the timer so difficult. If you can't work out how to set this, get help. You ought to feel confident to make small changes to the programmer at any time, depending on the season and the times you are home.

Do you always close your doors? If you are trying to maintain different temperatures across the rooms of your home, you will obviously fail if the doors are left open. This is especially important if you use supplementary heating in one room, such as a fire in your lounge, or install thermostatic radiator valves on all your radiators.

Do you make the most of the sun? If you have east or south facing rooms the sun can provide substantial morning and daytime heating. In the winter, when the sun is low, the sun can penetrate deep into rooms with well placed windows. Make sure your shutters, curtains and blinds are open when the sun is pouring in and close them (or some of them) again to keep the heat in when the direct sunlight has gone.

Gas-fired boilers

Your boiler is responsible for the majority of your energy costs so an inefficient boiler is costly to run (though not as costly as electric heating). Installing a new gas boiler is expensive but if you have an old G-rated boiler you will see immediate savings in your gas bills. An old boiler is not something you should hang on to just because it is reliable. It will be reliably wasting money and carbon.

All new boilers on the market are A-rated so look for the energy efficiency rating to make comparisons. This is now included as standard on the labelling and will also be listed on the SEDBUK database of boilers (www.sedbuk.com). This database includes details of old boilers and you can use the calculator on the website to work out exactly how big a difference an upgrade will make.

Many boilers are now 90% efficient or better. Your basic choice is between a combination boiler, which provides both heating and hot water on demand, and a regular boiler with a hot water cylinder. The former is more energy efficient, as there are no heat losses from the hot water cylinder, but the latter is usually necessary if you want to integrate a solar hot water panel into your hot water supply as this requires a hot water cylinder (see page 56).

All new boilers are condensing boilers. This means that extra heat is extracted from the flue gases as they condense, thereby improving the efficiency of the boiler. However this cools the flue gases and is the reason why plumes of condensing water vapour can sometime be seen emerging from boiler flues. If you do not currently have a boiler, it is vital to think about where best to site the flue on your exterior wall in order to minimise its visual impact and keep the flue exhaust away from eaves so that moist air does not get into your roof. Flue pipework can be 20 metres or more in length so you may be able to direct the exhaust through a roof, out of sight.

Wood burners and boilers

Wood is considered to be a 'low carbon' fuel because the cycle of growing the fuel and then burning it produces no net increase in atmospheric carbon dioxide, unlike mining and burning coal. Significant carbon emissions can, however, arise from the transportation of the fuel, so wood is only a truly sustainable fuel is it comes from a local, well-managed source. You should also aim to make the most of the energy in the wood by burning it as efficiently as possible.

In an urban context such as Bath, particulate emissions are also an important concern. The entire city of Bath is a Smoke Control Area, so you can only burn wood in your home if you do so using an 'exempt appliance'. This means that you can no longer use your open grate in the manner it was intended, regardless of whether you want to burn wood or coal. For details of exempt appliances, see http://smokecontrol.defra.gov.uk.

The options for wood burning extend all the way from simple stoves designed to heat a single room to automated wood pellet or log boilers which provide for both central heating and hot water and are sited, like gas boilers, in utility rooms rather than living spaces. In between there are many variants on these options including room stoves with back boilers, kitchen ranges, and wood pellet stoves that provide central heating but are designed for living room use.

All these options are possible for traditional homes in Bath as long as the appliance burns the fuel cleanly. If all you want is a room heater that will do a more efficient job than an open fire, there are many stoves available that will look good in a traditional fireplace, though you may need to make adjustments to the grate in order to install it. If you want to provide for all your heating and hot water, and you have space, you could replace your current boiler with a wood pellet boiler. The more complex your specification, the more expensive the solution is likely to be. Automatic fuel feeds, thermostatic control, integration with central heating and integration

with solar panels can all be achieved at a price. But none of this is necessary if all you want is a nice warm heat source for your main living space in the heart of winter.

There are a number of key issues you must get right when specifying a wood burner:

- how much heat do you want it to produce? Specifying the right size of appliance is vital. An oversized wood burner will not operate efficiently.
- do you want to retain heat for later? If a stove is set in a stone fireplace surrounded by masonry walls, as in most traditional homes in Bath, the heat will be absorbed by the fabric of the building and help to keep the room warm after the fire has gone out. If you have space, you can go further and connect the stove to an accumulator tank which can provide heat to radiators through the night.
- what fuel do you want to use and what is available? Fuels include logs, woodchip and wood pellets made from sawdust or other wood waste. You need to be sure not only that you will have a reliable supply but also that this supply will be of reliable quality. You will have problems if you burn a fuel with too high a moisture content, for example.
- where will you store the fuel? You need somewhere accessible and dry. The bigger the system and heat output, the bigger the storage requirement.
- how efficient is the appliance? All solid fuel burners have an EU efficiency rating so always check this – some wood stoves have poor efficiency ratings.

If you live in a traditional house in Bath, you will almost certainly have an existing flue which you may be able to reuse for a wood-fired system. However, if you do so, you should line the flue because wood smoke contains tars that will leach into stonework and could affect surrounding masonry and plaster. If you have an existing grate of historic value, your options may also be more limited.

The government's Renewable Heat Incentive, to be introduced in 2012, will provide financial support for some wood burning appliances but not wood stoves, as many of these can also be used to burn coal. For more details, contact the Energy Saving Trust (see page 71).

Heat pumps

Heat pumps are electrical machines that pump heat from cold places into warm places. They are called heat pumps because the heat is being pushed against its natural direction of flow. Just as an ordinary pump moves water against gravity, from low level to high level, so a heat pump moves heat energy from a low temperature source to a higher temperature output.

A fridge is a heat pump: heat is taken out of a cold place (the interior cabinet), making it even colder, and released out of the back of the cabinet, making the room marginally warmer. Home heating systems that use heat pumps work in the same way. Heat energy is taken from a cool source, such as the ground or the outside air, and transferred to maintain the temperature of the hot water that is pumped round the pipes of the heating system.

Heat pumps are clever machines but they take a lot of electricity to do all that pumping. And although the heat in the ground is there for the taking, the electricity will cost you. A ground source heat pump that is well specified and well run will deliver 3-4 units of heat to a home for every unit of electricity it takes to run it (this is known as its co-efficient of performance or COP). But electricity is around three times as expensive as gas, so you will be lucky if the costs of running it are any lower than an efficient gas boiler (and it is much more expensive to install). Also, mains electricity is almost three times as carbon intensive as gas, so a heat pump powered by mains electricity is not saving much carbon (if any) compared to a gas boiler.

Air source heat pumps are usually more carbon intensive than gas because they only deliver 2-3 units of heat for every unit of electricity. Most heat pumps are installed in areas where mains natural gas is not available.

The traditional homes of Bath are not ideal for heat pumps. For starters, they often have little land attached. Ground source heat pumps are usually installed by digging long trenches in big gardens and laying pipes one metre down. It is also possible to install a ground source heat pump using vertical boreholes but this is expensive and requires access for a drilling rig. But there is a further problem: heat pumps deliver a slow, regular flow of heat rather than big bursts of heat. This means that they are best used in very energy efficient homes that only need a background heat input. This is not a description that fits many of the traditional homes of Bath which tend to cool down rapidly overnight and then get warmed up in the morning with a burst of heat from the boiler.

Thus, if you want to save money or carbon, you should only consider a heat pump if a) you have enough garden for a ground source heat pump and b) you have done a thorough job of insulating and draught-proofing your home. You may also need to resize your heating system, for example with larger radiators or under-floor heating, as heat pumps work best producing heat at a lower temperature than boilers. An air source heat pump might be a good option if you do not have access to gas and are reliant on electricity for heating. However the intake of an air source heat pump looks like an air-conditioning unit, so if you have been refused a boiler flue for aesthetic reasons, you may also face problems getting permission to install an air source heat pump. However you can install them in a wider range of places – a hidden intake in a valley roof would be a good choice, for example.

If you do install a heat pump, spend some time with the installer and/or the manual in order to ensure that

you are completely confident about how to operate the machine properly. Recent trials in Britain have revealed poor householder understanding of heat pump controls, resulting in sub-optimal performance.

The government's Renewable Heat Incentive, to be introduced in 2012, will provide financial support for heat pumps. For more details, contact the Energy Saving Trust (see page 71).

Planning and building control

Listed buildings
If you are installing a new gas boiler in a location where there is no existing flue, you need to obtain listed building consent to install the flue as there may be a visual impact on the facade and historic fabric may be lost. This ought not to be a problem on the rear of the building but consent has been refused in some cases where the rear of the building is visible from the street.

To improve your chances of gaining consent:

- specify a discreet outlet
- paint the outlet the same colour as the wall
- if possible, install the system and outlet on a lower floor of the building
- if possible, offer to remove other services from the wall if they are not needed

Alternatively, put the exhaust through a vertical flue in a roof that cannot be seen.

Listed building consent is required for a wood burner if the installation involves the removal of an existing chimney piece, fire surround or hearth. It will also be required for a new flue. Consent is likely to be granted for an installation in an existing fireplace if there is no impact on material of architectural or historic interest.

Historic chimneys should be retained. Listed building consent is required for any alteration to them.

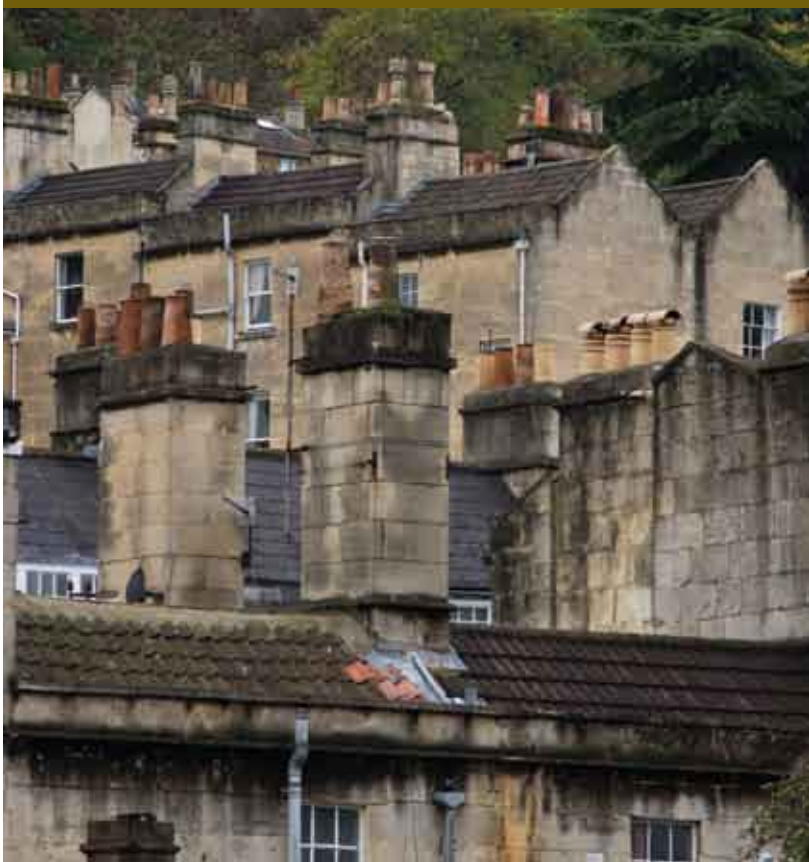
Other traditional buildings
If you live in an unlisted building in the World Heritage Site, planning permission is required for any chimney or flue installed on a wall or roof slope which fronts a highway, and forms either the principal elevation or a side elevation, or rises 1 m or more above the highest part of the roof slope.

Building regulations
If you are installing a solid fuel appliance, such as a wood-burning stove, you do not need to submit an application for Building Regulations approval if the work is carried out by an installer registered with one of the following organisations: Ascertiva group Ltd (NICEIC), Association of Plumbing and Heating Contractors (Certification) Ltd, Benchmark Certification Ltd, Building Engineering Services Competence Accreditation Ltd, ECA Certification Ltd, HETAS Ltd or NAPIT Registration Ltd.

If you do not use an installer who is registered with one of these schemes, you must submit a Building Regulation application and the work will be inspected for compliance with the Building Regulations.

Gas boilers should always be installed by a person who is registered on the Gas Safe Register.

The last place you should consider installing a heat pump: poorly insulated, densely packed houses with no gardens, on the gas main



PRESSING FOR CHANGE

Local views on heating systems in listed buildings in Bath

The following results describe the extent to which Bath residents who responded to our online survey agreed with the given policy options for listed buildings. *These results do not describe current Council policy*.

Boiler flues

Seventy percent of Bath respondents supported the installation of boiler flues on the secondary facades of listed buildings in the city, regardless of visual impact. Nearly half also supported their use on primary facades where there is no practical route to a secondary facade.

10% The installation of boiler flues should be permitted on all facades of all listed buildings in Bath.

36% The installation of boiler flues should be permitted on secondary facades of all listed buildings in Bath. Flues should only be permitted on primary facades where there is no practical route to the rear facade.

24% The installation of boiler flues should be permitted on secondary facades of all listed buildings in Bath.

28% The installation of boiler flues should be permitted on secondary facades of any listed building in Bath where this does not have a significant visual impact

1% None of the above.

Among respondents who live in listed buildings in Bath, 74% supported the installation of boiler flues on the secondary facades of listed buildings in the city, regardless of visual impact. Nearly half (49%) supported their use on primary facades where there is no practical route to a secondary facade, including 9% who support their use on all primary facades.

Bath Preservation Trust position

The Trust supports the installation of boiler flues on the secondary facades of all listed buildings in Bath. Outlets should be discreet and painted to match the colour of the external wall.

Wood burners and boilers

Almost all Bath respondents supported the use of wood burners and boilers in the city's listed buildings, though for two thirds this is only acceptable as long as an existing flue can be reused without damage to a significant grate.

30%: The installation of wood burners and boilers should be permitted in all listed buildings in Bath.

66%: The installation of wood burners and boilers should be permitted in any listed building in Bath where an existing flue can be reused without damage to a significant grate.

3% The installation of wood burners and boilers should not be permitted in any listed building in Bath.

1% None of the above.

Among respondents who live in listed buildings in Bath, 96% said they should be permitted in listed buildings, including 66% who wanted this only where an existing flue can be reused without damage to a significant grate.

Bath Preservation Trust position

The Trust supports the installation of wood burners and boilers in listed buildings in Bath as long as an existing flue can be reused without damage to an original grate.

Air source heat pumps

Three quarters of Bath respondents support the installation of air source heat pumps on secondary facades of listed buildings in the city, as long as they do not have a significant visual or noise impact.

13% The installation of air source heat pumps with intakes on secondary facades should be permitted in all listed buildings in Bath.

61% The installation of air source heat pumps with intakes on secondary facades should be permitted in any listed building in Bath where they are not visible and do not have a significant noise impact.

22% The installation of air source heat pumps should not be permitted in listed buildings in Bath.

3% None of the above.

Among residents who live in listed buildings, 72% support the installation of air source heat pumps on secondary facades of listed buildings in the city, as long as they are not visible and do not have a significant noise impact.

Bath Preservation Trust position

The Trust supports the installation of air source heat pumps with intakes and/or outlets on secondary facades as long as they do not have a significant visual or noise impact.

Solar energy

Most of the historic city of Bath faces south. The bowl cradles the city in such a way that the rising terraces enjoy abundant sunshine throughout the year. The builders of Georgian Bath were well aware of the value of sunshine in bringing heat, light and delight to their new homes. Unlike many modern homes, built with modest windows (for walls are cheaper to build than windows), most of the traditional homes of Bath celebrate the light. The builders of Bath would perhaps have been more sympathetic to solar panels than many of today's builders. A beautifully detailed, wrought-iron Victorian solar panel would have been a joy to behold.

Although the technology is modern, many of the traditional buildings of Bath are particularly well-suited to solar panels. The Georgian valley roof is ideal as it offers a safe environment to install and maintain solar panels, substantial unshaded roof area, and protection from the gaze of those who wish to admire the buildings of Bath without modern accretions. However, as the majority of roofs in Bath are not protected in this way, the potential impact of solar panels on the look of the city cannot be ignored.

One way of reducing the visual impact of solar panels is to integrate them into the roof finish itself. This can be achieved with Heritage solar slates which are designed specifically for traditional buildings as a replacement for traditional slates. They remain, however, an expensive option and the rather shiny solar slates still look different to a slate roof.

Before you consider whether or not a solar panel will look right on your roof, ask yourself whether this is the most appropriate action to be taking. It makes little sense to start producing your own energy if you are currently throwing energy away on a regular basis. Measures to save energy and use energy more efficiently should

A solar thermal panel, discreetly placed on the rear roof a Victorian house in Bath. This panel uses evacuated tubes to improve the efficiency of the solar collector.

always have priority over the installation of renewable energy technology.

Electricity or hot water?

There are two different types of solar panel, employing two completely different types of technology. A solar electric (or 'photovoltaic') panel employs highly advanced silicon-based electronics to generate electricity. A solar thermal panel, which produces hot water, is often little more than a black metal sheet with a pipe carrying water across it. Not surprisingly, photovoltaic panels tend to be much more expensive to install than solar thermal panels. More advanced solar thermal panels use special vacuum tubes to capture the sun's heat but even this technology pales against the sophistication of photovoltaics.

The cost and sophistication of the technology is not, however, a measure of the risks involved in installing these panels. If anything, solar thermal panels are more likely to cause problems and require maintenance because they are mechanical systems involving the regular pumping of water from the panel to your hot water tank and back again whereas photovoltaic panels are solid state electronics with no moving parts. However both types of panel are tried and tested and, with maintenance, should last for decades.

Solar thermal

It may not be worth installing a solar thermal panel if you do not have a reasonable demand for hot water in the summer. Modern washing machines and dishwashers are cold-fill only, so if you have new appliances, no children in the household and usually take short showers rather than long baths, your demand for hot water may be very low.

Solar thermal panels always work alongside, and do not replace, standard heating systems. In the winter you will get little or no hot water from a solar thermal panel so your hot water will be supplied by your boiler. Solar thermal systems usually require the installation of a new hot water tank with two internal heat exchanging coils, one for the boiler and one for the solar thermal panel, though 'direct' systems can be integrated with an existing tank. If you currently have a combination boiler and no hot water tank, a solar thermal panel may not be appropriate.

Photovoltaics

Photovoltaic panels are not constrained by your demand for electricity. If you generate more electricity than you need, you can export the surplus to the grid. When the sun goes down, you can buy it back. This is all done seamlessly and invisibly by the technology that comes with the photovoltaic panels. You can just sit back and enjoy your homemade electricity. If you are considering photovoltaic panels or slates, compare the efficiency of different products as this can range from 8% to 21%. If you have limited roof space, you should opt for the most efficient product you can afford.

Financial incentives

In April 2010 the government introduced special tariffs, usually known as 'feed-in tariffs' for photovoltaic and other renewable energy generating systems. This is cash paid to you by your utility company for the power you generate. The scheme is designed to encourage wider uptake of renewable energy technologies. A similar incentive for solar thermal panels (the Renewable Heat Incentive) is being introduced in 2012. To be sure of receiving these tariffs, you need to use an installer who is accredited with the Microgeneration Certification Scheme (www.microgenerationcertification.org).

For more information on these tariffs, contact the Energy Saving Trust (see page 71).

Photovoltaic panels in the valley roof of a listed Georgian house in Bath. The minimal fixings reduce the impact on historic fabric.

Photovoltaic 'solar slates' can just be distinguished from the real tiles on the upper part of the roof of this Grade II listed farmhouse in Wiltshire

Solar panels and solar slates

Most solar thermal and photovoltaic systems are installed as panels standing proud of the roof with pipes and cable routed through the roof to the house below. For solar thermal panels, pipes go down to the hot water cylinder. For photovoltaic panels, the wires go down to the inverters which convert the direct current output of the panels into 240V AC. This output is fed into the consumer panel next to your electricity meter.

Solar panels can be installed on any south-facing roof or, with an appropriate frame, on a flat roof. The roof has to be strong enough to support the weight of the panel and care is needed with fixings and routing for pipes and cables to ensure that the weather protection of the roof is not compromised. However the roof covering itself does not have to be replaced – an important benefit for installation on listed buildings.

Solar slates are photovoltaic modules designed to mimic and replace traditional roofing tiles. They can be integrated into a section of an existing roof or replace all the existing slates. They are designed to be installed in the same way as ordinary slates but must of course be wired up to an inverter as well. Solar slates have been designed to reduce the visual impact of solar systems, especially on traditional buildings. However they will inevitably have an impact on the historic fabric of a building if its roof currently has original slates in place. For more information, see www.solarslate-ltd.com.

Planning and building control

Listed buildings

If you live in a listed building you must obtain listed building consent *and* planning permission if you want to install a solar panel (thermal or electric) on your roof. The main issue is visual impact as there is little impact on historic fabric because of the way the panel is raised above the roof. Solar panels ought to be acceptable on listed buildings as long as the panel is not visible from the street or elsewhere in the city, for example when installed in valley roofs or on hidden rear roofs. However some applications have been refused in these circumstances.

Successful applications for listed building consent will demonstrate

- other methods to improve energy efficiency have been implemented
- no impact on significant historic fabric

- restricted visual impact
- structural soundness of the roof to cope with additional weight
- methods of fixing that will have the least harm

Solar panels can be installed on unlisted outbuildings or on frames on the ground without the need for listed building consent but planning permission is required because 'permitted development' rights – see below – do not apply to listed buildings. For both protection and aesthetic reasons, free-standing frames of solar panels are best disguised with fencing or planting wherever possible (though any such protection should not of course shade the panels).

Solar slates/tiles require listed building consent because replacing any roof covering with a different material will change the character of the listed building. These ought to be acceptable where there is no resulting harm to historic fabric, and if they are located where they will have a restricted visual impact, for example in the roof valley. As traditional slate roof coverings are important characteristics of Bath's listed buildings, consent may not be granted for solar slates on the principal front roof slope or other visible roof slopes.

Other traditional buildings
Within the city of Bath and its conservation areas, solar panels can be installed on the roofs of all unlisted buildings without the need for planning permission. They are a 'permitted development' as long as the following conditions are met:

- They are not installed above the ridgeline of the roof and project no more than 200mm from the roof surface.
- They are sited, so far as is practicable, to minimise the effect on the appearance of the building.
- They are sited, so far as is practicable, to minimise the effect on the amenity of the area.
- When no longer needed for microgeneration they should be removed as soon as possible.

There is no detailed specification of the second and third of these conditions, leaving a great deal open to interpretation.

Stand alone solar panels are a 'permitted development' in the World Heritage Site provided there is only one installation, it stands no higher than four metres above ground level, it is not visible from the highway and it is situated within five metres of the boundary of the curtilage of the property. The surface area of the solar panels must not exceed 9 m^2 and any linear dimension of the installation (including the supporting frame) must not exceed 3 m.

A stand alone solar array must, so far as practicable, be sited so as to minimise its effect on the amenity of the area. When no longer needed for microgeneration it must be removed as soon as reasonably practicable.

Building regulations
Installing solar panels on the roof of your property may require Building Regulation approval. If the work is carried out by an contractor registered with one of the following organisations for this kind of work, an application will not be necessary: Ascertiva group Ltd (NICEIC), Association of Plumbing and Heating Contractors (Certification) Ltd, Benchmark Certification Ltd, British Standards Institution, Building Engineering Services Competence Accreditation Ltd, ECA Certification Ltd, HETAS Ltd, NAPIT Registration Ltd, Oil Firing Technical association Ltd and Stroma Certification Ltd.

Although not an issue for Building Control, you should also ensure your installer is accredited with the Microgeneration Certification Scheme (www.microgenerationcertification.org) in order to receive payments for the renewable energy you generate.

PRESSING FOR CHANGE

Local views on solar panels in listed buildings in Bath

The following results describe the extent to which Bath residents who responded to our online survey agreed with the given policy options for listed buildings. *These results do not describe current Council policy*.

Solar panels

Four fifths (79%) of Bath respondents support the installation of solar panels on side, rear and valley roofs of listed buildings in Bath where the panel does not have a significant visual impact on a prominent roofscape, including 39% who were not concerned about visual impact.

24% The installation of roof-mounted solar panels should be permitted on all roofs of listed buildings in Bath.

15% The installation of roof-mounted solar panels should be permitted on side, rear and valley roofs of all listed buildings in Bath.

40% The installation of roof-mounted solar panels should be permitted on side, rear and valley roofs of any listed building in Bath where the panel does not have a significant visual impact on a prominent roofscape.

13% The installation of roof-mounted solar panels should be permitted on the valley roofs of all listed buildings in Bath.

5% The installation of roof-mounted solar panels should not be permitted on listed buildings in Bath.

3% None of the above.

Among respondents who live in listed buildings in Bath, 69% supported the installation of solar panels on side, rear and valley roofs of listed buildings in Bath where the panel does not have a significant visual impact on a prominent roofscape, including 27% who were not concerned about visual impact.

Bath Preservation Trust position

The Trust supports the installation of roof-mounted solar panels on any listed building in Bath where the panel is sited on a side, rear or valley roof and the panel does not have a significant visual impact on a prominent roofscape.

Solar slates

Almost all (95%) Bath respondents supported the use of heritage solar slates on listed buildings in the city but a majority would limit their use to roofs where there is no significant visual impact or loss of historic fabric.

39% The installation of heritage solar tiles should be permitted on all listed buildings in Bath.

56% The installation of heritage solar tiles should be permitted on any listed building in Bath where there is no significant visual impact or loss of historic fabric.

3% The installation of heritage solar tiles should not be permitted on listed buildings in Bath.

2% None of the above.

Among respondents who live in listed buildings in Bath, 92% supported the use of solar slates on listed buildings in Bath, including 64% who would restrict their use to roofs where there is no significant visual impact or loss of historic fabric.

Bath Preservation Trust position

The Trust supports the installation of heritage solar slates on any listed building in Bath where there is no significant visual impact.

5. Planning policy and practice

Getting permission

Throughout this guide we have indicated where you may need to seek permission from Bath and North East Somerset Council before carrying out energy performance improvements to your home. There are some improvements which obviously do not need permission – such as changing your light bulbs and upgrading your appliances – and a few for which every household must seek planning permission, such as installing exterior wall insulation. For much of what lies in between, the answer is usually: it depends. Above all, it depends on whether your home is listed or not. If it is, any change which has an impact on the character of the building will require listed building consent. If it is not, you will be able to do a great deal without the need to seek planning permission.

Even if planning permission is not required, you may need to get changes approved by the Council's building control department to ensure that your proposed works meet building regulations. However this is not necessary if you use a contractor who is registered to do the work to the appropriate standard (see Chapter 4 for details).

The following is a step by step guide to seeking planning permission from the Council:

1. Explore options and prioritise

Chapter 2 describes some of the issues you need to think about before deciding what to do. Begin with the energy hierarchy to specify the full range of changes you think are worth considering within your home and your budget. If you have a substantial budget, it will probably be worth your while seeking professional advice and working through the various options in detail. Whatever the size of your budget, the more time you spend researching your options and talking to suppliers the better.

2. Is permission required?

Establishing if planning permission or listed building consent is required may simply involve picking up the phone and speaking to a planning or conservation officer in the Council's planning department (see page 71). However, you will probably be asked to provide more details in writing before the Council can confirm whether or not any form of permission is required and what fees will apply. Planning permission may also be required if you want to change the use of a building.

If your home is not listed, you will probably enjoy 'permitted development rights' as defined by the Town and Country Planning (General Permitted Development) Order 1995 and subsequent amendments. If a change is a 'permitted development', you do not need to seek permission from the Council to undertake the work. However there may be restrictions within the General Permitted Development Order which you must follow. Relevant permitted developments and their restrictions are described in Chapter 4.

If your home has undergone development in the past which required planning permission, permitted development rights may have been revoked as a condition for the development. If this could apply to your home, check with the Council before undertaking the work.

The Council can restrict permitted development rights in any part of the city using a power called an 'Article 4 direction'. This power is used in different ways by different local authorities, which is partly why the rules are not always the same in different places. However, in Bath, at the time of writing, none of the measures described in this guidance have been restricted in this way. The General Permitted Development Order does not apply to listed buildings. In principle, no

'developments' to the fabric of listed buildings are allowed without the prior permission of the Council. Furthermore, the Council's conservation officers will always insist that every application for listed building consent is judged on its own merits, taking account of the specific circumstances, qualities and characteristics of the building under consideration.

While this approach provides an exceptional degree of protection for Bath's many heritage buildings, it leaves owners of listed buildings in Bath with no straightforward guidance about the likely acceptability of different measures to improve the energy performance of their homes. This is the vacuum that the survey reported in this guidance has sought to address.

Conservation area consent is only required for proposals to demolish buildings. The function of the conservation area is to define a specification which guides decisions about planning applications, and which must therefore be taken into consideration when preparing a planning application, if one is needed.

3. Seek pre-application advice

Once the Council's planning officers have confirmed whether or not permission is required, you need to obtain the relevant application forms from the Council's Planning Department or website. At this stage it is advisable to seek pre-application advice from the Council. For a fee, a planning or conservation officer will visit the property, discuss the options with you, clarify what information must be submitted and give you some indication of whether an application is likely to be approved or not.

If you live in a listed building, pre-application advice is an important opportunity to identify the range of issues you will need to address. You can also obtain free advice from the Bath Preservation Trust about the scope of the work being considered.

4. Consider professional help

Planning applications and listed building consents require the submission of detailed scale drawings and in most cases an accompanying design and access statement, planning statement and heritage statement. It is therefore advisable to appoint a professional (an architect, conservation architect, surveyor or chartered town planner) to prepare the application and supporting statements. This person will act as an agent on your behalf and will liaise with other professionals as necessary, such as structural engineers and building historians. For a very simple proposal it may be feasible for the application to be prepared by the applicant but in most cases drawings will need to be prepared by a skilled draughtsperson.

5. Make the case

Planning application forms and drawings need to be supported by a written explanation of the scheme, the thinking behind the proposal and how the solution has been reached. For planning applications, these design and access statements must provide details of the physical characteristics of the scheme. The statement should include contextual analysis and visual impact assessment including details of what the proposal will look like in the townscape, with photographs and photomontages.

If the proposal is likely to have an impact on neighbours it is advisable to discuss it with them first and provide details of responses to their comments in the planning application. If professional advice has been sought then details of this should also be included. Pre-submission discussion with the Bath Preservation Trust and Bath Heritage Watchdog may also be useful as both of these organisations regularly comment on planning applications once they are open to consultation.

Planning statements should aim to justify the proposal in terms of national and local planning policy and guidance (see page 66). The Council's Local Plan (soon to become the Local Development Framework) and supplementary planning documents define the priorities and constraints of local planning policy and so must be considered in detail. These policies will be the primary basis on which your application will be judged. If there are any departures from a policy position, you must make clear the reasons for this. You can also make reference to national planning policy statements when making your case.

Most applications for planning permission in Bath will require justification in terms of the impact on 'heritage assets', including the values of the World Heritage Site, the character and appearance of the conservation area and the significance of listed buildings and their setting. So even if your home is not itself listed you will need to take account of the impact on any listed buildings nearby. English Heritage has produced guidance which is helpful in undertaking assessments of the setting of heritage assets (see page 67).

In Bath, proposals also need to take account of the special qualities and unique characteristics of the city such as topography, unity in architecture, materials, form and height, the grain and pattern of the city, the framing of open spaces between buildings and important views and vistas.

You can get a sense of the Council's priorities, and an idea of what is likely to be acceptable, by reviewing previous planning applications, all of which are available on the Bath and North East Somerset Council website (www.bathnes.gov.uk).

6. Listed buildings

Listed building consent is required for any works, internal or external, that in the judgment of the Council would

affect a listed building's character as 'a building of special architectural or historic interest'. Primary legislation states that in considering whether to grant listed building consent for any works the Council (or in some cases the Secretary of State), 'shall have special regard to the desirability of preserving the building or its setting or any features of special architectural or historic interest which it possesses'.

The character of Bath's historic buildings may be adversely affected by physical alteration and changes to their setting. The original plan form, internal features and evidence of proportion are important and should not be compromised by unsympathetic alterations. Interior and exterior work must relate sensitively to the original building and will require an appropriate level of craftsmanship and professional skill. In almost all cases the materials used for alterations should match the original, be traditional or be superior in quality and execution.

For all applications for listed building consent it is vital to understand the special interest of the building. The term 'significance' is used as a catch all phrase to sum up the architectural, historic, artistic, archaeological or evidential interest of a listed building.

Applications for listed building consent will stand a better chance of success when there is proper understanding of the significance of the building and the extent of the fabric to which significance relates. Applicants are required to undertake an assessment of significance to the extent necessary to understand the potential impact of the proposals. Planners, homeowners and developers may therefore find it necessary to seek advice from professionally qualified and experienced individuals and organisations. Detailed guidance for identifying and assessing significance is set out in the English Heritage *PPS5 Historic Environment Planning Practice Guide*.

The Council will advise if a design and access statement is needed. Where one is required the assessment of significance and an impact assessment can be set out within it. Where such a statement is not required, and for more complex proposals, the Council may require that justification is presented in a 'heritage statement'. This statement would need to be informed and supported by physical and documentary evidence about the historic development of the building or any part of it. Evidence can be collected from a range of sources such as local and national records; historical maps, photographs and reports; and planning records. It may also be necessary to undertake on-site investigation for which the Council can provide advice on professional standards and practice.

For some types of work additional requirements may include a heritage impact assessment, photographic surveys, and schedules of work and investigation and recording (if any loss of significant fabric is proposed). Structural surveys may also be required, for example for solar panels on historic roofs, or for altering floors.

7. Consideration of proposals

Once an application has been submitted to the Council it will be checked and entered into the planning register, which anyone can see. The Council will then begin public consultation on the application. In most cases a planning officer will visit the application site and make an assessment of the proposal against local planning policies in the Local Plan/Local Development Framework. It may help to prepare a sample of how the work or installation will appear, for illustrative purposes, for the officer to examine when they visit the site.

Section 38 (6) of the Planning and Compulsory Act 2004 makes it clear that applications must be determined in accordance with the 'development plan' unless 'material considerations' indicate otherwise. Every planning application is determined on its own merits, and whilst the 'development plan' (the Council's Local Plan/ Local Development Framework) is the most important consideration, other material considerations will also be considered, i.e. anything relevant to planning in the proposal.

The planning or conservation officer will weigh up the proposals, taking into account the evidence provided, the differing heritage impacts and benefits, the condition of the building, how the proposal fits in with the appearance of the surroundings, the design and the materials to be used. They will take account of consultations with interested parties, the Council's planning documents and national planning policy.

For some types of listed building consent applications, the Council has a statutory obligation to undertake consultation with the national amenity societies, such as English Heritage and the Georgian Group.

8. Decisions

A decision on a planning application or an application for listed building consent can be made either by councillors at planning committee or by planning

When it comes to energy infrastructure, all sorts of things get planning permission. The Bath-stone coloured paint is a poor disguise in this instance.

officers under 'delegated' powers. The Council can determine the planning application in one of three ways:

- by granting planning permission;
- by refusing planning permission; or
- by granting planning permission subject to conditions.

If planning permission is granted then it is likely that this will be subject to conditions. The most common condition will be a time limit within which the development must begin, usually three years from when planning permission is granted. Another common condition is to require the work to be undertaken in strict accordance with approved drawings of specific details.

9. Refusal notices and appeals

In the event of refusal, details of how to appeal will be included with the decision letter from the Council. They can also be obtained from the Planning Inspectorate, the government organisation that manages the appeals process in England and Wales. You will be required to complete and return an appeal form which, with essential supporting documents, must reach the Inspectorate within 12 weeks of the date shown on the Council's decision notice. At this stage it may be advisable to seek professional help from a planning consultant or another support organisation.

The appeal involves a reconsideration of the application by an independent planning inspector and can take the form of written representations, an informal hearing or a public inquiry.

Written representations
Most planning appeals are decided by written representation. They are usually the simplest, cheapest and quickest method. With this method of appeal, both parties prepare a written statement of their case and the grounds of appeal should address the Council's reasons for refusal. The inspector visits the site and considers the written evidence from the applicant, the Council and anyone else who has an interest in the appeal.

If you are a third party and you write to the Council about the planning application, the Council should inform you of the appeal within two weeks of the Planning Inspectorate's decision to accept it. The comments you make about the application will be taken into account in the appeal unless you write to the Inspectorate directly.

The inspector writes a decision letter to both parties in which the appeal is either upheld and planning permission granted or dismissed and permission refused.

Informal hearings
Hearings are usually a round table discussion held in Council offices, village halls or community centres. They are open to members of the public and usually last about half a day. The inspector will open the hearing by explaining what the appeal is about. They will then go through some routine points, including asking who wants to speak. The inspector will give a summary of the applicant's case and the Council's case and outline which topics will be discussed. The inspector always leads the discussion. The applicant usually gives his or her views on a topic first, followed by the Council, then anyone else who wants to comment.

In most cases, when everyone who wants to speak has done so, the inspector will suggest that the hearing is continued on the site of the proposed development and after this the inspector writes the decision. Recorded evidence is allowed at the discretion of the inspector present on the day.

Inquiries
This type of appeal is less common for domestic planning applications and normally applies to major developments or developments of more than local importance. If you want to take a role in an inquiry and call your own witnesses, you should contact the Planning Inspectorate at the earliest possible stage. Inquiries are open to members of the public, and although you do not have a legal right to speak, the inspector will normally allow you to do so. Before the inquiry, if you want to see what the applicant and the Council have written, you should be able to see copies of their appeal documents at the Council's offices.

A group of individual interested parties may appoint one agent or solicitor to represent them all and the agent may make a request for 'Rule 6' status. If the inspector agrees to this, your agent will be asked to provide a statement of your case and details of any documents they will produce at the inquiry.

Inquiries are usually held in Council offices, village halls or community centres. An inquiry is the most formal of the appeal procedures and may last for several days, or even weeks. It is not a court of law, but the proceedings will often seem to be quite similar and the applicant and the Council usually have legal representatives.

The High Court
An appeal decision can only be challenged on legal grounds in the High Court. To be successful, you would have to show that the inspector had gone beyond his or her powers or that the Planning Inspectorate did not follow the proper procedures and so damaged your interests.

If your challenge is successful, the High Court will overturn the original decision and return the case to the Planning Inspectorate, who will re-assess it. This does not necessarily mean that the original decision will be reversed. If you decide to challenge the

decision, you must apply to the High Court within six weeks of the date of the decision.

Costs
The appeal process itself is free. However, the applicant and the Council have to pay their own expenses. If there is a hearing or an inquiry, one party may be asked to pay the other party's costs, as well as their own. The inspector will only do this if the person applying can show that the other side behaved unreasonably and put them to unnecessary expense.

Planning policy

This section provides an introduction to the national and local policies that may be relevant to a planning application or listed building consent application for changes to a traditional home in Bath. This is not a long checklist of things you can and cannot do but rather a broad range of policy which you must take into account when preparing a planning application. Consequently a great many judgments have to be made about the relevance and relative priority of different policy issues. Be aware that policy at both national and local levels is changing, so do not assume this section is up-to-date. The government intends to replace all the current national planning policy statements with one integrated policy statement. Locally, Bath and North East Somerset Council's Local Plan will be replaced in 2011 with a Local Development Framework including a new Core Strategy setting out the Council's priorities for the next ten years.

National planning policy statements

The national planning policy statements are a suite of policy documents covering a wide range of planning issues including heritage (PPS5), climate change (supplement to PPS1) and renewable energy (PPS22). They can all be downloaded from the website of the government's Department of Communities and Local Government (www.communities.gov.uk). Although the individual policy documents were published and revised at different times, each remains current until it is explicitly replaced by a new document.

National Planning Policy Statement 1: Delivering Sustainable Development (PPS1)
PPS1 sets out the government's broad objectives for the planning system as a whole. Paragraph 17 states that:

The Government is committed to protecting and enhancing the quality of the natural and historic environment, in both rural and urban areas. Planning policies should seek to protect and enhance the quality, character and amenity value of the countryside and urban areas as a whole. A high level of protection should be given to most valued townscapes and landscapes, wildlife habitats and natural resources. Those with national and international designations should receive the highest level of protection.

Planning and Climate Change: Supplement to PPS1
This supplement, which has the same status as the planning policy statements themselves, sets out how planning should contribute to reducing emissions and stabilising climate change. Paragraph 9 requires local councils to prepare, and manage the delivery of, spatial strategies that:

- *make a full contribution to delivering the Government's Climate Change Programme and energy policies, and in doing so contribute to global sustainability;*
- *in providing for the homes, jobs, services and infrastructure needed by communities, and in renewing and shaping the places where they live and work, secure the highest viable resource and energy efficiency and reduction in emissions.*

It makes clear the priority of action on climate change across all national planning guidance: where there is a difference in emphasis on climate change between the policies in this PPS and others in the national series this is intentional and this PPS [Planning and Climate Change] takes precedence.

National Planning Policy Statement 5, Planning for the Historic Environment (PPS5)
PPS5 encompasses all heritage assets including world heritage sites, conservation areas, listed buildings and buildings of local importance. The very first policy within it confronts the tension between protecting heritage assets and tackling climate change:

HE1.1 Local planning authorities should identify opportunities

to mitigate, and adapt to, the effects of climate change when devising policies and making decisions relating to heritage assets by seeking the reuse and, where appropriate, the modification of heritage assets so as to reduce carbon emissions and secure sustainable development. Opportunities to adapt heritage assets include enhancing energy efficiency, improving resilience to the effects of a changing climate, allowing greater use of renewable energy and allowing for the sustainable use of water. Keeping heritage assets in use avoids the consumption of building materials and energy and the generation of waste from the construction of replacement buildings.

HE1.2 Where proposals that are promoted for their contribution to mitigating climate change have a potentially negative effect on heritage assets, local planning authorities should, prior to determination, and ideally during pre-application discussions, help the applicant to identify feasible solutions that deliver similar climate change mitigation but with less or no harm to the significance of the heritage asset and its setting.

HE1.3 Where conflict between climate change objectives and the conservation of heritage assets is unavoidable, the public benefit of mitigating the effects of climate change should be weighed against any harm to the significance of heritage assets in accordance with the development management principles in this PPS and national planning policy on climate change.

English Heritage PPS5 Practice Guide
English Heritage's Guide to PPS5 is designed to assist local authorities, owners, applicants and other interested parties in implementing PPS5. Paragraph 25 states:

Where the ongoing energy performance of a building is unsatisfactory, there will almost always be some scope for suitable adaptations to be made without harm to the asset's significance. This will involve careful consideration of the most appropriate options for insulation, power use and power generation. Intrusive interventions, such as the external mounting of microgeneration technology, can harm the significance of a heritage asset. Where such interventions are proposed, a temporary, reversible installation will generally be preferable to one that causes irrevocable harm to an asset's significance. Local planning authorities are encouraged to support home owners and developers to find solutions that minimise or avoid harm to an asset's significance while delivering improved energy performance or generation.

Planning Policy Statement 22 Renewable Energy (PPS22)
PPS22 is principally concerned with renewable installations that are larger scale than domestic installations. It is a vital PPS to consult if you are interested in developing community-scale renewable energy projects. Paragraph 1(iii) states:

At the local level, planning authorities should set out the criteria that will be applied in assessing applications for planning permission for renewable energy projects. Planning policies that rule out or place constraints on the development of all, or specific types of, renewable energy technologies should not be included in local development documents without sufficient reasoned justification. The Government may intervene in the plan making process where it considers that the constraints being proposed by local authorities are too great or have been poorly justified.

The Local Plan and Local Development Framework

Bath and North East Somerset Council's principal planning policy document is the Local Plan, adopted in 2007. This sets out the goals and priorities of local spatial planning policy and is the primary point of reference for local decisions about planning applications. However the Local Plan is due to be replaced in 2011 by the Council's new Local Development Framework. This is a suite of documents including a Core Strategy which sets out the Council's vision for development in the area. The Local Development Framework includes a Statement of Community Involvement, describing how the Council plans to involve local people in preparing and reviewing all planning documents for the area, and supplementary planning documents address specific local issues of importance.

The Local Plan
Many of the policies within the local plan could be relevant to your planning application. They include:

D.2	General design and public realm considerations
D.4	Townscape Considerations
ES.1	Renewable Energy Proposals
GB.1	Control of Development in the Green Belt
GB.2	Visual amenities in the Green Belt
NE.1	Landscape Character
NE.2	Area of Outstanding Natural Beauty
NE.3	Important hillsides
BH.1	Impact on the World Heritage Site of Bath or its setting
BH.2	Listed Buildings and their settings
BH.5	Locally important buildings
BH.6	Development within or effecting Conservation Areas
BH.9	Parks and gardens of special interest
BH.11	Scheduled Ancient Monuments
BH.12	Important archeological remains

The Local Development Framework
The draft Core Strategy of the new Local Development Framework includes the following high level objectives:

Objective 1. Cross cutting objective: Pursue a low carbon and sustainable future in a changing climate

This includes:

- *encouraging and supporting the increased generation and use of renewable and low carbon energy, including through the delivery of community led schemes*
- *promoting sustainable and energy efficient design and construction*

Objective 2 Protect and enhance the District's natural, built and cultural assets and provide green infrastructure

This includes:

- *helping to conserve and enhance the quality & character of our built and natural heritage*
- *capitalising on the role our heritage has in promoting local distinctiveness, place-making and supporting regeneration*
- *maintaining an outstanding built & natural environment by ensuring that new development responds appropriately to the locally distinctive context and meets high standards of design*

Among the proposed new policies in the Core Strategy is CP1 on retrofitting existing buildings. This includes the following commitment:

The Council will seek to encourage and enable the sensitive retrofitting of energy efficiency measures and the appropriate use of micro-renewables in historic buildings (including listed buildings) and in conservation areas, whilst safeguarding the special characteristics of these heritage assets for the future. Proposals will be considered against Policy HE1 of PPS5 (see above).

The World Heritage Site

World heritage sites in England are protected in two ways. Firstly, individual buildings, monuments, gardens and landscapes are designated (listed) under the Planning (Listed Buildings and Conservation Areas) Act 1990 and the 1979 Ancient Monuments and Archaeological Areas Act. Secondly, the entire site is protected by national and local planning policy, as governed by the Town and Country Planning Act 1990.

Bath and North East Somerset Council's Local Plan states that the city's World Heritage Site status should be a key material consideration in the consideration of planning applications. The Local Plan contains policies on a wide range of topics affecting the world heritage site including economy, tourism, recreation, shopping, health and safety, housing, waste, transport, built and historic environment and natural environment. A single Local Plan Policy BH1 seeks to prevent harm either to the special qualities which justify the inscription of the site or to the setting of the site.

Within the Core Strategy of the Council's new Local Development Framework, a Core Policy for the World Heritage Site will recognise, and seek to protect and enhance, the 'outstanding universal value' of the site.

The City of Bath was inscribed on the UNESCO list of world heritage sites in December 1987 and is of 'outstanding universal value' for the following cultural attributes:

- The Roman remains, especially the Temple of Sulis Minerva and the baths complex (based around the hot springs at the heart of the Roman city of Aquae Sulis, which have remained at the heart of the City's development ever since) are amongst the most famous and important Roman remains north of the Alps, and marked the beginning of Bath's history as a spa town.
- the Georgian city reflects the ambitions of John Wood Senior, Ralph Allen and Richard "Beau" Nash to make Bath into one of the most beautiful cities in Europe, with architecture and landscape combined harmoniously for the enjoyment of the spa town's cure takers.
- The Neo-classical style of the public buildings (such as the Assembly Rooms and the Pump Room) harmonises with the grandiose proportions of the monumental ensembles (such as Queen Square, Circus and Royal Crescent) and collectively reflects the ambitions, particularly social, of the spa city in the 18th century.
- The individual Georgian buildings reflect the profound influence of Palladio, and their collective scale, style and the organisation of the spaces between buildings epitomises the success of architects such as the John Woods, Robert Adam, Thomas Baldwin and John Palmer in transposing Palladio's ideas to the scale of a complete city, situated in a hollow in the hills and built to a Picturesque landscape aestheticism creating a strong garden city feel, more akin to the 19th century garden cities than the 17th century Renaissance cities

The city is also protected by the guidance issued in Government Circular 07/2009 Protection of World Heritage Sites which seeks:

- *to protect the World Heritage Site and its setting, including any buffer zone, from inappropriate development*
- *to strike a balance between the needs of conservation, biodiversity, access, the interests of the local community and the sustainable economic use of the World Heritage Site in its setting*
- *to protect a World Heritage Site from the effect of changes which are relatively minor but which, on a cumulative basis, could have a significant effect*
- *enhancing the World Heritage Site where appropriate and possible through positive management*
- *Protecting World Heritage Sites from climate change but ensuring that mitigation is not at the expense of authenticity or integrity*

The Bath City Wide Conservation Area

Conservation areas are 'any areas of special architectural or historic interest the character or appearance of which it is desirable to preserve or enhance'. Conservation areas are protected under the same primary legislation as listed buildings, the Planning (Listed Buildings & Conservation Areas) Act 1990, which requires that 'special attention shall be paid to the desirability of preserving or enhancing the character or appearance of that area'.

The Bath City Wide Conservation Area covers two thirds of the city (1,486 ha). The designation gives broader protection than listing as all features are recognised as part of its character. The emphasis is on buildings and their settings, including the appearance, proportion, height, and massing of buildings; street patterns, building lines and exterior spaces; and roofscapes, views and skyline features. Architectural details such as windows and doors are also important.

The character of the conservation area is protected by Local Plan policy BH6 and the Bath City-wide character appraisal. The latter is a supplementary planning document and is therefore an integral part of local planning policy. It summarises the character and significance of Bath and provides guidance to enable future proposals for change to be considered n relation to the character of the city.

The character appraisal identifies the following key issues effecting the character and significance of Bath:

- hot springs – historical development and culture.
- the inherent quality of the architecture, consistency in materials, well detailed and well maintained Bath stone, colour and cohesion.
- topography – the way the buildings respond to the landscape.
- high quality public and private spaces.
- the valley, surrounding hillsides and River Avon.
- uniform height of buildings.

The following give Bath's Conservation Area its distinctiveness and significance and are important material planning considerations;

- materials
- high quality architecture and urban design
- setting and views
- building height and scale

Listed buildings

Listed buildings are graded to show their relative national importance. There are three grades I, II* and II. The whole of the building or structure is listed, interior and exterior, front, back and other structures attached or within the historic curtilage will also be included in the designation.

There is a statutory requirement, set out in the Planning (Listed Buildings & Conservation Areas) Act 1990, to protect listed buildings from inappropriate development that would harm their architectural or historic significance. Listed building consent is required for any works of demolition, alteration or extension that would in any way affect the character of the building as a building of special architectural or historic interest. In practice this can mean that minor alterations such as changing a door may need consent. Permitted development rights do not apply to listed buildings.

Applicants must base proposals for listed building consent on a proper understanding of the significance of the listed building (heritage asset). Detailed guidance about assessing the impact of alterations on the special architectural and historic interest of listed buildings is included in PPS5 and the English Heritage Practice Guidance.

The Council's Local Plan policy BH2 states that development, or works affecting a listed building will only be permitted where it would

- preserve the building's special architectural or historic interest
- preserve any feature of special architectural or historic interest which a building may possess
- retain the historic form and structural integrity of the building
- respect the character of the building in terms of scale, design and materials
- not adversely affect the building's contribution to the local scene including its role as part of an architectural composition

New works to listed buildings which are approved may be eligible for zero rate VAT. For further information, contact the HM Customs and Excise VAT advice line on 0845 010 9000.

Buildings of local importance

Buildings which are not listed but are still considered to be 'heritage assets' can be identified in the planning process as 'buildings of local importance'. Policy BH5 of the Council's Local Plan sets out criteria against which these applications should be assessed.

Development would only be permitted where it would

- conserve or enhance architectural interest or integrity;
- not adversely affect the contribution made to the context, local interest, or historical associations.

Further reading

Ayres, James: *Building the Georgian City*. Yale University Press. 1998

Wood, John: *Essay towards a Description of Bath*, London, 1765

Bath and North East Somerset Council: *Bath And North East Somerset Local Plan* (1st adopted draft), 2002

Bath and North East Somerset Council: *Draft Core Strategy*, 2011

Bath and North East Somerset Council: *City of Bath World Heritage Management Plan 2003-2009*, 2003

Bath and North East Somerset Council: *Bath City-wide Character Appraisal*, Supplementary Planning Document, 2005.

Bath and North East Somerset Council: *Walcot Street Works Conservation Area Character Assessment and Principles for Development*, 1997

Bath and North East Somerset Council: *Larkhall Character Statement and development Principles*, 1998

Bath and North East Somerset Council: *Landscape Setting Study*, 2010

Department for Culture, Media and Sport: *The Historic Envrionment: A Force for our Future*, 2001

UNESCO: *Policy Document on the Impact of Climate Change on World Heritage Properties*, 2008

6. Advice & suppliers

Disclaimer

This list been prepared to help owners of historic and traditional buildings find suppliers of services and materials. Whilst every reasonable care has been taken in compiling the list and the information is believed to be accurate at the time of issue, details to change.

Most of the firms included are from Bath or the South West of England. But it is not a comprehensive list and criticism is not intended of firms not included.

Likewise, inclusion on the list does not constitute any recommendation as to the suitability of the firms listed for the works you may be considering. Neither the Bath Preservation Trust nor the Centre for Sustainable Energy can accept any responsibility for the standard and quality of workmanship or materials. Nor do we have any financial interest in the firms included on this list.

Readers should ensure, prior to entering into any contract that the firm is suitable and has the necessary skills, knowledge and ability to carry out the works required of them.

Advice

English Heritage
(South West office)
29 Queen Square, Bristol BS1 4ND
0117 975 0700
www.english-heritage.org.uk
See also www.climatechangeandyourhome.org.uk. This English Heritage website provides advice on improving the energy performance of traditional and historic buildings. All English Heritage's publications on improving traditional homes are available from this site

Bath and North East Somerset Council
www.bathnes.gov.uk/planning
The planning section of the Council's website explains what improvements you can make to your home and what is likely to need planning permission or listed building consent.

Energy Saving Trust
21 Dartmouth Street,
London SW1H 9BP
www.energysavingtrust.org.uk
The Energy Saving Trust manages the UK's principal national advice service on domestic energy efficiency (0800 512 012). The freephone number connects you to an energy advisor in your own area

The Planning Portal
www.planningportal.gov.uk
This government website offers extensive advice on all planning issues. However remember that national advice and policy will always be complemented by local planning policy

The National Trust
(South West office)
Eastleigh Court, Bishopstrow,
Warminster, Wilts BA12 9HW
01985 843600
The National Trust tackles climate change at its properties through reducing energy use and generating energy from renewables, and through the management of its land for better for storage of carbon in soils and vegetation. Its website has a dedicated climate change section with details of the Trust's energy strategy and building projects, along with practical advice for what the public can do

Changeworks
36 Newhaven Road,
Edinburgh EH6 5PY
0131 555 4010
www.changeworks.org.uk
Changeworks has been involved in several award-winning projects to increase energy efficiency in older and historic properties without compromising the appearance or original fabric of the building. Comprehensive good practice guides can be downloaded from its website

Centre for Alternative Technology
Machynlleth, Powys SY20 9AZ.
01654 705 950.
www.cat.org.uk
CAT is an education and visitor centre which demonstrates practical solutions for sustainability: environmental building, eco-sanitation, woodland management, renewable energy, energy efficiency and organic growing

On-line case studies of eco-renovation

The following three websites contain examples of what other house owners have done to make their homes more energy efficient

Ecovation

http://ecovation.org.uk

Sustainable Energy Academy: www.sustainableenergyacademy.org.uk

Retrofit for the Future
www.retrofitforthefuture.org

Energy auditors

Energy Saving Experts
3 Fieldins, Winsley,
Wiltshire BA15 2JU
01225 862266
www.energy-saving-experts.com
Energy assessments for residential, commercial and public buildings

Lock-in Energy (Bath)
www.lockinenergy.co.uk
A Community Interest Company based in Bath that works within local communities encouraging and supporting energy reduction projects

Parity Projects (Bath office)
7 Eagle Road, Batheaston,
Bath BA1 7HL
07810 436 181
www.parityprojects.com
A leading UK-wide company specialising in the low-energy retrofit of older homes.

Professional networks

Royal Institute of British Architects
66 Portland Place London W1B 1AD
0207 580 5533
www.architecture.com

Institute of Historic Building Conservation
Jubilee House, High Street, Tisbury,
Wiltshire SP3 6HA
01747 873133
www.ihbc.org.uk

AECB (The Sustainable Building Association)
PO Box 32, Llandysul SA44 5ZA
0845 4569773
www.aecb.net

The Green Register
CREATE Centre, Smeaton Road, Bristol
BS1 6XN
0117 377 3490
www.thegreenregister.org.uk

Royal Town Planning Institute
41 Botolph Lane, London EC3R 8DL
020 7929 9494
www.rtpi.org.uk

Architects

The following are accredited in building conservation and have experience of working with traditional buildings

Aaron Evans Architects Ltd
3 Argyle Street, Bath BA2 4BA
01225 466 234
www.aaronevans.com

Batterham Matthews Design Ltd
1 Tollbridge Studios, Tollbridge Road
Bath BA1 7DE
01225 851122
www.bmd-architects.com

BBA Architects & Planners
Henrietta Mews, Bath BA2 6LR
01225 460427
www.bba-architects.co.uk

Chedburn Design & Conservation
Limpley Mill, Limpley Stoke,
Bath BA1 7DE
01225 859999
www.chedburn.com

Chris Bocci
Laurel House, Station Road, Freshford,
Bath BA2 7WQ
01225 722718
www.chrisbocciarchitect.co.uk

Dalley Smith Architecture
Meadow Farm, Bathampton,
Bath BA2 6SL
01225 460 395
www.dalleysmith.co.uk

David Brain Partnership
Ralph Allen's Town House, 2 Church
Street, Bath BA1 1SA
01225 445055
www.dbpbath.co.uk

Donald Insall Associates Ltd
7a Northumberland Buildings, Queen
Sqaure, Bath BA1 2JB
01225 469898
www.insall-architects.co.uk

Dziedzic, Marek Architect
44 Langdon Rd, Bath BA2 1LS
01225 421027
www.panmarek.co.uk

Esmond Murray Architects Ltd
21 Van Diemens Lane, Bath BA1 5TW
01225 447165
www.architectssomerset.co.uk

Feilden Clegg Bradley Studios LLP
Bath Brewery, Toll Bridge Road,
Bath BA1 7DE
01225 852545
www.fcbstudios.com

Hallett Pollard Hilliar
7 Sydney Wharf, Bath BA2 4NG
01225 471773
www.hallettpollardhilliar.com

Harrison and Brookes
9 Vicarage Street, Frome,
Somerset BA11 1PX
01373 474398
www.harrisonbrookes.co.uk

Hetreed Ross Architects
Attika Workspace, Bath Brewery, Toll
Bridge Road, Bath BA1 7DE
01225 851860
www.hetreedross.com

Horsfall & Norris
Red Tuns Barn, Trudoxhill, Frome,
Somerset BA11 5DR
01373 836200

Ian Robson
White House, Leigh Street, Leigh upon
Mendip, Radstock BA3 5QP
01373 813385

J H Consulting Architects Ltd
87 Walcot Street, Bath BA1 5BW
01225 471345
www.jhconsulting.org

Jonathan Rhind Architects
Coach House, Rumwell Hall,
Taunton TA4 1EL
01823 462 300
www.jonathan-rhind.co.uk

Mark Kingsley Architects
Piccadilly House, London Road,
Bath BA1 7DE
01225 852554
www.kingsleyarchitects.com

Mitchell Taylor Workshop
Wharf Studio, Widcombe Hill,
Bath BA2 6AA
01225 789033
www.mitchelltaylorworkshop.co.uk

MJW Architects
The Old Chapel, Mendip Road, Stoke St
Michael, Somerset BA3 5JU
01749 840180
www.mjwarchitects.com

Nash Partnership
23a Sydney Buildings, Bath BA2 6BZ
01225 442424
www.nashpartnership.com

Nicholas Magniac Associates
1 Malvern Villas, Bath BA1 5JS
01225 443219
www.magniac.com

Nick Shipp Architects
Haugh Winsley, nr Bath BA15 2JD
01225 867008
www.nickshipp.com

Nigel Spragg
22 Edgerton Road, Bath BA2 2DP
01225 338437

Simon Morray-Jones Architects
21 Milsom Street, Bath BA1 1DE
01225 787900
www.sm-j.com

Stride Treglown
St George's Lodge, 33 Oldfield Road,
Bath BA2 3NE
01225 466 173
www.stridetreglown.co.uk

Studio Architects Ltd
7 Sydney Wharf, Bath BA1 1RD
01225 482424
www.studioarchitects.co.uk

Wrigley Associates
30 Alexandra Road, Lyncombe Hill, Bath
BA2 4PW
01225 337420
www.wrigleyassociates.co.uk

Surveyors

The following are accredited in building conservation and have experience of working with traditional buildings

Alan Hardiman Associates
196-198 Cheltenham Road,
Bristol BS6 5QZ
0117 9243697

John Mill Associates
Blenheim House, Henry Street,
Bath BA1 1JR
01225 460056
john.mill@btinternet.com

Martin Parish Associates
19 Larkhall Place, Bath BA1 6SF
01225 448633

Nigel Sherwen
3 Stanley Villas, Camden Road, Bath,
Somerset BA1 5JE
01225 442961

Philip Hughes Associates
Old Manor Stables, Tout Hill, Wincanton,
Somerset BA9 9DL
01963 824240
www.pha-building-conservation.co.uk

S M Harris & Associates
Midland House , 30 James Street West,
Bath BA1 2BT
01225 448383
simon.harris@smharrisandassociates.net

Structural engineers

FKW Ltd
Buttercliffe Rise, Long Ashton,
Bristol BS41 9JA
01275 392839

Hockley & Dawson
Smithbrook Barns, Cranleigh,
Surrey GU6 8LH
01483 548784
www.hockleyanddawson.co.uk

Mann Williams
4 Palace Yard Mews, Bath BA1 2NH
01225 464419
www.mannwilliams.co.uk

Builders and trades

Emery Bros. Building Contractors
Darlington Wharf, Darlington Road, Bath
BA2 6NL
01225 462153
www.emery.co.uk

Footprint Building
155A South Liberty Lane,
Bristol BS3 2TL
0117 963 5243
www.footprintbuilding.co.uk

Hawker Joinery Ltd
Northend Joinery Works, Northend, Bath
BA1 7HN
01225 858299
www.hawker-joinery.co.uk

Keith Moyle Building & Plastering Services
5 Hanover Square, Bath BA2 5LQ
01225 837223
www.keithmoyle.co.uk

Eco and traditional building materials

Black Mountain Insulation
Expressway 3,Tir Llwyd Industrial Estate,
Rhyl, Denbighshire LL18 5JA
01745 361911
www.blackmountaininsulation.com

Construction Resources, London
111 Rotherhithe Street,
London SE16 4NF
020 7232 1181
www.constructionresources.com

Ecological Building Systems,
Pacific House, Parkhouse,
Carlisle CA3 0LJ
05600 758025
www.ecologicalbuildingsystems.com

Ecomerchant
Head Hill Road, Goodnestone,
nr Faversham, Kent ME13 9BU
01795 530130
www.ecomerchant.co.uk

Farrow & Ball Paints
124-126 Walcot Street,
Bath BA1 5BG
01225 466700
www.farrow-ball.com

Bristol Wood Recycling Project
13 Cattle Market Road, Bristol BS1 6QW
www.bwrp.org.uk

Green Building Store
Heath House Mill, Golcar, Huddersfield
HD7 4JW
01484 461705
www.greenbuildingstore.co.uk

The Green Shop, Gloucestershire
Cheltenham Road, Bisley, Stroud, Glos
GL6 7BX
01452 770629
www.greenshop.co.uk

Holkham Linseed Paints
Longlands, Holkham, Wells-next-the-Sea,
Norfolk NR23 1RU
01328 711348
www.holkhamlinseedpaints.co.uk

Lime Green
Coates Kilns, Stretton Road, Much
Wenlock, Shropshire TF13 6DG
01952 728 611
www.lime-green.co.uk

Mike Wye & Associates
Buckland Filleigh Sawmills, Buckland
Filleigh, Devon EX21 5RN
01409 281644
www.mikewye.co.uk

Natural Building Technologies
The Hangar, Worminghall Road, Oakley,
Bucks HP18 9UL
01844 338 338
www.natural-building.co.uk

The Natural Paint Store
Green Park Station, Bath BA1 1JB
01225 461177
www.thenaturalpaintstore.com

Second Nature
Soulands Gate, Dacre, Penrith, Cumbria
CA11 0JF
017684 86285
www.thermafleece.com
www.edenbloc.co.uk

Ty-Mawr Lime
Unit 12, Brecon Enterprise Park, Brecon,
Powys LD3 8BT
01874 611350
www.lime.org.uk

Windows

Bath Restoration Ltd
Single Hill, Bath BA2 8LZ
01761 435 205
www.restorebath.org

Clement
Weydown Industrial Estate, Haslemere,
Surrey GU27 1HR
01428 643393
ww.clementwindows.org.uk
www.castrooflight.co.uk

Georgian Sashcraft Ltd
Unit 15, Charmborough Farm,
Holcombe, Bath BA3 5FX
01761 233777
www.sash-windows-bath.co.uk

Granada
01246 453 209
www.1st-4-secondary-double-glazing.co.uk

Hawkes & Son Sash Windows
597 Semington Road, Melksham,
Wiltshire SN12 6DY
01225 354521
www.hawkes-sash.co.uk

MagneGlaze
27 Blymhill Common, Shifnal,
Shropshire TF11 8JP
01952 691033
www.magneglaze.co.uk

The Pole Company
1 Saracen Street, Bath BA1 5BR
01225 425563
www.thepolecompany.co.uk

The Roof Light Company
Wychwood Business Centre, Shipton-under-Wychwood
Oxon OX7 6XU
01993 833108
www.therooflightcompany.co.uk

Sash Window Consultancy
Priston Mill Farm, Priston,
Bath BA2 9EQ
01761 470870
www.sashconsultancy.co.uk

Selectaglaze
Alban Park, Hatfield Road,
St Albans AL4 OJJ
01727 837271
www.selectaglaze.co.uk

Storm Windows
James Scott Road,
Halesowen B63 2QT
01384 636365
www.stormwindows.co.uk

Velux
Woodside Way, Glenrothes,
Fife KY7 4ND
01592 778 225
www.velux.co.uk

Draughtproofing

Reddiseals
The Furlong, Droitwich,
Worcs WR9 9BG
0845 165 8234
www.reddiseals.com

StormFlame
PO Box 289, Southampton SO31 6ZN
01329 841 416
www.draftproofing.com

Ventrolla
Hornbeam Business Park,
Harrogate HG2 8PB
01423 859 323
www.ventrolla.co.uk

Window Care Systems
Unit 19, Darwell Park, Mica Close,
Amington, Tamworth
Staffs B77 4DR
01827 302517
www.repair-care.com

Energy systems

The following list includes renewable energy installers, trade associations and purchasers

1 World Solar
Unit 4, Montpelier Central Trading Estate,
Bristol BS6 5EE
0117 942 6668
www.1worldsolar.co.uk
Microgeneration business that also sells the UK's first 'shower heat recovery system'

Ace Energy
0800 083 2588
3 Monmouth Place, Bath BA1 2AT
ace.plumbing@btconnect.com
Supports domestic customers looking to improve their energy efficiency. Helps with grants, too

Appliance Services
113a Eastfield Road, Westbury-on-Trym,
Bristol BS9 4AN
0117 381 2963
www.appliance-services.co.uk
Repairing, servicing and installing domestic heating appliances and hot water solar systems

Ayres Plumbing & Heating
1 School Lane, Amesbury,
Salisbury SP4 7DT
01980 590421
www.ayres-heating.co.uk
Air and ground-source heat pumps, solar panels, condensing boilers

Bath Energy Ltd
Monkton Combe Mill, nr Bath BA2 7HD
01225 722607
info@bathenergy.co.uk
Solar (PV and thermal), heat pumps (ground and air-source), biomass and high efficiency gas and oil boilers

Dunster Woodfuels Ltd
Loxhole Sawmills, Dunster, Minehead,
Somerset TA24 6NY
01643 821188
www.dunsterwoodfuels.co.uk
Installers of biomass room heaters and boilers

EcoFirst
Tithe Barn, Abbey Manor Business Centre, Preston Road,
Yeovil BA20 2FJ
0845 257 5064
www.ecofirst.net
Design and installation of solar (thermal and PV), rainwater harvesting, heat recovery systems and wind turbines

Freesource Energy Ltd
39 Market Place,
Chippenham SN15 3HT
www.freesource.co.uk
0800 6191262
Independent supplier and installer of a wide range of renewable energy products and technologies

Gec-co
University of Southampton Science Park,
2 Venture Road, Chilworth, Southampton
SO16 7NP
0845 602 6461
www.gec-co.co.uk
Design, supply and installation of ground and air source heat pumps, solar arrays and heat recovery units

Good Energy
0845 601 1410
Monkton Reach, Monkton Hill,
Chippenham SN15 1EE
www.good-energy.co.uk
Renewable energy supplier

Green Energy
10845 456 9550
Unit 6, Peerglow Centre, Marsh Lane, Ware,
Herts SG12 9QL
www.greenenergyuk.com
Green electricity solutions for homes and businesses

Gregor Heating & Energy
0117 935 2400
www.gregorheating.co.uk
Heating services company supplying domestic solar thermal, solar PV, ground source and heat pump systems

JHS Power Solutions
0845 302 4779
www.jhspowersolutions.co.uk
Solar PV systems for domestic and commercial projects, newbuild or retrofit

LS Services
48 Murhill, Limpley Stoke,
Bath BA2 7FG
01225 723509
lsservices@supanet.com
Renewable energy installer

Premier Plumbing & Heating
248 Ferndale Road, Swindon, Wiltshire,
SN2 1HB
01373 826333
www.ppheating.co.uk
BPEC-qualified in unvented cylinder and solar hot water heating systems

PV Systems
Severn House, 1-4 Fountain Court,
Woodlands Lane, Bradley Stoke, Bristol
BS32 4LA
0292 082 0910
www.pvsystems.com
Solar energy installations for the commercial, industrial and public sectors

Sarum Solar Ltd
13 Ashfield Road, Salisbury SP2 7EW
0845 408 0444
www.sarumsolar.co.uk
Installers of renewable energy systems

Select Solar
Blakehill Business Park, Chelworth Road, Cricklade SN6 6JD
0845 003 1353
www.selectsolar.co.uk
Solar power specialists with a huge range of PV products

Shellard Energy
10 Argyle Street, Bath BA2 4BQ
01225 839090
www.shellard-winter.co.uk
Joinery, construction and renewable energy

Solarsense
Helios House, Brockley, Backwell, Bristol BS48 4AH
01275 461800
www.solarsense-uk.com
Award-winning, fully accredited solar installers (PV and thermal)

Solar Slate Ltd
Severn House, 1-4 Fountain Court, Woodlands Lane, Bradley Stoke, Bristol BS32 4LA.
01454 627841
www.solarslate-ltd.com
Roof integrated solar photovoltaic slates

Solar Trade Association
7th Floor, Capital Tower, 91 Waterloo Road, London SE1 8RT
www.solartradeassociation.org.uk
Represents the interests of its members, made up of UK-based solar (PV and thermal) companies

Soltrac Ltd
St Marys Cottage, Wardour, Tisbury, Salisbury SP3 6RE
01747 873003
www.soltrac.co.uk
Specialists in solar (PV and thermal)

Somerset Solar
8 Annaly Road, Chedder, Somerset BS27 3AU
01934 743105
www.somersetsolar.co.uk
Installers of solar thermal systems

South West Heating Ltd
Homefield, Gloucester Road, Bath BA1 8BP
0845 338 7048
www.swheating.com
Solar and underfloor heating, compatible condensing boilers and rainwater harvesting

Southern Solar Ltd
Monarch House, Smyth Road, Bedminster, Bristol BS3 2BX
0845 456 1706
www.southernsolar.co.uk
Specialists in the installation of solar (thermal and PV) systems

Treco Ltd
6 Millennium Place, Tiverton Business Park EX16 6SB
0845 130 9012
www.treco.co.uk
Comprehensive range of biomass heating systems

Ultra-Warm Ltd
42 High Street, Corsham, Wiltshire SN13 0HF
01249 713476
www.ultrawarm.co.uk
Heating installers and engineers with solar (thermal)

United Heating Ltd
Unit B5, Southgate, Commerce Park, Frome BA11 2RY
01373 452300
www.unitedheating.co.uk
Domestic renewable heating systems

Windhager UK
Bumpers Farm Industrial Estate, Chippenham, Wiltshire SN14 6BB
01249 715295
www.solarthermal.co.uk
Technical design, customer service support and distribution of the Windhager range of solar and biomass products

Centre for Sustainable Energy

BATH PRESERVATION TRUST