Sustainable Construction and Retrofitting Supplementary Planning Document

ADOPTION DRAFT
FEBRUARY 2013

L D F
Bath and North East Somerset
Local Development Framework

Bath & North East Somerset Council

For more information on the *Sustainable Construction & Retrofitting Supplementary Planning Document* please contact the Planning Policy team at: green_build@bathnes.gov.uk

This document can also be viewed on our website:
www.bathnes.gov.uk/greenbuild

The Sustainable Construction & Retrofitting Supplementary Planning Document can be made available in a range of languages, large print, Braille, on tape, electronic and accessible formats by contacting Planning Policy on:

Telephone: 01225 477548
Fax: 01225 394199

Design by SteersMcGillanEves
www.steersmcgillaneves.co.uk

Cover images: Designscape Architects (2012); David McLaughlin (2012).

Thank you

Bath & North East Somerset Council would like to thank the following organisations and individuals for their involvement and support in preparing this document:

Archipeleco
Bare, Leaning and Bare
Bath Preservation Trust
The Centre for Sustainable Energy
Changeworks
Designscape Architects
English Heritage
Hayesfield Girls' School, Bath
Historic Scotland
JH Consulting Architects
Transition Bath
West of England Sustainable Construction Network
White Design

Jonathan Pilbeam and Jordan Green, UWE Architecture & Planning Undergraduate students (2011/2012) for their project support and research.

Quick Guide

Contents

1 Introduction

This chapter introduces the topic and policy background

Introduction

Background

This Supplementary Planning Document accompanies Bath & North East Somerset's Local Plan and Draft Core Strategy policies CP1: Retrofitting and CP2: Sustainable Construction.

Aims:

- Provide simple, practical guidance for our community on retrofit and sustainable construction
- Facilitate all householders and small scale developers to approach build projects more sustainably
- Support the uptake of retrofitting measures
- Support planning, housing, building control and conservation officers to provide consistent and quality advice

Sustainable Construction

The Council would like to ensure that all design, construction and build projects use Sustainable Construction principles. For larger scale developments, specialist expertise can often be employed or known methodologies can be used such as Code for Sustainable Homes, Passivhaus or the Building Research Establishment Environmental Research Methodology (BREEAM) – explained further in Chapter 2.

However, there are opportunities for almost all build projects, large or small, to be more sustainable and this document introduces and explores, in pictures, the key Sustainable Construction principles. These principles are founded on the well-established methodologies.

Retrofitting

The Council seeks to encourage retrofitting measures to existing buildings to improve their energy and water efficiency and their adaptability to climate change. Support for appropriate domestic scale renewables is also important.

This document profiles the main building types found in Bath & North East Somerset and explains through diagrams how they are built and what materials are used. Find out whether your building is of traditional or modern construction, understand how it works (Chapter 3) and consider your occupancy behaviours before considering which retrofitting options you might like to consider (Chapter 4).

The Council encourages 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 also safeguarding the special characteristics of these heritage assets – for more information see Energy Efficiency and Renewable Energy Guidance: For listed buildings & undesignated historic buildings in Bath & North East Somerset (forthcoming)

For further resources about sustainable construction and retrofitting, information and sign posting see Chapter 5.

This document is supported by our Sustainable Construction & Retrofitting website www.bathnes.gov.uk/greenbuild

Bath Green Homes

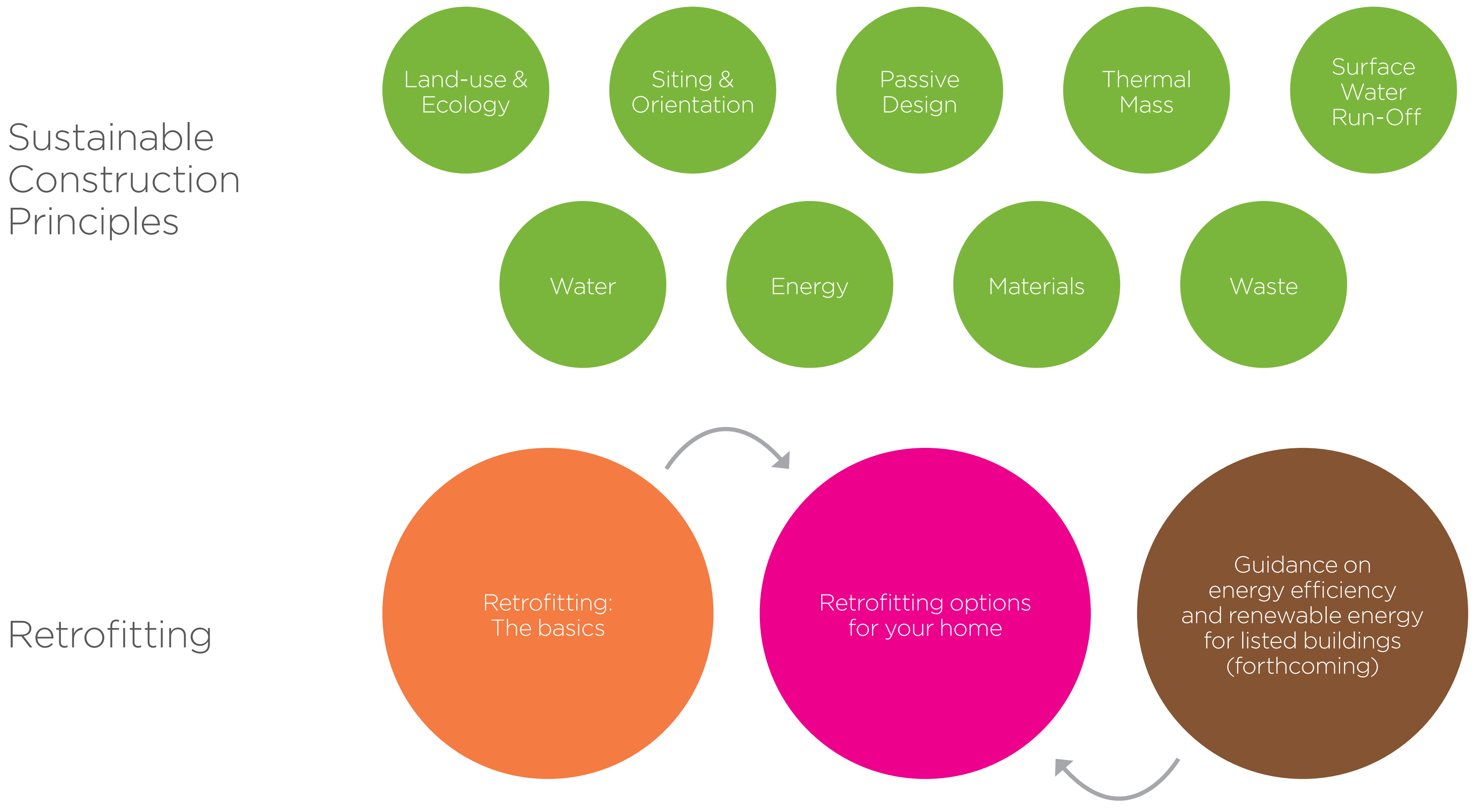
Interested in inspiring local projects? Find out more about **Bath Green Homes** www.bathgreenhomes.co.uk

Not sure how to fund your retrofit? Find out more about the **Green Deal** www.bathnes.gov.uk/services/environment/sustainability

Interested to find out what you can do without planning permission? **Retrofitting Permitted Development Checklist** www.bathnes.gov.uk/greenbuild

Interested in further guidance for listed buildings and historic buildings? **Energy Efficiency and Renewable Energy Guidance: For listed buildings & undesignated historic buildings in Bath & North East Somerset (forthcoming)** www.bathnes.gov.uk/greenbuild

Structure diagram



Policy Background

It is important to understand the national and local policy context for sustainable construction and retrofitting.

National Planning Policy Framework

In March 2012, the Government replaced the previous Planning Policy Statements with a new National Planning Policy Framework (NPPF). The NPPF places significant emphasis on sustainable development and core principles such as improving biodiversity, using natural resources prudently, minimising waste and pollution and mitigating and adapting to climate change including moving to a low carbon economy (para 7). These principles underpin this Supplementary Planning Document.

The Supplementary Planning Document reflects a number of the Government's "core planning principles" in particular :

- Seeking to secure high quality design
- Supporting the transition to the low carbon future in a changing climate – including encouraging the use of renewable energy
- Conserving heritage assets in a manner appropriate to their significance
- Take account of and support local strategies to improve health (particularly in relation to fuel poverty)

Part 10 (paras. 95 & 97) of the NPPF is also particularly relevant as this states that local planning authorities should:

- Plan for new development in ways which reduce greenhouse gas emissions
- Actively support energy efficiency improvements to existing buildings
- Have positive strategies to promote energy from renewable and low carbon sources

Bath & North East Somerset Council's local policies

Local Plan
Policies of particular relevance are likely to be D2 and D4 Design Policies; ES1 Renewable Energy policies (due to be replaced by CP3 Core Strategy policy) and BH2 and BH5 in relation to listed and historic buildings.

Core Strategy
This supplementary planning document supplements policies CP1 on Retrofitting and CP2 on Sustainable Construction.

Guidance

English Heritage's PPS5 Practice Guidance
Paragraph 25 is particularly relevant in relation to improving energy performance of existing heritage assets.

Historic Environment Guidance
English Heritage provide a range of guidance relating to listed buildings and historic buildings, which are referenced throughout this Supplementary Planning Document.

English Heritage have produced a Climate Change and Your Home website to help home owners understand more about the potential impacts of climate change and ways to save energy if you live in an older home. www.climatechangeandyourhome.org.uk

Warmer Bath, the Guidance produced jointly by the Centre for Sustainable Energy and Bath Preservation Trust is a practical guide about how to improve the energy efficiency of Georgian and Victorian homes in Bath.

Energy Efficiency and Renewable Energy Guidance: For listed buildings & undesignated historic buildings in Bath & North East Somerset (forthcoming)

This guidance is being produced to sit alongside this Supplementary Planning Document and provides specific guidance particularly useful for listed building owners.

2 Sustainable Construction: The Principles

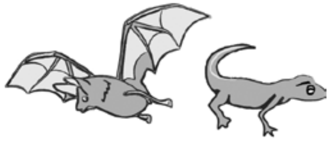
This chapter introduces nine key sustainable construction principles based on common assessment tools

Land-use & Ecology

Whenever we build, we must protect and plan for the plants and animals that already live on the site. We should also look for opportunities to enhance and create new habitats and support biodiversity.

Bath Asparagus at Peasedown St John
Can existing plants be retained?

Pond at Weston All Saints Primary School, Bath
Are there opportunities to enhance habitats and biodiversity?



Some animals & plants are legally protected. Are there any at your site? To find out, a protected species survey may be required. For example, bats may roost in trees and buildings, and a pond may contain great crested newts.

What is your development doing to help protect living creatures such as birds, insects, mammals and reptiles?

Look out for opportunities for enhancements e.g. can you incorporate bird boxes, swift bricks or bat boxes in your design?

For many sites, it is important to carry out an ecological survey prior to any work starting to identify the flora and fauna that need to be protected.

Land on sites should be used efficiently with new planting supporting existing local species of flora and fauna. Opportunities to connect and introduce multifunctional green infrastructure should be considered e.g. by adding green roofs, street trees or space for growing food.

The following are good sources of information on how to identify and protect animals and plants on your construction site:

The district's **Requirements for Biodiversity and Geological Conservation Assessment** can be found on the Council's planning web pages. The Council's Ecologists can advise further if required.

Natural England
Guidance on protected species such as bats.

Bristol Regional Environmental Records Centre
A primary source of and repository for local wildlife and geological data

Avon Wildlife Trust
A leading local wildlife charity and additional source of information and advice.

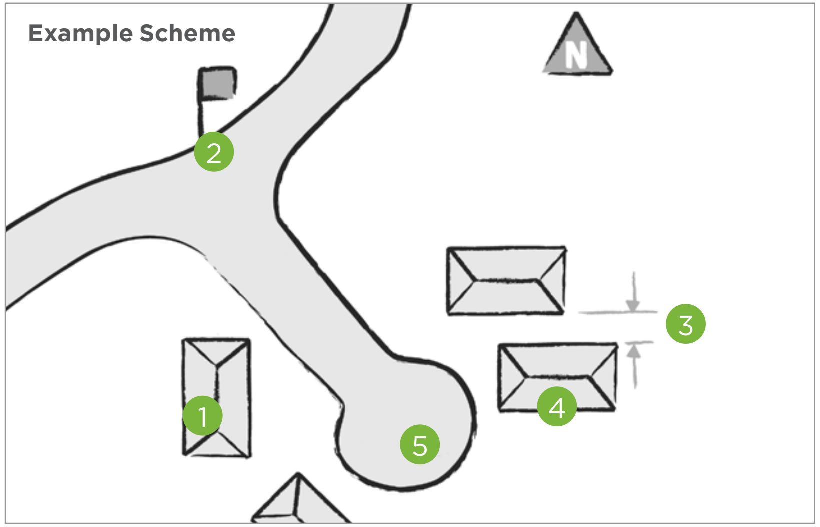
Wildthings Biodiversity Action Plan
Highlights wildlife of local importance and promotes the use of native species and describes their benefits. This is particulatly important for new planting schemes.

Green Infrastructure Strategy
Find out more about the Green Infrastructure networks in your area which include open spaces, parks and gardens, allotments, woodlands, street trees, green roofs, fields, hedges, lakes, ponds, playing field, as well as footpaths, cycleways and waterways. Consider how your development can strengthen and connect to local green infrastructure.

Siting & Orientation

When siting new buildings, there is an opportunity to orient them to:

- Maximise natural daylight and sunlight into the building. See Passive Design.
- Ensure that the largest part of the roof's surface is facing South, or at least SSE/SSW so that any solar panels on the roof have maximum access to the sun.
- Maximise the roof pitch angle to be PV ready in future
- South facing elevations could utilise naturally ventilated conservatories and sun lobbies to control solar gain within dwellings. See Passive Design.
- Consider the topography of the land and character of the place together with solar orientation when siting and laying out your new building. The Building for Life Tool on the Design Council website can help with this.
- Space can be left around the main buildings to allow for rain water collection and the use of Sustainable Urban Drainage Systems or SUDS in the landscaping around dwellings. See Water and Surface Water Run-off sections for details.



- When considering the siting of solar thermal systems the supply and demand of hot water should be considered to maximise their efficiency e.g. early morning hot water for showers

Comments on Example Scheme

1 Very restricted south facing roof surface.

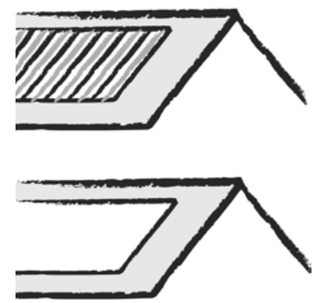
2 Is the site maximising access to public transport? Is walking and cycling designed into the scheme? What is more accessible cycle parking or car parking? Have pedestrian routes been fully considered?

3 Buildings in close proximity to each other can block out their neighbours natural daylight and overshadow neighbour's roofs, reducing their ability to use solar power.

4 Plenty of south facing roof – even if the intention is not to install solar panels during construction, make the roof 'solar ready' for future installation.

5 A path, driveway or front garden of 5m2 or more that is impermeable will require planning permission. It is usually much better to finish with porous surfaces that allow rain falling on the site to drain locally rather than overburdening the existing drainage systems. See Surface Water Run-off section.

Solar panels

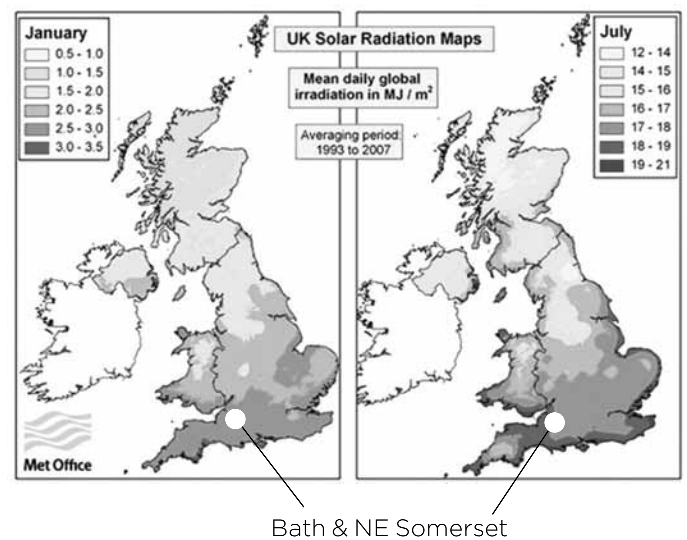


Solar thermal panels heat the hot water for the building

Photovoltaics generate electricity for the building. The feed in tariff scheme will generously compensate you for generating your own electricity. See www.energysavingtrust.org.uk

UK solar radiation

The south west is well placed nationally for solar energy!

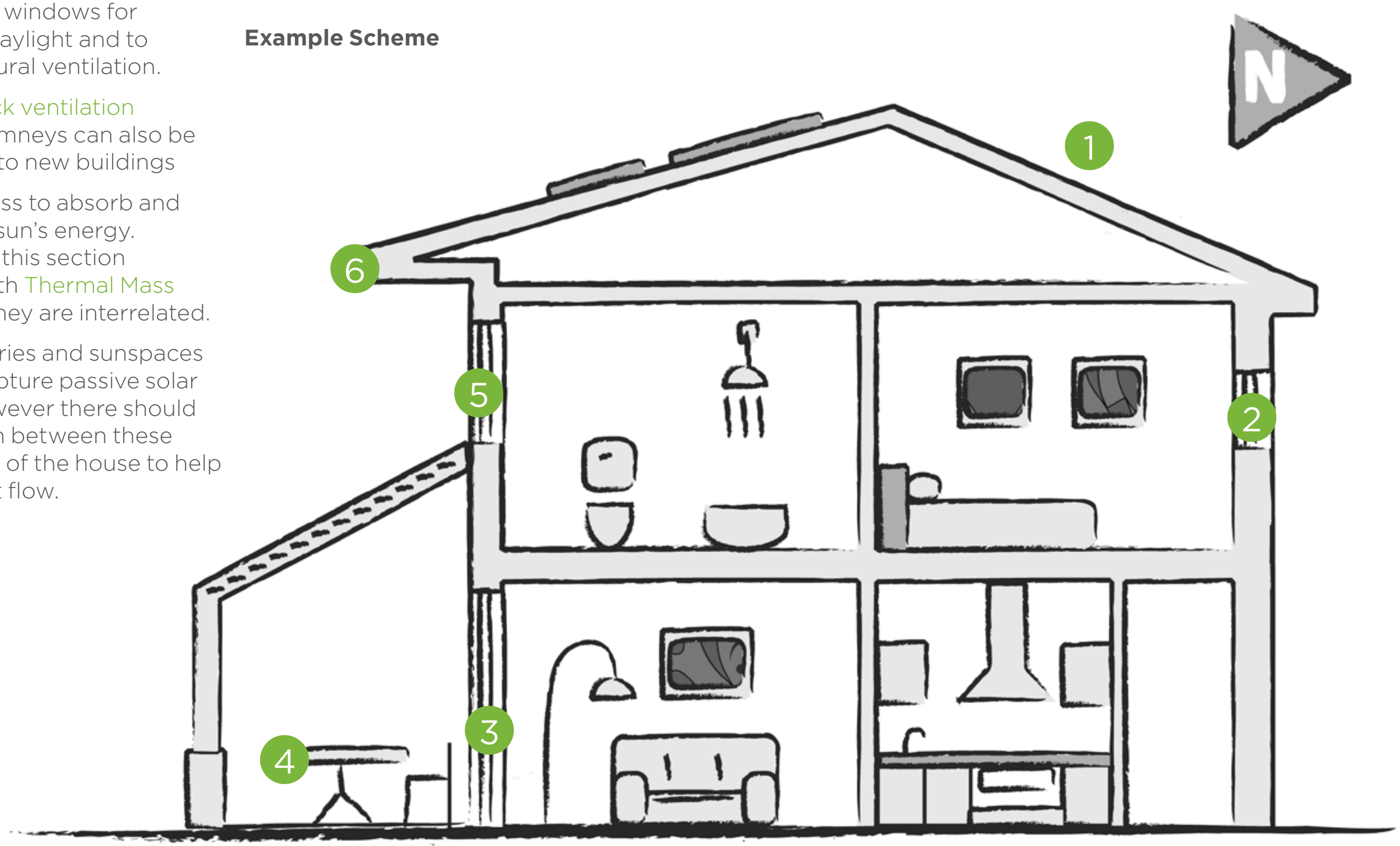


Passive Design

Although 'active' systems such as solar panels and other renewable energy technologies play a part in reducing carbon emissions, a less expensive and longer term option is to use 'passive' measures such as:

- Well placed windows for maximum daylight and to provide natural ventilation.
- Natural stack ventilation through chimneys can also be designed into new buildings
- Thermal mass to absorb and release the sun's energy. Please read this section together with Thermal Mass section as they are interrelated.
- Conservatories and sunspaces can held capture passive solar energy. However there should be a division between these and the rest of the house to help control heat flow. A conservatory or sunspace can otherwise drain heat from the main house in the winter or lead to overheating in the summer.
- Sun pipe light tubes can be used to redistribute natural daylight to interior spaces.

Example Scheme



Comments on Example Scheme

1 Insulation in the roof helps keep heat in during the winter and out during the summer

2 Smaller windows on the north side help to reduce heat loss where the sun doesn't shine

3 Make sure the wall between the main building and the conservatory is built as an external wall to ensure minimal heat loss in winter. See Part L of the Building Regulations for more information.

4 Conservatories on the South (or SSW/SSE) side of the building can capture huge amounts of free, carbon neutral energy from the sun. If the floors are solid (ceramic tile or stone for example), they can soak up the heat from the sun over the course of the day and release it in the evening (see Thermal Mass)

5 Large south facing glazing or windows will let lots of natural light in, avoiding using artificial light, but make sure you can shade in summer. External blinds, brise soleil and shutters can all help control the amount of daylight and sunlight entering the building

6 Consider solar shading in your design, for example the use of a roof overhang, blinds, shutters or even natural tree shading or green walls/roofs.

Thermal Mass

Building materials that are heavyweight (brick, block, concrete) can be used to absorb and release heat in buildings and help moderate the temperature.

A During the day:
Its important on south facing facades to try and keep the highest summer sun out by using roof overhangs & solar shading

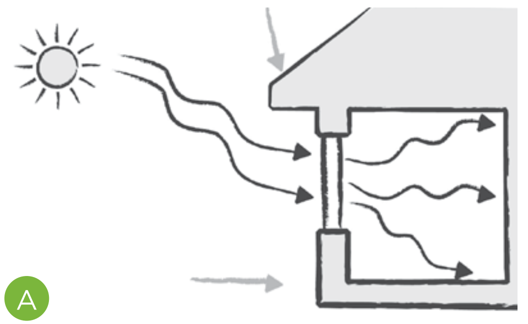
Heavyweight walls, floors and ceilings (thermal mass can absorb the suns heat and help keep the building cool).

B At night time:
Opening windows at night lets heat out and allows cooler air from outside to cool the thermally massive elements and reduce overall temperature: 'night time cooling'. In the morning, the building is ready to start the cycle again. In addition to helping cool buildings in summer (an important consideration with scientific predictions of hotter summers) thermal mass can help keep heat in winter if the insulation is on the outside.

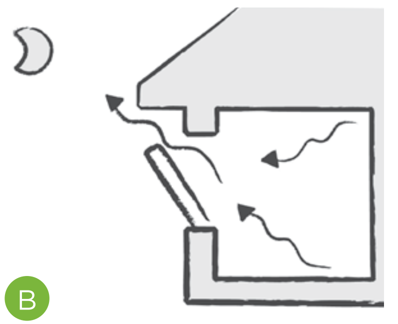
C Heat from inside the building warms up the thermally massive materials and then the insulation on the outside keeps the heat in – like a giant tea cosy over the building. Take care to ensure tha the insulation is continuous and there are no gaps causing 'cold bridging'

D Another benefit of thermal mass is that it helps to iron out the peaks and troughs in temperature, making indoor temperatures more comfortable for the occupants.

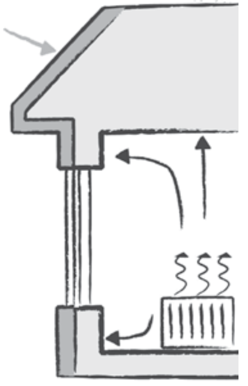
E Don't forget to ensure there is adequate ventilation too – in summer, a breeze makes people feel more comfortable even at relatively high temperatures



A

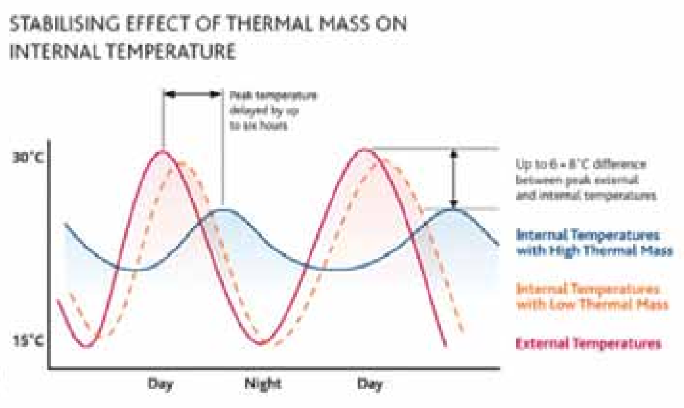


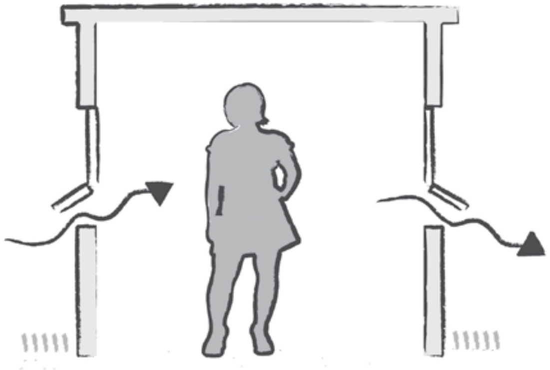
B



C

D





E

Embodied Energy and Thermal Mass
The embodied energy of materials and the use of the building is also an important consideration in any build project for example sustainably sourced timber has low thermal mass but less embodied energy.

Modern construction materials such as straw bale have both excellent thermal properties and a low environmental impact.

Surface Water Run-Off

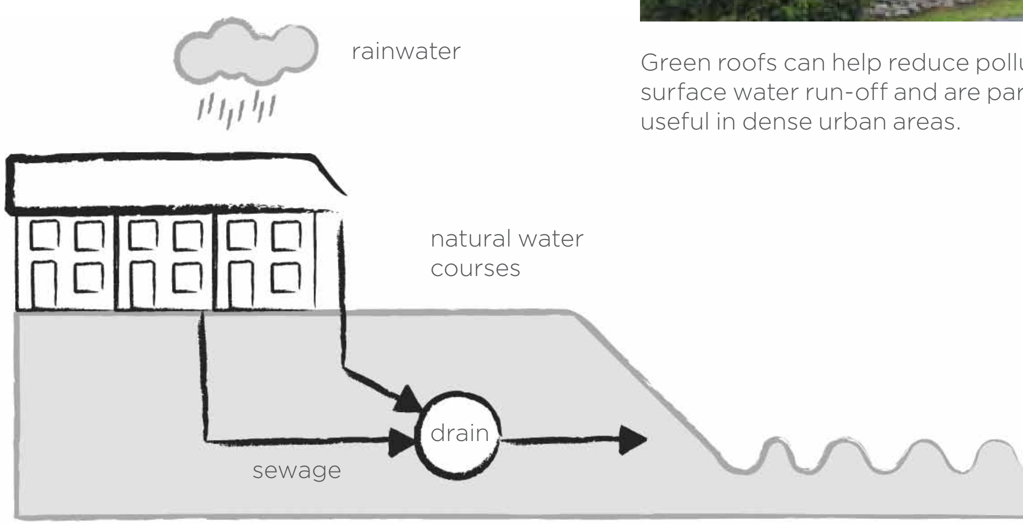
As cities grow, the amount of land we cover with impermeable surfaces such as tarmac, increases. As our climate changes, it is predicted that we will get more extreme weather including severe rain storms.

When it rains heavily, drains cannot cope and this can lead to problems such as flash flooding. Guttering and drainage systems need to be designed with increased rainfall in mind as part of a climate change adaptation strategy.

Sustainable Urban Drainage systems can be incorporated to reduce the potential impact of new and existing developments in terms of surface water drainage.

Simple, natural solutions can often be possible although for some sites engineering options will need to be explored.

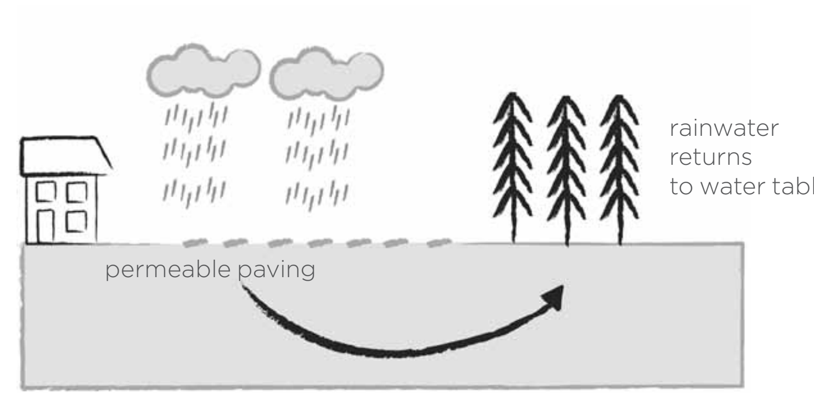
Sustainable drainage is a requirement of the Flood and Water Management Act 2010, which is enforced through the planning system.



The River Avon bursting its banks in central Bath after severe rain.

Green roofs can help reduce pollution and surface water run-off and are particularly useful in dense urban areas.

The solution is to introduce permeable surfaces on paths, drives and car parks, so that when it rains, the ground absorbs the water and the sewage system does not become over burdened.



Case Study:
The Sustainable Urban Drainage system at Weston All Saints Primary School, Bath. This scheme shows that with intelligent design SUD systems can incorporate natural play space and bring visual interest and opportunities for new habitats.

Useful links:

A Community for sharing information on sustainable drainage:
www.susdrain.org

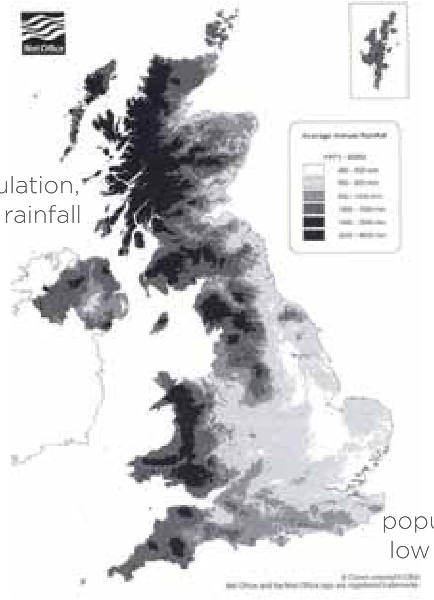
Guidance for urban rain gardens:
www.raingardens.info

Information on various types of green roofs
www.livingroofs.org

Water

We have a fixed amount of water on the planet so we are not going to run out. However, each time we 'clean' used water we use energy, so we need to manage our water use effectively.' For some uses, such as flushing WC's, we do not need to use drinking water – rain water will do the job very well.

In the UK, we have areas of water stress – the parts of the country with the most rain are the least populated.



low population, high rainfall

high population, low rainfall

There are simple ways to use less water:

Low flush, dual flush WC's

Flow restrictors on taps

Low flow shower heads

Environment Agency studies show that CO2 emissions from water use in households come mostly from heating water. CO2 emissions from a hot water storage cylinder and pipes contribute significantly and can only be reduced by energy efficiency measures such as improved pipe or cylinder insulation rather than using less water.

You can also reduce your reliance on processed mains water

Rainwater Harvesting

Grey Water recycling

- **Greywater recycling** is the use of waste water from baths, showers and hand basins for toilet flushing, irrigation or washing machine supply.
- **Rainwater harvesting** is the collection of rainwater from roofs or hard standings for use for toilet flushing, laundry water supply or irrigation.

More information can be found in Chapter 4

And by changing your behaviour

Showering rather than having a bath

Turning off the taps when you don't need running water

You can find out more about water saving opportunities and can often get free gadgets from water utility companies such as Wessex Water – www.wessexwater.co.uk and Bristol Water – www.bristolwater.co.uk.

Energy

There are two ways buildings use energy:

during construction
embodied energy: this term refers to the total energy required to manufacture or construct an object, material or building.

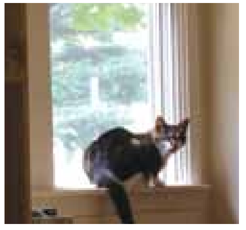
during use operational energy: this is the energy which is used on a daily basis for heating and electrical appliances.

You can reduce the amount of energy your building is responsible for by:

1 Using low impact building materials

2 Making your building more energy efficient

high performance windows



use of natural daylight

use low energy lighting

high levels of insulation

Install heating controls

monitoring to check your energy usage

avoid overheating in summer

You can also use low carbon technologies to reduce the amount of fossil fuels to heat, light and cool your buildings, such as:

gas condensing boiler

solar thermal panels for hot water

photo voltaics for electricity generation

wind turbines (where appropriate)

bio mass (if a local supply can be secured)

heat pumps

Materials

Most of the materials we use come from non-renewable sources, and sooner or later we will run out. It also takes energy (usually from fossil fuels) to make building products thereby contributing to climate change.

We can help to address this by using sustainable materials...

Did you know that Kingston University has catalogued over 1,200 recycled materials for use at the construction industry in its Sustainable Materials Library?

Rematerialise is both an online resource and a library you can visit and only contains items that come from renewable resources or less non-renewable resources.

Seek natural, environmentally friendly, locally sourced materials e.g. sheep's wool insulation

Responsibly sourced used materials
eg. reusing roof tiles

Materials with recycled content
eg. old newspapers as insulation

Materials that can be recycled
It takes 95% less energy to use recycled aluminium than virgin aluminium

Renewable Materials
FSC (Forest Stewardship Council) timber for wood floors

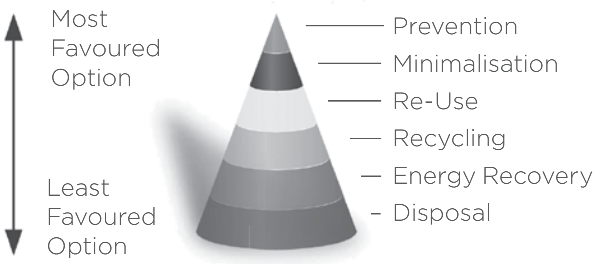
Waste

Constructing buildings creates huge amount of waste – over 100m tonnes each year – over a third of all waste created in the UK.

Consider how existing buildings on a site can be retained and adapted for re-use.

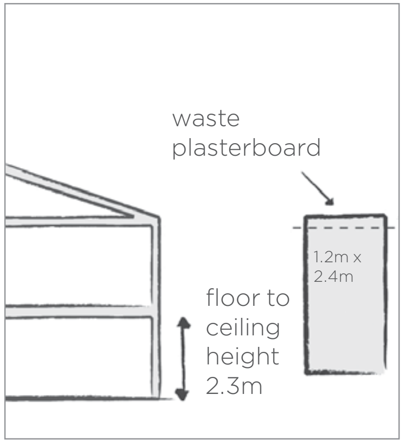
We can make a big difference by:

Whether its construction waste, or waste from households, industry etc, we have to reduce the amount of materials we use in the first place and reduce waste – otherwise known as an 'unused resource'.



Do you have a site waste management plan? This could save you money!

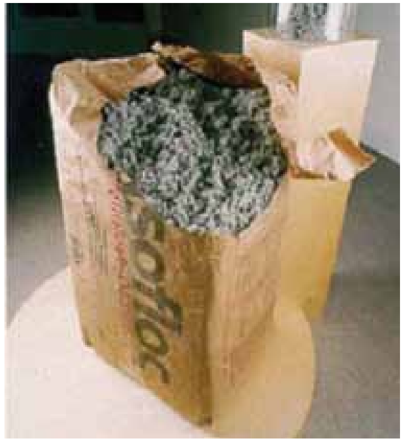
Designing our buildings to use materials more effectively



Using less material

Segregating waste onsite for recycling

Using 'waste' to produce new building materials



Legislation & Assessment Tools

Building Regulations

LABC

Assessment Tools

Code for Sustainable Homes

The national standard for the sustainable design and construction of new homes. From May 2008 it has been mandatory for all new homes to be rated against the Code and include a Code or nil rated certificate.

The Council has proposed specific requirements for Code 4 for all major developments from 2013 and for some specific sites higher targets are also required.

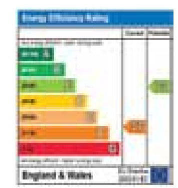
Passivhaus

Passivhaus is an energy performance standard that was developed in Germany in the early 1990s. The approach dramatically reduces the requirement for space heating and cooling. This is primarily achieved by adopting a fabric first approach to the design, specifying high levels of insulation to the thermal envelope with exceptional levels of airtightness and the use of whole house mechanical ventilation.

The Passivhaus Standard can be applied not only to residential dwellings but also to commercial, industrial and public buildings.

BREEAM

BREEAM sets the standard for best practice in sustainable building design, construction and operation and has become one of the most comprehensive and widely recognised measures of a building's environmental performance. It is mainly used for non-residential development.



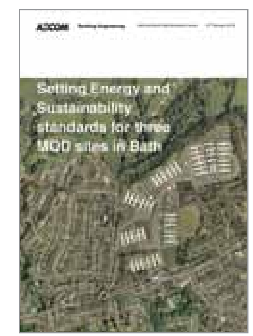
Energy Performance Certificate

Energy Performance Certificates (EPCs) give information on how to make your home more energy efficient and reduce carbon dioxide emissions.

Display Energy Performance Certificates showing operational energy in use are required for all public buildings.

Case study : Bath Western Riverside

The first phase of Bath Western Riverside is being built to Code for Sustainable Homes level 4 and includes measures such as district heating, brown roofs and state of the art insulation.



Case Study : Ministry of Defence Sites in Bath

The Council has set outs its aspirations for higher Sustainable Construction standards in its Concept Statements for the former Ministry of Defence sites.

Case Study: The Nucleus at Hayesfield Girls' School, Bath

Completed in 2012, this new building is super-insulated, passively designed and built using pre-fabricated renewable, locally sourced, carbon sequestering materials.

Land-Use and Ecology
Raised habitat beds and new nesting areas for birds, bats, hedgehogs and insects are provided.

Located on an existing area of hardstanding and built way from existing trees.

Siting & Orientation
The building has been designed to be PV ready and the roof includes containment and solar orientation for the later inclusion of PV cells.

The siting away from existing trees prevents shading which may otherwise compromise the performance of the future PV.

Passive Design
Careful siting and orientation reduces excessive solar gain. An efficient layout of spaces to ensure a low-surface-area to volume ratio increasing the building's thermal performance.

Thermal Mass
Thermal mass provided by the straw bale construction is complemented by a nighttime cooling strategy. Careful location and sizing of glazing, and solar shading helps to regulate temperatures. Deep window reveals and external shading are included at the south and west elevations.

Surface Water Run-Off
Permeable paving surfaces around the building help prevent excess run-off during heavy rain. Rain water is diverted to a new soakaway in the adjacent playing field.

Energy

Embodied energy –
The timber and straw superstructure has sequestered 376 tons of atmospheric carbon dioxide.

Operational energy -
Low energy light fittings are used with motion and daylight sensors.

Energy, environmental and weather monitors in and around the building have been installed provide data that can be studies as part of the science curriculum. Realtime data displays allow students to understand the carbon emissions from the building.

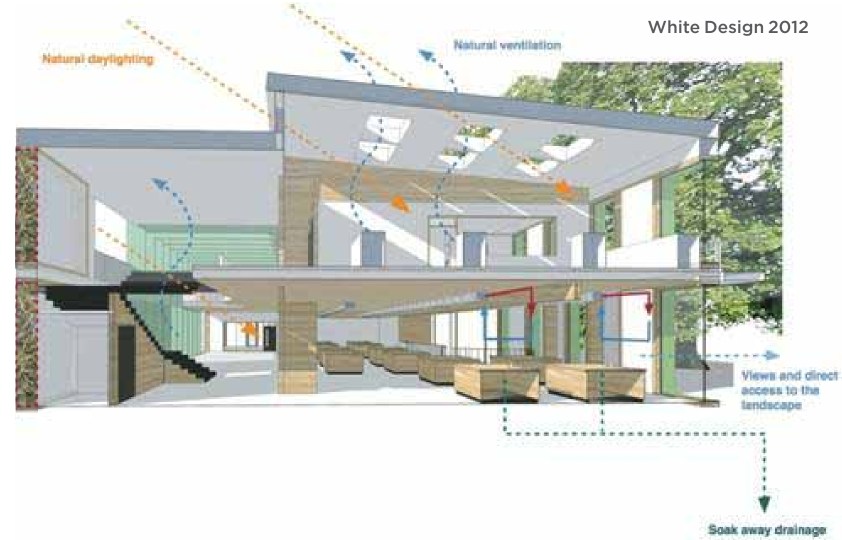
The building is heated using a highly efficient gas condensing boiler.

The building uses a mix mode system of mechanical and natural ventilation: all teaching spaces are designed to provide close-controlled natural ventilation whilst a mechanical ventilation heat recovery system can be used to minimise heat loss in the winter months.

Materials
Materials with low embodied carbon and a high recycled content were selected.

Building materials included straw bales, grown and made at a farm just outside Bath, which form the super-insulated building envelope. This technology was developed at the University of Bath. The external furniture is produced from oak planks responsibly sourced and recycled from a local building.

Waste
Offsite prefabrication meant that onsite waste was greatly reduced during construction. The timber structure is digitally cut to minimise waste. Straw bale trimmings produced during manufacture were composted, used as bedding for farm animals or recovered as biomass.



White Design 2012


White Design 2012

Link to full case study:
www.white-design.com/architecture/hayesfield-school-stem-centre-science-building/

3 Retrofitting: The basics

This chapter introduces the concept of retrofitting and the five main building types in Bath & North East Somerset.

Introduction to Retrofitting

Retrofitting is the incorporation of measures to reduce energy consumption in buildings. These can be to the fabric of the buildings such as insulating walls and includes appropriate use of renewable energy technologies such as solar panels.

Why is retrofitting relevant to Bath & North East Somerset?

Supports climate change commitments

- The UK has a target for 15% if energy to be from renewable sources by 2020, we need to play our part
- 41% of our districts carbon emissions are from domestic properties so we know domestic energy use is a major issue

Helps improve the condition of our homes and our quality of life

- Our district has a high proportion of pre 1919 homes with solid walls, constructed with traditional techniques so a tailored approach is needed
- Fuel poverty and excess winter deaths are particular issues for the area
- The Housing Conditions Survey (2012) shows there is huge potential for improvements to thermal comfort in our Housing Stock

Promotes our low carbon economy

- Environmental services play a significant role in the local economy
- Retrofit is predicted to generate £540m in sales and 3200 jobs per year across the West of England (2011-2020)
- Supports programme to encourage local green jobs and training

Residents can save money on energy bills

- Increases awareness of existing grant funds in B&NES e.g. for insulation and external wall insulation
- Supports local residents accessing financial incentives such as feed-in-tariffs and the renewable heat incentive

Supports the introduction of the Green Deal

The innovative Green Deal financial mechanism eliminates the need for householders and businesses to pay upfront for energy efficiency measures and instead introduces a way of meeting the cost of installation through savings on the electricity bills. The Green Deal will be accompanied by a new Energy Company Obligation (ECO) subsidy which will integrate with the Green Deal.

The Council intends to take a leadership role in helping people in the area to retrofit their homes, including with the use of Green Deal and ECO.

Our community is engaged on these issues

There are an impressive range of community led action-orientated projects around climate change and energy efficiency in Bath & North East Somerset for example:

Bath Green Homes - An annual Open Homes event run in collaboration between the Council, Transition Bath and Bath Preservation Trust to showcase local examples of inspiring, warm, energy efficient homes.

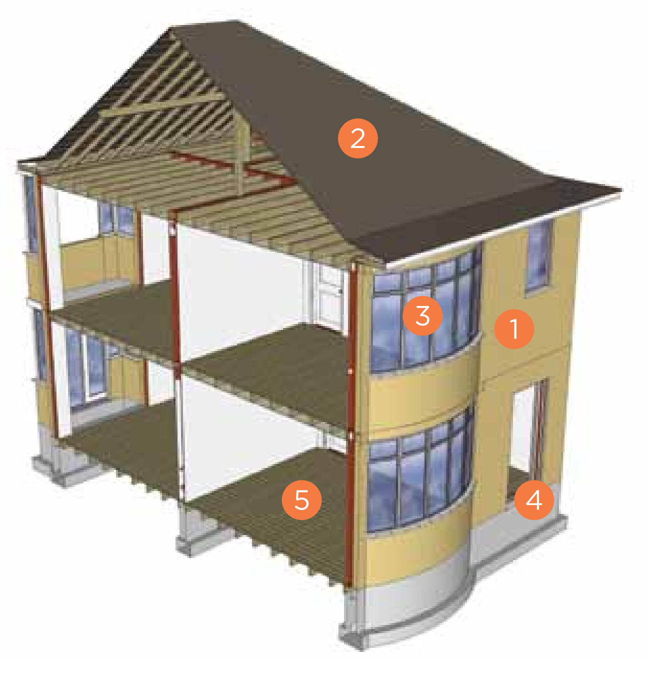
Energy Efficient Widcombe - A project aimed at enabling residents in Widcombe to be more energy efficient. A series of online information packs for different house types in this ward has been prepared by the group.

London Road & Snow Hill Climate Change Mitigation Strategy - A Design Council CABE Funded project identifying adaptations suitable to enhance the character of the Conservation Area and save energy.

Heat Loss

61% of UK home energy use is related to space heating. To prioritise your retrofit it is useful to consider the average energy loss for a typical house. The Energy Saving Trust breakdown for typical heat loss in a house is as follows:

1. Walls **33%**
2. Roof **26%**
3. Windows and Doors **21%**
4. Ventilation and Drafts **12%**
5. Floor **8%**



An Introduction to the typical house types

Our Homes

Bath & North East Somerset is fortunate to have a wealth of historic and modern homes. Traditional and Modern buildings are quite different structurally and different techniques and materials are used in their construction.

It is often assumed that the older a building is the less energy efficient it will be. However, research shows that this often not the case. Historic buildings were often designed when energy was expensive, whereas twentieth century buildings are often among the most inefficient.

Key features of traditional construction are: thick solid walls, natural ventilation and the use of natural breathable materials. Modern construction techniques are more likely to include: cavity walls, tightly controlled ventilation and the use of cement and plastics.

After 1985, Building Regulations include energy as a consideration and since then increasingly energy efficient construction techniques are being used.

Our Approach

In this section, the five most common house types in Bath & North East Somerset are introduced. It is important to understand how your building is constructed, how it functions as well as how you use it when you are thinking about how best to save energy and water in your home.

Section drawings are included to help illustrate key points.

The information should help you to diagnose:

- What are the main environmental issues for your house type?
- What are the main retrofitting opportunities for your house type?

Chapter 4, introduces a range of retrofitting measures are introduced and explained using annotated diagrams and summary information.

Buildings of Traditional Construction

17th Century Detached Cottage p20

Georgian Townhouse p22

Victorian/Edwardian Terrace p24

Buildings of Modern Construction

Early Modern 1930s Semi-Detached p26

Late Modern Post 1985 New build p28

17th Century Building

Section drawing of a typical 17th Century house in Bath & North East Somerset

Example of a 17th Century Building in Bath & North East Somerset

17th Century Building

Ensuring your building is in a good state of repair will be critical to optimising its energy efficiency. Poor or inappropriate maintenance can can lead to excess drafts, damp problems and condensation which will damage the building and increase energy bills.

Typical Issues

1 Small windows and deep reveals mean that natural light levels are quite low and more internal lighting is needed. However, small windows particularly on the north side can also help reduce heat loss.

Windows on the upper floors are often set closer to the floor, which can lead to drafts.

2 Windows are normally single-glazed leaded lights which are thermally poor with simple iron casements that can be a source of draughts unless close fitting.

3 Stone tile roof coverings are particularly draughty and many will not have roof underlay.

Mortar fillets can prevent the junctions between the roof and gable wall from being draughty if kept in good repair.

4 Plastered sloped parts of the ceiling such as the underside of the roof (known as skeilings) are unlikely to be insulated and accessing these cavities can be troublesome without removing fabric internally or externally. Thick timber purlins can make insertion of insulation between rafters particularly difficult.

5 Large open fireplaces are good for burning wood (a renewable resource) but allow heat to be lost up the chimney. The larger flue sizes can also be a significant source of draughts.

6 Traditional timber partitions (completely wooden walls made up of beams and infill planks) or timber stud partitions between rooms allow heat to transfer within the building and make heating to different temperature zones harder ...the heat from your living spaces may be lost to rooms not being used!

7 Uninsulated ground bearing flagstone floors lose heat from the interior, but their moisture permeability (breathing) can be adversely affected by insulation, increasing the likelihood of rising dampness in the walls.

8 Large timber beam ends inserted in the masonry walls can introduce cracks through which colder air can penetrate the building.

9 Stout masonry walls, ground bearing floors and large timbers all provide good thermal mass – however this can be slow to respond to swift changes in the weather or intermittent usage of rooms.

The high thermal mass does reduce the need for summer cooling of the building but poor insulation at roof level can lead to rapid heat gain in summer and heat loss in winter.

10 Small modular rooms can help retain heat in parts of the house in use, and can be more efficient than modern open plan arrangements.

Illustrative examples of other early buildings from 17th century or before can be found on the English Heritage Climate Change and Your Home website

The Energy Efficiency and Renewable Energy Guidance: For listed buildings & undesignated historic buildings in Bath & North East Somerset (forthcoming) provides further guidance

Georgian/18th Century Building

Section drawing of a typical 18th Century Georgian house in Bath & North East Somerset

Example of a Georgian/18th Century Building in Bath & North East Somerset

Georgian/18th Century Building

Ensuring your building is in a good state of repair will be critical to optimising its energy efficiency. Poor or inappropriate maintenance can can lead to excess drafts, damp problems and condensation which will damage the building and increase energy bills.

Typical Issues

1. Parapet and valley gutters drain via through-channels which require openings to the roof space and introduce cold bridging and condensation risks.
2. Roof windows and light wells are often poorly performing thermal elements but improve natural light levels to the interior. They can also be useful for natural stack ventilation.
3. Suspended timber upper floors built into the external walls introduce numerous cracks or fissures through which cold air can penetrate the building.
4. Internal floors and partitions are uninsulated and heat can easily transfer from room to room.
5. Large single-glazed sliding sash windows should be put in good repair to eliminate draughts; also ensure timber shutters operate well as they can provide valuable insulation at night or when the room is not being used.
6. Vault spaces have poor levels of light and ventilation but their earth-sheltered arrangement can be a useful thermal buffer to the habitable rooms at basement level.
7. A large open stairwell and hall can quickly dissipate heat and be hard to keep warm. Keeping internal doors closed will help.
8. External doors often contain slender timber panels and single glazed fan-lights which readily allow heat transfer.
9. Numerous fireplaces and flues allow heat to be lost up the chimneys and draughts to enter the building. However, they also ensure good ventilation and indoor air quality.
10. Taller room heights and generous windows allow good levels of natural light and ventilation.
11. External walls are typically quite slender, particularly on the upper storeys, and heat is lost through solid masonary.
12. Parapet gutters should be insulated to minimise cold bridging through the thin lead and timber linings.
13. Upper floor rooms are typically uninsulated lightweight construction; skeilings, dormer cheeks and roofs will require improvement to their thermal performance.
14. Roofs are often uninsulated and roof voids can sometimes be small or hard to access.

Illustrative examples of Georgian buildings or before can be found on the English Heritage Climate Change and Your Home website

Warmer Bath also provides more detail on the design and construction of Georgian townhouses

The Energy Efficiency and Renewable Energy Guidance: For listed buildings & undesignated historic buildings in Bath & North East Somerset (forthcoming) provides further guidance

Victorian/Edwardian Building

Section drawing of a typical Victorian/Edwardian house in Bath & North East Somerset

Example of a Victorian/Edwardian Building in Bath & North East Somerset

Victorian/Edwardian Building

Ensuring your building is in a good state of repair will be critical to optimising its energy efficiency. Poor or inappropriate maintenance can can lead to excess drafts, damp problems and condensation which will damage the building and increase energy bills.

Typical Issues

1 Roofs are uninsulated and roof coverings were laid without roof underlays, making heat loss and draughts an issue.

2 An open stairwell and hall can quickly dissipate heat and be hard to keep warm. Keeping internal doors closed will help.

3 Gable walls and those to outhouses may be quite slim. four inch thick walls perform particularly poorly thermally.

Purlins and joists built into these slender walls can also reduce the performance further, introducing air-paths for draughts.

4 External walls are typically quite slender and heat is easily lost through the solid masonry

5 Roofs to bay windows can be difficult to insulate, and often present a cold bridge for the building.

6 Internal floors and partitions are uninsulated and heat can easily transfer from room to room.

7 Single-glazed sliding sash windows should be put in good repair to eliminate draughts. Where present, ensure timber shutters are in working order as these can provide useful insulation at night or when the room is not being used.

8 External doors often contain slender timber panels and single-glazed overlights which readily allow heat transfer.

9 Suspended timber ground floors have ventilated spaces beneath which can raise draughts through the boards and floor edges.

10 Fireplaces and flues allow heat to be lost up the chimneys and are routes for draughts to enter the building.

11 Suspended timber upper floors built into the external walls introduce numerous fissures or cracks through which cold air can penetrate the building.

12 Tall room heights and multiple windows, including those set in bays provide high levels of natural light and ventilation but can be a source of heat loss.

13 Dwarf roofs to bay windows can be difficult to insulate due to limited accessibility.

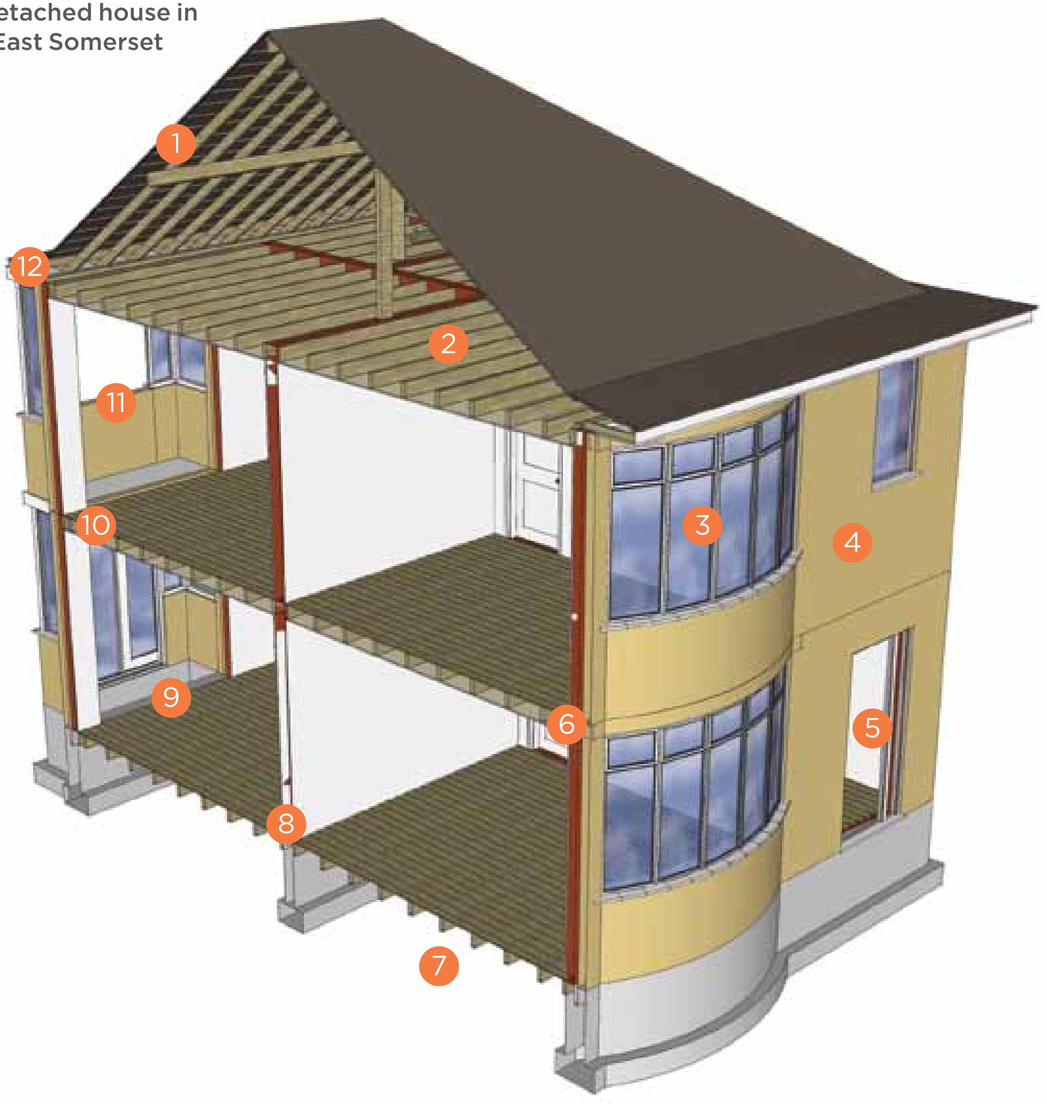
Illustrative examples of Victorian/Edwardian can be found on the English Heritage Climate Change and Your Home website

Warmer Bath also provides more detail on the design and construction of 19th and 20th Century terraces

The Energy Efficiency and Renewable Energy Guidance: For listed buildings & undesignated historic buildings in Bath & North East Somerset (forthcoming) provides further guidance

Early 20th Century Building

Section drawing of a typical 1930s Semi-Detached house in Bath & North East Somerset



Example of an Early 20th Century Building in Bath & North East Somerset

Early 20th Century Building

Ensuring your building is in a good state of repair will be critical to optimising its energy efficiency. Poor or inappropriate maintenance can can lead to excess drafts, damp problems and condensation which will damage the building and increase energy bills.

Typical Issues

1 Party walls at roofspace can be incomplete, allowing heat transfer and air movement between properties.

2 Roofs are uninsulated and roof coverings were laid without roof underlays, making heat loss and draughts an issue.

3 Original large 'picture' windows with single glazed metal framed casements in timber surrounds have very poor thermal performance.

Wall cavities were not closed at openings.

4 External walls are typically quite slender and heat is easily lost through the solid masonry.

Early cavity walls often contain rubble particularly at lower level making them difficult to insulate without causing cold bridging. Un-insulated cavity walls have a superior thermal performance to traditional solid walls, but are still poor compared to modern building standards.

5 External doors often contain slender timber panels and single-glazed side screens which readily allow heat transfer.

6 Internal floors and partitions are uninsulated and heat can easily transfer from room to room.

7 Suspended timber ground floors have ventilated spaces beneath which can raise draughts through the boards and floor edges.

8 Draughts can easily enter building at junctions between floors and walls.

9 Fireplaces and flues allow heat to be lost up the chimneys and draughts to enter the building. Air bricks connecting rooms provide further routes for heat loss.

10 Suspended timber upper floors built into the external walls introduce numerous fissures or cracks through which cold air can penetrate the building.

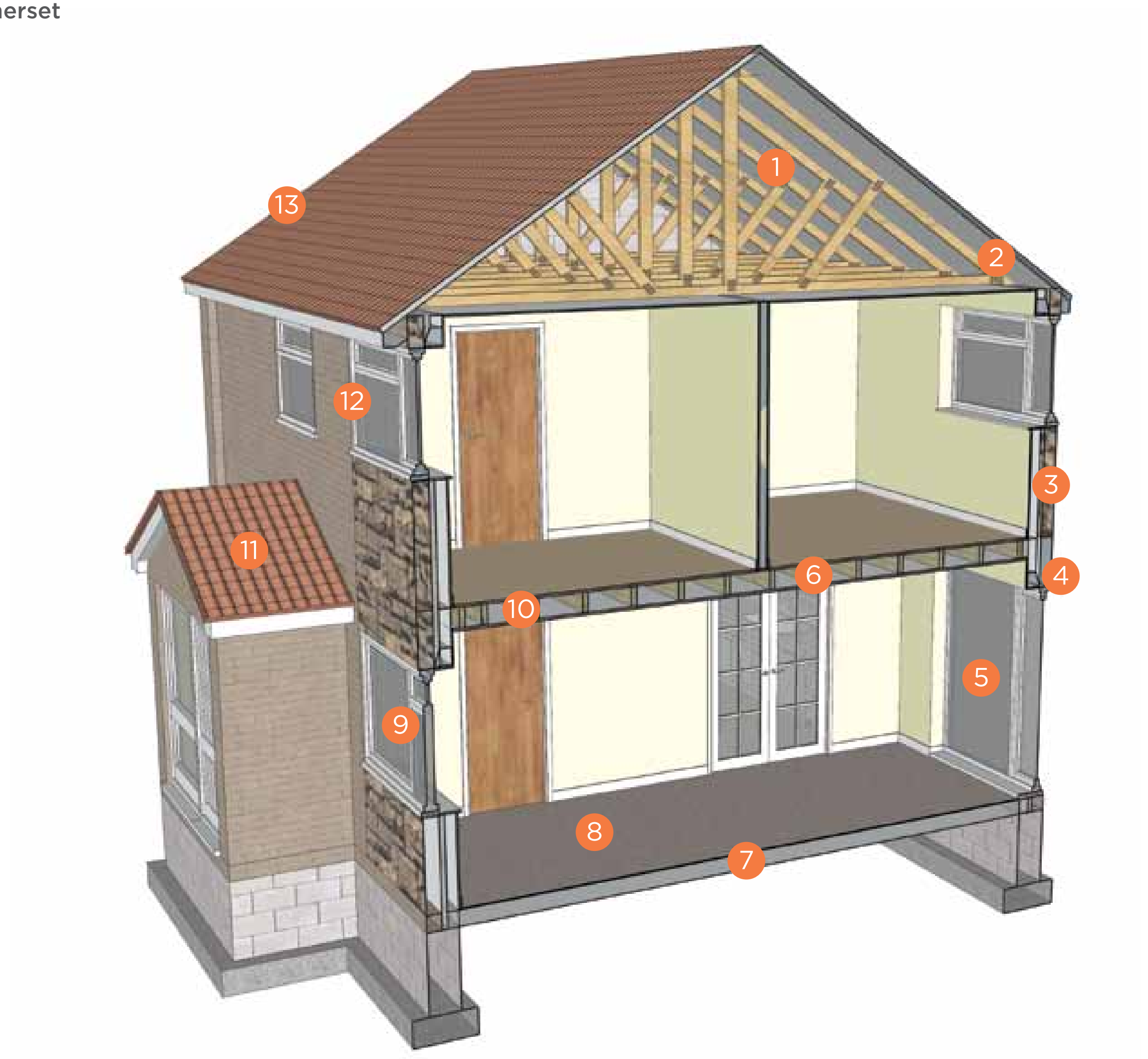
11 Tall room heights and multiple windows, including those set in bays, provide high levels of natural light and ventilation but can be a source of heat loss.

12 Roofs to bay windows can be uninsulated concrete with asphalt coverings, so being a source of heat loss.

Illustrative examples of 20th Century buildings can be found on the English Heritage Climate Change and Your Home website

Late 20th Century Building

Section drawing of a typical Post 1985 House in Bath & North East Somerset



Example of a Late 20th Century Building in Bath & North East Somerset

Late 20th Century Building

Ensuring your building is in a good state of repair will be critical to optimising its energy efficiency. Poor or inappropriate maintenance can can lead to excess drafts, damp problems and condensation which will damage the building and increase energy bills.

Typical Issues

1 Slender trussed rafter roofs may require strengthening to accommodate roof mounted renewable energy systems.

2 Roof space is likely to be 'cold', with some loft insulation likely to be present at ceiling level only. The roof requires ventilation to dissipate humidity which rises from the living spaces below.

Cold bridging is common at the eaves, where insufficient insulation depth is present and an air path is required for ventilation.

3 External masonry cavity walls are uninsulated although have thermally efficient blockwork to the inner skin.

Wall cavities are closed with masonry at perimeters and openings, forming cold bridges.

4 Uninsulated steel building lintels are typical, locally reducing thermal performance of external walls at door and window heads.

5 Large patio doors are common, with low grade air-filled, small cavity, double glazing.

UPVC or aluminium doors are not likely to be thermally broken – allowing heat transfer through their frames.

6 Internal floors and partitions are uninsulated and heat can easily transfer from room to room.

7 Uninsulated ground-laid concrete floor slab set above external ground level acts as thermal bridge to transfer heat.

8 Inefficient 'flame effect' gas fires common to living room, served by class 2 flue.

9 Windows typically softwood with air-filled, small cavity, double glazing that are not substantially more efficient than older window types.

10 Suspended timber upper floors built into the external walls introduce numerous fissures or cracks through which cold air can penetrate the building.

11 Porch roof and walls likely to be of lower thermal performance than rest of building so can be a source of heat loss.

12 Windows with minimal openings for ventilation and increased air tightness of building envelope means mechanical ventilation is required to extract humidity from kitchen and bathrooms.

13 Gas fired central heating with wall mounted boilers and hot water storage tanks are typical of the low efficiency installations originally fitted.

Illustrative examples of 20th Century buildings can be found on the English Heritage Climate Change and Your Home website

Key Considerations

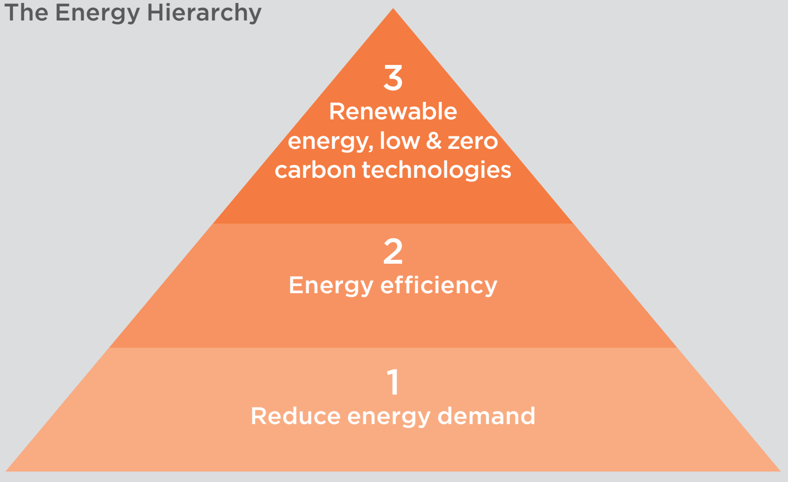
Introduction

When considering options to improve energy for your house, as well as your house type you also need to consider your occupancy behaviors. There may be quick win options which involve simple low key interventions or behavior change.

The Energy Hierarchy

The Council supports the energy hierarchy approach. So reduce your energy demand first, become more efficient and finally look to generate or use renewable energy. We will need to do all three, but this is a good way to prioritise action.

The Energy Hierarchy



Damp, Condensation & Ventilation

It is critical before considering retrofitting options for your home to understand damp, condensation and ventilation, so that you can prevent damp and condensation issues in your home.

Damp is moisture from the air or the ground that has been prevented from passing through a building and is trapped. It can include rising damp from the ground, condensation from the air or trapped inside the building fabric (interstitial).

In older houses damp problems occur when impermeable materials such as cement render, plasters and vinyl paints and wallpapers, are applied on top of breathable materials. The impermeable layers trap moisture and cause damp problems. In addition, rain penetration, rising damp and pipe leakage are other common causes of damp.

Materials do not insulate well when they are wet, as, it is the air within the material that has the insulating properties. A dry building will feel cosier and more comfortable. Even if a damp house and a dry house have the same internal temperature, the damp house will feel less comfortable and colder.

Condensation is actually the most common cause of damp within homes. It occurs when large quantities of water vapour from day to day activities are trapped inside. When warm moist air comes into contact with cooler air, on a surface with a lower temperature (e.g. a window or an outside wall). This can prove ideal for the germination of black mould. The key to solving condensation issues is ventilation. By improving the ventilation within a property you can often quickly reduce and eliminate damp and mould problems.

Common Causes of Condensation

The illustration below gives you an idea of how much extra water you could be adding to the air in your home in a day

Drying clothes indoors	9 pints
Cooking and the use of a kettle	6 pints
Bottled gas heater	4 pints (8hrs use)
2 people at home for 16 hours	3 pints
A bath or shower	2 pints
Washing dishes	2 pints

Adapted from Stafford BC Damp, Condensation and Mould Guidance Leaflet

Suggested Solutions to Condensation and Damp

To resolve damp and condensation issues

- Identify if problems are associated with building defects or condensation
- Keep your property well ventilated - open windows on a daily basis
- Try to keep at least a small gap between walls and furniture against 'cold walls
- If drying clothes, it is always better to do it outside. If this is not possible, put them in an enclosed room with plenty of ventilation and keep the window open.
- When cooking, cover pots and pans
- Check to make sure necessary ventilation within your property are not blocked or closed, such as air bricks, vents or chimneys
- Try to keep heating levels within your property at a constant temperature
- Remove impermeable layers e.g. remove cement render and apply a breathable lime render instead of installing expensive technical damp proofing solutions

For more information about how to minimise the risk of retrofitting in a pre-1919 home see Warmer Bath (Chapter 3)

Take a look at the YouTube video on damp from BBC Radio Scotland

4 Retrofitting options for your home

This chapter introduces 24 different retrofit options ranging from energy and water efficiency measures to heating and domestic renewable energy options.

Planning consents and other considerations

When considering retrofitting options for your home it is important to consider any planning planning permissions or listed building consents you might need. In addition, you are likely to also be required to meet building regulations.

Other considerations such as cost and environmental performance are also worthy of consideration at an early stage.

A simple flag system to highlight planning, listed building and building regulations required for each of the retrofitting options is used on each page, alongside the written commentary.

PD

Permitted Development

Where this symbol appears you may be able to undertake this measure without the need for express planning permisssion using your permitted development rights, subject to meeting specific criteria.

Specific works are 'permitted' through the General Permitted Development Order 1995 and its subsequent amendments. This legislation allows minor development and works that require planning permission to be undertaken without the need to submit a planning application. The Order sets out the specific types of works that are 'permitted' and the criteria they must meet.

The Council has prepared a Retrofitting Permitted Development Checklist to accompany this Supplementary Planning Document which outlines the specific criteria you will need to consider. Your permitted development rights are restricted if you are within Bath (due to the World Heritage Site designation which covers the entire city), if you are within a Conservation Area or within an Area of Outstanding Natural Beauty.

Even if works are permitted development it is advisable to seek a Certificate of Lawfulness from the planning department. For a small fee you can confirm in writing that your works are permitted development.

P

Planning Permission

Where this symbol appears you are likely to require express planning permission to undertake this intervention on your house. Unless you can undertake the necessary works using permitted development rights. Local planning policies e.g. design and character policies will apply.

L

Listed Building Consent

Where this symbol appears, if your house is a listed building, you may also require listed building consent for a retrofitting measure.

The Energy Efficiency and Renewable Energy Guidance: For listed buildings & undesignated historic buildings in Bath & North East Somerset (forthcoming) provides further guidance in relation to listed building consents that may be required and outlines key factors in these decisions.

BC

Building Control

Where this symbol appears, you are likely to need to meet buildings regulations and have works checked to ensure compliance.

COST OF MEASURE(£)

£££ Highest

££ Medium

£ Lowest

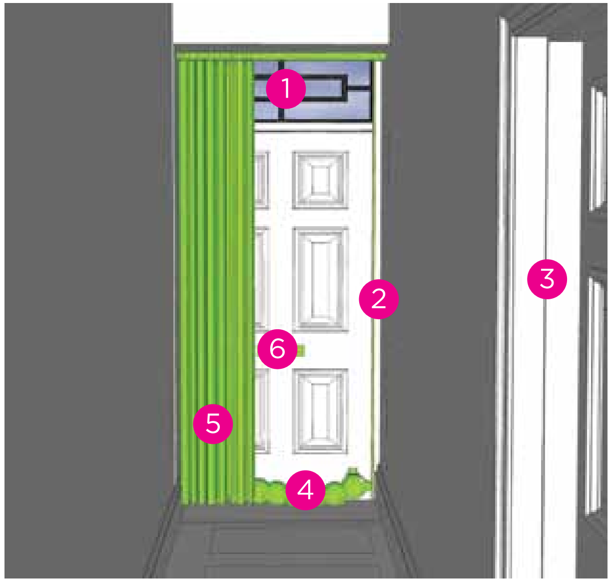
ENVIRONMENTAL RATING (CO_2 savings)

Highest

Medium

Lowest

Timber Door Draftproofing



Cost score £
Environmental score

L

1 Over door windows, glazed panels and the panels of the door themselves can all be upgraded to improve their thermal performance.

2 The door should be repaired to ensure a good fit with its frame and the junction between the two upgraded with brush seal draughtstrips or similar.

3 Don't forget to close other internal doors before you let heat out when leaving the building.

4 A draught excluding letterbox flap and escutcheon to the key-hole will close easy routes for draughts to enter the home.

5 A heavy curtain will reduce heat loss and limit draughts when the door is closed

6 A draught excluder is an effective way to prevent cold air entering through a door

So what is it?

External doors of a home are typically of simple construction, with slender panels in a door leaf which is set within a timber frame.

This arrangement can be poor at containing heat. A more significant problem is drafts, particularly if there are gaps around the door that are poorly fitted, allowing warm air to escape and cold air to enter. In addition letter boxes and key-holes can also provide a route for drafts. At the perimeter of a door leaf draft proofing should be fitted to close the gap when the door is closed.

Simple mastic beads can improve the fit, and there are many proprietary brush seals and compression seals which are easily installed.

Consideration should also be given to the junction between the frame and the wall, where mortars, mastics and seals may also need repair.

Simple draughtproofing can be achieved with an excluder and thermal performance upgraded with a heavy curtain.

An escutcheon to the key hole, draught flap and brush seal to the letter box will also help.

Glazed panels and over door windows are also sometimes present and can contribute to the overall heat loss through a door. These can be upgraded as described for windows, described later in this chapter.

Where possible, an internal lobby will greatly reduce heat loss when passing through the door. At the very least, consider closing doors to adjoining rooms before leaving the building!

How effective is it?

The external doors of a building are as important to consider as any other element – as they typically account for up to 15% of the heat loss from a dwelling.

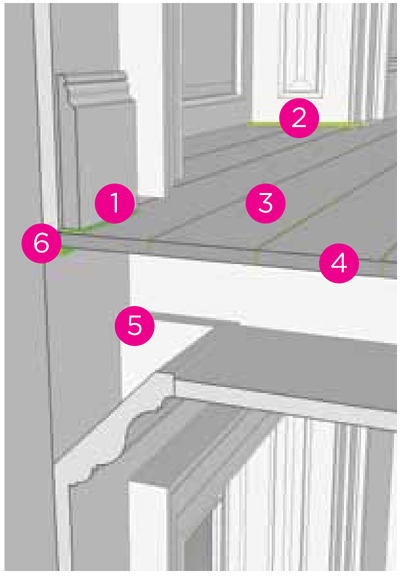
What does it cost?

The majority of door upgrade techniques are DIY measures and are therefore good value.

A mastic bead can improve the fit between joinery for as little as £5. Proprietary draughtstrips are available for between £2-5/ Metre. Draunght-excluding letter flaps cost around £15.

Secondary glazing overdoor windows, glazed panels and upgrading the door panels themselves will depend on the complexity of the door; but it should be possible to achieve this for between £50 and £100.

Timber Floor Draftproofing



Cost score £

Environmental score

L

1 Caulking smaller gaps with plaster, decorators filler, or mastic can be an effective way to close air-paths between the interior and a floor void.

2 With larger gaps, where floors have 'relaxed' for example scribed timber fillets may be necessary to effectively close the joint.

3 Hardboard coverings and underlays beneath carpets can also be effective at reducing draughts

4 Many timber floors have gaps between the boards through which air can pass; especially those with older plain-edged and butt-jointed boards. Closing these gaps with a compressible caulking strip (preferable as it allows expansion and contraction of the boards) a filler, mastic or timber slips will help prevent draughts. In severe cases it may even be necessary to lift and relay the boards.

Although exposed timber floors are very popular today, it is worth remembering that many were not intended to be 'on show' and their quality of materials and workmanship reflected this.

5 Floor voids and the spaces behind cornices, panelling and the like should be insulated as described elsewhere.

6 Where there are larger gaps, these can be sealed with compacted compressible insulation such as mineral wool or sheeps wool.

So what is it?

At the edges of a building the places where walls and floors meet afford many opportunities for heat energy to be lost through small gaps.

Cold air can enter the building through 'infiltration' commonly referred to as draughts. Heat can also be lost from the interior through 'exfiltration'.

The arrangement of floor carpentry typically inserts timber joists or wall-plates into the external walls and as these materials behave differently to the masonry, over time cracks and gaps can appear between them.

Air paths are then created through the building fabric.

In some older buildings there may also be bonding timbers, lintels and brackets for features such as panelling and cornices; all of which can introduce further gaps in the building fabric.

Often the masonry of the walls is not as well put together in the smaller spaces between these built-in timbers. Mortars and plasterwork may also be less complete. This means that in the region of a floor, the wall itself may have significantly more gaps than elsewhere on the building.

Internally, room joinery such as panelling, shutters and skirting boards can become less close-fitting over time as the floors and walls of a building move and age. Plaster finishes can also crack and open up behind elements of the building prone to impact – such as skirting boards. This opening up of the elements of a building introduces further gaps through which air can pass.

How effective is it?

The effectiveness of draughtproofing at the perimeter of timber floors will vary from building to building, due to their different arrangement of construction and relative condition or state of repair.

Typically, floor to wall junctions are 5-7% of the building exterior, but uninsulated and draughty construction will contribute proportionately more to the heat loss. Simple upgrade measures here can therefore be remarkably effective.

What does it cost?

Draughtproofing timber floors can be very cost effective as the measures normally involve low cost materials that can easily be DIY installed.

Where concealed by joinery, decorative finishes and carpets the appearance of the measures is less important than their function and this also reduces the cost of installation.

A tube of decorators caulking costs as little as £3!

Chimney Draftproofing Balloon

Cost score
Environmental score

1 The open fireplace can remain as a feature in the room and without needing to be permanently closed it can easily be used when required.

2 A chimney balloon is a simple DIY installation fitted within easy reach at the foot of the flue.

The air-bag adopts the shape of the flue as it is inflated and provides an air cell which acts as a thermal buffer to insulate against heat loss, as well as a physical barrier to reduce draughts.

3 The existing flue remains unaltered and capable of functioning normally when the chimney balloon is deflated.

So what is it?

Most older buildings and many modern ones contain a chimney or flue, serving a fireplace. All of these have an open throat at the hearth, connected to the outside by a narrow void or 'flue' that normally terminates at roof level.

In an active fireplace the flue will be warmed by the fire and the thermal mass of the chimney will help dissipate heat around the home. A used flue is unlikely to suffer from cold down-draughts unless it is not working properly, but a fully functioning flue loses a significant portion of the heat produced by a fire directly to the outside. In an un-used fireplace however the picture is different; the flue becomes a route by which cold air can enter the building and energy used for heating the home by central heating, for example, is wasted.

A chimney balloon is a simple and effective means to prevent draughts and reduce heat loss from un-used flues. It can also significantly reduce noise infiltration, which may be of benefit for properties in town centres or close to roads, rail and flight-paths.

The balloon consists of a simple plastic 'air-bag' which is placed inside the chimney flue and inflated by a foot pump or tube until it forms a snug fit with the sides of the chimney flue – forming an effective seal. Balloons are available in a range of standard sizes to suit the most commonly found flues, but can also be made to measure for even the largest and most unusually shaped flues.

Balloons are simply fitted and fully reversible; they can easily be removed for cleaning or during the fairer summer months, when natural stack-effect ventilation through a chimney would reduce energy consumption from mechanical extract fans and air conditioning systems.

Open chimney flues do aid natural ventilation and the removal of moisture and damp, so it is not always advantageous to block a flue permanently or completely.

How effective is it?

As much as 80% of the heat from a room can pass through a chimney flue; the insertion of a chimney balloon will greatly reduce this figure.

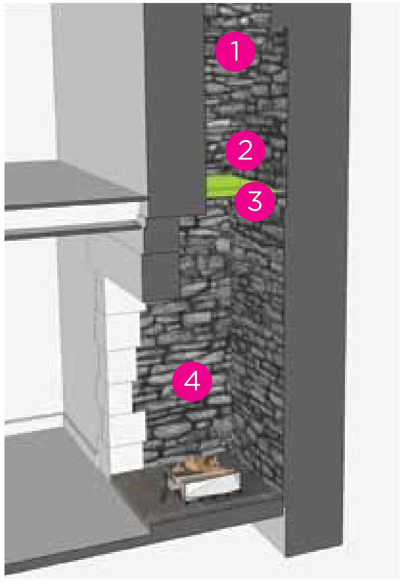
By being both adjustable and reversible a chimney balloon can be effective during the winter months and allow the flue to provide ventilation and cooling during the summer months.

What does it cost?

Together with a valve, pump and re-usable air-bag a chimney balloon installation can cost less than £30.

The effect on reducing energy consumption means this modest sum can easily be recovered in the first year.

Chimney Register Plate



Cost score £
Environmental score

1. The existing flue remains unaltered and capable of functioning normally when the register plate is opened.

2. A register plate will need regular cleaning as soot, nesting material and other debris can accumulate on the upper surface and this may present a fire hazard if left.

3. A register plate is normally made of steel, set within a simple frame. The frame is mechanically secured to the masonry of the chimney and its perimeter is usually sealed with fire cement or a rope gasket to produce a close fit.

An opening 'flap-door' allows smoke to pass when the flue is in use and can be adjusted to provide different degrees of ventilation at other times.

4. The open fireplace can remain as a feature in the room and without needing to be permanently closed it can easily be used when required.

So what is it?

A register plate is fire proof structure which is fitted in the lower part of a chimney and physically closes the flue to prevent draughts.

Many fireplaces in 19th and 20th century properties will already have integral chimney plates installed.

Unlike a chimney balloon, a register plate can remain in-situ when the fire is in use. A flap door contained in the plate is simply opened to allow smoke to escape when required. With a stay fitted, this flap door can also be adjusted to open varying degrees to aid ventilation as required.

In addition to use with open fires, a register plate may also be required where log burners, multi-fuel stoves and other biomass burners are inserted into an existing fireplace.

A register plate would normally be constructed of metal and specially fabricated to suit the size and shape of the particular flue.

For safety reasons advice should be sought from a suitably qualified person before inserting any structure that restricts the size of an operable flue.

A registered member of HETAS or the National Association of Chimney Sweeps (NACS) may be able to help.

How effective is it?

As much as 80% of the heat from a room can pass through a chimney flue; the insertion of a register plate will greatly reduce this figure.

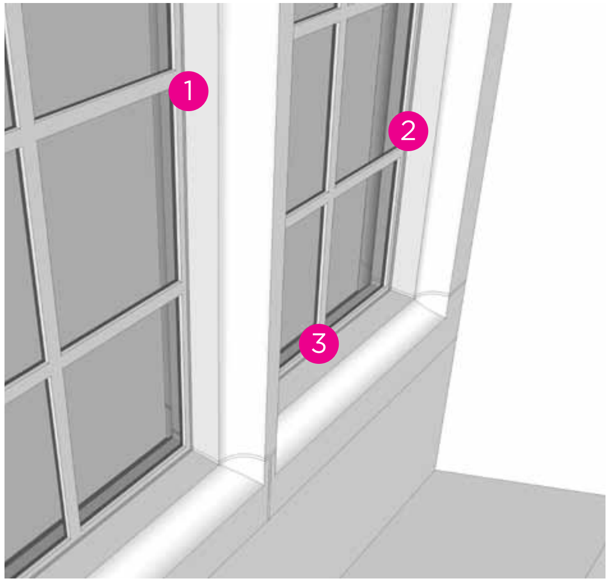
By being adjustable a register plate can be effective year round – simply open or close to control heat loss, draughts and ventilation.

What does it cost?

As a register plate is made to measure and requires permanent fitting, a little more work is required than for DIY measures.

The cost will vary with the size and complexity of the flue but a typical flue will cost £250-500.

Metal Framed Window Draftproofing



Cost score £
Environmental score

BC L

1 Proprietary compression and wiping seals are also available which can be discreetly fitted at the perimeter of the window.

2 A simple draughtproofing technique is to apply around the window where the faces meet the frame, with a release tape applied to the frame. This achieves a good fit, with minimal impact on the building fabric and can be applied when re-decorating.

3 The gap between a metal window and its frame or surround can account for a significant amount of the heat loss.

Improving the fit of the window by keeping it in good repair will help and draughtproofing will ensure the energy lost is kept to a minimum.

So what is it?

Most metal framed windows are single glazed with large plain glass panels, or in the case of earlier windows, with multiple small panes held in lead. Later windows often have a metal sub-frame, but early windows may be simply set in rebates against stone or timber surrounds.

In either case the closeness of fit between the opening parts of the window and their frame or surround will greatly affect the performance of the window by allowing draughts to enter and heat to leave the building.

In addition to placing the window in good repair, simple draughtproofing techniques can be used to improve the situation.

A simple technique such as release tape and a mastic bead can be part of the routine decoration of the window. Compressible and wiping seals are also commonly available which sit discretely at the junction between frame and window.

How effective is it?

As much as 80% of the heat lost through a single glazed window can be through air-leakage or ‘draughts’ and addressing this makes good sense.

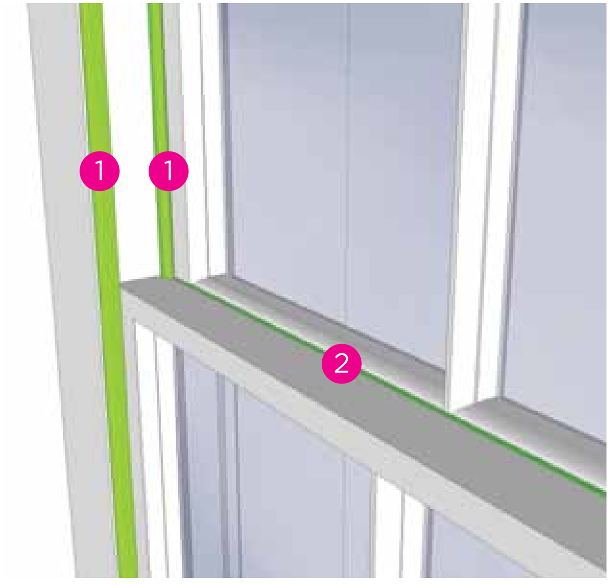
As a conductive material, metal windows will always facilitate greater loss of heat compared to other non-conductive materials.

What does it cost?

The simplest draughtproofing measures are DIY level installations and are therefore quite inexpensive. A mastic and tape decoration upgrade can be installed for less than £5.

Proprietary weather seals are available which vary in cost between simple self-adhesive profiles for less than £1/Metre to those with profiled and replaceable seals for a little more. If DIY fitted, the cost will be modest and likely less than £20 per window.

Timber Sash Window Draftproofing



Cost score
Environmental score

L BC

1 Staff bead and parting-bead can be replaced with components incorporating brush seals for draughtproofing.

2 The gap between the upper and lower sash can be improved with the addition of a mastic bead or brush seal.

Draftproofing will need to be applied around the whole sash, and may also be needed for the gaps where the wheels are. Proprietary systems are available which are rebated into the joinery and are almost invisible when fitted.

So what is it?

These windows normally have glazed timber sashes (frames) set within box profile outer frames that contain counter weights to allow the window to slide vertically.

Unlike casement windows which close against the frame, these windows rely on a gap between the perimeter of the sash and the frame to provide sufficient room to be able to open. This means that a sliding sash window has a feature of its design which introduces a route for air movement. As the windows age and components wear, this gap can become enlarged, allowing cold air to enter and warm air to leave the building.

In addition to placing the window in good repair, simple draughtproofing techniques can be used to improve the situation.

A simple technique such as release tape and a mastic bead can be part of the routine decoration of the window. Proprietary systems are also available that replace the beads with ones containing brush seals which can significantly reduce air infiltration. Additionally, compression seals can be rebated into the joinery at the head of the top sash and foot of the lower one and wiping seals can be rebated into to the junction between the two.

What does it cost?

The simplest draughtproofing measures are DIY level installations and are therefore quite inexpensive. A mastic and tape decoration upgrade can be installed for less than £5.

Proprietary weather seals are available which vary in cost between simple self-adhesive profiles for less than £1/Metre, pin-on, surface-fixed brush seals for £2-3/Metre; through to professionally fitted systems which replace beads and rebate seals into the sash joinery.

These professionally fitted systems can cost considerably more, but often include overhaul of the entire window.

A simple mastic bead and release tape can improve the fit between the head of the upper sash and the frame. This can also be used at the foot of the lower sash. Alternatively, proprietary compression seals are available. Some of these can be fully rebated into to the joinery.

How effective is it?

A significant amount of the heat lost through a single glazed window can be through air-leakage or ‘draughts’ – so addressing this makes good sense.

It can be possible to raise the performance of a sash window to a level equivalent to modern double glazed replacements by combining draftproofing with shutters, blinds and heavy curtains.

With such measures it is possible to raise the performance of a sash window to a level above many modern double glazed replacements!

Timber Casement Window Draftproofing

Cost score
Environmental score

BC

L Not normally required by depends on proposed system

1 The gap between casements and the window surround should be improved to reduce air movement.

2 A simple mastic bead and release tape can components and can be part of the routine re-decoration.

3 Proprietary pin-on or self adhesive weather-strip components are available which can be fitted at the junction between casement and surround.

Alternatively, professionally fitted systems are available which can be fully rebated into to the joinery.

So what is it?

Timber casement windows typically have opening frames which sit within a timber surround, when closed. Normally hinged to one side, these frames are designed to be a close fit with the surround to keep weather out, but a gap has to exist to allow the window to open.

Over time and through wear this gap can increase in size. Warm air can be lost from the building through this gap and cold air can enter.

In addition to ensuring that the window is well maintained simple upgrade techniques can be used to improve the situation.

A simple mastic bead and release tape will do much to improve the fit between window components and can be installed as part of the routine decoration of the window.

Proprietary 'draught-strip' components are also available to provide a combination of compression seals and wiping seals to effectively close the air path at the perimeter of a casement window.

What does it cost?

The simplest draughtproofing measures are DIY level installations and are therefore quite inexpensive. A mastic and tape decoration upgrade can be installed for less than £5.

Proprietary weather seals are available which vary in cost between simple self-adhesive profiles for less than £1/Metre, to pin-on, surface-fixed brush seals for around £2-3/Metre.

Professionally fitted systems are also available, which although considerably more costly will normally be fitted as part of a comprehensive window overhaul.

How effective is it?

A significant amount of the heat lost through a casement window can be through air-leakage or 'draughts' – so addressing this makes good sense.

Recent research has shown that placing the window in good repair can reduce air leakage by a third and draughtproofing will substantially improve on this.

When combined with other measures, such as secondary glazing, blinds or heavy curtains the benefit from simple draughtproofing can be considerable.

Secondary Glazing

Cost score £
Environmental score

L BC

❶ A typical secondary glazing system sits discreetly inside the window reveal, close to the existing joinery.

❷ The existing timber window can be retained without the need for change – sustainably prolonging the service life of these traditional building features.

So what is it?

Secondary glazing units are normally single glazed, glass or polycarbonate sheet (light weight).

Systems can be demountable, for removal in the summer months; hinged, or sliding to allow flexibility and opening for ventilation and cleaning.

The simplest systems are single pane panels which are secured to the rear of the window frame, or in some cases to the sash or casement itself. These can even be secured with magnetic tape, making them easy and quick to fit and reducing 'retrofitting' work to a minimum!

The perimeter frames are narrow, so as to remain unobtrusive and fit within a small space and some can accommodate double-glazed units if space permits. Slender profile double glazing can be a good solution, and will help raising an existing window toward triple-glazed performance levels without loss of the existing window.

In addition to the enhanced thermal performance, secondary glazing can also eliminate draughts and improve acoustic privacy.

How effective is it?

Recent research has shown that the addition of a simple secondary glazing system to a traditional double hung sliding sash window can reduce heat losses by 58%.

When combined with timber shutters and heavy curtains the energy saved on a chilly winter's evening can be every bit as good as a high performance modern window!

What does it cost?

The cost will depend on a number of variables, such as the system used, the complexity of opening lights/panels, glazing specification and of course the size. Better value may also be possible when more windows are purchased, if you fit it yourself or by having simpler units where there is no need for regular opening, for example.

A typical installation such as the one illustrated here, with two single glazed low-e glass panels, the lower panel of which is sliding would cost in the region of £400 for a 1.8x1.2m window.

Slim Profile Double Glazing

Cost score ££
Environmental score

L BC PD P

1 The slim double-glazed units can be putty or mastic seated and decorated to match the window joinery.

As the weight of the glazed parts of the window will be increased, hinges, sash-weights and other components may need upgrading slightly.

2 Existing single panes are replaced with new slim-section double-glazed panels, which are set in the original glazing rebates.

3 Treatment of windows in historic buildings and houses in Conservation Areas presents a challenge to find an appropriate style to match the appearance of existing windows. Careful specification is needed, and upgrading should be considered first.

Typically only 10-12mm thick, and capable of using original or replica glass, the high performing slim double-glazing panels can be difficult to distinguish from the original when fitted.

So what is it?

Most older timber and metal windows have slender components which were designed to have a single sheet of glass set within a simple rebate, often secured with putty.

Slim-profile double glazing is a method by which the thermal performance of these windows can be improved, by replacing the single layer of glass with a narrow double-glazed panel around 10-12mm thick.

These panels use thin glass with a slim cavity that is normally filled with an inert gas, to improve its resistance to the passage of heat. Sometimes, the original glass can be re-used as one of the panes in the new unit.

For many windows this change can be achieved without the need to adjust the original window, although some sash weights or hinges may need upgrading to accommodate the additional weight.

If the rebate is sufficiently deep, the panels can be putty fixed to match the original glass. The perimeter spacer used to separate the glass sheets can be colour matched to the joinery and the final appearance hard to detect.

How effective is it?

Slim profile double glazed panels can help raise overall window performance to a high level.

Dependant on the cavity size, glass type and choice of gas fill typical thermal transmittance values between 2.0 and 1.6 W/SqM/K can be achieved. (Vacuum filled units can double this performance)

Together with placing the window in good repair a draught-proofed, slim double-glazed window with a thermal blind, shutters and curtains can easily out-perform many new windows.

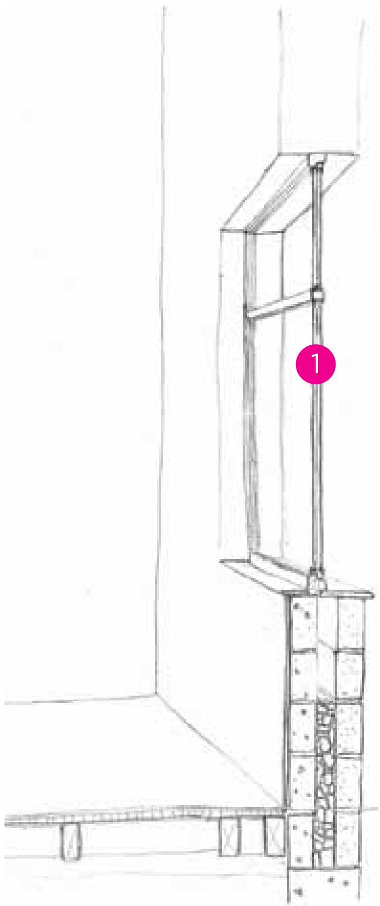
What does it cost?

The more highly performing slim double-glazing panels are vacuum filled and made to order abroad, so are very expensive; however there are now a number of suppliers in the UK who can make panels to measure at a reasonable price.

The gasses in these glazing panels are more expensive than normal double-glazed panels; installation costs and the complexity of the window will also affect the price.

Slim profile double-glazing will cost in the region of £600-800 to install in an average 6-over-6 sash window.

Double and Triple Glazing



Cost score ££
Environmental score

L BC PD P

So what is it?

1 Double or triple glazing is formed by two or three window panes separated by a gap filled with air or another gas such as Argon to create an insulating barrier limiting heat transfer through windows. The panes are separated with spacers that should be designed to prevent heat loss and condensation.

A typical house loses 10% of its heat through the windows. As part of a refurbishment scheme the replacement of existing windows with new high performance windows should be seriously considered.

Treatment of windows in historic houses or houses in conservation areas can be more problematic. Replacing windows to match the appearance of the existing windows requires careful specification if the windows cannot be upgraded. The designer should co-operate with Planning and Conservation Officers to ensure that any compromise between performance and appearance can be optimised.

How effective is it?

Around two thirds of the energy lost from a standard window is through radiation through the glazing. The inside pane of a double-glazed unit absorbs heat from the room and transmits it through conduction and convection to the cooler outside pane, and so to the outside. The thermal transmittance of a glazing unit, known as the U-value, is expressed in units of Watts per square metre per degree of temperature difference (W/m2C). Where windows are replaced in existing dwellings the building regulations require a minimum ‘Window Energy Rating’ of C or a U Value = 1.6W/m2C.

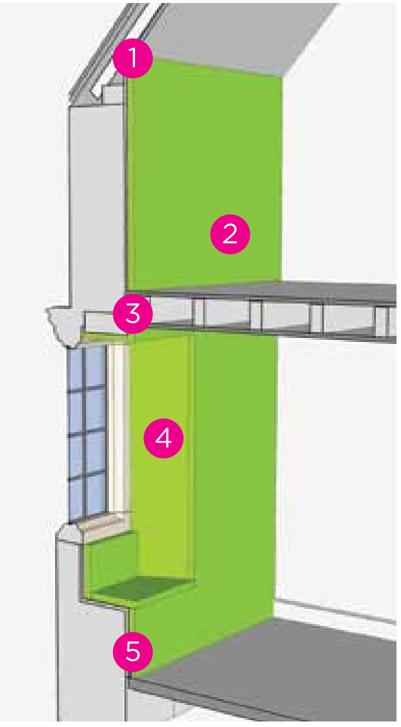
A small amount of heat is lost through convection within the glazing cavity. In some circumstances, particularly in wider glazing cavities, air within the cavity is warmed by the inner pane. The warm air rises and is replaced by cooler air and so sets up a convection current which transfers heat from the inner pane through to the outer pane(s). Convection up to 20mm in double-glazing units particularly with argon gas, which is denser than air, is insignificant; In triple glazing there is an improved performance up to between 18-20mm.

Technical Information from www.greenspec.co.uk

What does it cost?

The cost of double and triple glazing varies considerably according to the materials used for the frame and gas used for the performance of the glazing units. Quotes need to be obtained to compare the many variables.

Internally Applied Solid Wall Insulation



Cost score £££
Environmental score

L BC

English Heritage Advise on Internal Solid Wall Insulation www.english-heritage.org.uk/publications/eehb-insulating-solid-walls/

1 The insulation should be carried over lintels wall-plates and the like and arranged so as to be contiguous with insulation at ground and roof level.

2 Internally applied insulation can be a sheet, compressible insulation or a wet-applied layer. In each case the construction arrangement and impact on the existing building will be different and advice should be sought on the correct system for your building.

Most systems have a plaster decorative layer as the internal finish and can be decorated to match elsewhere.

On terraced buildings insulation may be carried partly across the party walls to reduce the thermal bridging at the edges of the building.

3 Insulation must be carried into the floor voids to ensure continuity.

4 Insulation is carried into the reveals of windows and doors to ensure there are not cold spots where the wall is thinnest.

5 Insulation may require adjustment of building features such as skirting boards and redecoration.

So what is it?

The majority of buildings constructed before the early part the C20 have solid external walls, formed of masonry. The more slender of these are ashlared Bath stone or brick, with stouter walls typically of smaller stones with dressings at openings and edges, and a core of rubble and mortar.

These solid walls often have shallow (or no) footings, no damp-proof courses and are finished with porous plasters and natural paint finishes. The walls absorb and release moisture form the ground, weather and humidity from occupation and are commonly known as 'breathable'.

Stouter solid walls have good thermal mass and can be quite insulative due to their thickness, however the walls of the later C18 and C19 are often quite slender and poorly performing thermally.

As there is no cavity for these walls insulation must be placed externally or internally, on the face of the wall. The insulation is visibly evident and may take up some floor space. It can also necessitate adjustment of building features such as cornices and skirting boards and will impact the passage of moisture through the construction. The position of the insulation internally or externally will affect the thermal mass of the wall, with externally applied insulation preferred for maximising this benefit.

A desire is generally expressed for natural breathable insulants, such as hemp fibre, wool and cellulose, however other systems are available. Breathable paints and decorative treatments (including wallpaper) must also be used to ensure that moisture can continue to dissipate through the insultation.

There are currently a number of research studies looking at the technical, performance and risk factors connected with solid wall insulation and these have yet to be completed.

Expert advice should always be sought before undertaking solid wall insulation.

How effective is it?

The external walls of any building are normally the largest proportion of its envelope and so offer the greatest potential for heat loss. This element is therefore very important to improve. Issues with damp and condensation can considerably reduce the thermal performance of solid walls. They should be addressed before undertaking solid wall insulation, as such installations have been shown to potentially accelerate these problems.

The effectiveness of the insulation will vary with the type of insulation chosen, thickness and configuration of the existing building.

For most buildings, an improvement in the thermal performance of walls will be improved by around 35%.

What does it cost?

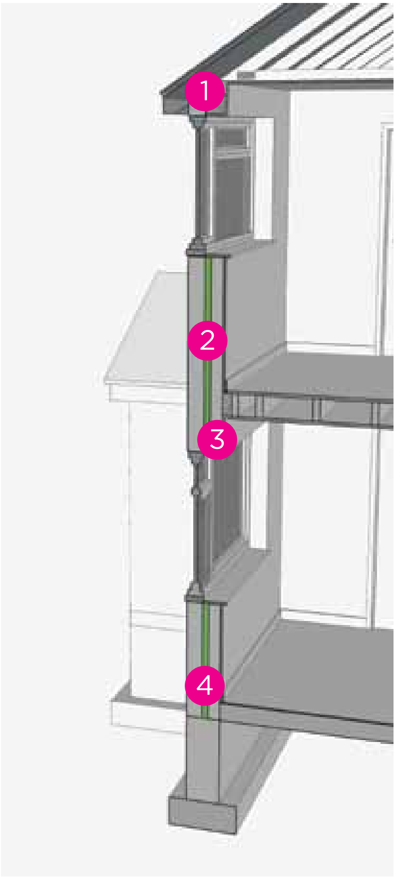
For simple internally applied insulation systems the cost will will be in the region of £100-150/SqM.

This cost will vary with the type of insulation, thickness and complexity of building – typically a two-storey mid-terrace dwelling will cost £6-8k. Other buildings will be considerably more.

Typical payback periods for internally applied solid wall insulation are longer term, between 10-15years.

Some grants and financial assistance are available. Refer to The Energy Savings Trust, your utility company or the local authority for more information.

Cavity Wall Insulation



Cost score £
Environmental score

L BC

1 The edges of cavities at the roof and openings may need physical closers installed to ensure the insulation does not escape.

2 Typically, fibre insulation or expanded polystyrene spheres are injected into the cavity through a series of entry holes drilled in the facade. The cavity is fully filled.

3 Some additional insulation measures may be needed around lintols, vents and other features which bridge the cavity.

4 Cavity wall insulation should be carried over the abutment with other insulation measures at the head and foot of the wall, to ensure there are no cold spots on the exterior at the floor and roof.

So what is it?

The majority of buildings constructed in the 20th Century have external walls constructed of two layers, the outer being a weathering skin and the inner one usually structural. Space between the layers is a cavity used to drain any moisture which passes though the outer layer – preventing it from reaching the inside.

These ‘cavity’ walls are usually quite thin and being made of slender components normally have low thermal performance.

Cavity wall insulation is a method of improving the building envelope by insulating the void between the skins of a cavity wall.

A number of methods are available which involve an insulant being injected into the void. These insulants vary in their thermal efficiency, moisture resistance and integrity (ability to support themselves). The more commonly used insulation types are expanded polystyrene spheres and blown fibres.

The insulation is normally fitted over 1-2 days with holes drilled at intervals on the facade to allow the insulation to be injected. Particular care must be taken at openings, perimeter of the cavities, ventilation routes and damp-courses to ensure the building can function as designed. A detailed survey will need to be undertaken by the installer to assess the suitability of he building for the insulation type being proposed.

Some highly exposed walls may not be suitable for cavity wall insulation.

In later modern homes the cavity may already be partially filled with an insulation board and here retrofitting top-up insulation can be difficult as the void can be quite narrow.

This insulation can be fitted without disruption, making it a suitable choice for many.

How effective is it?

The external walls of any building are normally the largest proportion of its envelope and so offer the greatest potential for heat loss. This element is therefore very important to improve.

The effectiveness of the insulation will vary with the type of insulation chosen, size of cavity and proportion of wall to say windows, roof, etc.

For most, an improvement in wall performance will of around 35% will be possible.

What does it cost?

For most cavity walls retrofit cavity wall insulation will cost in the region of £50/SqM.

This cost will vary with the type of insulation, thickness of cavity and complexity of building – e.g. amount of scaffold required.

Typical payback periods for cavity wall insulation are medium term, between 5-8 years.

Some grants and financial assistance are available. Refer to The Energy Savings Trust, your utility company or the local authority for more information.

Externally Applied Solid Wall Insulation

External Wall Insulation on a property in Bath & North East Somerset undertaken as part of the Council's Freedom from Fuel Poverty Project

Cost score £££
Environmental score

L BC PD P

External Wall Insulation involves fixing an insulating layer to the outside of the house, followed by a render or cladding. Internal wall insulation can be an easier solution, however, in some cases this could be disruptive or could alter room sizes. Greater thickness of insulation is typically required compared to internal wall insulation.

So what is it?

This measure can help where external walls are poorly insulated and there is no cavity. It can also be employed where walls are insufficiently weathertight causing excessive drafts and heat loss, this can be particulary appropriate for end terrace properties.

External Wall Insulation is more complex than Internal Wall Insulation as features such as window surrounds and rainwater goods will be affected. Even where elevations are quite plain, simple alterations such as the deepening of window and door reveals and the alteration of eaves lines need to be needed. These alterations will require scaffolding and possibly a temporary roof to reduce the risk of water penetration during the works.

If you are in a Conservation Area, some key factors to consider are:

- External Wall Insulation is likely to be more suitable on the fronts of modern, rather than traditional buildings, unless the traditional building is currently, or has previously been, rendered.
- External Wall Insulation is likely to be more suitable for the side or back elevations of houses in a Conservation Area unless these are prominent or decorative in design.
- Insulation which does not create a significant difference in appearance may be more suitable, particularly for traditional buildings
- The thickness of insulation may also be a factor, if it brings the front of the building closer to a highway.
- The method of affixing the insulation to the building, and other changes to the building that may be needed (e.g. altering the roof line) will also be considered in view of their potential for damage to the building.

How effective is it?

The external walls of any building are normally the largest proportion of its envelope and so offer the greatest potential for heat loss. This element is therefore very important to improve. Issues with damp and condensation can considerably reduce the thermal performance of solid walls. They should be addressed before undertaking solid wall insulation, as such installations have been shown to potentially accelerate these problems.

The effectiveness of the insulation will vary with the type of insulation chosen, thickness and configuration of the existing building. For most buildings, an improvement in the thermal performance of walls will be improved by around 35%.

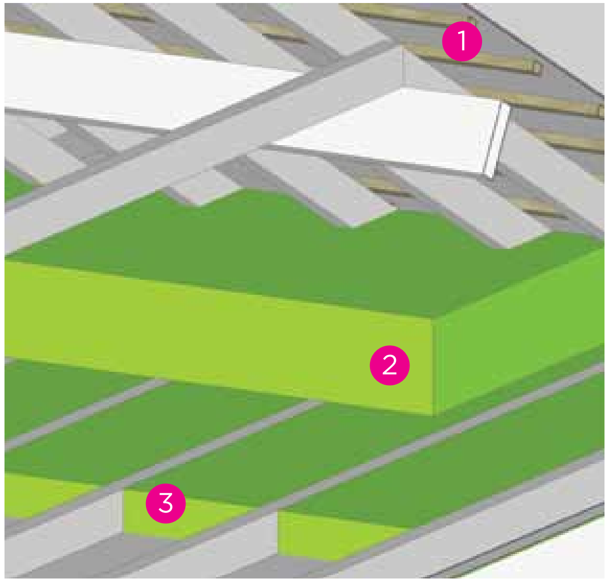
What does it cost?

Energy Saving Trust report that the average house could save £475 a year on your energy bills by installing external solid wall insulation.

They estimate the total cost of installing a standard system as around £10,000. This excludes any costs associated with scaffolding, moving rainwater goods or satellite dishes. This may be a more expensive solution than internal wall insulation although it may be less disruptive for occupants.

Listen an audio clip featuring a BBC Somerset interview with Steve, a customer of Bath & North East Somerset Council's Freedom from Fuel Poverty project, to find out how solid wall insulation transformed his families life.

Roof Insulation at Ceiling Level



Cost score £

Environmental score

L BC

English Heritage Guidance on Insulating Roof at Ceiling level www.english-heritage.org.uk/publications/eehb-insulating-pitched-roofs-ceiling-level-cold-roofs/eehb-cold-roofs.pdf

1 Some adjustments may be required to improve ventilation in the roofspace above loft insulation.

2 Typically 270mm of insulation is required as a minimum at ceiling level and should be laid in alternate layers across and between the ceiling joists to avoid cold spots.

3 Although normally insufficient, you should ensure your existing loft insulation is well fitted, to eliminate cold spots through which heat can pass.

Care should be taken to adequately insulate tanks, pipes and other services in the roof. Also ensure that the loft access door is draughtstripped and insulated.

So what is it?

The roof of a building is normally simply made from thin tile, slate or lead coverings on a slender timber frame. With only this and a thin layer of plaster between the upper floor rooms and the outside it is easy to see how heat can be readily lost through an unimproved roof.

Many properties will already have some loft insulation, commonly laid as a loose quilt between the ceiling joists. This arrangement is a good start, but the joists remain uninsulated, the insulation is often too thin and in may cases poorly fitted – particularly around the eaves, where the interior is closest to the outside. Top-up insulation is therefore often required.

To achieve adequate performance it is recommended that loft insulation is the equivalent of c.300mm mineral wool or fibre quilt. The insulation should be laid in layers between and across the timbers so as to reduce heat loss through joints.

Ventilation of the roof space is an important factor to consider as moisture within the roof void should be encouraged to dissipate through ventilation. It may therefore be necessary to introduce ventilators to improve the air circulation in the roof.

Modern insulation materials are commonly wrapped, to enclose the fibres and ensure the insulation is unaffected by moisture. Care should be taken however as existing and older insulations may have small fibres which can be hazardous in a confined environment.

In addition to improving the insulation levels, loft access doors, tank and pipes should also be insulated.

Although normally insufficient, you should ensure your existing loft insulation is well fitted, to eliminate cold spots through which heat can pass.

How effective is it?

Up to 35% of the heat loss from a home passes through the roof this area is therefore very important to improve.

Fortunately, there are very many insulation systems and products available and most can be fitted in less than a day.

For a typical energy spend of £1500 per year, loft insulation will normally recover its installation cost within 12-18 months.

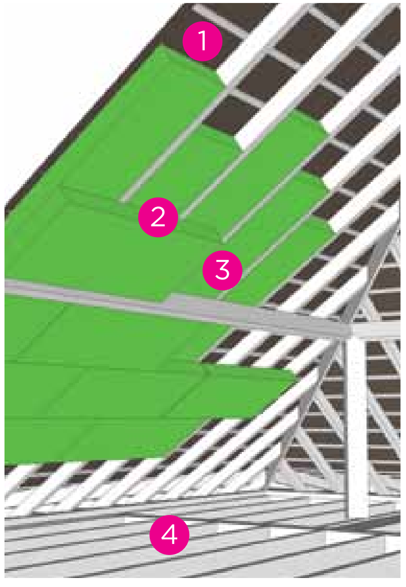
What does it cost?

The majority of roofs can be insulated for modest cost with £150-300 being typical for a smaller home.

The work can be DIY to reduce cost, but there are a number of installation schemes available which subsidise the cost for an installer to fit the insulation.

Remember – improving the fit of insulation you already have will cost you nothing.

Roof Insulation at Rafter Level



Cost score £

Environmental score

L BC PD P

English Heritage technical guidance on insulating roofs at rafter level www.english-heritage.org.uk/publications/eehb-insulating-pitched-roofs-rafter-level-warm-roofs/eehb-warm-roofs.pdf

1 Some adjustments may be required to improve ventilation of the roof above the insulation. Vents, counter-battens, breathable underlays and the like are basic measures which a builder or roofing contractor could fit.

2 Insulation is laid in alternate directions so as to eliminate heat loss through joints.

3 Typically rigid insulation boards are laid between and beneath the rafters to achieve the required level of insulation.

Compressible insulation types can be held in place with a net or breathable building membrane.

With insulation at rafter level, the roof can remain useable and tanks, pipes and the like may not need separate insulation.

4 Retaining existing insulation at ceiling level will reduce the heat from the home spent warming the roofspace.

So what is it?

The roof of a building is normally simply made from thin tile, slate or lead coverings on a slender timber frame. With only this and a thin layer of plaster between the upper floor rooms and the outside it is easy to see how heat can be readily lost through an unimproved roof.

For some later buildings, there is already insulation at rafter level at rafter level, but most properties will likely have any insulation laid as a loose quilt between the ceiling joists. This arrangement is a good start, but the joists remain uninsulated, the insulation is often too thin and in may cases poorly fitted – particularly around the eaves, where the interior is closest to the outside. Top-up insulation is therefore often required.

Insulation at rafter level can be supplemented or newly retrofitted and is typically set both between and beneath the rafters; in alternate directions so as to reduce heat loss through the joints. Rigid insulation boards which are self-supporting can be used, alternatively, soft insulation can be supported with a net or breathable building membrane.

Rafter level insulation products are normally higher performing, to reduce the thickness required, but to achieve adequate performance it is recommended that loft insulation is the equivalent of c.300mm mineral wool or fibre quilt.

A ventilation path must be established above the insulation, to dissipate any moisture which could condense on the colder timbers or reduce the performance of the insulation. This will normally only involve basic adjustments of the building by a roofing contractor or builder.

Although a little more complex to fit than insulation at ceiling level, rafter level insulation allows the roofspace to be used and reduces the need to upgrade loft access, water tanks, pipes, etc. as the roof space is ‘warm’.

This technique will likely be required where the ceilings follow the line of the roof and there is no roofspace available.

Planning permission or Permitted Development rights would need to be used where the insulation is changing the roof height.

How effective is it?

Up to 35% of the heat loss from a home passes through the roof this area is therefore very important to improve.

Fortunately, there are very many insulation systems and products available with strong competition in price to ensure good value.

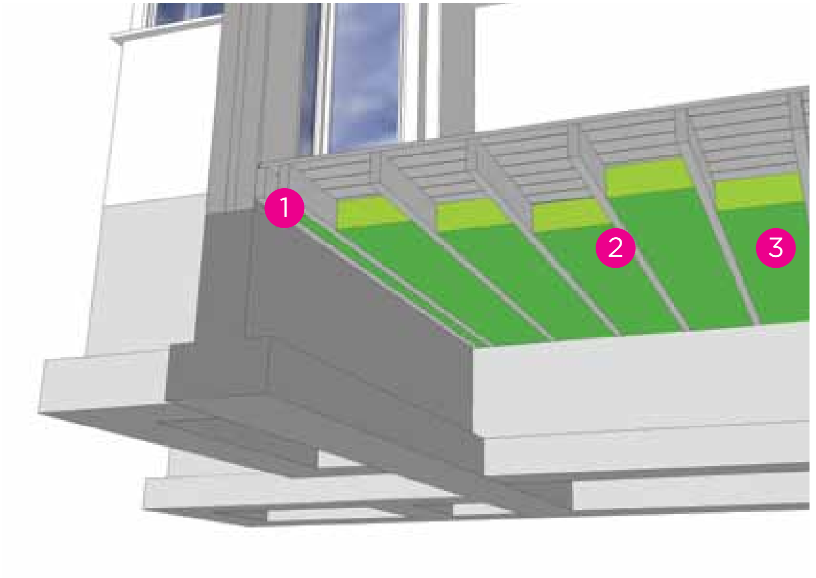
For a typical energy spend of £1500 per year, rafter level insulation will normally recover its installation cost within 2-3 years.

What does it cost?

The majority of roofs can be insulated at rafter level at a reasonable cost; with £900 – £1200 being typical for a smaller home.

Many systems can be retrofitted from below in less than a day, although some work may need to be undertaken by a contractor, to ensure ventilation routes are achieved.

Timber Floor Insulation



Cost score ££

Environmental score

L BC

English Heritage's technical guidance on insultating suspended timber floors www.english-heritage.org.uk/publications/eehb-insulation-suspended-timber-floors/

1 It is very important to insulate between the last joist and the wall as these narrower spaces are closest to the exterior and are therefore the coldest.

2 Don't forget to ensure that building services which pass below the floor are also insulated. This can be especially important where the addition of insulation elsewhere results in a lower underfloor temperature.

3 Typical underfloor insulation measures involve laying insulation between the joists.

Rigid insulation will need to be carefully trimmed to give a close fit and could be supported on timber battens secured to the joists. A compressible insulation such as mineral wool or sheepswool will give a snug fit and can be supported on a lightweight net laid over the joists.

In some cases the floor void may be large enough to work in and here, further insulation can be set below the joists.

Ensure that any sub-floor ventilation and air bricks are not obstructed and the insulation is at least 150mm clear of the ground level. In methane or radon affected areas seek advice from the building control department of your local council.

So what is it?

The loss of warmth through floors is not a new concern; as some of our oldest properties had double boarded floors or lime mortar 'pugging' between the joists to improve their thermal performance. However, the vast majority of suspended timber floor structures in buildings are uninsulated and offer little resistance to the passage of heat energy.

Beneath the 25mm or so of timber boards, the underfloor void of a suspended timber ground floor is commonly ventilated and cold – presenting an ideal route for the dissipation of heat. At their edges, heat lost through these floors can also pass out via poorly performing walls.

In addition to ground floors, heat passes between rooms themselves – meaning that heat from a living area can be lost through upper floors to an unoccupied or cooler space elsewhere in the home.

Insulating timber floors will normally involve lifting some of the floor boards and laying insulation between the joists so as to improve the thermal performance of the most slender element i.e. the boards themselves. Where possible, it is also desirable to improve the performance of the joists also, perhaps by under drawing the entire floor.

In some cases is it may be possible to insulate from above the boards by overlaying the floor with insulation and new floor finish. Adjustment of doors, room joinery and fireplaces will need to be considered in this case.

How effective is it?

In a typical dwelling 60% of the energy used is for space heating and around 15% of this is lost through the ground floor.

Whilst some heat will always pass through the building fabric insulating a suspended timber floor within the joist depth (as indicated) can reduce this to below 5%.

Overall, this can be 5-8% of your carbon emissions saved.

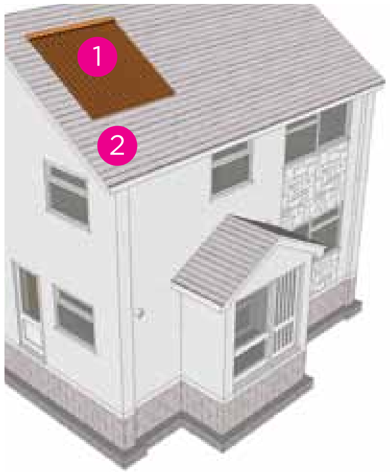
What does it cost?

For an annual energy bill of £1500 around £135 is spent heating the ground beneath you feet!

Figures form the Energy Savings Trust suggest that an average DIY installation will cost around £100 and can recover its cost within two years.

This measure can therefore cost less than the energy being wasted!

Solar Thermal



Cost score ££

Environmental score

L BC PD P

English Heritage Guidance on Domestic Solar Thermal Installation www.english-heritage.org.uk/publications/small-scale-solar-thermal-energy-and-traditional-buildings/

1 The panels should ideally face as close to south as possible and be set at an angle for maximim efficiency. Some variation is possible, although the performance will fall off incrementally. North facing roofs are not suitable.

Choosing a location free from over-shading chimneys trees and buildings will be necessary to ensure maximum efficiency.

Evacuated tube systems can be more efficient and take up less space than flat-plate panels. However, the flat-plate panels tend to be cheaper, more robust and more discreet.

2 The roof of your building may require strengthening locally to accommodate the solar collectors and you should consider safe access for installation and cleaning.

Solar thermal collectors do not have to be mounted on the main building, and can be installed on outbuildings but will work more efficiently if they are located close to where the water is being used.

So what is it?

Solar Thermal collectors use infra -red heat radiation from the sun to warm water for domestic use.

Typically these systems circulate water from a buffer tank into a roof mounted collector, where they absorb heat. This pre-heated water is stored in a hot water cylinder and then used by a conventional boiler for domestic hot water. By using already warmed water, these systems reduce the amount of fossil fuel otherwise consumed.

Many different types and designs of solar panel are available, that should suit most roof types and locations. These include many different styles of flat-plate panels through to more complex evacuated tube systems.

Collectors are normally 1-2 panels, placed out of the way on the roof of a building. It is helpful to have the system close to and above the place where the water is to be used, to allow gravity to reduce the electricity used for circulating the system. It is also worth bearing in mind that the collectors can get very hot, so safety will be a consideration if installed at a lower level.

Although most efficient in warmer weather, solar thermal collectors will work all year round and on sunny days can eliminate the need for a boiler altogether.

The panels should face south and be set at an angle to maximise their efficiency. North and East facing roofs are not suitable.

The service life of a system will typically be c.20-25 years.

Specific consent may be required from the local authority for protected buildings or those in a conservation area.

Note: The collectors are heavy and may require strengthening of the roof locally. The collectors also require cleaning from time to time so safe access should be considered.

How effective is it?

The equipment uses well established technology and gives a good service life if well cared for.

Solar thermal collectors are less efficient in the winter, when it is cold; but over an annual cycle they can greatly reduce the energy needed for hot water use in the home.

Efficiently-used systems are typically capable of delivering around 50% of your annual domestic hot water requirement.

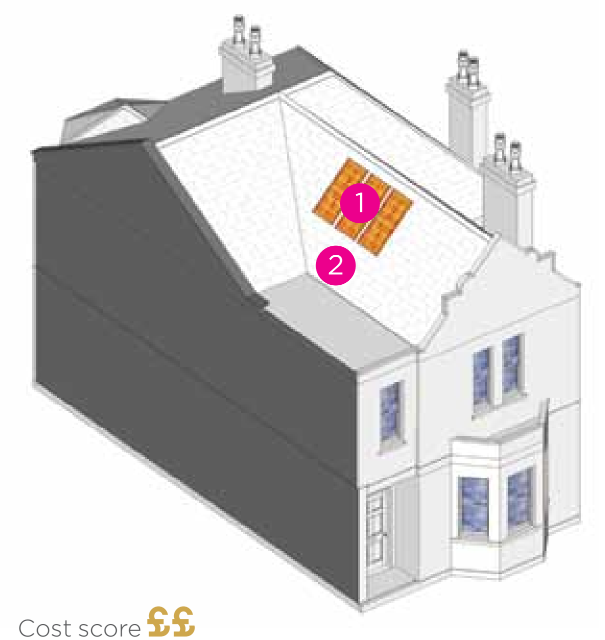
What does it cost?

The cost for a Solar Thermal installation will vary with the size, output and complexity of installation. Most systems can work with an existing boiler and infrastructure, which can also reduce cost.

A normal domestic sized installation will be in the region of £5k. The cost could be more if a boiler replacement is required.

Have you considered?
Roof mounted solar thermal systems are heavy and may require strengthening of the roof locally. The system may need cleaning from time to time and safe access should be considered.

Solar Photovoltaics



Cost score ££

Environmental score

L BC PD P

English Heritage Guidance on Domestic Solar PV Installation www.english-heritage.org.uk/publications/small-scale-solar-electric-photovoltaics-energy/

① The solar PV array must be located on a predominantly south facing slope, ideally at an angle around 30 degrees. Shallower angles and orientations away from south can be implemented, thought this will incrementally reduce the efficiency of the array.

Choosing a location free from over-shading chimneys trees and buildings will be necessary to ensure maximum efficiency.

② The roof of your building may require strengthening locally to accommodate the solar PV panels and you should consider safe access for installation and cleaning.

Solar PV installations can be set elsewhere around your home, such as free-standing in the garden or on the roof of a garage or outbuilding.

So what is it?

Solar Photovoltaic (or PV) systems use energy from solar radiation to generate. This can be supplied directly to the home or via a connector to the national grid.

The PV 'array' is normally a flat panel or series of panels and which is commonly placed 'out of the way' on the roof of the building.

PV installations can be sited anywhere that does not regularly get overshadowed, however. Garden sheds, garages and outbuildings can be equally good sites!

Although most efficient on a sunny day, solar PV can operate in overcast weather. The panels should face south and be set at an angle to maximise their efficiency. North and east facing roofs are not suitable.

Most PV panels are now guarenteed for peak efficiency for 20-25 years and systems can be augmented over time. Replacement of the inverter and general maintainance of the system will be needed.

Specific consent may be required from the local authority for protected buildings or those in a conservation area.

Solar slates can also be installed. These look like natural roof tiles, and generate clean electricity. These can be more subtle, appropriate solutions for sensitive solutions, but will still require careful consideration of impact, siting and historic fabric.

Have you considered?
The panels are heavy and may require strengthening of the roof locally. The panels also require cleaning from time to time so safe access should also be considered.

How effective is it?

Solar PV panels do not burn fossil fuels to generate electricity and are classed as renewable technology; or micro-generation.

The equipment uses well established technology and gives a reasonably good service life if well cared for.

Systems are typically capable of delivering between 1.5-6 kW/Hrs electricity per day at peak performance and would do much to mitigate the energy costs of lighting and small appliances.

What does it cost?

The cost for a Solar PV installation will vary greatly with the size, output and complexity of installation. Clearly a crane used for installation will cost more than a ladder!

A normal domestic sized installation will be in the region of £7-10k.

A government scheme exists which can provide a payment for surplus electricity delivered to the National Grid. Details are available from your utility company, The Energy Savings Trust or Department for Energy and Climate Change.

Boiler and Heating Controls

Cost score ££

Environmental score

L BC

PD P may be needed for flues or ventilation

1 A programmable time switch can make the installation much more efficient at delivering heat and hot water only when you need it.

2 A modern condensing boiler can be over 90% efficient, saving a third or more on your heat energy costs. Most are smaller in size and easier to locate than their older predecessors.

3 A thermostatically controlled radiator valve will allow you to set the temperature for each space individually making sure you only have it warm where you need it to be.

4 Modern radiators use less water, can operate at lower system temperatures and are more efficient at transferring the heat than older ones.

So what is it?

Many homes have a centralised heating system, with a boiler providing hot water which is circulated through a series of radiant panels. These systems use electrical energy to circulate the water and due to the high system losses and less efficient radiators typically circulate water at around 80°C. The whole home is often heated to the same temperature.

Modern radiators have been developed which have high thermal efficiency, can use less water and at a lower temperature, to deliver the same amount of heat to the room.

By adding a thermostatically controlled valve to the radiator, those rooms which are unused can be set to a lower temperature, reducing the energy needed.

By replacing an old and inefficient boiler with a new one the amount of energy required for heating and hot water can be considerably reduced.

In addition, fitting a new control panel can allow the timing of the heating and hot water services to vary from morning to evening, between different days and even over the course of a month – in case you are away on holiday for example.

In addition to replacing the boiler for a centralised heating and hot water system, consideration should be given to local heat sources such as an open fire, stove or radiant electric fire. These methods can reduce the heat demand when the temperature only dips slightly, but warming the whole house would be wasteful. Alternatively, if you regularly only use a few rooms in your home they can allow the remainder of the space to be heated to a lower overall temperature.

Any upgrade to the system should also have the circulating pipework insulated, so as to reduce heat loss in the system. Uninsulated pipes running in cold floor voids are not an effective way to heat the home.

How effective is it?

Cellular rather than open plan spaces are more efficient to heat. It may be worth considering reverting back to cellar plan layout if you live in a traditional home.

For most dwellings the single largest consumer of energy is the boiler which warms the home and heats water. Typically 60% of your energy is used here and it therefore makes good sense to ensure the boiler is both efficient and well maintained.

Modern condensing gas fired boilers can turn as much as 90% of the heat from burning fossil fuels into hot water. This compares with older boilers which are commonly around 60% efficient and some oil and solid fuel appliances which can be as low as 30-40%.

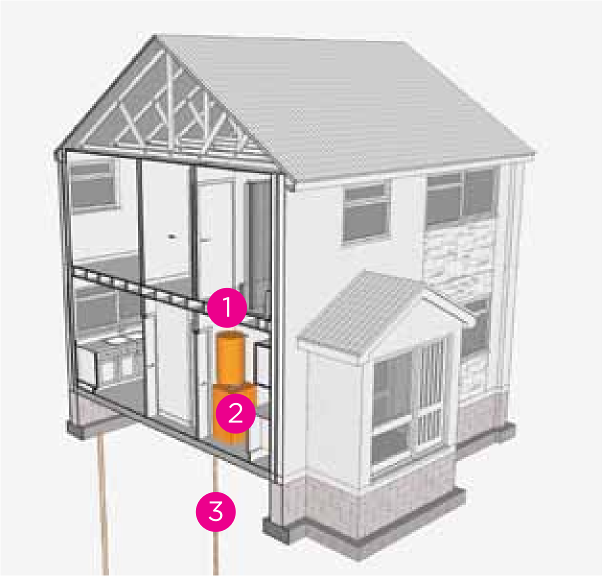
Upgrading your boiler could therefore potentially save 30-50% on your fuel usage!

What does it cost?

An efficient condensing gas fired boiler can cost between £2-3k, with stoves normally between £500-800. A 7-day heating programmer will be less than £100 and a thermostatic radiator valve can be as little as £10.

Some works to adjust your exiting installation may be needed but the benefit form reduced fuel usage will normally recover this cost within a short period.

Ground Source Heat Pump



Cost score ££

Environmental score

L BC PD

1 Ground source heat exchange systems can connect to existing heating and hot water infrastructure, although will work best with efficient radiator and underfloor heating installations.

The size of the heat exchanger and buffer tank will depend on the building size, insulation level and the amount of hot water likely to be used.

2 A typical heat exchanger is the size of a domestic appliance and the buffer tank similar to a hot water storage cylinder.

3 Ground loops can be laid a as 'slinky' pipe in a shallow trench, as a compact cassette or in a deep borehole.

The size and type of installation will depend on space available and ground conditions.

So what is it?

Ground Sourced Heat Pumps use the solar heat energy stored in the ground to provide heat and hot water for a home. They are an alternative to conventional boilers.

The systems use a simple refrigerant circulated within a pipe which that is laid below ground. A small amount of heat from the ground is transferred into the fluid and this passes to a heat exchanger; which in turn stores the heat in a 'buffer' tank of warm water.

The below ground pipe or ground loop can be laid in a shallow trench or a deep borehole, dependant on space and ground conditions.

The heat exchanger is typically the size of a floor mounted boiler and can be located away from an external wall.

Ground sourced heat exchangers can provide water at lower temperatures and are suitable for domestic hot water systems. They can also serve the more efficient radiator or underfloor heating systems which operate at lower system temperatures.

In Summer months it may be possible to reverse the flow of the heat exchanger and use the heating system to cool the building.

How effective is it?

Ground sourced heat pumps do not burn fossil fuels and are classed as renewable technology. However, the system does require electricity to operate.

The equipment is simple, well established and has a good service life. A heat exchanger with a high efficiency should be used where possible.

Particularly useful where a home is off gas-grid they can deliver 75% savings in heating and hot water costs.

The equipment is simple, well established and gives a good service life. A heat exchanger with a high efficiency should be used where possible.

The system requires electrical energy to operate but with a well insulated building and other energy efficiency measures can deliver savings around 75% on heating and hot water cost.

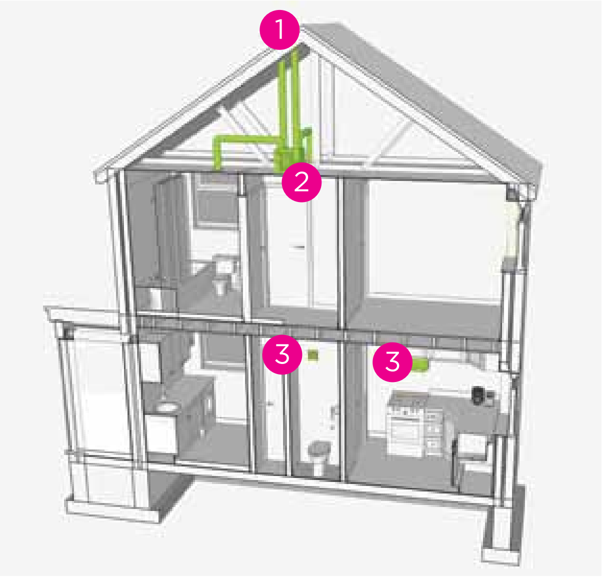
What does it cost?

For an average home the cost of a GSHP installation will be around 50-75% more than a conventional boiler. This can be considerable higher if boreholes are required as these are typically £1500-2500 each to drill.

Archeological Issues

The boreholes required by many GSHP systems can potentially have a extremely damaging impact on archaeological deposits and structures. If you are concerned that you may live in an archeologically sensitive area, and would like advice about how to avoid causing such damage you can contact the Council's planning department for advice.

Mechanical Ventilation and Heat Recovery



Cost score ££

Environmental score

L BC PD

P may be needed for flues or ventilation

1 All extract is taken through a single outlet which can be discreetly located on the building, for example at roof level.

2 Ductwork will be required to connect the various extract outlet locations to the MVHR plant. Some slimline systems are available which can fit inside partition and ceiling voids.

The MVHR plant can be installed in a concealed location such as a cupboard or roof space.

3 Extracts from kitchens, WC's and utility rooms at lower floors and bathrooms, shower rooms and en-suite's at upper floors can all be connected to the MVHR system.

So what is it?

It is a regulatory requirement for all modern homes to have a means to rapidly remove humidity and foul air from the interior.

In the majority of dwellings this work is simply done by opening a window, but even this uses energy by allowing warmed air to escape. Alternatively, many homes have mechanical extract fans which remove cooking odours, foul air and humidity from WC's bathrooms and showers.

All such fans use electrical energy to remove warm and humid air room the building, which in turn, is replaced with cold air from the outside. In addition to the energy used to operate the fan, these systems remove valuable heat energy, lowering the internal building temperature and consequently increasing the demand for space heating.

Mechanical ventilation and heat recovery systems (MVHR) combine the various extract fan functions in a home with a small heat exchanger. This takes warmth from the waste air being removed and uses it to heat the incoming air which is replacing it. This reduces the energy needed to raise the temperature of incoming air by making use of the heat otherwise thrown away.

The warmed replacement air can be introduced at a suitable location anywhere in the home.

How effective is it?

These systems do use electrical energy to operate and therefore are likely only to be of net benefit in reducing energy for larger or more highly serviced homes.

Passive systems are available however which use wind pressure and thermal stack-effect to naturally move air through the system and these can be useful in some situations where the benefit is otherwise marginal.

High levels of insulation and air-tightness are required throughout the home to gain maximum benefit, and to prevent the system inadvertently drawing in cool air from the outside.

What does it cost?

An MVHR system will connect all the extract outlets from the home to a centralised plant, this may mean some alteration to the existing building, finishes and electrical services. The extent of this will vary with the complexity of the building, number of extracts and their location.

A typical proprietary system for a smaller modern dwelling such as the one illustrated here would be in the region of £800-1200.

The Domestic Building Service Compliance Guide (2010) is available free from

www.planningportal.gov.uk

Green Walls and Roofs

Partially earth-sheltered house with extensive Green Roof in Charlcombe, Bath.

Intensive grass roof on house in Claverton Down, Bath

Designscape Architects (2012)

Designscape Architects (2012)

Cost score ££

Environmental score

L PD P BC

Green roofs can be incorporated into existing buildings, typically flat roofs including roof extensions or garages or part of a new build design.

So what is it?

There are two basic types of green roof - extensive and intensive.

Extensive systems typically use 8-10cm of soil can can grow sedum grasses and drought tolerant plants. They are low maintenance and should not require watering Their potential to retain water is lower due to the more limited soil depth and nature of the planting, and are therefore less structurally problematic and have a lower weight when the soil is saturated. They can be installed on roof pitches up to 40 degrees.

Intensive systems typically use more than 30cm of soil, and can support a wider variety of plants such as grasses and shrubs, they can look more like gardens and can be more likely to incorporate native planting.

They do need greater irrigation and can be high maintainance. However, their ability to retain moisture is much greater. They are suitable on roof pitches up to 22 degrees.

How effective is it?

Green Roofs have major benefits in terms of of water retention, they slow the passage of rainwater to drains and sewers and can help reduce surface water flooding in periods of heavy rain.

Green roofs can also improve the environment creating local climate advantages cooling and humidifying the air. In urban contexts they can also cumulatively help to reduce urban heat island effects.

The vegetation helps absorb carbon dioxide from the air, and also assists with the absorption of air pollution and dust. They also provide a habitat for animals and plants.

Green Roofs themselves have beneficial insulating qualities, particularly when accompanied by additional insulation.

What does it cost?

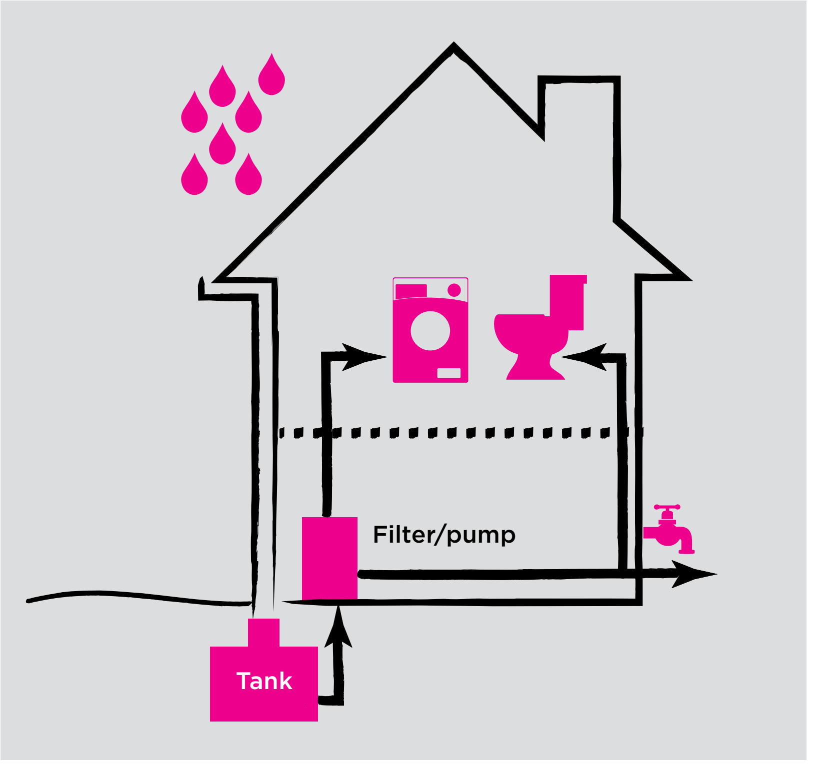
When installing or designing a green roof, serious consideration will need to be given to the structural soundness of the roof and future access to maintain the roof structure. Existing roof structures are often not designed to take this extra weight, particularly when waterlogged and may need to be structurally strengthened. When designing extensions or new build these considerations can be taken into account at an early stage. Costs will vary significantly.

What about a green wall?

A green wall including ivy, creepers or vertical planting could improve the thermal performance of your wall. Benefits include protection from wind and reducing water penetration. They help absorb carbon dioxide and pollutants and provide habitats for insects and nesting birds.

The orientation of the wall will be a key factor in determining what can be grown. Cold, sunless walls have even temperatures and moist soil that suits hydrangeas and ivies. Warm walls that recieve a lot of sun can be perfect for tender plants such as wisteria, jasmine and many times of clematis.

Rainwater harvesting



Cost score ££

Environmental score

L BC PD P

It is most effective to reduce your water use. After you have done this it is worth considering rainwater harvesting.

So what is it?

Rainwater harvesting is the collection of rainwater from roofs or hardstandings for use for toilet flushing, laundry water supply or irrigation.

Rainwater Harvesting systems collect rainwater from your roof or other surfaces and store it for later use - the water is not to be used for drinking, cooking or showering. Water can is stored in over-ground tanks (often located in sheds, outhouses or garages). If short on space the tanks can be stored underground. Filters and pumps are then used to provide water to the building or a tap nearby. Additional filters can be used to make the water suitable to drink, however, these can be a more expensive add on.

Greywater recycling is the use of waste water from baths, showers and hand basins for toilet flushing, irrigation or washing machine supply. The definition of greywater excludes sewage and also waste water from kitchen sinks.

How effective is it?

Rainwater harvesting systems are easiest to fit when you are building a house or doing significant renovation as it will require changes to the plumbing system and potentially digging for water tank if stored underground.

Household rainwater systems reduce demand on drinking water supplies and decrease pressure on storm-water drains and sewers. Rainwater collected can be stored and used for garden use, car washing, WC flushing and washing machine use. Industrial pollution, contamination from bird droppings and other dirt means that rainwater is rarely used for other uses.

What does it cost?

The UK Rainwater Harvesting Association estimates that a good quality domestic rainwater harvesting system should cost between £2,000 and £3,000. The cost of running the pump is estimated at only 10p per week.

If you are on a water meter, it is estimated that the payback period for a rainwater harvesting system would be 10 to 15 years.

Use an online rainwater calculator to find out if it is worth looking at rain water harvesting for your house.

The Environment Agency have produced an Information Guide on Rainwater Harvesting for Domestic Use

Grey Water Recycling

It is most effective to reduce your water use. After you have done this it is worth considering greywater recycling.

So what is it?

Greywater recycling is the use of waste water from baths, showers and hand basins for toilet flushing, irrigation or washing machine supply. The definition of greywater excludes sewage and also waste water from kitchen sinks.

How effective is it?

33% of our average water usage comes from showers, basins and baths. This grey water can be recycled and reused for the flushing of toilets, which are calculated to use a further 30% of domestic water usage.

What does it cost?

You will see immediate reduction in water bills if you have a water meter following the installation of a greywater recycling system in your home. The systems are suitable for inclusion in a new build home as well as being retrofitted into an existing one, although the costs will differ.

The Environment Agency have produced a Greywater for Domestic Use Information Guide

Cost score ££

Environmental score

L BC

5 Useful resources and information

This chapter includes key references and a glossary.

Further information

Bath & North East Somerset Council
For all queries on planning, building control and listed buildings you can contact the Council via the Council Connect Service

councilconnect@bathnes.gov.uk

01225 39404

07797 806545

Bath & North East Somerset Building Control
For Building control advice
www.bathnes.gov.uk/environmentandplanning

Bath & North East Somerset Council
Sustainable Construction & Retrofitting Supplementary Planning webpage with latest information about local events, projects and information sign-posted . Additional information on permitted development rights for microgeneration can also be found here.
www.bathnes.gov/greenbuild

Sustainability webpage includes a planning and sustainability page with links to more information on local planning, building control and listed buildings advice
www.bathnes.gov.uk/environmentandplanning/Sustainability/Pages/default.aspx

Other key sources

Centre for Sustainable Energy
Free advice on domestic energy use

Direct Gov
Guide to greener living

Ecobuild
The worlds biggest event for sustainable design, construction and the built environment.

Energy Saving Trust
Independent and impartial advice about energy and water saving

English Heritage
Understand the best ways to save energy if you have an older house, includes a useful "home energy toolkit" you can also get customised advise for your house type

Green Register
A register of sustainable construction professionals in the South West

Historic Scotland
Research on energy efficiency in historic buildings including pilot studies

The Institute of Historic Building Conservation
The principle professional body for building conservation practitioners and historic environment specialists.

Low Impact Living Initiative
Retrofitting Factsheets and information

National Insulation Association
Find an accredited insulation installer locally

National Microgeneration Scheme
National quality assurance certification scheme for microgeneration products and installation

Planning Portal
UK Government's online planning regulation and building resource. Find out if you need planning permission or use the interactive house features – terrace and semi-detached – for advice on common householder projects including microgeneration.

Recycled Products
Find a recycled product

Society for the Protection of Ancient Buildings
Provide practical advice and training on building conservation.

Transition Bath
Bath based group increasing awareness of climate change and planning changes to deal take action at a local level.

Warmer Bath
Informative local guide to improving energy efficiency of traditional homes in the city of Bath

Wessex Water
Free water saving packs and information about water saving.

Zero Carbon Hub
Information on challenges, issues and opportunities related to developing, building and marketing your low and zero carbon homes

Glossary

Refrofitting
Installation of energy efficiency measures in existing buildings

Energy Efficiency
Reduction in consumption of energy for heat and power

Sustainable construction
Building with positive Environmental impact

Green Infrastructure
Strategically planned network of green spaces and other environmental features

Natural Stack Ventilation
Cool fresh air drawn in from openings at lower levels of a building by opening a ventilation out let at a higher level e.g. a window or ventilation hatch

Biomass/Biofuel
Plant derived fuel that is a renewable energy source

Skeiling
Plastered sloped underside of a roof

Breathable
Materials and building fabric that allows moisture permeability

SUDS (Sustainable Urban Drainage)
Techniques to reduce adverse imapcts of surface water drainage.

Cold Bridge
Occurs when there is a thermal break in the insulating materials between the inside and outside of a building e.g. a gap in the wall or roof insulation, allowing heat to escape

Heating and hot water

- **Efficient controls** – installing a thermostat, thermostatic radiator valves and a timer will help to make heating systems work in the most efficient way and will reduce fuel bills
- **Underfloor heating** – in some cases, underfloor heating can be a suitable alternative to conventional radiators. The system uses a low operating temperature that can be linked in with alternative heating sources that output at the same low temperature, for example solar panels
- **PV's, solar thermal, biomass** – by installing renewable energy systems to heat hot water and provide space heating, less fossil fuel is used and therefore less CO2 is emitted than conventional systems such as electric heating

Windows:

- **Frames** – there are several choices of materials for window frames such as plastic, timber and aluminium. Timber window frames are the best choice from an environmental point of view but the timber should be sourced from well managed forests
- **Glazing details** –heat loss through window glass is much greater than through walls and roofs. Insulating double or triple glazed units are now easy to source and the glazing unit is filled with an inert gas, making it even more energy efficient
- **Solar shading** – adding blinds, shutters and/or solar shades on the outside of the windows can keep unwanted sun out in the summertime and will help to keep indoor temperatures at a comfortable level
- **Thermal bridging** – it is important to make sure that the gap between the window frame and the wall is well sealed otherwise heat will be lost around the window even if the window itself is very energy efficient

Interior Design:

- **Lighting** – LED lighting (and to a lesser extent, compact fluorescent lights) use a fraction of the energy of normal light bulbs but give the same light output and there are a range of options to choose from. Although initially more expensive to buy, they last for many times longer than conventional bulbs and the costs are easily recouped over time Natural daylight is even cheaper.
- **Painting** – synthetic paints contain hundreds of chemicals in them and can cause health problems when used. There are a number of alternative 'natural' paints and finishes available that are better for the environment and better for the occupants
- **Flooring** – there are many natural flooring alternatives to conventional synthetic choices (nylon carpet, pvc vinyl flooring and laminate as examples) that have a lower impact on the environment, are more durable and in many cases are healthier alternatives such as linoleum, wool carpet and solid timber flooring

Glossary

Roof:

- **Insulation** – as much as 20% of energy bills can be saved by good loft insulation (200mm minimum) which is easy and inexpensive to install
- **room in a roof** – where appropriate, creating a room in the roof (the attic space) rather than building out to the side of back of a house can be less expensive and saves on materials. Even if the room is not in the original plans for the attic, making sure the roof is not filled with trussed rafters allows a room in the roof to be created at a future date.
- **Materials** – using natural slate or clay tiles as opposed to concrete tiles or asphalt means less energy is used to make the building materials in the first place thereby reducing fossil fuel use
- **solar panels** – providing the roof faces south (or south east/west) and is unshaded there will be an opportunity to generate heat for hot water and/or electricity from solar panels. The roof structure needs to be designed so that it is strong enough to take the extra weight of the panels

Ventilation:

- **Airtightness** – lots of heat is lost through unintentional gaps in the walls, floors and roofs of buildings creating draughts and so it is extremely important to make sure these are eliminated. This down to good detailing and good site workmanship
- **natural and mechanical ventilation** – fresh air is an important aspect of a healthy building and can be provided by natural ventilation systems rather than mechanical which use energy to operate
- **heat recovery** – if mechanical ventilation systems are used, a heat recovery system can really help to capture and reuse the 'waste' heat from outgoing air
- **Indoor Air Quality (IAQ)** – it is important to provide adequate fresh air into a building to maintain a healthy indoor environment and to remove pollutants such as smoke, cooking odours and offgasing from building materials. When a building is very airtight it is even more important that fresh air is regularly introduced to a building through either natural or mechanical means
- **Moisture control** – moisture build-up in a building – due to cooking, breathing and washing – can cause mould growth resulting in an unhealthy indoor environment. Trickle vents in windows, mechanical extract and careful use of opening windows can expel the moisture and keep levels down to a minimum

Walls:

- **Insulation** – up to half the heat can be lost through uninsulated walls so it is essential that adequate insulation – in the cavity, internal or external depending on the wall construction – is installed. This will reduce fuel bills and make the building more comfortable to occupy
- **thermal mass** – using heavyweight materials such as brick, block and concrete can moderate the temperatures inside buildings by holding onto the heat during the day and releasing again at night time when it is needed
- **materials** – using natural materials such as brick and timber cladding means less energy is used to make the building materials in the first place saving on fossil fuel use

Water:

- **reduce consumption** – the best way to save water is to reduce it at the point of use so installing low flush, dual flush WC's, low flow shower heads and tap aerators will help save water and reduce water bills
- **rainwater harvesting** –Collecting rainwater and using it for washing machines, garden irrigation and to flush WC's reduces the use of mains water (which is cleaned using fossil fuel energy) and reduces water bills
- **surface water runoff** – if rainwater that falls onto a property is kept on site it can help to reduce the burden on mains drainage during heavy rainfall and allow topping up of the local water table. Using porous paving, swales and retention ponds will all help to keep rainwater on site

Floors:

- **insulation** – a significant amount of heat can be lost through uninsulated floors so it is essential that adequate insulation – below or above the slab or between joists depending on the floor construction – is installed. This will reduce fuel bills and make the building more comfortable to occupy
- **thermal mass** – using heavyweight materials such as concrete or floor finishes such as tiles or stone can moderate the temperatures inside buildings by holding onto the heat during the day and releasing again at night time when it is needed
- **materials** – using natural floor finishes such as stone, timber and linoleum means less energy is used to make the building materials in the first place and saves on fossil fuel use