Sustainable Construction & Retrofitting Supplementary Planning Document

FINAL CONSULTATION DRAFT

22 MARCH – 3 MAY 2012

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Bath and North East Somerset Local Development Framework

Bath & North East Somerset Council

CONTENTS

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Bath Preservation Trust and Centre for Sustainable Energy, authors of Warmer Bath

English Heritage

INTRODUCTION TO SPD

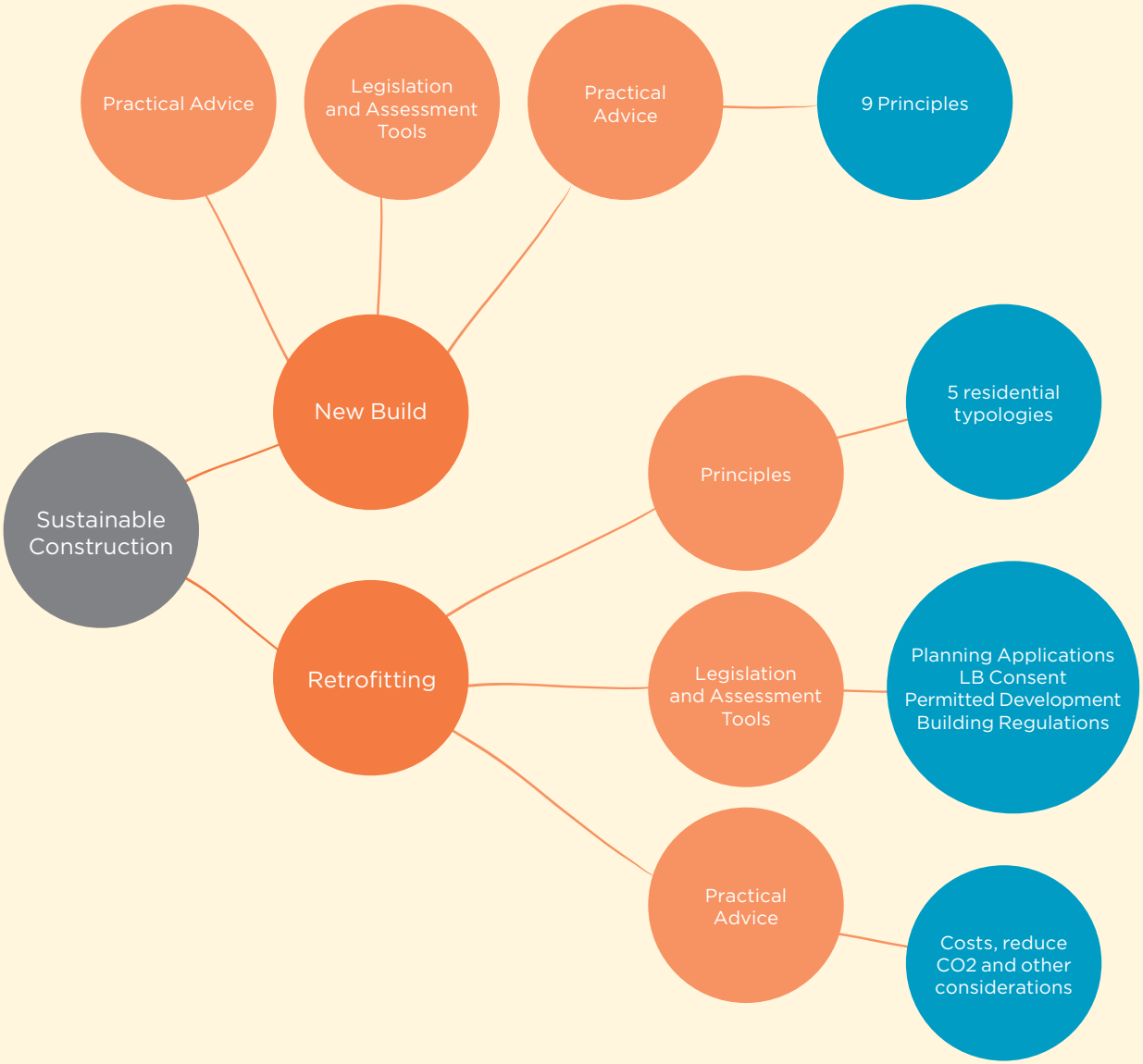
This supplementary planning document accompanies the Council's Core Strategy policies CP1 and CP2. It is a guide for small developers, proposing less than 10 dwellings and home owners on how to build and retrofit homes sustainably to reduce energy consumption and fuel bills.

This document has been prepared together with Planning, Conservation, Housing, Sustainability and Building Control Officers. It aims to offer home owners and small scale home builders in Bath & North East Somerset clear direction on how to contribute to the Council's aspirations to increase the energy efficiency of all homes in our district.

We welcome any comments regarding the content of this document. Contact details are listed in the directory.

Structure Of SPD

The diagram describes the structure of this document. The principles of sustainable construction are relevant primarily for new buildings and extensions. Retrofitting options for the five pre-dominant building types in the district are described. This includes the problem issues for each building type and suggestions for energy efficiency opportunities that could be applied to them together with details of risks and considerations for each measure. Each suggested measure is explained in more detail with drawings, photographs, symbols for required consents and a carbon saving/cost analysis to help home owners decide which measure is most appropriate for their home. A glossary of terms and directory of useful information including the contact details of relevant Council Officers completes the document.



POLICY BACKGROUND

House type relevant: New Builds, Extensions & Retrofits

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

National

Draft National Planning Policy Framework
States that the planning system should aim to secure "radical reductions in greenhouse gas emissions" through "active support for energy efficiency improvements to existing buildings and the delivery of renewable and low-carbon energy infrastructure"

Until they are superseded, the following national policies also remain relevant:

Planning Policy Statement 1: Delivering Sustainable Development

Planning Policy Statement 1: Planning and Climate Change – Supplement to Planning Policy Statement
Clarifies priority on action on climate change across all national policy.

Planning Policy Statement 5: Planning for the Historic Environment
Local Plan Policies HE.1, HE.2 and HE.3 are particularly relevant.

Guidance

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

Microgeneration in the Historic Environment
English Heritage provide a range of other guidance relating to listed buildings and historic buildings

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.

INTRODUCTION TO SUSTAINABLE CONSTRUCTION

House type relevant: New Builds & Extensions

The following Sustainable Construction principles expand upon criteria set out in the Code for Sustainable Homes (CSH) and Building Research Establishment Environmental Assessment methodology (BREEAM) requirements. Pre-assessments for CSH for residential buildings and BREEAM for non-residential buildings are required to accompany all planning applications.

Your sustainable construction approach can be outlined in the 'Design & Access Statement' for your planning application or as a separate document. You can use drawings, diagrams and photographs to support your approach.

Some sustainable construction principles will influence the appearance of your proposed development. Early discussions and design development with architects and Council planners can enable a balance to be achieved between architecture that performs well environmentally and sits happily in its environment.

The nine sustainable construction principles described in this SPD apply primarily to new buildings though some can also apply for extensions.

They are:
1. Land-Use & Ecology
2. Siting & Orientation
3. Passive Design
4. Thermal Mass
5. Surface Water Run-off
6. Water
7. Energy
8. Materials
9. Waste

Further information is provided on a practical advice diagram that describes what sustainable construction methods can be applied to different parts of a new building or extension.

All development proposals must meet legislative requirements. The Legislation & Assessment Tools chapter details some of these.

LEGISLATION & ASSESSMENT TOOLS

House type relevant: New Builds, Extensions & Retrofits

Building Regulations

LABC

Standards

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.

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.

PASSIVE HOUSE

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.

BREEAM

Energy Performance Certificate

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

Consent

Proposals to construct new homes will always require planning consent. Some extensions will be permitted development and others would require planning consent. Listed Building consents may also be required.

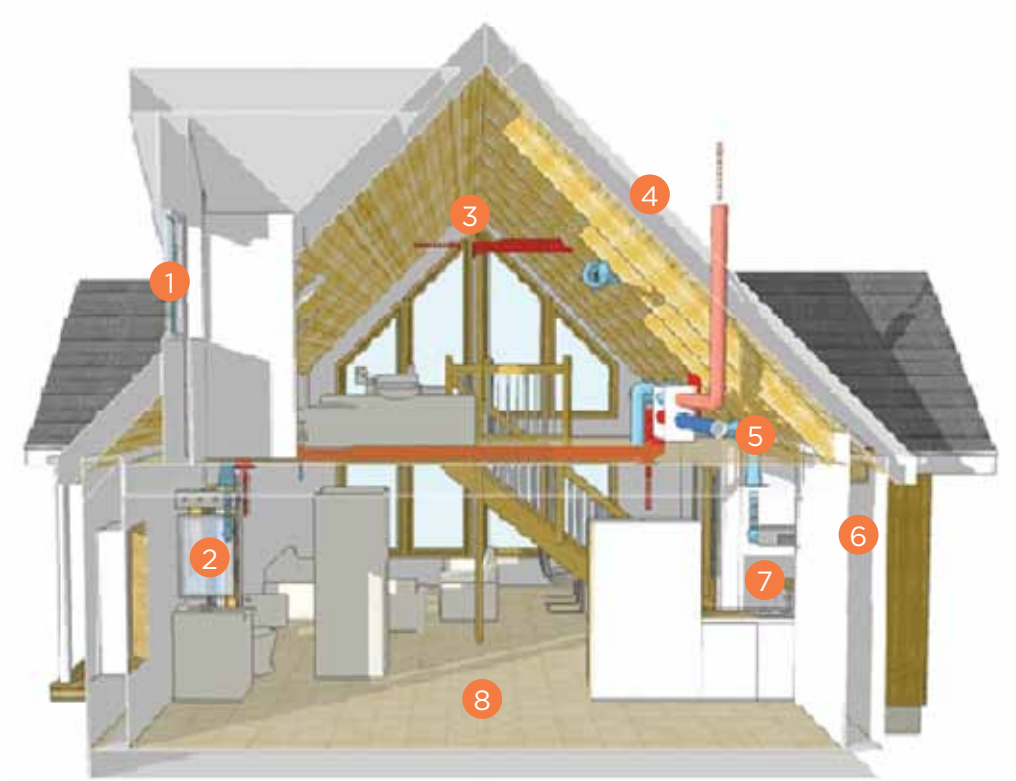
It is essential to check with the planning department about the consents that may be required for your site and also whether any constraints to development apply, such as Green Belt legislation. Pre-application advice to provide such information is available for a small fee, details are in the directory.

Where there is a likelihood that planning or listed building consents would apply to sustainable construction principles or retrofitting measures or where they may be permitted development, the symbols below will appear throughout the document. Where you see the Building Control symbol below please contact your local authority building control service who can advise on the specific requirements to meet building regulations. Please follow up the implications of these with the relevant Council officers.

- (P) Planning consent
- (L) Listed building consent
- (B) Building control
- (D) Permitted Development

PRACTICAL SUSTAINABLE CONSTRUCTION ADVICE

House type relevant: New Builds & Extensions



1 Windows
- Frames
- Glazing
- Details
- Solar Shading
- Thermal Bridging

2 Heating & Hot Water
- Efficient Controls
- Underfloor Heating
- Photovoltaics, Solar Thermal, Biomass

3 Interior Design
- Lighting
- Paints
- Flooring

4 Roof
- Insulation
- Room-in-a-roof
- Materials
- Solar panels

5 Ventilation
- Airtightness
- Natural & Mechanical Ventilation
- Heat Recovery
- Indoor Air Quality (IAQ)
- Moisture Control

6 Walls
- Insulation
- Thermal Mass
- Materials

7 Water
- Reduce Consumption
- Rainwater Harvesting
- Surface Water run off

8 Floors
- Insulation
- Thermal Mass
- Materials

All terms are defined in the Glossary

PRACTICAL SUSTAINABLE CONSTRUCTION ADVICE

House type relevant: New Builds, Extensions & Retrofits

Here we have listed the top 3 issues relating to each of the eight subject areas on the Practical Advice section in order of carbon savings. Most carbon saved is indicated first-this is very approximate but gives an idea of the measures relative to each other within each section, therefore a £££ in Windows section for example is not equivalent in monetary value to £££ in another section. We have added £'s to each measure, £ being least expensive, ££ medium and £££ quite expensive (there is not necessarily one of each £, ££ and £££). Please note that in some situations such as the Windows section some of the measures would be applicable for retrofitting too.

Data supplied by archipeleco architects

HEATING AND HOT WATER:

Carbon saving measures:
1. Improving the thermal performance of the external envelope (££)
2. Installing solar thermal (£££)
3. Installing thermostat, timer and TRV's (£)

WINDOWS:

Carbon saving measures:
1. Using high performance windows (£££)
2. Installing draught proofing (££)
3. Adding shutters, blinds and heavy curtains (£)

INTERIOR DESIGN:

Carbon saving measures:
1. Designing in natural daylight (no additional cost)
2. Using natural wall and floor finishes (££)
3. Using low energy lighting (£)

ROOF:

Carbon saving measures:
1. Installing roof/loft insulation (£)
2. Designing a room in a roof (££)
3. Using natural materials (££)

VENTILATION:

Carbon saving measures:
1. Installing a mechanical ventilation heat recovery (££)
2. Having controllable trickle vents in windows (£)
3. Mechanical extract fans in kitchens and bathrooms (£)

[Please note that 1 and 2 are not strictly carbon saving measures but effective actions for providing adequate ventilation]

WALLS:

Carbon saving measures:
1. Super insulate external walls (£)
2. Use the thermal mass of walls to store heat (£)
3. Use low impact materials (£)

WATER:

Carbon saving measures:
1. Install water saving devices (£)
2. Install a rainwater harvesting system (£££)
3. Specify porous paving for external landscaping (££)

FLOORS:

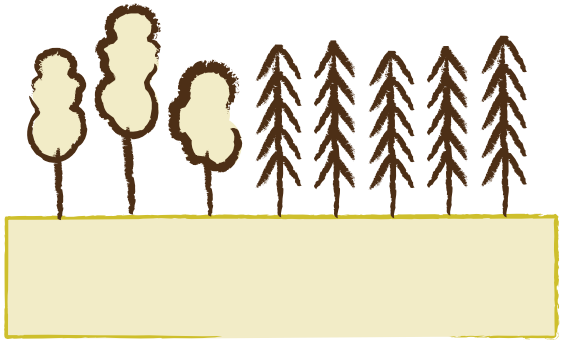
Carbon saving measures:
1. Super insulate ground floors (£)
2. Use the thermal mass of floors to store heat and place insulation under slabs (£)
3. Use low impact materials (£)

LAND-USE & ECOLOGY

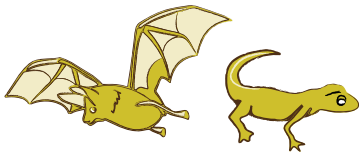
House type relevant: New Builds, Extensions & Retrofits

Whenever we build, we must protect the plants and animals that already live on the site.

Examples of these are:



Existing trees – providing habitats for many species



Protected species such as bats and newts

Existing plants

Living creatures such as insects, mammals and reptiles

For significant 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 organisations are good sources of information on how to identify and protect animals and plants on your construction site:

Bristol Regional Environmental Records Centre
Details of local groups, helplines and data on what flora and fauna can be found on most sites.

Avon Wildlife Trust
Gives planning advice in a series of guidance notes.

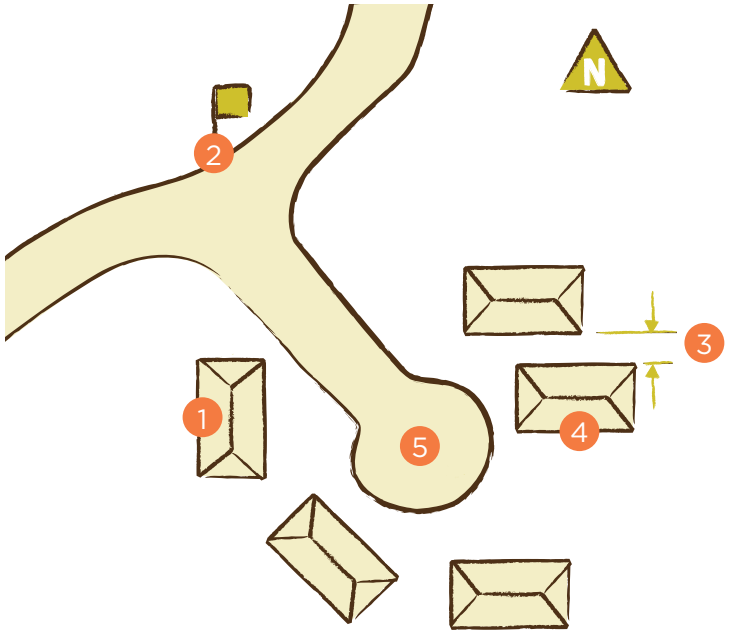
In addition, the district's **Requirements for Biodiversity and Geological Conservation Assessment** can be found on the Council's planning web pages.

SITING & ORIENTATION

House type relevant: New Builds & Extensions

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

- maximise natural daylight and sunlight into the building (see Passive Design for more details)
- 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.
- 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 found on the archived Commission for Architecture and the Built Environment web pages 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.



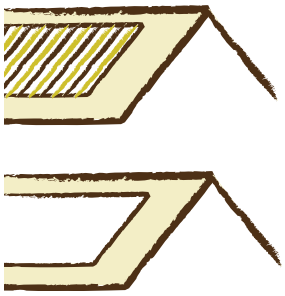
1 Very restricted south facing roof surface.

2 Is the site near public transport? Where there is a choice of sites, one that has access to public transport will be more attractive to users and reduce dependence on private car use.

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.

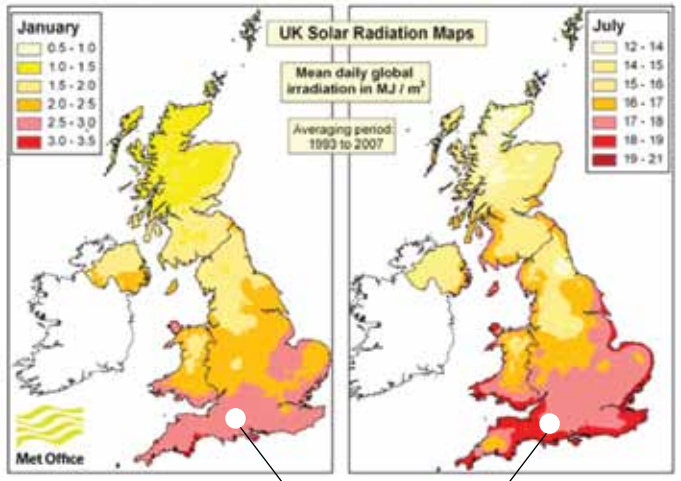
5 It is a legal requirement for paths, drives and car parks over 5m2 to be finished with porous surfaces to allow the rain falling on the site to grain to the local water table rather than potentially overburden our existing drainage system. See Surface Water Run-off section.



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



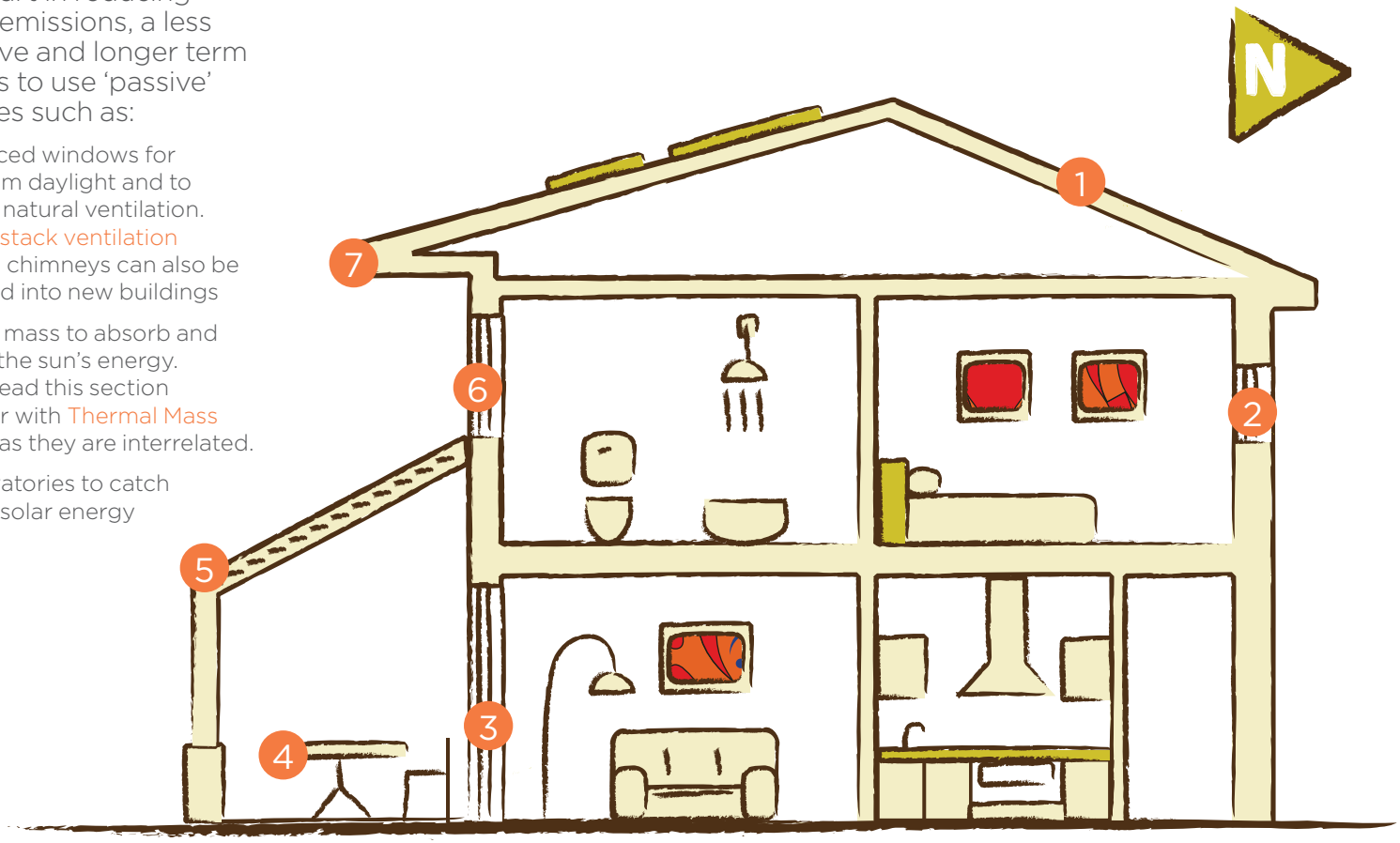
Bath & NE Somerset

PASSIVE DESIGN

House type relevant: New Builds & Extensions

Although 'active' systems such as solar panels and other renewable 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 to catch passive solar energy



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 Build in solar shading so that the conservatory does not overheat in summer.

6 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

7 Large overhang on South facing roofs helps prevent overheating

THERMAL MASS

House type relevant: New Builds & Extensions

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

These materials are called 'thermally massive'. Please read this section alongside 'Passive design' as they are interrelated.

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.

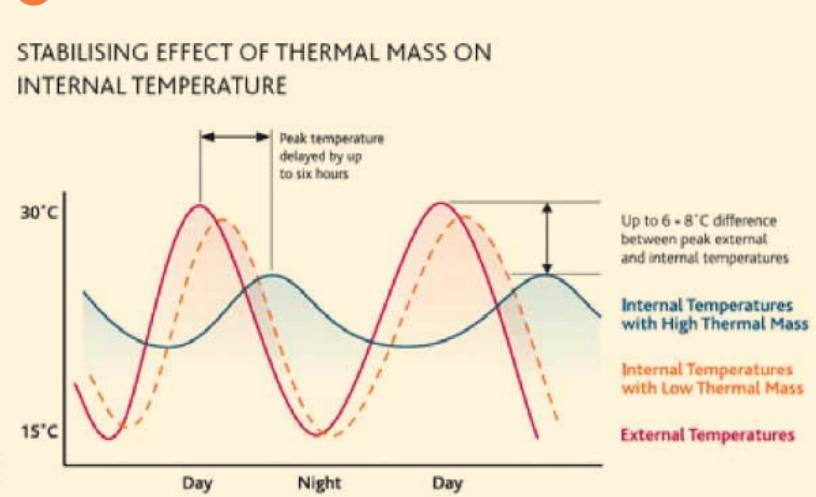
B **At night time:**
Opening windows at night time lets the heat out and allows cooler air from outside to cool the thermally massive elements and cool the building down: 'night time cooling' In the morning, the building is cooler and ready to start the cycle again. In addition to helping buildings stay cool in summer – an important consideration as climate change science predicts hotter summer temperatures in the future – thermal mass can help keep the heat in in winter if the insulation is on the outside.

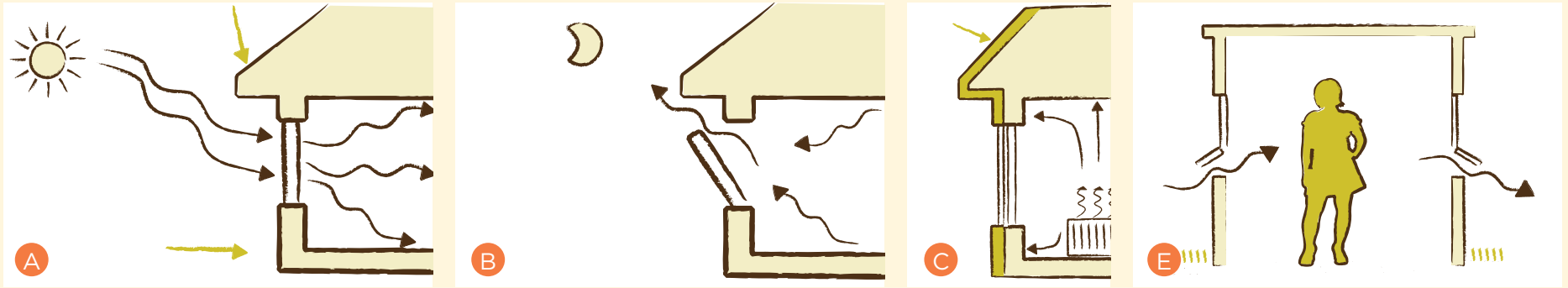
C Heat from inside the building warms up the thermally massive materials and then the insulation on the outside keeps the heat in – like a giant tea cosy over the building. Take care to ensure that the insulation is continuous and there are no gaps causing 'cold bridging'

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

D





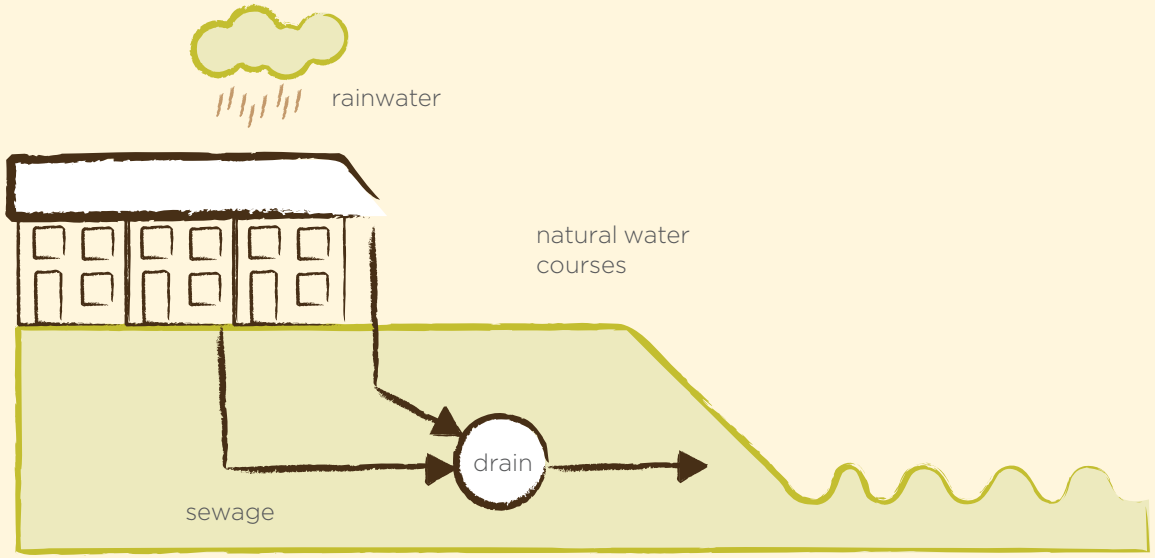
SURFACE WATER RUN-OFF

House type relevant: New Builds & Extensions

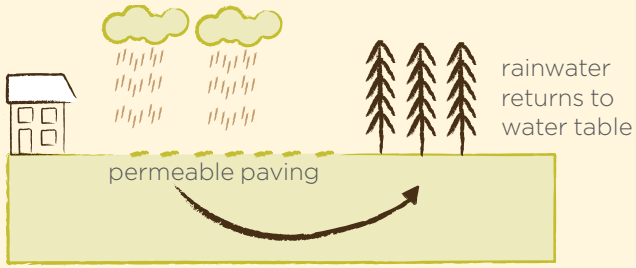
As our cities grow, the amount of land we cover with impermeable surfaces such as tarmac, increases. As our climate changes, it is predicted that we will get more extreme weather including severe rain storms.

When it rains heavily, the drains cannot cope and sometimes raw sewage from buildings is mixed with this rain and is discharged into natural water courses.

Photograph shows the River Avon bursting its banks in central Bath after severe rain.



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.



Other ways of dealing with surface water run off are to create temporary 'reservoirs' to slow the rate of water to the drains.

green roofs can help

create swales to hold the rainwater

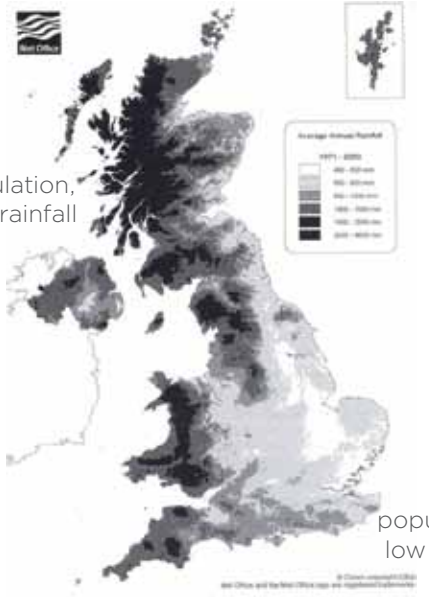
These solutions are called Sustainable Urban Drainage Systems or SUDS. Sustainable drainage is a requirement through the Flood and Water Management Act 2010, which is enforced through the planning system.

WATER

House type relevant: New Builds, Extensions & Retrofits

Although we have a fixed amount of water on the planet so we are not going to run out, we use energy every time we 'clean' used water. 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.



There are simple ways to use less water:

low flush, dual flush WC's

flow restrictors on taps

low flow shower heads

You can also reduce your reliance on processed mains water

collecting rainwater for garden irrigation

collecting rainwater to flush WC and in washing machine

And by changing your behaviour

showering rather than having a bath

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

ENERGY

House type relevant: New Builds, Extensions & Retrofits

There are two ways buildings use energy:

during construction
embodied energy

during use
operational energy

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

good 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

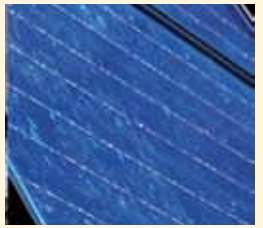


Photo voltaics for electricity generation

wind turbines (where appropriate)

bio mass (if a local supply can be secured)

heat pumps

MATERIALS

House type relevant: New Builds, Extensions & Retrofits

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...

It is important to use materials that are local, responsibly sourced and healthy for us to live in.

Reclaimed 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

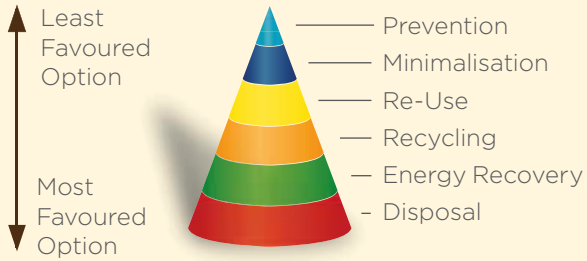
WASTE

House type relevant: New Builds, Extensions & Retrofits

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. Significant demolitions in a conservation area will require conservation area consent.

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'.

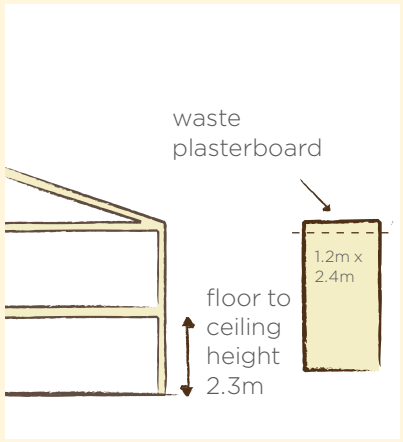


Site Waste Management Plans (**SWMP**) are a legal requirement for projects over £300,000

Using less material

Segregating waste onsite for recycling

Designing our buildings to use materials more effectively



Using 'waste' to produce new building materials

INTRODUCTION TO RETROFITTING

DEFINITION: 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 enregy technologies such as solar panels.

WHY IS RETROFIT RELEVANT TO BATH & NORTH EAST SOMERSET?

Supports climate change commitments

- Target for UK is for 15% of energy to be from renewables by 2020, we need to play our part
- 41% of our districts carbon emissions are from domestic properties so our homes are a major issue

Helps improve the condition of our homes

- Our district has a high proportion of hard to treat pre 1919 homes with solid walls, constructed with tradional techniques
- Fuel poverty and excess winter deaths are a particular issue for the area

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

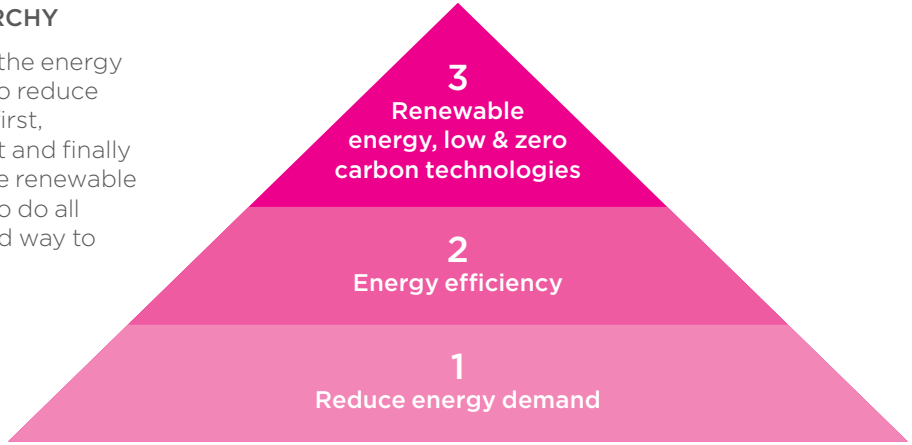
- Increases awareness of existing grant funds in B&NES e.g. for insulaton
- Supports local residents accessing financial incentives such as feed-in-tariffs and the renewable heat incentive
- The green deal, due to be launched in winter 2012 will offer new access to finance for retrofitting measures

Our community is engaged on these issues

- Links to a range of local initiatives, projects and events
- Bath Homes Fit for the Future project

THE ENERGY HIERARCHY

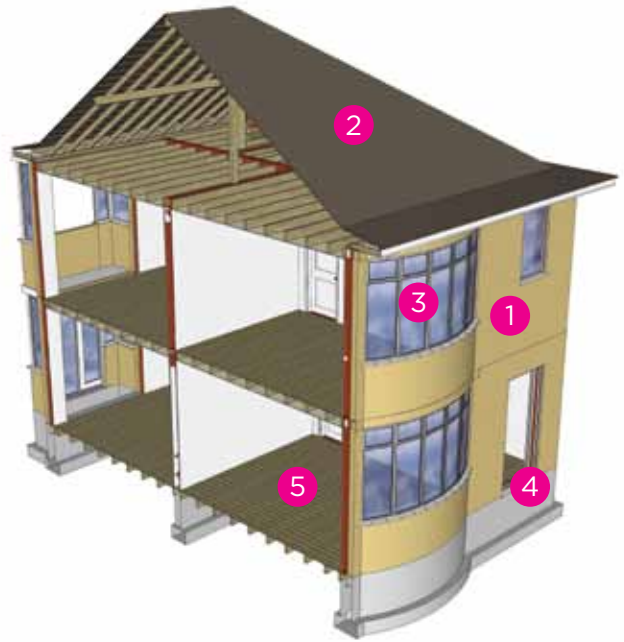
The Council supports the energy hierarchy approach. So reduce your energy demand first, become more efficient and finally look to generate or use renewable energy. We will need to do all three, but this is a good way to prioritise action.



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%**



INTRODUCTION TO RETROFITTING

OUR APPROACH

In this section five common house types found in Bath & North East Somerset are introduced, each has different construction and so behaves differently environmentally.

The information should help you to diagnose:

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

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

Where there is a likelihood that the works will be permitted development or require planning, listed building or building control consent this is highlighted. Estimated relative costs and carbon savings of each measure are also highlighted.

The following format is used:

- (P) Planning consent
- (L) Listed building consent
- (B) Building Control
- (D) Permitted Development

17th century detached cottage p20

Georgian townhouse p22

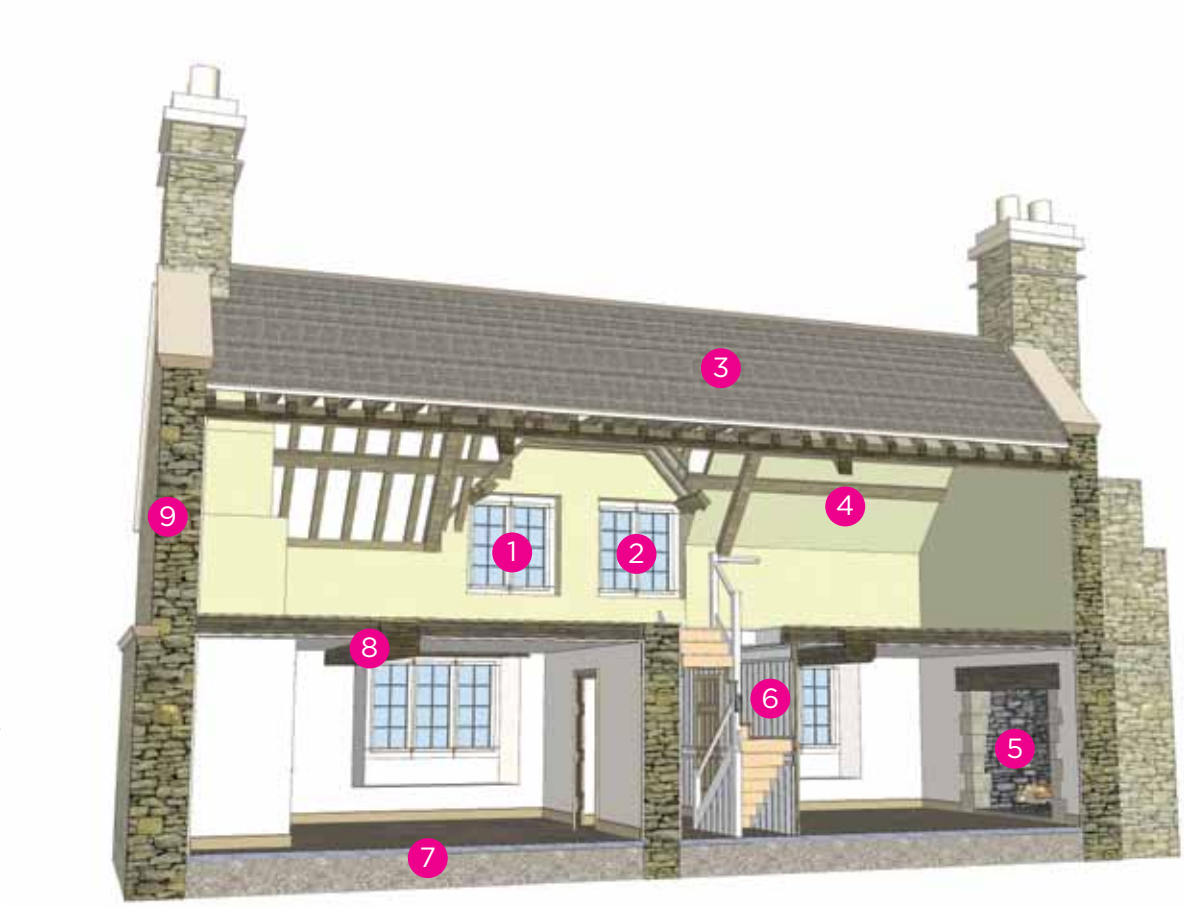
Victorian/Edwardian terrace p24

Early modern 1930s semi detached p26

Late Modern Post 1985 new build p28

17TH CENTURY BUILDING

House type relevant: 17th Century building



1 Smaller windows set in deep reveals mean that natural light levels are often quite low.

Windows to upper floors are often set closer to the floor, which makes matters worse.

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 stout timber purlins can make insertion of insulation between rafters particularly difficult.

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

6 Plank and Muntin walls (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.

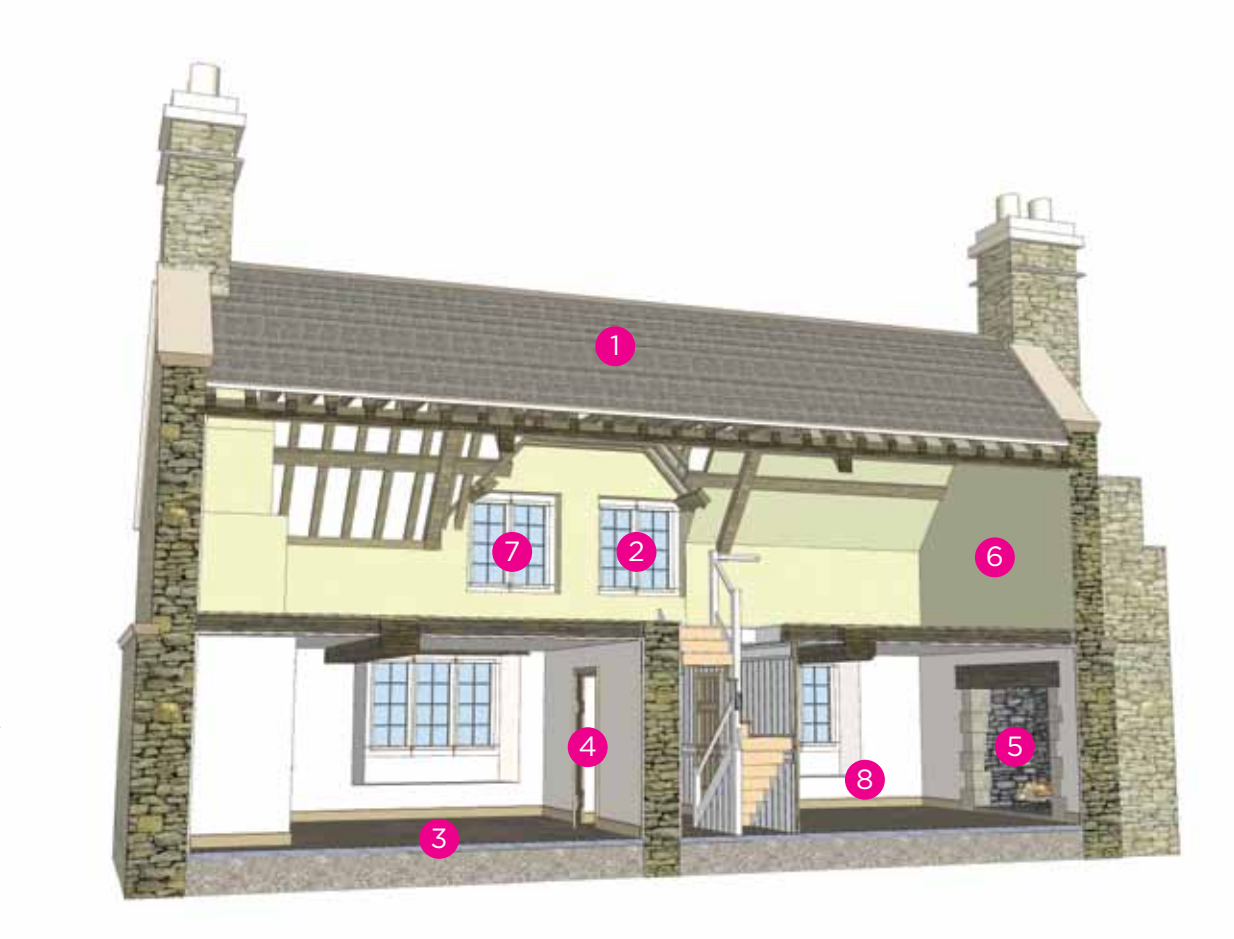
8 Large timber beam ends inserted in the masonry walls can introduce cracks through which colder air can penetrate the building.

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.

17TH CENTURY BUILDING

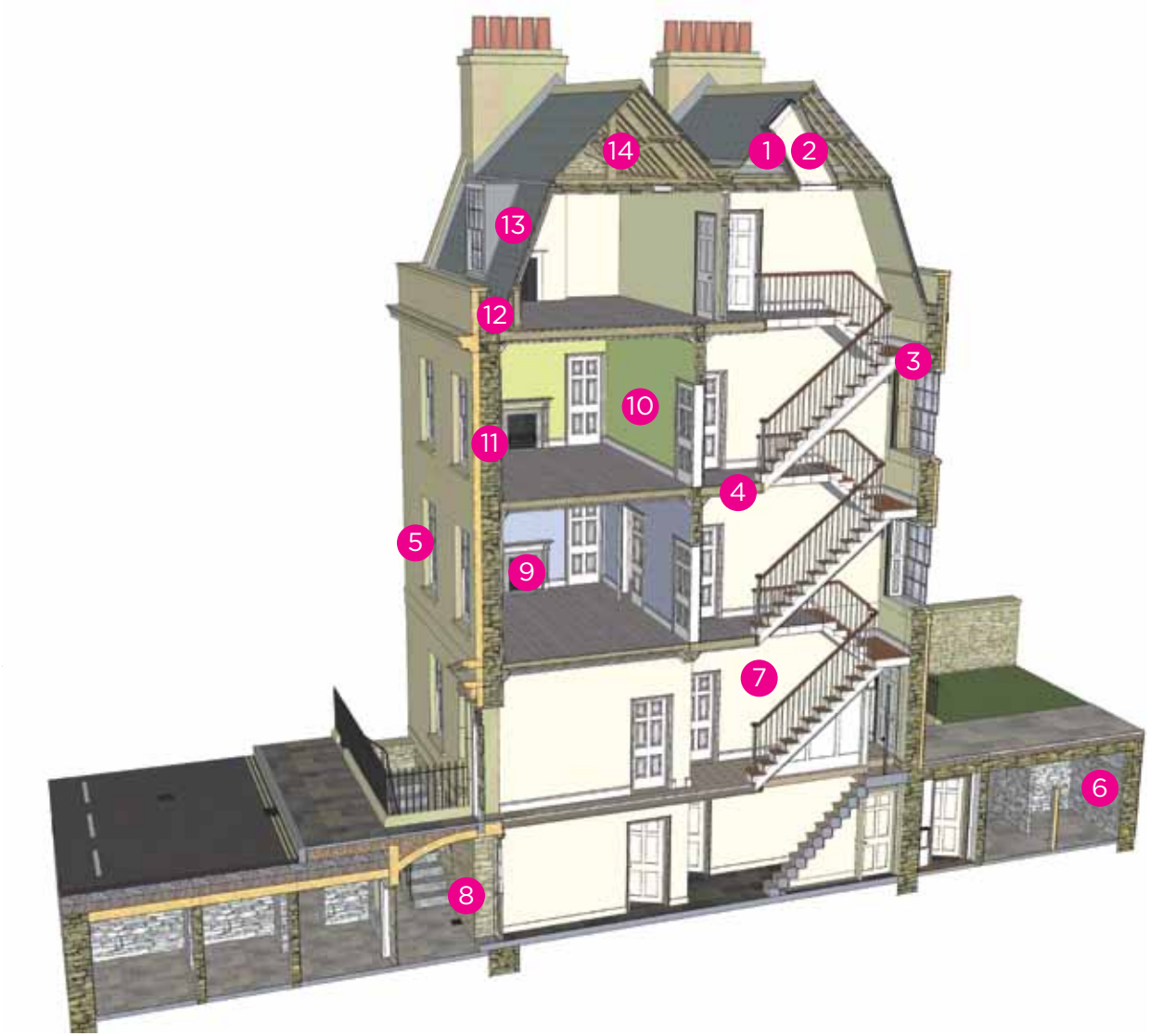
House type relevant: 17th Century building



1. SEE INSULATION FOR ROOFS p43
2. SEE DRAUGHTPROOFING WINDOWS p35
3. SEE INSULATION FOR FLOORS p45
4. SEE DRAUGHTPROOFING DOORS p31
5. SEE DRAUGHTPROOFING CHIMNEYS p33
6. SEE INSULATION FOR WALLS p41
7. SEE SLIM PROFILE DOUBLE GLAZING p39
8. SEE HEATING OPTIONS p48

GEORGIAN/ 18TH CENTURY BUILDING

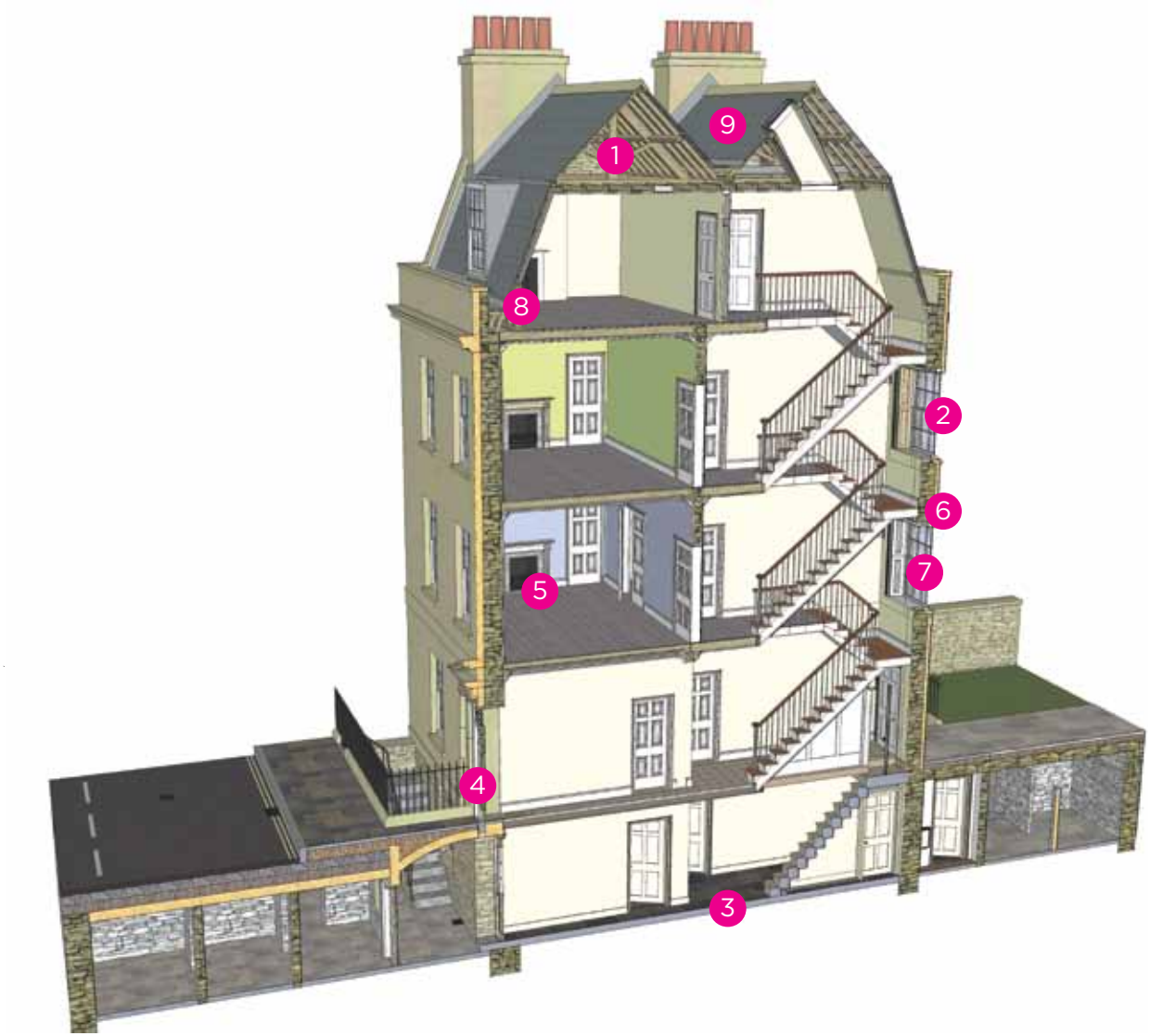
House type relevant: Georgian/18th Century building



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.
10. Taller room heights and generous windows allow good levels of natural light and ventilation.
11. External walls are typically quite slender and heat is easily lost through the solid masonry.
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.

GEORGIAN/ 18TH CENTURY BUILDING

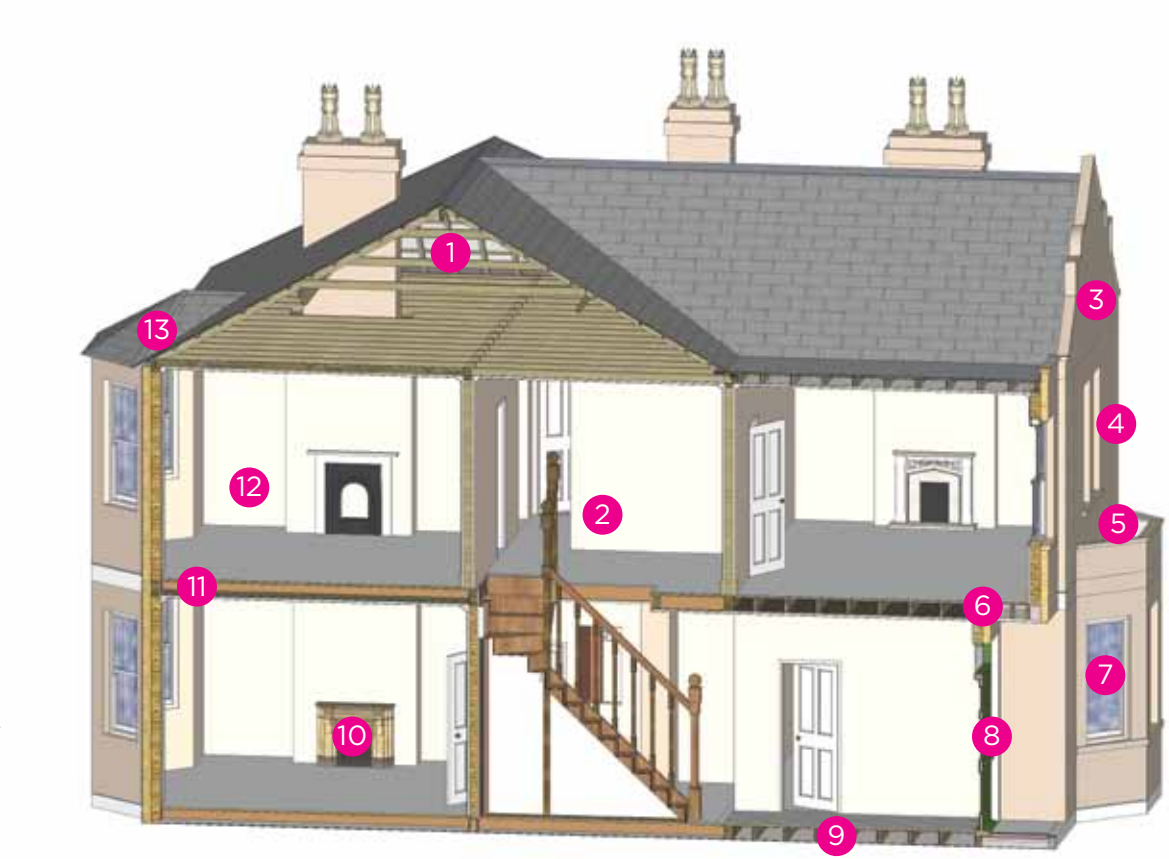
House type relevant: Georgian/18th Century building



1. SEE INSULATION FOR ROOFS p43
2. SEE DRAUGHTPROOFING WINDOWS p35
3. SEE INSULATION FOR FLOORS p45
4. SEE DRAUGHTPROOFING DOORS p31
5. SEE DRAUGHTPROOFING CHIMNEYS p33
6. SEE INSULATION FOR WALLS p41
7. SEE SLIM PROFILE DOUBLE GLAZING p39
8. SEE HEATING OPTIONS p48
9. SEE SOLAR THERMAL AND PHOTOVOLTAICS p46

VICTORIAN/EDWARDIAN BUILDING

House type relevant: Victorian/Edwardian building



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. 4 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, but 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.

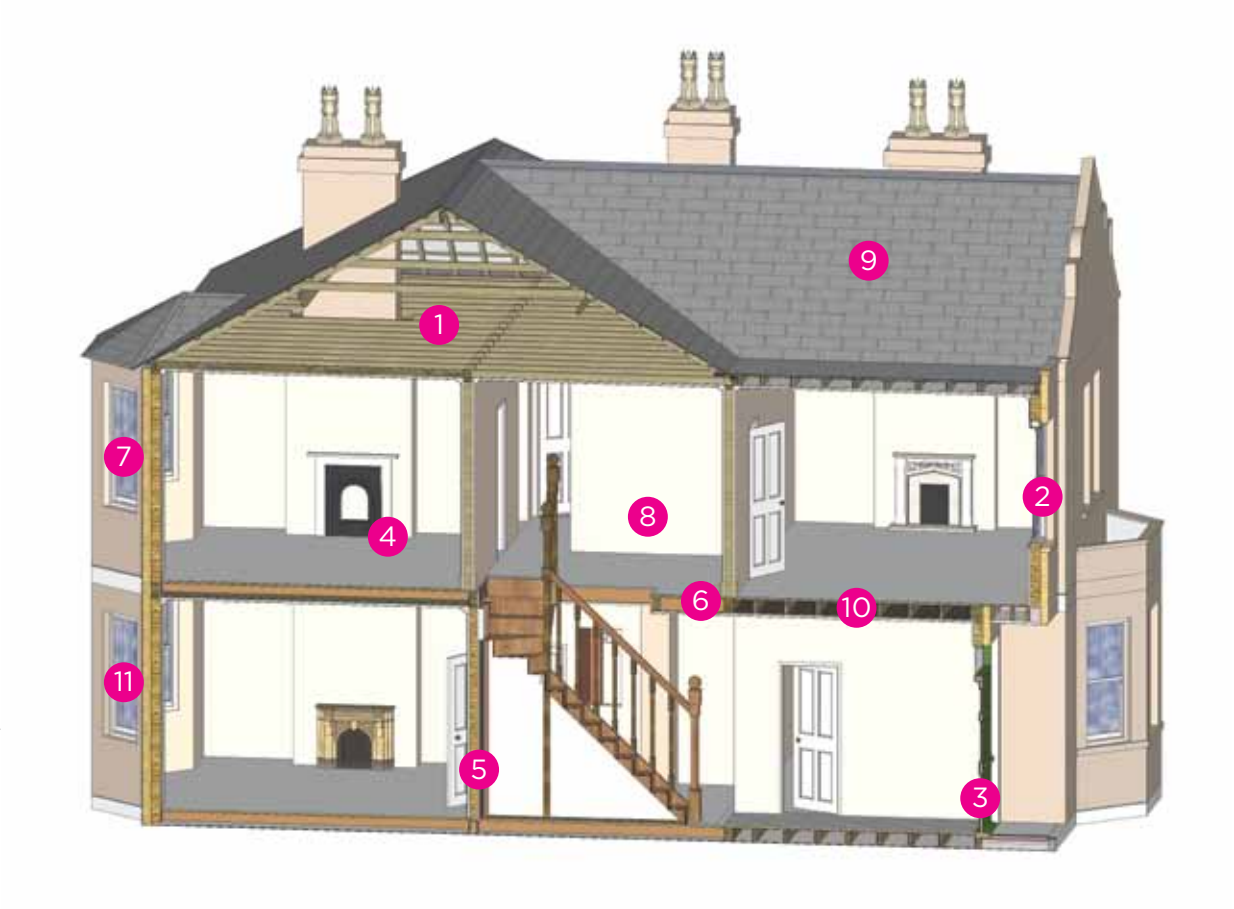
11. Suspended timber upper floors built into the external walls introduce numerous fissures or cracks through which cold air can penetrate the building.

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 access.

VICTORIAN/EDWARDIAN BUILDING

House type relevant: Victorian/Edwardian building



1. SEE INSULATION FOR ROOFS p43
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5. SEE INSULATION FOR WALLS p41
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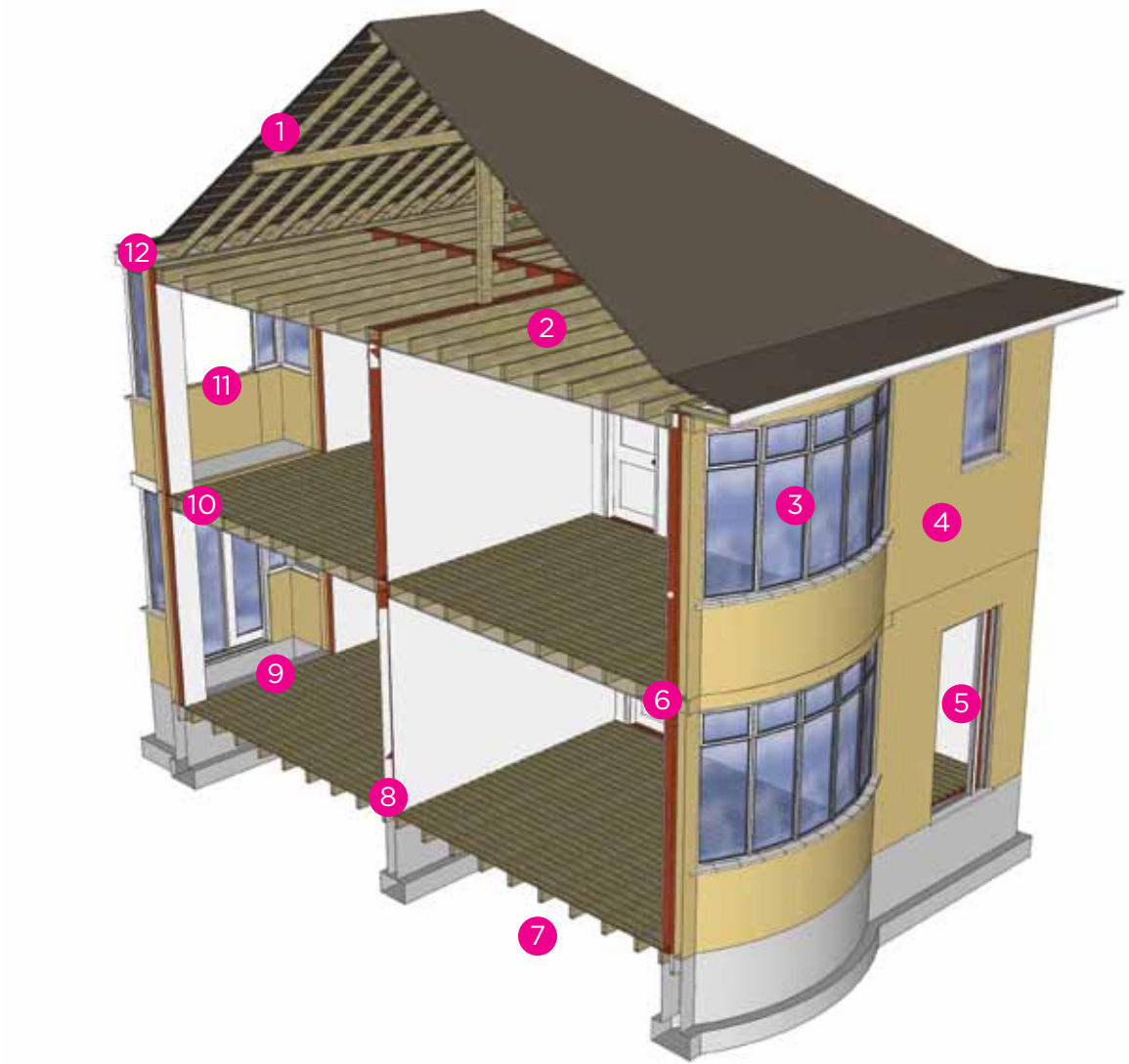
7. SEE DOUBLE & TRIPLE GLAZING p40
8. SEE HEATING OPTIONS p48
9. SEE SOLAR THERMAL AND PHOTOVOLTAICS p46
10. SEE DRAGHTPROOFING FLOORS p32
11. SEE SLIM PROFILE DOUBLE GLAZING p39

EARLY 20TH CENTURY BUILDING

House type relevant: Early 20th Century building



1. Party walls at roofspace likely to 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.

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.

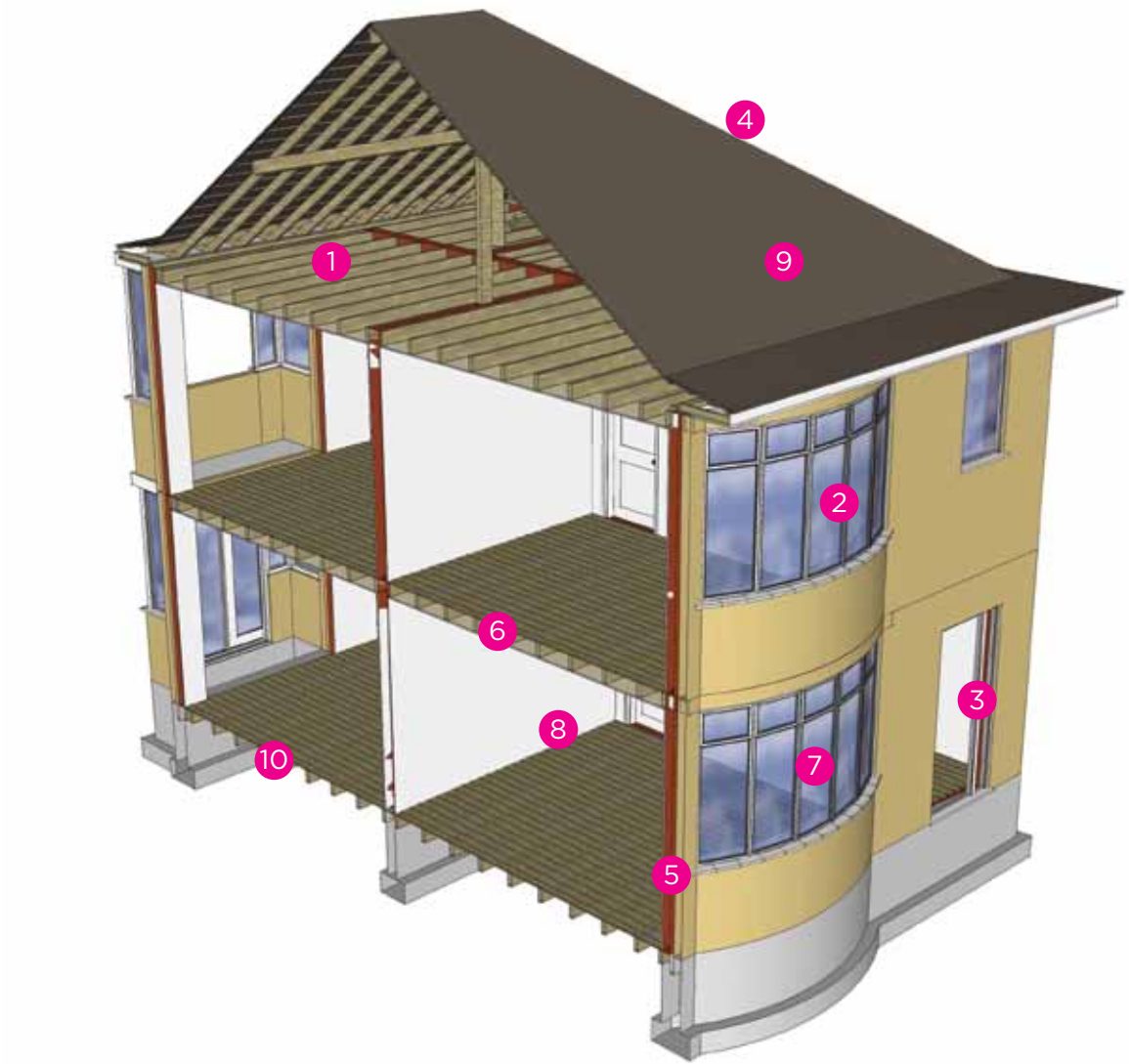
10. Suspended timber upper floors built into the external walls introduce numerous fissures or cracks through which cold air can penetrate the building.

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.

EARLY 20TH CENTURY BUILDING

House type relevant: Early 20th Century building



1. SEE INSULATION FOR ROOFS p43
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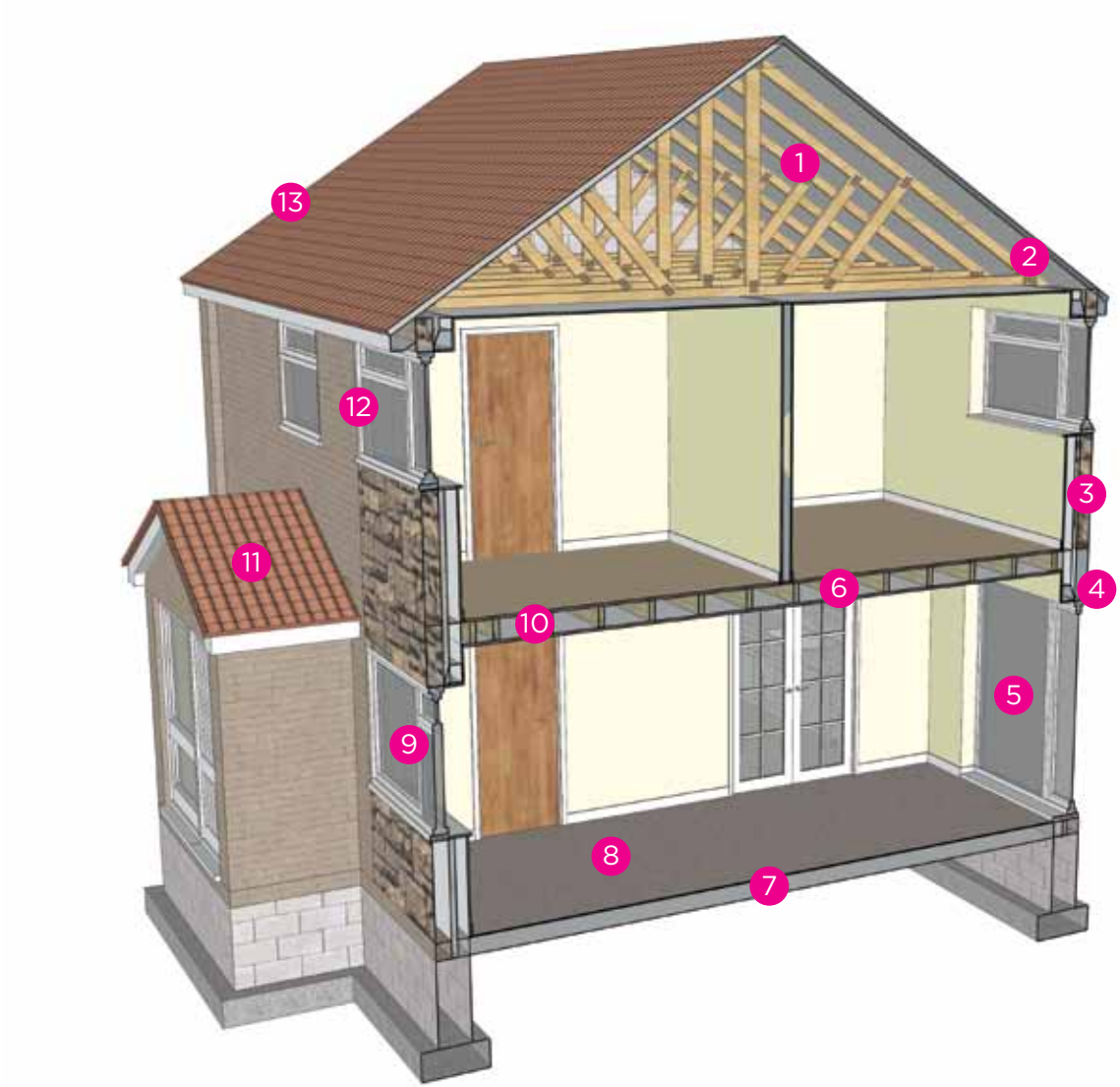
3. SEE DRAUGHTPROOFING DOORS p31
4. SEE DRAUGHTPROOFING CHIMNEYS p33
5. SEE INSULATION FOR WALLS p41
6. SEE SUSPENDED TIMBER FLOOR INSULATION p45
7. SEE DOUBLE & TRIPLE GLAZING p40
8. SEE HEATING OPTIONS p48
9. SEE SOLAR THERMAL AND PHOTOVOLTAICS p46
10. SEE DRAGHTPROOFING FLOORS p32

LATE 20TH CENTURY BUILDING

House type relevant: Late 20th Century building



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 lintols 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.

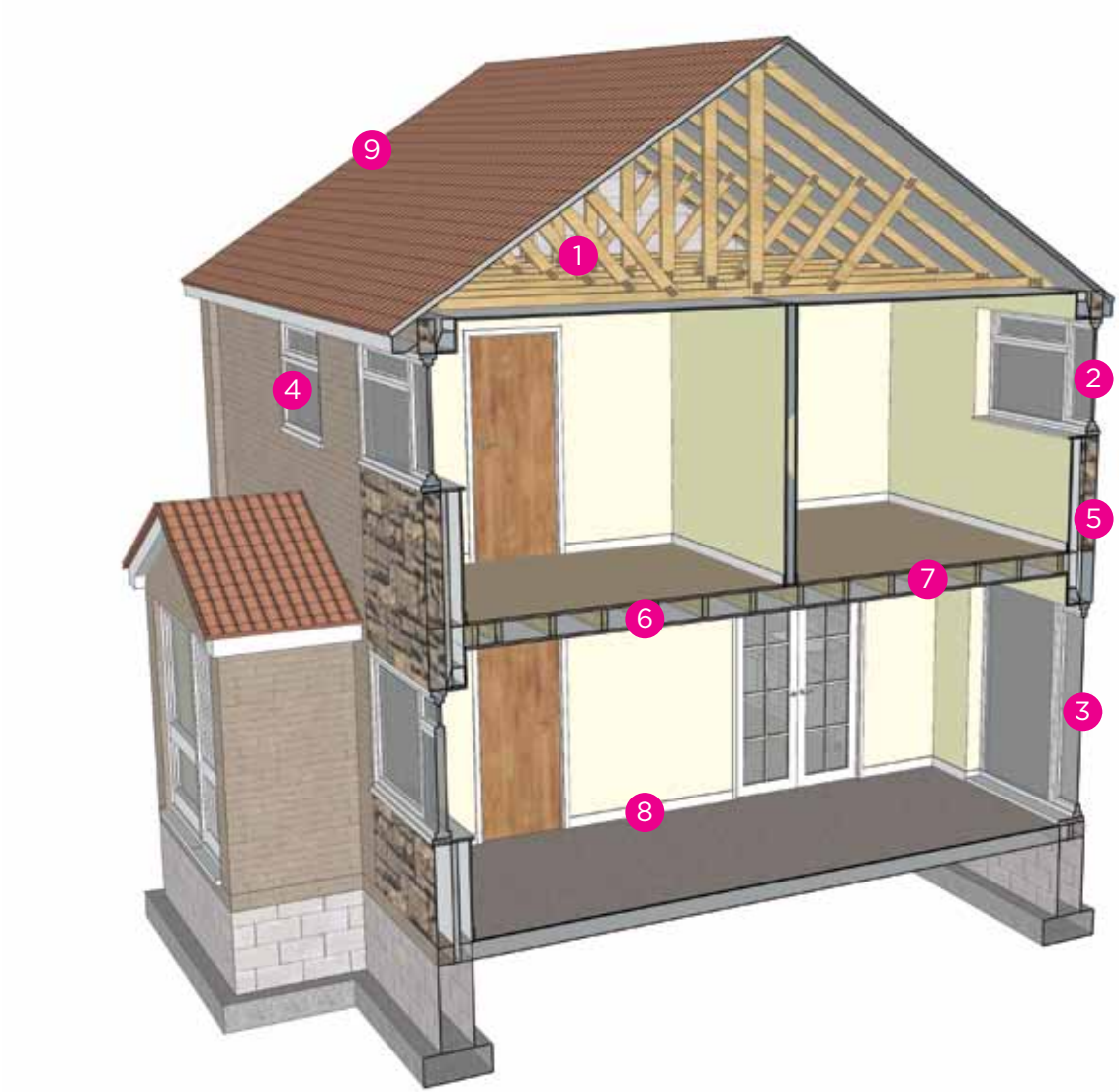
11 Porch roof and walls likely to be of lower thermal performance than rest of building so can be a source of heat loss.

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.

LATE 20TH CENTURY BUILDING

House type relevant: Late 20th Century building



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CONSENTS & CONSIDERATIONS FOR RETROFITTING

House type relevant: All house types

Where planning and listed building consents are needed or where building control regulations would apply to retrofitting measures these are highlighted. Some of the measures are permitted development and this is also indicated, although it is still advisable to seek a Certificate of lawfulness from the planning department for a nominal fee to confirm that works do not require planning permission. See the Directory for details of who to contact.

Additional advice in relation to listed buildings.

- (P) Planning consent
- (L) Listed building consent
- (B) Building Control
- (D) Permitted Development

COST OF MEASURE(£)

£££ Highest
££ Medium
£ Lowest

ENVIRONMENTAL RATING (CO2 savings)

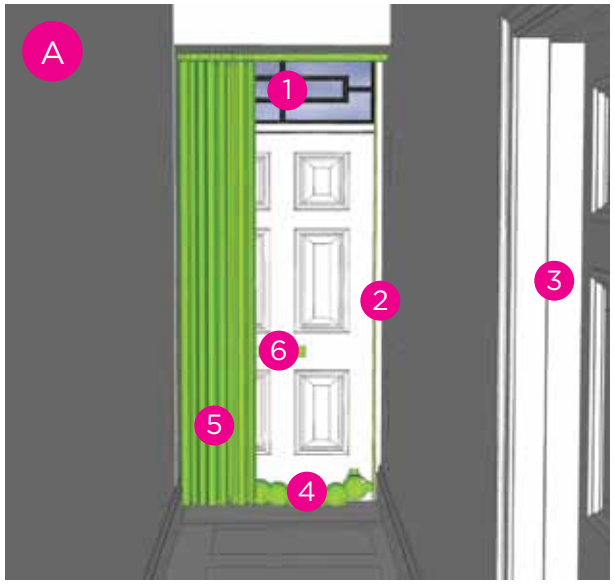
- ● Highest
- ●● Medium
- ●●● Lowest

For more information on Carbon savings for retrofit measures see the data table in Appendix 1

For more information on Costs of retrofit measures see Appendix 2

DRAUGHTPROOFING DOORS

House type relevant: All house types



Cost score **£**

Environmental score ●

Other consents: n/a

A Timber Door Draughtproofing

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 is of low thermal performance, but a poor fit between the door and its frame can be of greater significance, allowing cold air to enter and warm air to leave the building. In addition to the fit of the door, letterboxes and key-holes can also provide a route for draughts. At the perimeter of a door leaf draughtproofing 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 should be upgraded as described for windows, elsewhere.

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?

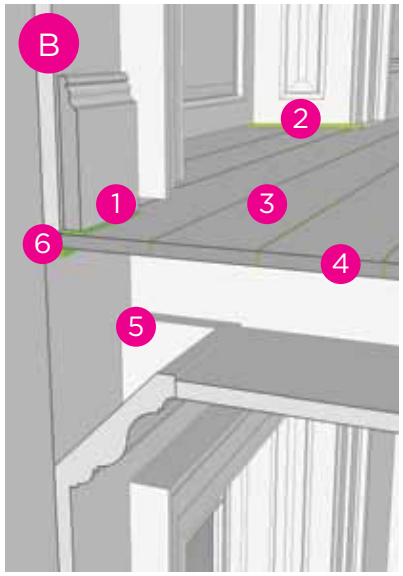
The majority of door upgrade techniques are DIY measures and are therefore good value.

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.

DRAUGHTPROOFING FLOORS

House type relevant: All house types



Cost score **£**

Environmental score ●

Other consents: n/a

B Timber Floor Draughtproofing

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 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 For larger gaps try well compacted compressible insulation such as mineral wool or sheepswool.

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, lintols 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?

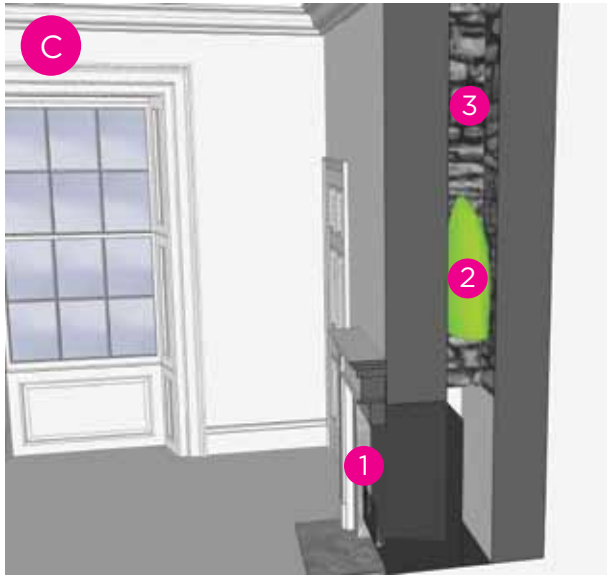
Draughtproofing timber floors can be very cost effective as the measures normally involve low cost materials that can easily be DIY installed.

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!

DRAUGHTPROOFING CHIMNEYS

House type relevant: 17th Century – Early 20th Century



Cost score **£**

Environmental score ●

Other consents: n/a

C Chimney Draughtproofing – Balloon

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.

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.

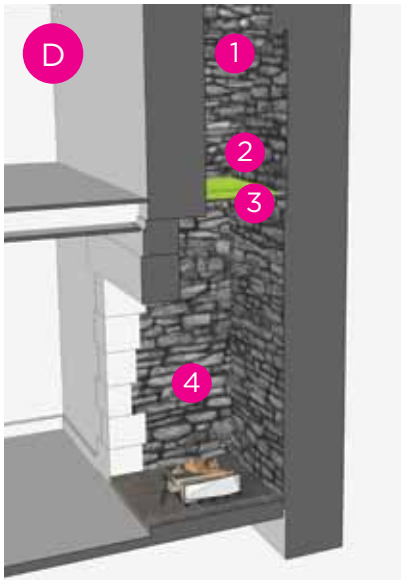
What does it cost?

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.

DRAUGHTPROOFING CHIMNEYS

House type relevant: 17th Century – Early 20th Century



Cost score **£**

Environmental score ●

Other consents: Safety advice required from suitably qualified person

D Chimney Draughtproofing – Register Plate

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.

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.

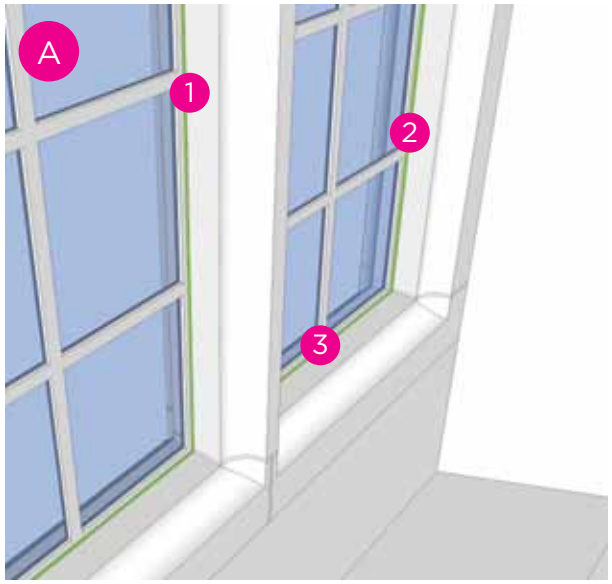
What does it cost?

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.

DRAUGHTPROOFING WINDOWS

House type relevant: All house types



Cost score **£**

Environmental score ●

Other consents: Ⓑ

Ⓐ Metal Framed Window – Draughtproofing

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

❷ A simple draughtproofing technique is to apply a mastic bead to the mating face of the window, 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.

❸ 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.

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

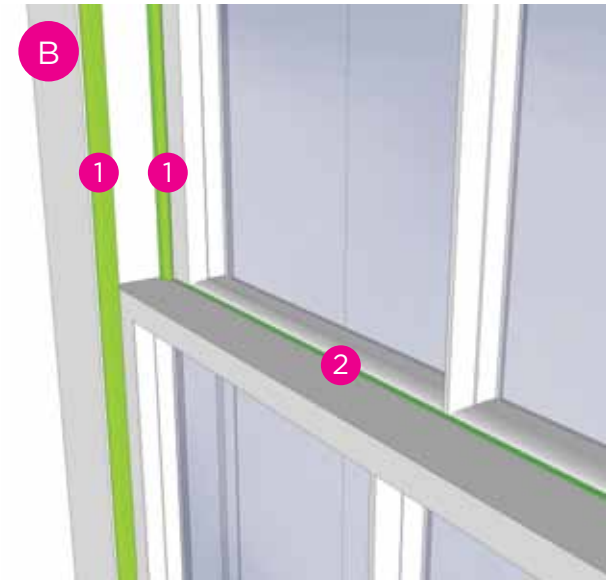
What does it cost?

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.

DRAUGHTPROOFING WINDOWS

House type relevant: 17th Century – Victorian/Edwardian



Cost score **£**

Environmental score ●

Other consents: L B D

B Timber Sash Window – Draughtproofing

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.

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.

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, shutters, blinds or heavy curtains the benefit from simple draughtproofing can be considerable. With such measures it is possible to raise the performance of a sash window to a level above many modern double glazed replacements!

DRAUGHTPROOFING WINDOWS

House type relevant: All house types

Cost score **£**

Environmental score ●

Other consents: L B D

C Timber Casement Window – Draughtproofing

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 improve the fit between the window 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, often referred to as draughts.

In addition to placing the window in good repair, 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?

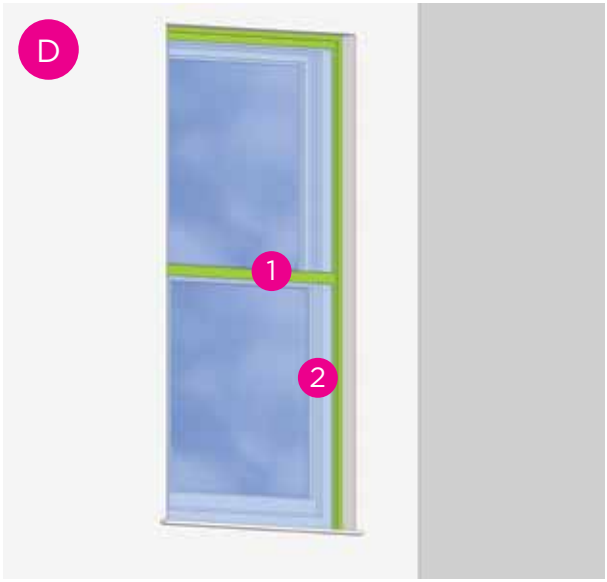
A significant amount of the heat lost through a casement window can be through air-leakage or 'draughts' – so addressing this makes good sense.

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.

DRAUGHTPROOFING WINDOWS

House type relevant: All house types



Cost score **£**

Environmental score ●●

Other consents: L B D

D Secondary Glazing

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

2 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, 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 improve the thermal performance 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!

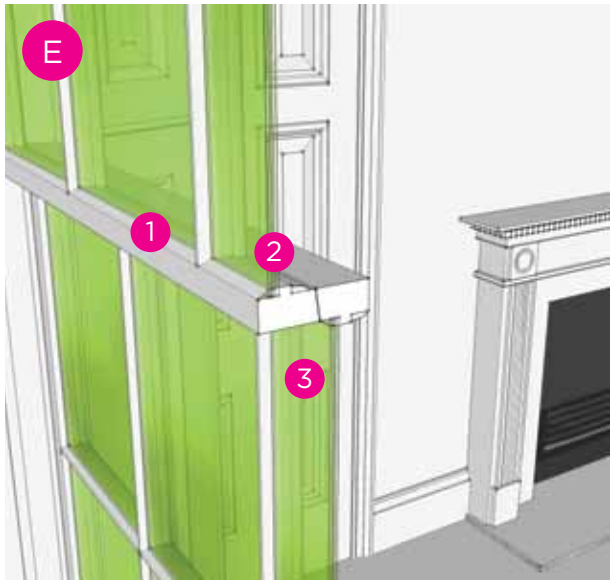
What does it cost?

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

House type relevant: 17th Century – Victorian/Edwardian



Cost score **££**

Environmental score ●

Other consents: L B P

E Slim Profile Double Glazing

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 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.

Slim double-glazing is an option as part of a package of measures to upgrade an existing window which allow original or otherwise sound windows to be retained and extend their useful life.

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.

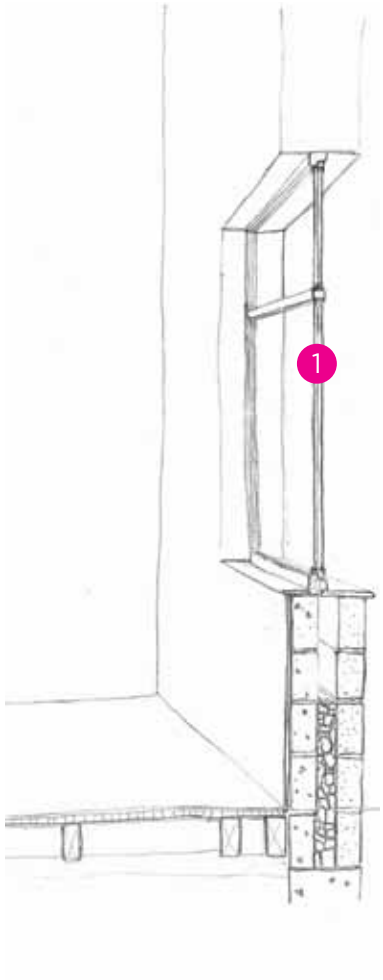
The gasses in these glazing panels are more expensive than normal double-glazed panels; installation costs and the complexity of the window will also affect the price.

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

House type relevant: Victorian/Edwardian – late 20th Century

F



Cost score **££**

Environmental score ●●●

Other consents: LBD

F Double/Triple Glazing

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.

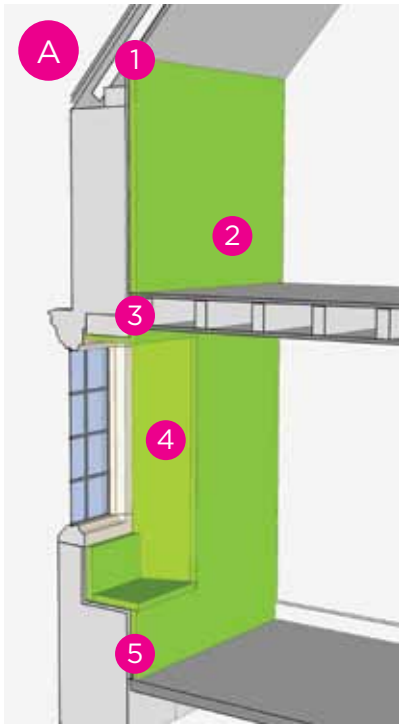
Technical Information from www.greenspec.co.uk

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.

INSULATION FOR WALLS

House type relevant: All house types



Cost score **£££**

Environmental score ●●●

Other consents: Ⓛ Ⓑ
On occasion the building regulations require a minimum amount of insulation (as well as ventilation) to be installed or applied to the element (If external insulation Ⓛ Ⓑ. Can be Ⓓ if certain conditions met otherwise requires Ⓟ)

Ⓐ Solid Wall Insulation

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

❷ 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.

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

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

❺ Insulation may require adjustment of building features such as skirting boards.

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 bathstone 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.

In protected buildings consent may also be required from the local authority before an installation can be undertaken.

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.

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

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

What does it cost?

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

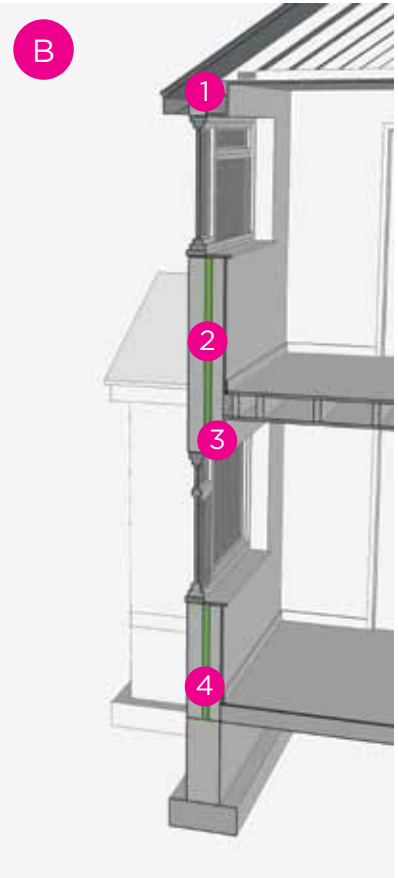
This cost will vary with the type of insulation, thickness and complexity of building – typically a two-storey mid-terrace dwelling will cost £6-8k. Other buildings will be considerably more.

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.

INSULATION FOR WALLS

House type relevant: Early and late 20th Century



Cost score **£**

Environmental score ●●●

Other consents: L B
On occasion the building regulations require a minimum amount of insulation (as well as ventilation) to be installed or applied to the element

B Cavity Wall Insulation

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 C20 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. It is normally non-reversible and non-visible.

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.

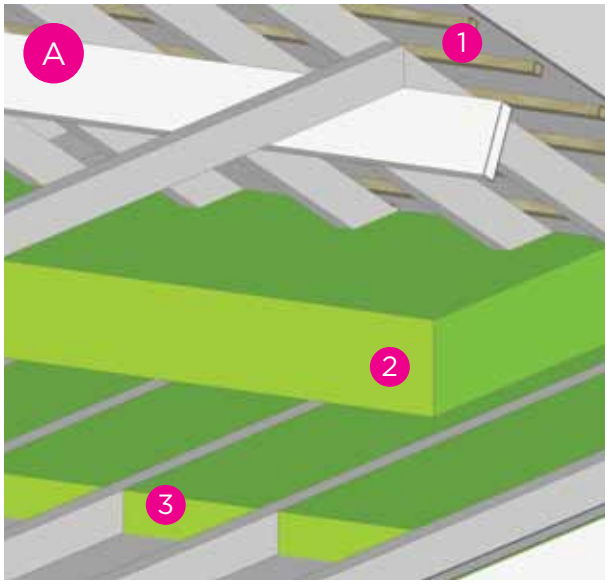
This cost will vary with the type of insulation, thickness of cavity and complexity of building – e.g. amount of scaffold required.

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.

INSULATION FOR ROOFS

House type relevant: All house types



Cost score **£**

Environmental score ●●●

Other consents: L B
On occasion the building regulations require a minimum amount of insulation (as well as ventilation) to be installed or applied to the element

A Roof Insulation at Ceiling

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

2 Typically 200-300mm of insulation is required 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.

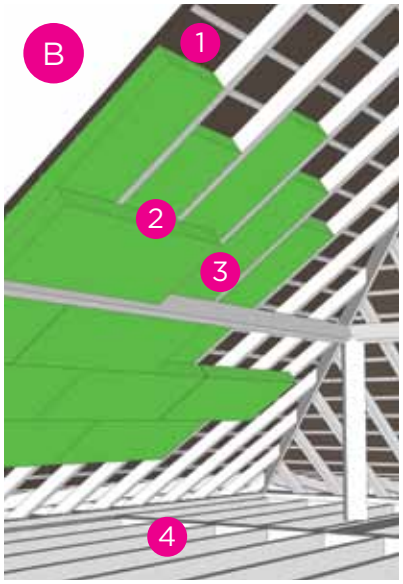
The work can be DIY to reduce cost, but there are a number of installation schemes available which subsidise the cost for an installer to fit the insulation.

For details of financial incentives and grant programmes available contact The Energy Savings Trust, utility company or your local authority for more details.

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

INSULATION FOR ROOFS

House type relevant: All house types



Cost score **£**

Environmental score ●●●

Other consents: L B
On occasion the building regulations require a minimum amount of insulation (as well as ventilation) to be installed or applied to the element

B Roof Insulation at Rafter Level

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, the insulation is already 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.

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?

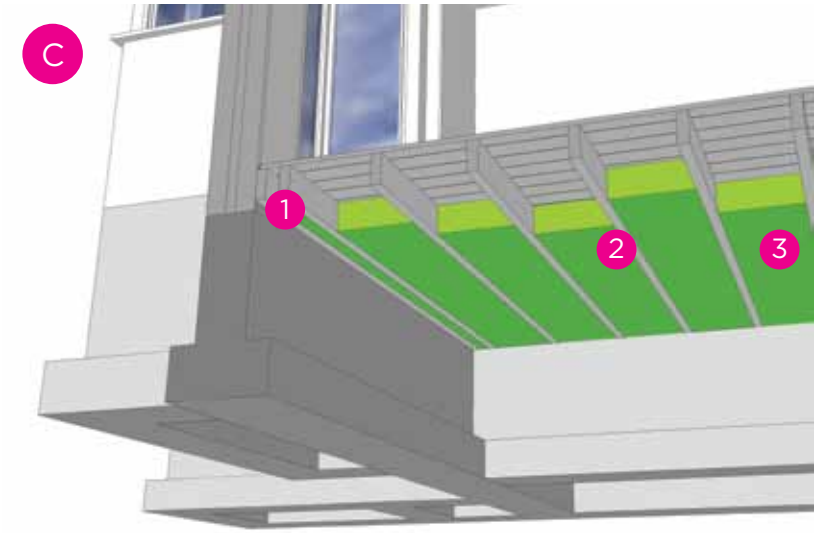
The majority of roofs can be insulated at rafter level at a reasonable cost; with £900 – £1200 being typical for a smaller home.

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.

There are a number of installation schemes available which subsidise the cost for an installer to fit the insulation. For details of financial incentives and grant programmes available contact The Energy Savings Trust, utility company or your local authority for more details

INSULATION FOR FLOORS

House type relevant: All house types



Cost score **££**

Environmental score ●●

Other consents: L B
On occasion the building regulations require a minimum amount of insulation (as well as ventilation) to be installed or applied to the element

C Timber Floor Insulation
(see also timber floor draughtproofing)

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 carpentry.

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?

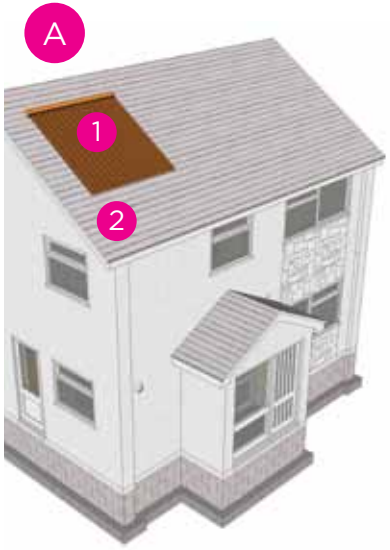
For an annual energy bill of £1500 around £135 is spent heating the ground beneath you feet!

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 & PHOTOVOLTAICS

House type relevant: All house types



Cost score **££**

Environmental score ●

Other consents: LB
(*Can be* D *subject to certain conditions being met otherwise* P)

A Solar Thermal

This diagram shows a typical Solar Thermal Collector installation for a later modern dwelling.

1 The solar thermal collector must be located on a predominately south facing slope, ideally at an angle around 30 degrees.

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

Evacuated true types are more efficient and may take up less space than a flat-plate system.

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 can be set at low level but will work more efficiently if kept close to where the water is 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 can then be used by a conventional boiler for domestic hot water and sometimes heating. By using already warmed water, these systems reduce the amount of fossil fuel otherwise consumed.

Several types of installation are available, from simple flat-panel collectors to more sophisticated, but more efficient, vacuum evacuated tubes.

Collectors are normally a series of 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 in the summer 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?

Solar PV panels do not burn fossil fuels to generate electricity and are classed as renewable technology.

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

Solar thermal collectors re 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.

Systems are typically capable of delivering up to 40% of your annual domestic hot water requirement.

What does it cost?

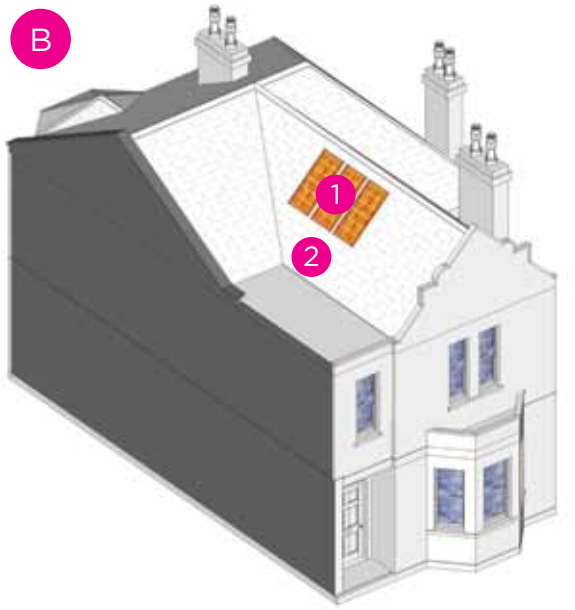
The cost for a Solar Thermal installation will vary greatly with the size, output and complexity of installation. Some systems can work with an existing boiler and infrastructure, which can also reduce cost.

A normal domestic sized installation will be in the region of £5-7k (plus boiler if needed).

A government 'Green Deal' scheme is expected which may help to offset the cost of a renewable heat installation. Details are available form your utility company, The Energy Savings Trust or Department for Energy and Climate Change.

SOLAR THERMAL & PHOTOVOLTAICS

House type relevant: All house types



Cost score **££**

Environmental score ●●

Other consents: LB
(Can be D subject to certain conditions being met otherwise P)

B Photovoltaics or SOLAR PV

This diagram shows a typical Solar PV installation for a Victorian building.

1 The solar PV array must be located on a predominately south facing slope, ideally at an angle around 30 degrees.

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 small amounts of electricity. 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.

The service life of a PV panel will be 15-20 years and systems can be augmented over time.

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

Note: 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 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 form your utility company, The Energy Savings Trust or Department for Energy and Climate Change.

HEATING OPTIONS

House type relevant: All house types

Cost score **££**

Environmental score ●●●

Other consents: (L) (B)
The building regulations require fixed building services to be installed and commissioned in accordance with the Domestic Building Service Compliance Guide, DCLG 2010 available free, from www.planningportal.gov.uk. (*(P) may be needed for flues or ventilation or this can (D)*)

(A) Boiler and Heating Controls

(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.

Don't forget that insulating pipes, tanks and storage vessels can greatly reduce the energy lost from your heating and hot water system.

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 easily reduce the heat demand during those times when the temperature only dips slightly but warming the whole home may otherwise be necessary. Alternatively, if you only 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 – but they are sadly all too common!

How effective is it?

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 caould therefore potentially save 30-50% on your fuel usage!

What does it cost?

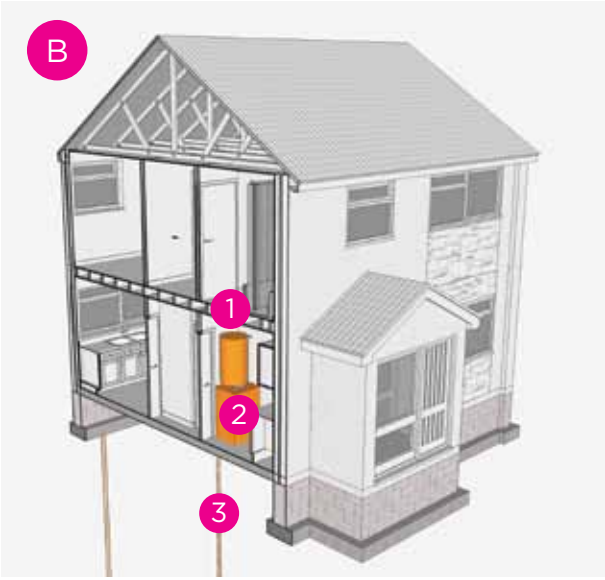
An efficient condensing gas fired boiler can cost between £2-3k, with stoves normally between £500-800. A 28-day heating programmer will be less that £100 and a thermostatic radiator valve can be as little as £10.

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.

A boiler scrappage scheme may help to meet the cost of upgrading this element of your home. Details are available from your utility company, The Energy Savings Trust or Department for Energy and Climate Change.

HEATING OPTIONS

House type relevant: All house types



Cost score **££**

Environmental score ●●

Other consents: L B
The building regulations require fixed building services to be installed and commissioned in accordance with the Domestic Building Service Compliance Guide, DCLG 2010 available free, from www.planningportal.gov.uk. (*Can be* D)

B Ground Sourced Heat Pump

This diagram shows a typical GSHP installation in a later modern dwelling.

1 Ground sourced 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.

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?

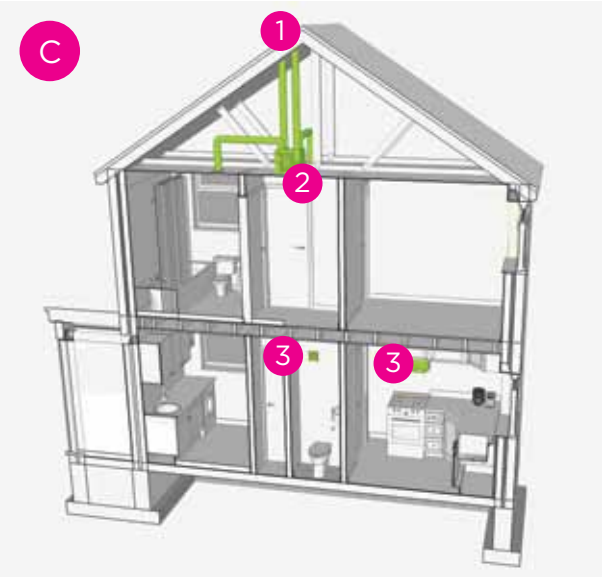
For an average home the cost of a GSHP installation will be around 50-75% more than a conventional boiler.

(This can be considerable higher if boreholes are required as these are typically £1500-2500 each to drill)

The lower running cost of the systems make it possible to recover the cost in the short to medium term.

HEATING OPTIONS

House type relevant: Victorian/Edwardian – late 20th Century



Cost score **££**

Environmental score ●●

Other consents: LB
The building regulations require fixed building services to be installed and commissioned in accordance with the Domestic Building Service Compliance Guide, DCLG 2010 available free, from www.planningportal.gov.uk. (P *may be needed for flues or ventilation or this can* D)

C Mechanical Ventilation and Heat Recovery

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 is a cardboard box sized piece of equipment which 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.

An MVHR installation normally has a chamber around the size of a modest cardboard box, located out of view, in the roofspace for example. Extracts from the kitchen, bathroom, etc are then connected to it and air is taken through a central duct to the outside. 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.

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.

LISTED BUILDINGS

Listed buildings are nationally recognised for their special architectural or historic qualities and are protected in law by the Planning (Listed Buildings and Conservation Areas) Act 1990.

It is a criminal offence to carry out unauthorised works to a listed building which alters character or appearance, without consent.

The listed building consent symbol highlights where listed building consent is likely to be required for each retrofitting measure. L

The table on p52 goes into more detail on what may or may not require planning or listed building consent in listed buildings.

Listed buildings are varied in their design, construction, character and status. When Listed Building Consent is necessary the Council assesses each proposal on its individual merits. In some cases the scope for alteration and adaptation may be limited; in other cases a greater degree of change may be justifiable.

The Council advocates a holistic and structured approach to devising proposals to improve energy efficiency in listed buildings. This should include assessment of:

- the heritage values and significance of the building;
- the condition of the building fabric and building services;
- their impact on heritage values and significance;
- the technical risks;

This will help to identify the measures best suited to an individual building. Less intrusive improvements should be provided before more potentially harmful measures are considered. In practical terms the following strategy is recommended:

- understand how the building currently performs;
- ensure the existing building fabric and services are in good repair and properly maintained to obtain the optimum performance from them;
- look at benign enhancements, such as improving the efficiency of lighting and heating systems, controls and equipment; and thermally lined curtains and blinds first.
- control draughts, particularly through doors, windows and flues, to reduce air infiltration throughout the building during colder weather;
- propose lower risk insulation opportunities such as loft and floor insulation first and consider higher risk opportunities, such as solid wall insulation, once other less invasive works have been explored or implemented;

It is worth noting that under Building Regulations Part L there are exemptions and special considerations relating to heritage assets that encompass both statutorily protected and unlisted, traditionally constructed buildings. Applicants are therefore encouraged to seek advice regarding this matter from building control specialists. Details are in the Directory.

Detailed advice on improving the energy efficiency in historic buildings, produced by English Heritage, is available: Climate Change and your Home

English Heritage has also published relevant detailed guidance regarding thermal efficiency of traditional buildings; please see Climate Change and the Historic Environment

Advice about the need for planning consents should always be obtained from the Council's Planning department at an early stage and before any work is started.

The Council also recommends the employment of an appropriately qualified and experienced architectural or conservation professional when considering changes to historic buildings. Contact details are in the Directory.

Bath & North East Somerset Council encourages listed building owners to identify feasible solutions to deliver climate change mitigation with the least or no harm to the significance of the historic asset and its setting. In the following guidance, we highlight issues to be considered when you apply for listed building consent. Attention to detail and the manner in which works are undertaken are critical in relation to listed buildings.

A justification may include demonstration that energy saving measures, with less or no impact on historic fabric have been undertaken or considered. Listed Building Consent will be addresses on the impact of the proposed measures that the judgement will be made on.

The table on p52 below provides local historic building guidance for retrofitting measures for listed buildings in Bath & North East Somerset. Applicants should also consider national policy and English Heritage guidance and are recommended to employ a Conservation Architect.

LISTED BUILDINGS

Sustainable Construction & Retrofitting SPD: Guidance for measures on listed buildings in Bath & North East Somerset

	Is listed building/ planning consent required?	SPD position	Factors that will be considered during consent process
Reinstate missing shutters	Reinstatement of shutters requires listed building consent	There is a presumption in favour of reinstating shutters where there is evidence of their existence	• Professional installation will be encouraged • Shutters should be sympathetic to the design and materials of the window and replicate the original
Draught proofing Windows and doors	• Listed building consent is normally required for any draught proofing which has a visual or physical impact on the window. • Draught proofing that is easily reversible, such as flexible stick-on strips, may not need listed building consent	There is a presumption in favour of careful draught-proofing windows and doors in all listed buildings	•Professional installation and the use of unobtrusive products, such as rebated edge seals, should be considered where the strength of the frame will not be compromised
Secondary Glazing	• Temporary, seasonal solutions to secondary glazing, such as plastic film, that are easily reversed and have no impact on the fabric of the window do not need listed building consent • Integrated, fixed secondary glazing will need listed building consent	The design and detailing of windows can be a significant component of a building's overall appearance and character. --- There is a presumption in favour of permitting the use of secondary glazing in any listed building where there is no impact on the special architectural or historic interest of the building	• Ensure that the proposed secondary glazing will not interfere with the use of shutters, if you have them • Ensure that the design is as discreet as possible and has minimum visual impact on the existing window including careful alignment of glazing bars • Ensure that any distinctive architectural details of the existing architrave are not disguised by the frame of the secondary glazing • Minimise the impact of permanent fixings required to secure the new frame • Consider fitting secondary glazing within a removable frame • Consider how changes will impact on the relationship with neighbouring heritage assets, particularly in the case of terraced properties with a unified composition

LISTED BUILDINGS

	Is listed building/ planning consent required?	SPD position	Factors that will be considered during consent process
Double glazing: replacement windows	Replacement or alteration of windows will require listed building consent, and in certain cases will require planning permission	• There is a presumption in favour of the replacement of windows with timber framed slim profile double-glazing units where such alterations would preserve or enhance the special architectural or historic interest of the building. For example where existing windows are inappropriate modern replacements	• The section of these units should be no greater than 12mm (4mm x 2 glazing + 4mm cavity) • The thickness and profile of glazing bars should be replicas of the original glazing bars. • At no time will applied glazing bars or applied lead cames be considered appropriate in a listed building. • UPVC double glazing will not be considered appropriate due to its lack of authenticity and visual impact
Double-glazing: replacement panes in existing windows	Replacement of panes will require listed building consent.	There is a presumption in favour of replacement of individual glass panes in significant windows with slim-profile double-glazing for all listed buildings, with crown-effect glass used for the outer pane where historic crown glass will be lost.	• The section of these units should be no greater than 12mm (4mm x 2 glazing + 4mm cavity) • Care should be taken not to damage the original window frame when applying the new pane.
Draught proofing floors, skirting boards and ceilings	Listed building consent is needed for most methods of draught-proofing floors, skirting boards and ceilings	There is a presumption in favour of the replacement of individual glass panes with slim profile double-glazing units where such alterations would preserve or enhance the special architectural or historic interest of the building	• The section of these units should be no greater than 12mm (4mm x 2 glazing + 4mm cavity) • Care should be taken not to damage the original window frame when applying the new pane • Take care to ensure that slender glazing bars are sufficiently robust to withstand the increased weight • Early and original glass needs to identified and preserved • Care should be taken to adjust the sash weights to counter balance the increase in weight created by the double glazing

LISTED BUILDINGS

	Is listed building/ planning consent required?	SPD position	Factors that will be considered during consent process
Insulating suspended timber floors	• The insulation of suspended floors may require listed building consent if the works involve alterations that affect the character of the building such as disturbing plaster ceilings or historic floor boards	There is a presumption in favour of the installation of ground floor insulation under suspended timber floors in all listed buildings except where significant historic surfaces have to be removed, and where there is an adverse impact on skirting boards and door architraves	• If the floors are original, consider adding insulation over the floor, minimising impacts on the original fabric. • If you are adding insulation over your floor, consider natural breathable materials, for example carpets and carpet liners can be wool, sisal or hemp. • Sprayed foams should be avoided as they are not easily reversible should future repairs be required • Work will be expected to be undertaken by a qualified professional
Insulating under solid floors	Works that involve lifting historic floor surfaces or digging out ground surfaces will need listed building consent	There is a presumption in favour of ground floor insulation under solid floors in listed buildings except where significant historic floors or archaeological features will be adversely affected	• Work should be undertaken by a qualified professional • Breathable materials should be used i.e. those that are moisture permeable
Loft insulation	Loft insulation may be installed in listed buildings without consent as long as the insulation is not adhesive, avoids disturbance to historic surfaces and roof profiles, and can be removed without any damage to the building fabric or the significance of the building. Discreet tile vents may not require consent if the character of the listed building is unaltered.	There is a presumption in favour of benign and passive insulation measures in listed buildings	• Care should be taken not to restrict the ventilation of cold roofs • Roofs can be the least altered areas of heritage assets and care should be taken to maintain historic roof profiles, verge details, and plaster surfaces • Natural, sustainable and breathable materials, such as sheeps' wool, is encouraged

LISTED BUILDINGS

	Is listed building/ planning consent required?	SPD position	Factors that will be considered during consent process
Ventilation	Listed building consent is required to install an outlet for an extractor fan or heat-recovery ventilation system in an external wall	Preamble: Activities such as clothes drying, cooking or showering, in combination with comprehensive draught proofing, can lead to increased levels of moisture in the air which may result in condensation and damp. This can be damaging to historic buildings. Fully functioning windows remain the best solution --- There is a presumption in favour of the installation of ventilation outlets in discreet locations	• Specify a discreet outlet and paint the outlet the same colour as the wall • If possible, offer to remove redundant services from the wall where they are not needed • Consider putting the exhaust through a vertical flue in a roof that cannot be seen.
Solid wall insulation: external	Listed building consent is needed for external wall insulation, and planning permission will usually also be required	There is a presumption in favour of the installation of external wall insulation at listed buildings on secondary elevation which are, or have been, rendered and where the existing wall is of no architectural or historic significance	• Use a finish which is appropriate for the traditional construction and sympathetic to the architectural context • Breathable lime-based insulating render should be considered • A through colour lime render finish the colour of local stone may be suitable but where painting is proposed then is should be in breathable finish • Great care is necessary to ensure that detailing at roof eaves, and window and door reveals do not damage the building's ability to shed moisture • Permeable or breathable materials should be always be considered when alterations are proposed to the exterior of historic buildings • Consideration will be given to whether there is an intrinsic historical problems of damp in the building and whether this has been successfully resolved • Work must be undertaken by an appropriately qualified professional

LISTED BUILDINGS

	Is listed building/ planning consent required?	SPD position	Factors that will be considered during consent process
Solid wall insulation: internal	Interior walls define the character of listed buildings so you must seek listed building consent	There is a presumption in favour of installation of internal wall insulation in listed buildings as long as there is no impact on important historic features such as the proportions of the room, window and door reveals, skirtings, architraves, dado rails, any cornice and built in furniture	• Breathable insulating lime or lime/hemp plaster should be considered • Features such as cornicing and ceiling roses must be preserved • Consideration will be given to whether there has been a history of damp in the building and whether this has been successfully resolved • Work must be undertaken by an appropriately qualified professional • The removal of historic surfaces should be avoided
Boiler flues	The installation of a new gas boiler, or a replacement boiler in a location where a new external flue is required, will require listed building consent. Associated new internal and external plumbing routes will also require consent	There is a presumption in favour of boiler flues in discreet locations provided there is no adverse cumulative impact.	• Specify a discreet outlet and paint the outlet the same colour as the wall • At properties and terraced buildings in multiple occupancy where flues may have a cumulatively damaging effect consider using alternative means of heating • Consider putting the exhaust through a vertical flue in a roof that cannot be seen • Plumbing routes should avoid notching and weakening floor joists • If possible, offer to remove redundant services from the wall where they are not needed • Careful planning and design will be needed to ensure that new pipe runs do not damage historic surfaces and decorations • Flues will need to be carefully sited to ensure compliance with the Building Regulations. Contact details are in the Directory
Wood burners and boilers	Listed building consent is required for a wood burner if the installation involves the removal of an existing chimney piece, fire surround or hearth. It will also be required for a new flue or new flue liner	There is a presumption in favour of the installation of wood burners and boilers in listed buildings as long as an existing flue can be reused without damage to an historic fireplace	• Care must be taken regarding fire risk where wood burning stoves are introduced in combination with flue liners within thatched properties • Consideration should be given to using existing chimneys and flues

LISTED BUILDINGS

	Is listed building/ planning consent required?	SPD position	Factors that will be considered during consent process
Air source heat pump	The installation of flues or pipes in association with an air source heat pump in a location where there is no existing flue, will need listed building consent	There is a presumption in favour of the installation of air source heat pumps with intakes and/or outlets in discreet locations	• Air source heat pumps do not usually save more carbon than gas so are best installed in off-gas areas. • Heat pumps should only be used in houses that are well insulated, since the heat they provide is more suitable for background heat than the bursts of heat needed in the morning and evening to heat less efficient homes. This is unlikely to be the case in listed buildings.
Ground source heat pumps	If you are installing a ground source heat pump in a location where there is no existing flue, you need to obtain listed building consent to install the flue or a pipe on the outside of a protected building. Other external development may require planning permission, and in some cases Scheduled Monument Consent	There is a presumption in favour of the installation of ground source heat pumps where there is no adverse impact on below ground archaeology, the character of the protected building, or its setting	• Heat pumps should only be used in houses that are well insulated and fairly airtight, since the heat they provide is more suitable for background heat than the bursts of heat needed in the morning and evening to heat less efficient homes. This is unlikely to be the case in listed buildings. • Ground source heat pumps that are installed by digging long trenches in big gardens and laying pipes one metre down. Trenches should not disturb archaeological features • In Bath there is significant concentration of known archaeology and archaeological potential where ground disturbance is likely to harmful • Ground source heat pump using vertical boreholes need to have regard to the Avon Act (1982) which protects the source of the Bath hot springs.

LISTED BUILDINGS

	Is listed building/ planning consent required?	SPD position	Factors that will be considered during consent process
Solar panels including photovoltaic and solar water panels	Listed building consent and planning permission would be required for solar panels on listed buildings, their the curtilage and outbuildings.	There is a presumption in favour of roof-mounted solar panels on any listed building where the panel is discreetly located.	• Fixing equipment should cause no damage to significant historic fabric and the installation should be reversible without significant long term impact on historic fabric. • Cabling, pipework, fuse boxes or other related equipment can be accommodated without loss of, or damage to, significant historic fabric. • The possibility of siting panels on outbuildings or as a ground mounted array should be considered • Ensure there is a supply of replacement matching stone/handmade tiles if tiles need to be removed • The internal slope of an 'M' shaped roof may provide a discreet location
Solar photovoltaic slates	• Listed building consent would be required for solar slates	There is a presumption in favour of the installation of solar slates on any listed building where there is no loss of authenticity, character or a significant visual impact.	• Solar slates should be of a similar colour and appearance to the original tiles •Cabling, fuse boxes or other related equipment can be accommodated without loss of, or damage to, significant historic fabric • Solar slates are more likely to be acceptable on new structures

LISTED BUILDINGS

	Is listed building/ planning consent required?	SPD position	Factors that will be considered during consent process
Domestic-scale wind turbines	Building mounted turbines will require listed building consent, and free standing turbines will require listed building consent where the obligatory cable runs and any other related equipment is to be attached to the protected building. There may also be a need for planning permission in some cases	There is a presumption in favour of domestic wind turbines on or within the curtilage of listed buildings except on elevations or roofs that are prominent, or where there is a risk of damaging vibration or wrenching, or where the special architectural or historic interest will be harmed	• A minimum NOABL average wind-speed of 6m/s or a year-long anemometer reading of 6m/s will be needed. Domestic wind turbines require sufficient wind in order to be effective. • Visual impact of the equipment should be minor or can be accommodated without loss of special interest, or harm to the setting of heritage assets • Fixing the equipment should not damage significant historic fabric • The installation must be reversible without significant long term impact on historic fabric. • Cabling, pipe-work, fuse boxes or other related equipment should be accommodated without loss of, or damage to, significant historic fabric. • A consent condition will be imposed requiring removal of the equipment, including cabling etc and making good of the historic fabric as soon as it falls out of use. • Issues such as weight, vibration and increased wind pressure should be considered, especially in timber framed buildings and roof structures
Hydro power	Listed building consent required for works to structures within the curtilage of a listed building. Planning permission will also normally be required	There is a presumption in favour or hydro power turbines provided care is taken to understand and protect the significance and setting of heritage assets	• For proposals concerning historic mill-runs, opportunities should be taken to restore historic mill features where possible • The materials and colours should be in keeping with the heritage asset
Flood Doors	Requires listed building consent	Flooding presents a major risk to listed buildings in certain areas. The Council will be sympathetic to proposals for flood mitigation equipment which requires approval.	• Care should be taken to understand and protect significance • It is expected that a high level of risk to the building has been evidenced

GLOSSARY OF TERMS

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 OF TERMS

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

DIRECTORY OF USEFUL CONTACTS AND INFORMATION

BATH & NORTH EAST SOMERSET COUNCIL CONTACTS

For all queries on planning, building control and listed buildings you can contact us via Bath & North East Somerset's Council Connect service. www.bathnes.gov.uk/contactus/Pages/councilconnect.aspx

If you would like confirmation that development you are proposing does not require planning permission, the planning department can provide a "Certification of Lawfulness" for a nominal fee on request.

For Building control advice www.bathnes.gov.uk/environmentandplanning

LABC

USEFUL RESOURCES:

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.uk/greenbuild

Sustainability webpage includes a planning and sustainability page with links to more information on local planning, building control and listed buildings advice

Centre for Sustainable Energy
Free advice on domestic energy use

Customs and Excise
0845 010 9000
New works to listed buildings may be VAT exempt and fabric improvements to buildings are usually only 5% VAT so you can claim back the extra you spend.

Direct Gov
Guide to greener living

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

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

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

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

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

Recycled Products
Find a recycled product

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.

Society for the Protection of Ancient Buildings

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

APPENDIX 1: CARBON SAVINGS

Measure	CO2 saving per measure (t/Co2/yr)	Lifetime CO2 saving per measure (t/Co2)	Embodied Energy t/ Co2
Biomass boiler for all heat, replacing oil	4	80	
External Solid Wall Insulation	1.9	57	0.03
Internal Solid Wall Insulation	1.8	54	0.03
Solar Photovoltaic panels	1.4	35	0.24
Ground Source Heat Pump	1.6	32	
Filling a loft with no insulation	0.73	21.9	0.012
Filling a cavity wall	0.56	16.8	
Boiler Replacement and Heating Upgrade	1.1	16.5	
Replacing single with double glazing	0.68	13.6	0.012-0.026
Air Source Heat Pump	0.81	12.15	
Secondary Glazing	0.5	10	
Floor insulation (timber floor)	0.24	4.8	
Solar Thermal panels	0.23	4.6	
Draughtproof windows, doors, keyholes etc	0.22	4.4	
Filling a loft with less than 200mm of insulation	0.11	3.3	0.012
Fill gaps between floor and skirting board	0.1	1.5	
Borrow a real-time energy monitor	0.2	0.2	

Data derived from Severn Wye Energy Agency (Feb 2012)

APPENDIX 2: COST ESIMATES

Costs estimates for retrofit measures (professional installation)

House type	C17 cottage	Georgian townhouse	Victorian/ Edwardian terrace	Early modern	Late modern
Measure		Cost (£)			
Supplementary loft insulation	1846	615	1369	547	845
DIY draft proofing	264	533	667	385	385
Low energy lighting	129	225	139	139	139
Improved heating controls	1929	3502	2017	2017	2105
Curtains	528	1056	1452	377	277
Carpet underlay (wool/felt)	315	n/a	757	565	516
Thermal blinds	506	1012	1391	1170	1170
Secondary glazing	5345	9716	17430	10614	6531
Water efficiency	No cost	No cost	No cost	No cost	No cost
Suspended ground floor insulation	n/a	n/a	4770	3582	n/a
Professional draft proofing	n/a	8987	12357	1250	975
Boiler replacement	1980	3480	2280	1980	1980
Roof underlay	n/a	n/a	1846	1631	1645
PIR/ Heat motion sensors to stairwell	138	336	138	138	138
Draft proofing chimney flues	976	3176	975	651	n/a

To inform this document, the planning department commissioned Bath based Quantity Surveyors Bare Leaning and Bare to run a cost exercise for 30 different retrofitting measures for each of the five house types in this Supplementary Planning Document. Costs were then calculated, using specifications derived from the scale drawings of each house produced for this project.

The information presented in strongly informed by local build projects and other legitimate building cost sources, and data sources and product descriptions are referenced.

It should be noted that these are estimate costs at August 2011 rates. Costs for many products and their installation are decreasing as installation becomes more commonplace. Costs include the cost of any products and labour costs to install, and the cost of securing any planning, listed building or building control consents needed is not included. In the same way, income generated through feed-in-tariffs or similar or cost savings to your energy bills are not taken into account, as this has been subject to change.

DIY installation where appropriate of different material specification of house size and dimensions will yield different costs.

For the source information, and more detail on methodology and sources of costs data, please see the BLB (2011) *Report on Typical Costs of Retrofitting Measures to improve energy efficiency of existing buildings and the installation of microgeneration technology in the Bath & North East Area.*

The table below summarises the contractor cost estimates for professional installation of the retrofit measures for the whole house.

APPENDIX 2: COST ESIMATES

House type	C17 cottage	Georgian townhouse	Victorian/ Edwardian terrace	Early modern	Late modern
Draughtproofing floors	n/a	n/a	1137	908	852
Suspended upper floor insulation	1909	5082	2282	1198	1648
Living green walls	No cost	No cost	No cost	No cost	No cost
Thermal shutters	600	1600	16500	8250	6750
Double/triple glazing	n/a	n/a	n/a	4062	5281
Insulated solid floors	10252	14834	n/a	n/a	n/a
Cavity wall insulation	n/a	n/a	n/a	422	844
External wall insulation, externally	40450	12015	30184	16143	28407
External wall insulation, internally	30465	21520	28260	4861	8545
Mechanical heat and ventilation recovery	766	5450	1315	4895	4895
Ground source heat pump	15600	15600	15600	15600	15600
Biomass stove	3115	4113	3115	2757	610
Solar thermal	4800	4800	4800	4800	4800
Solar PV	18000	18000	18000	18000	18000
Micro CHP	8124	11424	8124	8124	8124
Air source heat pump	10000	15000	10000	10000	10000

CONSULTATION DETAILS

The Council has prepared this document for public consultation. The draft Supplementary Planning Document sets out guidance for small scale and householder development, including advice on how to improve the environmental performance of new builds or extensions and for methods for improving energy efficiency of existing buildings. If and when adopted, it will be used to guide decisions on planning and listed building applications.

Copies of the draft Supplementary Planning document are available for public inspection in:

- The Guildhall, High Street, Bath, BA1 5AW
- The Hollies, Midsomer Norton, Bath, BA3 2DP;
- Riverside, Temple Street, Keynsham, Bristol, BS31 1LA

between the hours of 8.30am to 5pm Mondays – Thursdays and 8.30am to 4.30pm on Fridays.

The document can also be viewed on the Bath & North East Somerset Council website www.bathnes.gov.uk/greenbuild and during library opening times, at all the public libraries within the District including the mobile libraries.

Comments on the SPD can be made by returning the SPD comment form or by emailing us at greenbuilding@bathnes.gov.uk

All comments must be received within the 6 week consultation period which will run from 22nd March and will close at 5pm on 3rd May 2012.

Further information on the Sustainable Construction and Retrofitting Supplementary Planning Document can be obtained by telephoning 01225 477617 or emailing greenbuilding@bathnes.gov.uk