

Retrofitting Historic Buildings for Sustainability



Acknowledgements

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Costs are intended as a guide only. All references to legislation included permitted development rights accurate at time of printing, although these are updated frequently.

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Introduction

According to the English Housing Condition Survey 2007, England has the oldest housing stock in Europe with 21% constructed prior to 1919. Westminster is particularly rich in historic buildings; three quarters of Westminster housing was constructed prior to 1915, with half prior to 1870.¹ It has over 11,000 listed buildings, in 56 Conservation Areas, which together cover 76% of the City. These older properties are often sought after for their character, which has a cultural as well as economic value. In Westminster such buildings are well protected and valued. But with rising fuel prices pushing more people into fuel poverty and new obligations on landlords coming into force which mean that from 2018 the most inefficient properties cannot be rented out,² there is a drive to ensure that historic properties do not slip into this category.

Nationally buildings are responsible for around 40% of carbon dioxide (CO₂) emissions, but in Westminster buildings account for around 90% of CO₂ emissions³. With stretching UK commitments to an 80% reduction in CO₂ emissions by 2050, a London Mayoral target to reduce CO₂ emissions by 60% by 2025⁴, and estimates that around 75% of buildings expected to be in use in 2050 have already been built, we cannot rely on improved performance of new buildings alone to offset rising CO₂ emissions. More needs to be done to retrofit existing buildings, including historic buildings, to ensure they are fit for the future.

This guidance is consistent with the National Planning Policy Framework. This sets out a series of core principles for land-use planning which include encouraging the reuse of existing resources and conversion of existing buildings as part of a transition to a low carbon future and conserving heritage assets so they can be enjoyed by future generations. It requires local authorities to adopt both proactive strategies to mitigate and adapt to climate change, helping to secure 'radical reductions in greenhouse gas emissions', and strategies for the conservation and enjoyment of the historic environment. It states that in drawing up such strategies local authorities should recognise that heritage assets are an irreplaceable resource and conserve them in a manner appropriate to their significance. It builds on London Plan policies and the Council's own Core Strategy policy CS24 Heritage which says: '...Historic and other important buildings should be upgraded sensitively, to improve their environmental performance...' See the section on planning policies from page 60 for further information.

The City Council is working with developers, businesses and residents to help shape a sustainable city where buildings of high environmental performance are commonplace. The sensitive and appropriate refurbishment of historic buildings, incorporating features of sustainable design, is key to delivering this vision in Westminster. This document aims to encourage retrofitting of historic buildings wherever possible by setting out guidance on likely permissions and consents that will be necessary for individual measures in the following three cases:

- Unlisted properties in a conservation area
- Listed properties
- Unlisted properties outside a conservation area.

This guidance will be of most use to owner occupiers in pre-1919 properties of a solid wall construction, but many measures are equally applicable to later buildings. It covers energy efficiency measures, domestic microgeneration equipment, which will contribute to a reduction in energy bills, and green roofs which increase biodiversity and reduce flood risk. It will be of use to council officers, architects, engineers, developers and residents who would like to improve the performance of their building.

While most cost-effective to undertake a comprehensive programme of retrofit measures to an empty building, this will not often be possible, so the guidance highlights opportunities where it is particularly practical or cost-effective to undertake certain measures together. It also identifies risks inherent in particular measures, and requirements arising from Part L1B of the Building Regulations. Importantly, while this can require energy efficient upgrades when certain defined works are undertaken, historic buildings are exempted from the full requirements. They are however required to be made as energy efficient as possible to the extent that this does not prejudice the character of the building or increase the risk of long-term deterioration.

Conservation of historic buildings is part of sustainable development – it minimises the use of new natural resources; prevents the wastage of existing resources; provides economic value through tourism revenue; and contributes a range of social values important to our health, well-being and education⁵. Appropriate refurbishment of historic buildings is a crucial part of their conservation to ensure they have a sustainable future. Improving the environmental performance of buildings and protection of the historic built environment are therefore complementary objectives. Planning policies for both heritage conservation and sustainable design have a crucial role to play. So too does guidance to illustrate how this balance can be achieved through the development management process.

Limitations of this guidance

Measures contained in this guidance are not necessarily recommended as appropriate for all properties. The notes in the permissions and consents and risks sections should be carefully considered, and advice sought where there is any doubt. All costs are approximate and will vary depending on many factors including location, condition of property, cost of labour and whether the measures are being undertaken in isolation or as part of a larger programme of works. Details of permitted development rights and all costs were accurate at time of writing. It is intended to update the online version of this document periodically.

Leasehold/Freehold Issues

It is recognised that leaseholders will be constrained by the terms of their lease which often limits their ability to make alterations to a property without the consent of the freeholder⁶. This means in practice that they have a reduced scope to make changes, often only being able to change internal fittings and boilers, rather than alter the building fabric. Tenants will have little ability to make changes, although from 2016 the Energy Act will give tenants the right to request consent for reasonable improvements to the energy efficiency of their property, and this consent cannot be unreasonably withheld where financial support is available (such as the Green Deal or Energy Company Obligation).

Landlords and freeholders, who have sold the leasehold are also at present unlikely to consider investing in substantial energy efficiency measures as currently they cannot recharge the costs to leaseholders, who are the beneficiaries of any energy efficiency improvements, although the Energy Act contains provisions which will require buildings to achieve a minimum EPC rating of 'E' from 2018 if they are to be rented out. At present a landlord who wishes to install such measures must first obtain agreement as to apportioning of costs and ongoing maintenance.

Permitted Development

Some types of development are considered to be 'permitted development', for which planning permission is not required. This guidance seeks to give some advice relating to this, although it should also be noted that permitted development rights are amended regularly. The Planning Portal website (www.planningportal.gov.uk) is a good source of information. Also areas covered by an 'Article 4 direction' (see below) which are listed on the Council's website may have had their permitted development rights altered. These may also have been removed by a condition on a planning application. Where there is any doubt over whether an application is required, you may seek an optional "Certificate of Lawful Development", which may be applied for ahead of works, or retrospectively. This gives peace of mind that works are lawful, and may be of use when a property is sold in the future.

Conservation areas

These are areas of special historical or architectural interest where the distinctive townscape, buildings, spaces and other features of special interest are protected. There are 56 conservation areas covering 76% of Westminster. These can be seen on the map at figure 1.

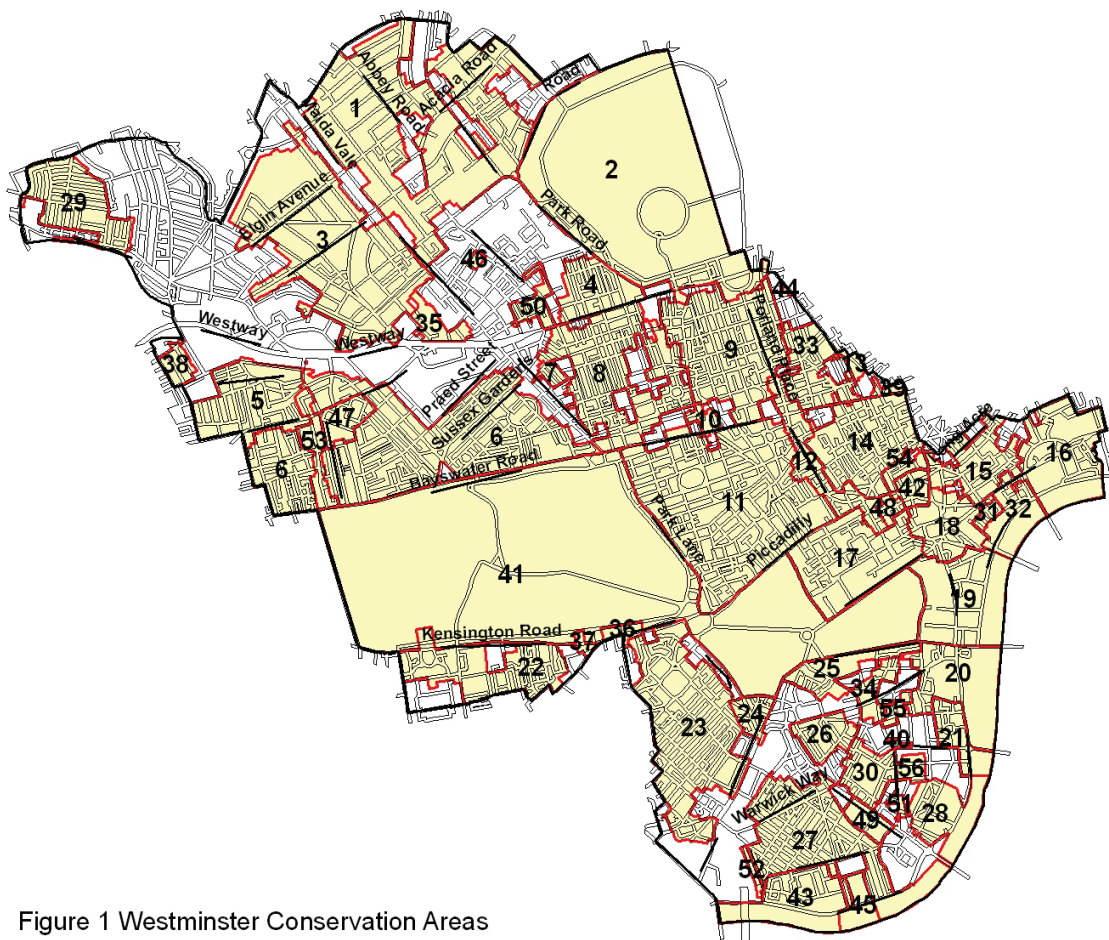


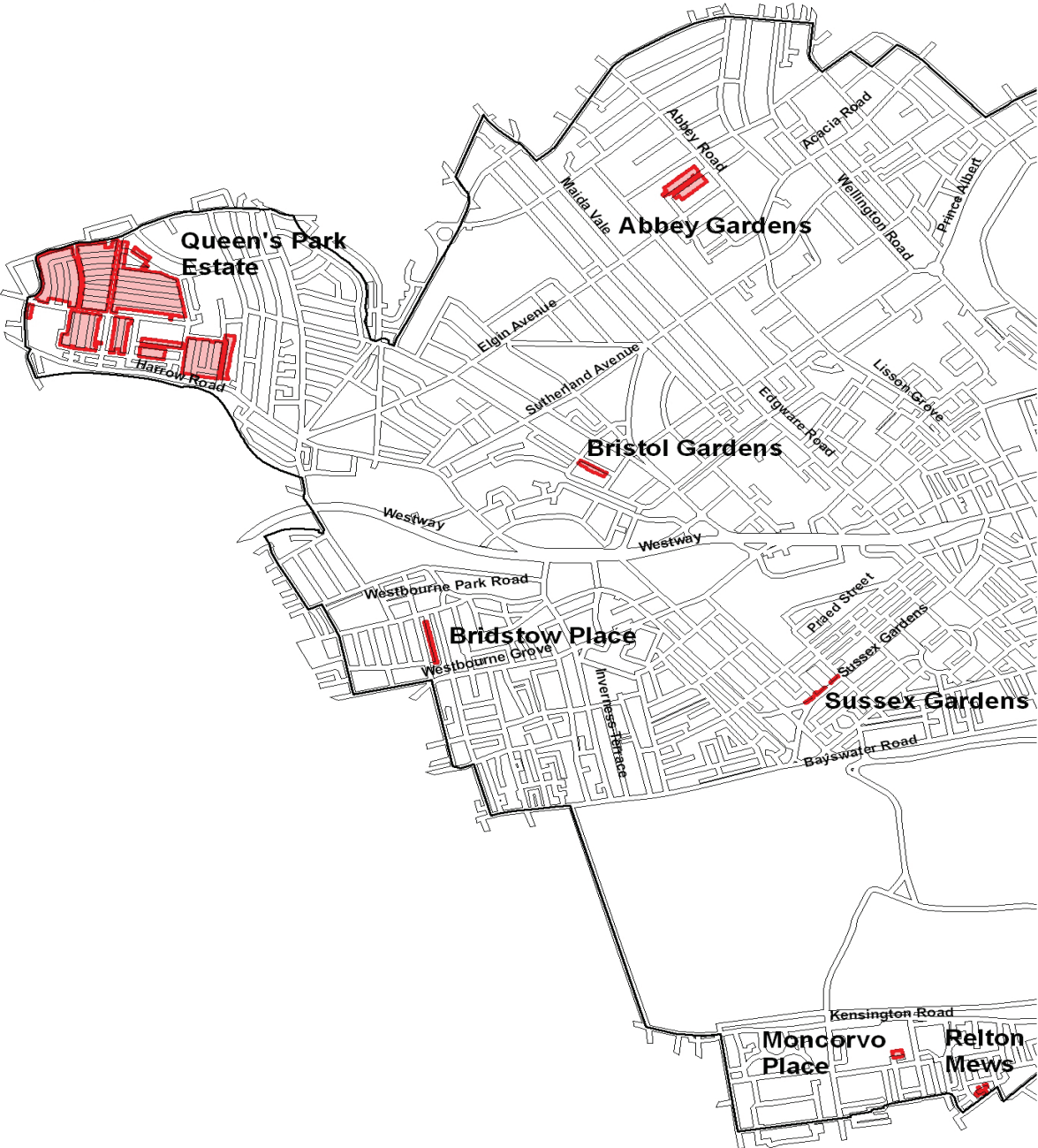
Figure 1 Westminster Conservation Areas

- | | |
|--|--|
| 1 St John's Wood | 29 Queens Park Estate |
| 2 Regent's Park | 30 Vincent Square |
| 3 Maida Vale | 31 Adelphi |
| 4 Dorset Square | 32 Savoy |
| 5 Westbourne | 33 East Marylebone |
| 6 Bayswater | 34 Broadway & Christchurch Gardens |
| 7 Molyneux Street | 35 Paddington Green |
| 8 Portman Estate | 36 Albert Gate |
| 9 Harley Street | 37 Knightsbridge Green |
| 10 Stratford Place | 38 Aldridge Road Villas & Leamington Road Villas |
| 11 Mayfair | 39 Hanway Street |
| 12 Regent Street | 40 Medway Street |
| 13 Charlotte Street, West | 41 Royal Parks |
| 14 Soho | 42 Leicester Square |
| 15 Covent Garden | 43 Churchill Gardens |
| 16 Strand | 44 Cleveland Street |
| 17 St James's | 45 Dolphin Square |
| 18 Trafalgar Square | 46 Fisherton Street Estate |
| 19 Whitehall | 47 Halffield Estate |
| 20 Westminster Abbey & Parliament Square | 48 Haymarket |
| 21 Smith Square | 49 Lillington Gardens |
| 22 Knightsbridge | 50 Lisson Grove |
| 23 Belgravia | 51 Regency street |
| 24 Grosvenor Gardens | 52 Peabody Avenue |
| 25 Birdcage Walk | 53 Queensway |
| 26 Westminster Cathedral | 54 Chinatown |
| 27 Pimlico | 55 Peabody Estates |
| 28 Millbank | 56 Page Street |

Article 4 Directions

For some buildings there may be further controls on development, including minor changes such as to external doors or windows. These are referred to as Article 4 Directions and relate to works that would otherwise be 'permitted development'. A list of the areas subject to an Article 4 Direction together with detailed information on properties covered, and the exact works for which planning permission is required can be found on the Council's website. The Article 4 Direction areas are: Abbey Gardens, NW8; Bridstow Place, W2; Bristol Gardens, W9; Moncorvo Close, SW7; Queen's Park, W10, Relton Mews, SW7; Sussex Gardens, W2. For further detail on the exact wording and properties in these areas subject to the order please see <http://www.westminster.gov.uk/services/environment/planning/permission/permitted-development-rights/>. The map at figure 2, below shows the location of the Article 4 Direction Areas in Westminster.

Figure 2 Article 4 Direction Areas



Listed Buildings

Listed buildings are those included on the national register of Buildings of Special Architectural or Historic Interest. These have special protection and would require listed building consent for changes affecting the building's character as one of special architectural or historic interest, such as materials, details and finishes (internally or externally).

Approach to retrofitting historic buildings

Before beginning to think about measures to retrofit to a property, it is necessary to understand the building as it is already, to think about what simple changes can be made. Start by considering the following questions:

1. **How is the building used?** Can it be used more efficiently? Firstly you should ensure that you are already undertaking measures that can be implemented at no cost⁷, which involve changes to behaviour rather than the building fabric, and low cost minor alterations and additions to make the building more energy efficient. These will, be quick and simple to implement, have limited impact on the historic fabric and in most circumstances will not require permissions from the City Council. These measures should also be possible for leaseholders and tenants, although for draughtproofing it may be necessary to opt for lowest intervention measures which don't involve screwing brushstrips into window frames without landlord's consent.

Low cost measures

- Replace conventional light bulbs (which can now no longer be purchased) with low energy Compact Fluorescent Lamp (CFL) bulbs and halogen spotlights with lower energy alternatives such as LED spotlights.
- Insulate hot water tanks and pipes. A British Standard cylinder jacket of 75mm will cost around £12 and save you £35 a year in energy bills.⁸
- Draught proof doors and windows. If existing windows are in good repair then draught sealing can be effective in reducing heat loss and fuel bills by up to £25 per year.⁹
- Repair and use original internal shutters where possible. Although not as effective as secondary or double glazing, they will reduce heat loss to some extent, as will closing the curtains.¹⁰
- Use a removable chimney balloon or open/close chimney damper plates where present to minimise draughts in winter and improve ventilation in summer.
- Select energy and water efficient fittings and appliances.
- Use a real time energy display, in a prominent location to give an overview of energy consumption and to help manage energy use.

2. Consider the type of heritage protection that applies

Is your property a listed building? The Council website includes a feature to search for listed buildings by map or by searching the database of listed buildings:

<http://www.westminster.gov.uk/services/environment/planning/conservationlistedbuildings/listedbuildings/> This is a guide only, the only definitive list is in the 'Greenback' book held by English Heritage and the local authority.

Is it within a conservation area? See

<http://www.westminster.gov.uk/services/environment/planning/conservationlistedbuildings/areaprofiles>

Consider developing a strategy for your building refurbishment measures that adopts the 'Energy Hierarchy' approach of being 'lean, clean and green', focusing firstly on measures to improve energy efficiency which will reduce the amount of energy that is required in the building, (making it more 'lean'). Typically this will include no/low cost measures referred to above and those which conserve energy such as insulation. Then consider whether it is possible for the supply of energy to be as efficient and 'clean' as possible; lower carbon sources of energy such as connection to a combined heat and power plant or district heating will be the most efficient energy source for buildings with appropriate heating/hot water demand to make it economic. Finally consider installing renewables such as electricity generating solar panels. Such a strategy should take into account which measures are most suitable for your property and whether they will complement one another, and which are most cost effective or practical when undertaken together, what the risks are as well as heritage and conservation considerations. Seek professional advice where necessary.

3. What scope do you have to make changes?

Freeholders will have the most scope, while leaseholders and tenants will be constrained by the terms of their lease and will require permission/consent of the freeholder/landlord. Landlords wishing to make energy efficiency upgrades to their property will need to agree this with leaseholders, including any cost apportionment and ongoing maintenance costs and note that leaseholders cannot be compelled to agree to this.

4. What is the budget?

Each building is unique and costs will vary depending on the requirements. Consider the cost effectiveness, and the likely payback period of measures that will have a medium to high cost. Check eligibility for any grants or loans to assist with costs, or for any feed-in-tariff for renewables as these will improve the payback period.

5. What permissions/consents do you need to obtain?

Some measures will be 'permitted development' for which planning permission is not required, as long as the property is not subject to an Article 4 direction or planning condition amending the permitted development rights. This will often depend on whether the property is a house or flat, although for some types of measure, permitted development does apply to flats. This guide will give you an idea of the likely permissions and consents that might be needed in Westminster, in terms of planning and listed building consent, but you may also need sign off under Building Regulations for certain works, and where no '

competent person' scheme exists. Where you are uncertain about whether a particular measure is 'permitted development', you can always apply for a 'certificate of lawfulness'. This may be important if the property is sold in the future.

6. Undertake work

Ensuring that any new systems work effectively, and that occupants (and future occupants) understand how to use them. There may also be changes necessary to the way in which a property is occupied, which must be clearly understood. For example, with many types of internal solid wall insulation it is vital not to pierce the waterproof membrane behind the insulation which might happen easily when putting up shelves or hanging a picture.

7. Monitor and undertake necessary maintenance

Grants and Sources of Funding

Grants and assistance are available from Government to those in receipt of certain means tested benefits under its Warm Front scheme in England. This will typically fund replacement insulation and heating costs. Qualifying households can get improvements worth up to £3,500 (£6,000 where oil central heating and other alternative technologies are recommended). Contact Warm Front on 0800 316 2805

Energy companies with a certain number of customers are obliged by the Carbon Emissions Reduction Target (CERT) to provide financial assistance towards installation of energy efficiency measures. Contact the London Energy Saving Trust Advice Centre on *freephone* 0800 512 012 for up to date information about grants and discounts.

The Council has a legal responsibility to assist in achieving national and European targets for the improvement of the energy efficiency of the housing stock. The City Council also wishes to assist in reducing the numbers of persons living in fuel poverty. This is where a household has to spend more than 10% of their disposable income on fuel costs. As such the Council offers the following assistance:

- Owner occupiers and private tenants in Queen's Park and Harrow Road wards can obtain free loft insulation and draught proofing regardless of their circumstances through the Loft and Draught Proofing Insulation grant. To qualify buildings should have:
 - less than an average of 150mm of loft insulation in the main or sole pitched roof space **and/or**
 - Have inadequate draught-proofing to window and external door openings.

For information on how to apply contact Westminster Home Improvement Agency on 020 7641 8959.

- Decent Homes grants are available until the end of 2012/13 to owner-occupiers on means tested benefits who live in a home that fails the decent homes standard. It can provide up to £5000 for gas central heating; repairs to existing heating systems; draught-proofing; loft insulation; hot water tank jackets; cavity wall insulation and home repairs. To find out more and apply contact Westminster Home Improvement Agency on 020 7641 8959.





It is expected that there will be significant changes to the current national programme of grants which may impact on Westminster policies, for up to date information see the Energy Saving Trust.

Measures

This section outlines measures which might be appropriate to retrofit in Westminster. It excludes measures which might be appropriate in other locations but which are not considered generally to be suitable in Westminster such as biomass heating, which has considerable negative air quality impacts and is not generally considered to be sustainable unless you have a nearby source of fuel.

For each measure a table summarises the different consents that might be needed in terms of the three alternative heritage building scenarios.

These have been colour coded as below, with the lightest colour reflecting those measures which may be permitted development, or for which permission is unlikely to be needed, and the darkest colour indicating that permission would need to be sought and the measure is unlikely to be acceptable.

-  1 Measure unlikely to require permission or consent; may be permitted development in some cases.
-  2 Measure likely to require planning permission or consent and may be acceptable subject to detailed design.
-  3 Measure unlikely to be considered acceptable in most cases.
-  Dotted outline indicates a different approach depending on whether the building is a flat or a house, see summary chart at pages 58-59.

Loft and roof insulation

				Permissions and consents...		
Does Building Regs apply	Does Part L1B require this? http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADL1B_2010.pdf	Disruption	Risks	Unlisted within a conservation area	Listed building	Unlisted outside a conservation area
Not for simple installation of loft insulation in an existing loft, but where renovating a thermal element, e.g. replacing a roof, loft insulation will be required.	<p>Part L1B requires improvements to the whole of thermal elements, such as roofs where renovation work is taking place on more than 50% of the surface of that element.</p> <p>Note: buildings which are:</p> <ol style="list-style-type: none"> 1. listed 2. in conservation areas 3. of architectural and historical interest, referred to in a local authority development plan 4. of traditional construction. <p>will not be required to undertake works which would 'prejudice the appearance and character of the building'. It is not likely to be the case here. English Heritage have produced guidance on applying part L to historic buildings¹¹</p>	Low	Low risks if installing between existing joists, but ensure an air gap around edges of loft to avoid damp and allow air to circulate. Installation of insulation at rafter level has more risks associated.	Permission not required as long as it doesn't alter external appearance of roof	Permission/consent not normally required as long as it doesn't alter external appearance of roof or involve modification of roof structure.	Permission not required as long as it doesn't alter external appearance of roof

Installing insulation in existing roof voids can have a significant positive impact on energy efficiency. Historic buildings with a timber roof structure lend themselves to insulation between joists and rafters without any visual impact or harm to the historic building. Natural insulation materials such as wool are particularly beneficial as these allow a building to breathe, reducing the possibility of moisture and damp problems. When fitting, an air gap must be left around the margins of the building to allow air to circulate. Care should be taken around electrical cables (lay these over the insulation), and allow a gap around any lights that may heat up (e.g. downlighters installed for the rooms below). It is also advised to insulate loft hatches.

Whilst insulation of a loft (between joists) is straightforward (sometimes referred to as 'cold roof'), insulation at rafter level (where a loft space has already been converted to provide additional space, referred to as 'warm roof') is more complicated. There are various options including insulation between the rafters, on top of the rafters and below the rafters. Some options will result in the roof height changing. Additional considerations in heritage buildings may include whether there is a historically significant lining or ceiling fixed to the underside of the rafters. If this cannot be removed, and the only way to attach insulation is by removing the roof tiles and inserting from above then this may not be economic, unless other works to the roof are being undertaken at the same time.



Generally in Westminster this will be acceptable as long as it doesn't alter the roof height as seen from the exterior. If proposals are more extensive, involving alterations to roof height then this is likely to require planning permission, and if a listed building, listed building consent.

Risks: There are risks associated with reducing air flow and ventilation and consideration should be given to the most appropriate materials and technique, particularly for roof level insulation. Ensure an air gap is retained around margins of loft.

Costs and grants: Capital costs of loft insulation will vary depending on the size of loft, depth of existing insulation and whether the work is professionally installed or DIY. There are additional costs associated with the time to empty and refill a loft, and possibly extending joists if the householder requires the loft to be boarded (otherwise significant depths of insulation material may reduce utility of the loft). Costs quoted by contractors to fit loft insulation in a listed building will be significantly higher reflecting the range of additional possible issues that can complicate the job.



Loft and roof insulation	Unit	Cost (lower)	Cost (Upper)	Cost (average)	Subsidies (refer to EST website for latest info¹²)
Listed building ¹³	80m ²	£1000	£1400	£1200	50-100%
Unlisted building ¹⁴	80m ²	£193	£352	£272.50	50-100%

Costs of rafter level insulation will be higher, depending on the complexity of the technique and the material selected.

When to do this: Loft insulation can be undertaken at any time, either in isolation or as part of a whole house refurbishment. It is sensible to insulate any water tanks and lag pipework at the same time, and don't forget an insulated loft trapdoor. If you have downlighters that you are planning to change, do this before installing insulation (and remember to leave a clear space around them to minimise risk of overheating). When converting loft spaces or replacing a roof, insulation will be required.

For further information see:

- Factsheet produced by English Heritage:
http://www.climatechangeandyourhome.org.uk/live/insulating_roofs_generic.aspx
- <http://www.helm.org.uk/upload/pdf/eehb-warm-roofs.pdf?1308028610>
- 'An Introduction to Low Carbon Domestic Refurbishment' Construction Products Association (2010)
[http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20\(LOW%20res\).pdf](http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20(LOW%20res).pdf)
- Roofs – A guide to Alterations and Extensions on Domestic Buildings, Westminster City Council SPG (2004)
<http://www3.westminster.gov.uk/spgs/publications/Roof%20guide.pdf>

Floor insulation (suspended timber floors)

				Permissions and consents...		
Does Building Regs apply	Does Part L1B require this? http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADL1B_2010.pdf	Disruption	Risks	Unlisted within a conservation area	Listed building	Unlisted outside a conservation area
Yes where insulation is exposed to the ground or air building regulations applies.	<p>Part L1B requires improvements to the whole of thermal elements, such as floors where renovation work is taking place on more than 50% of the surface of that element.</p> <p>Note: buildings which are:</p> <ol style="list-style-type: none"> 1. listed 2. in conservation areas 3. of architectural and historical interest, referred to in a local authority development plan, 4. of traditional construction. <p>will not be required to undertake works which would prejudice the appearance and character of the building. This would depend on the existing floor. English Heritage have produced guidance on applying part L to historic buildings^{xv}</p>	High – it makes sense to do this when floor boards are being lifted or replaced due to the cost and disruption.	Low risk, but care needed when lifting floorboards. Ensure air bricks are not covered by insulation as circulating air is needed to prevent damp and rot.	Internal alterations of an unlisted property in a conservation area don't require planning permission.	May require listed building consent depending on existing floor.	Permission not required.

Heat loss through the floor amounts to around 15% for the average house. Simple draught-proofing of gaps between floor and skirting and between floorboards with sealant can be undertaken relatively easily and at low cost (around £20). Suspended timber floors on the ground floor, typical for many older properties can be insulated to improve thermal comfort. This will be quite straightforward if there is a cellar or crawlspace below, but without this, floorboards can be lifted and insulation inserted underneath, supported by netting. This should be to the depth of the joist only and should not block air bricks. Care needs to be taken when lifting boards to minimise damage. Avoid blocking airbricks when draughtproofing or when insulating, and take care to maintain cross ventilation beneath suspended timber floors to avoid rotting floor timbers. Consider the potential loss of historic fabric (floorboards/skirting/door surrounds/doors) that may occur if insulation increases floor height.

Advantages: Underfloor insulation can save around £50 per year on energy bills and improve thermal comfort, with draught proofing saving around £15 per year.

Disadvantages: This will be fairly disruptive as it will require rooms to be emptied, and floorboards to be lifted, which risks damaging the floor. For this reason it is sensible to take advantage of any opportunity to insulate, for example if existing rotten floorboards are being replaced.

Risks: Incorrectly installed insulation which blocks air bricks and reduces air circulation beneath a floor may result in damp and condensation problems. The risks inherent in lifting floorboards may be too great in a listed building where one of the features for which it is listed is a particularly attractive floor. Some historic buildings may also contain historic pugging, which is a coarse mortar between joists and beneath floor boards to deaden sound.

Costs: Generally although the capital cost of insulation is not high, there is significant disruption and cost in having floors lifted. The cost of lifting floorboards properly can be around £25/m² while the cost of the insulation itself is only around £5/m²

Floor insulation (suspended timber)	Unit	Cost (lower)	Cost (Upper)	Cost (average)	Subsidies (refer to EST website for latest info ¹⁶)
Unlisted building ¹⁷	80m ²	£875	£917	£896	50-100%

When to do this: Floor insulation is disruptive therefore it is best done as part of a whole house refurbishment, or when floorboards are being lifted or replaced, for example to install or access heating pipes below. When it is carried out ensure that gaps are sealed such as under skirting boards and where water and gas pipes are located to minimise draughts.

For further information see:

- Factsheet produced by English Heritage:
http://www.climatechangeandyourhome.org.uk/live/insulating_timber_ground%20floors.aspx
- 'An Introduction to Low Carbon Domestic Refurbishment'
Construction Products Association
(2010)[http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20\(LOW%20res\).pdf](http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20(LOW%20res).pdf)
- Information from the Energy Saving Trust
<http://www.energysavingtrust.org.uk/In-your-home/Roofs-floors-walls-and-windows/Floor-insulation>

Internal solid wall insulation

				Permissions and consents...		
Does Building Regs apply?	Does Part L1B require this? http://www.planningportal.gov.uk/uploads/br/BR_PDF_AD1B_2010.pdf	Disruption	Risks	Unlisted within a conservation area	Listed building	Unlisted outside a conservation area
Yes	<p>Part L1B requires improvements to thermal elements, such as walls where renovation work is taking place on more than 50% of the surface of that element (or 25% of the whole building envelope)</p> <p>Note: exemptions for buildings which are:</p> <ol style="list-style-type: none"> 1. listed 2. in conservation areas 3. of architectural and historical interest, 4. of traditional construction. <p>These buildings should 'improve energy efficiency as far as is reasonably practicable. The work should not prejudice the character of the host building or increase the risk of deterioration of the building fabric or fittings'.</p> <p>English Heritage have produced guidance on applying part L to historic buildings¹⁸</p>	High - this will probably be best done with a vacant property or when a whole house is being refurbished as the kitchen and bathroom may need refitting.	Very high-Specialist advice and installation required due to possible moisture and ventilation problems.	Internal alterations of an unlisted property in a conservation area don't require planning permission.	Would require listed building consent for changes affecting the building's character as one of special architectural or historic interest, such as materials, details and finishes. This may be granted in limited circumstances, such as where original finishes have already been lost.	Internal alterations of an unlisted property don't require planning permission.

Solid wall insulation can be a way of improving the thermal efficiency of a building, and could save energy and reduce heating bills. Most of the historic buildings in Westminster have solid masonry walls, either of brick or stone. Masonry walls are not good insulators and they often feel cold to the touch because they conduct heat. The only way to insulate them is by adding a layer of insulation either internally or externally. Around 35% of heat loss from a typical home is through its walls.

Advantages: This can improve the thermal comfort of a property and reduce energy bills substantially. It raises no planning issues for unlisted buildings in conservation areas and may in certain circumstances be acceptable for listed buildings for example where internal finishes have already been lost. It is also likely to be cheaper than external wall insulation although there are likely to be additional costs associated with the need to reapply decorative finishes, and possibly refit kitchens and bathrooms, so for this reason is best considered for whole house refurbishment projects.

Disadvantages: It is disruptive and will typically require a property to be empty, and probably kitchens and bathrooms to be completely refitted. It will take up internal floorspace and alter the relationship of the door and window reveals, and will require skirting boards, cornicing and decorative plasterwork to be relocated. Again there are inherent risks in creating thermal bridges for moisture which can result in damp and rot problems in localised areas, so an air gap is recommended. It is also more expensive than external insulation, and the additional costs associated with having to vacate a property and completely refit kitchens and bathrooms adds significantly to the overall cost, unless such works are programmed when a whole house refurbishment is planned. In some situations, such as listed buildings where there is little remaining internal historic

fabric this may be acceptable, but will require listed building consent.

Risks: Older properties were designed to breathe, i.e. allow a certain amount of moisture in and out. Typically, they would only have heating in some rooms, and would be cooler than we keep them today. Modern materials including insulation and even emulsion paints are more moisture resistant and can restrict the ability of walls to breathe. The risk of water vapour passing into a wall, but not being able to escape, is that it can condense inside the fabric of the wall. This is known as 'interstitial condensation', and it may cause damage to a wall structure and finish. Thermal bridging, where water vapour condenses on relatively cooler uninsulated surfaces can also be a problem around roofs, floor joists, windows and partition walls. Any damp problems, whether through water penetration, rising damp, or any other sources must be dealt with first before deciding on the most appropriate strategy for internal insulation. Once this has been dealt with there are generally two strategies.

Breathable solution: The first and less risky, and probably the most appropriate option for historic buildings, and certainly where there have been any previous damp problems, is to ensure that materials with similar breathable qualities are used for the internal insulation (though this also applies to roof and floor insulation, in order to avoid moisture condensing on vulnerable areas). In this case no vapour barrier is needed, and there is no risk of it failing in future. In addition care must be taken not to introduce any impermeable finishes such as vinyl wallpaper or emulsion paint (internally or externally).

Watertight solution: The second approach is to ensure the walls are made completely watertight, either through the use of a carefully installed vapour barrier (which might be plastic sheeting) or insulation with integral vapour membrane. In either case it should be taped across all joints and penetrations (e.g. sockets) and great care will be needed to ensure that future occupants do not break the vapour membrane when hanging pictures or putting up shelves for example, as there are very serious risks of interstitial condensation resulting in damage to walls with even the smallest penetration to the vapour barrier.

Thermal Bridges: Very careful detailing will also be needed to ensure that there are no thermal bridges in places where insulation coverage is incomplete or reduced which might result in more water condensation at these points due to them being relatively colder than insulated surfaces. Particular care is needed around windows and doors and at the ends of floor joists embedded in masonry walls, particularly intermediate floors, and specialist advice should be sought on what is most suitable. A ventilated cavity between a new internally insulated

stud wall and the existing external wall can be created, which can overcome many of the moisture and damp related risks,

although the cavity must be ventilated to the outside of the building. Internal insulation should be returned a short distance along the party walls in terrace properties. Often it is hidden in the alcove alongside the chimney breast.

Costs: The costs of solid wall insulation vary very significantly and are also related to property type, wall area, finish, number of installations (economies of scale may apply for example to social housing projects where a bulk number of units can be insulated). However there are additional costs associated with the disruption, the need to vacate a property and possibly the need to refit the kitchen or bathroom, and reapply details such as skirting boards or coving where appropriate. For this reason it is probably most cost-effective to consider this as part of a whole house refurbishment.

Internal Solid Wall Insulation	Unit	Cost (lower)	Cost (Upper)	Cost (average)	Subsidies (refer to EST website for latest info ¹⁹)
Listed building ²⁰	80m ²	£6400	£8000	£7200	0-50%
Unlisted building ²¹	80m ²	£5600	£8500	£7050	0-50%

When to do this: Owing to the disruption and likelihood that kitchens and bathrooms would need to be refitted this is best done as part of a whole house refurbishment with a vacant property although it can be undertaken room by room.

For further information see:

- Factsheet produced by English Heritage:
http://www.climatechangeandyourhome.org.uk/live/insulating_solid_walls.aspx
- 'An Introduction to Low Carbon Domestic Refurbishment'
Construction Products Association (2010):
[http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20\(low%20res\).pdf](http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20(low%20res).pdf)
- Information from the Energy Saving Trust
<http://www.energysavingtrust.org.uk/In-your-home/Roofs-floors-walls-and-windows/Solid-wall-insulation>

Case Study: 88 Lothrop Street, Queens Park, Westminster (Retrofit for the Future)

Consultant: Eco Alchemists Ltd

Client: CityWest Homes

Goal: 80% reduction in carbon emissions.

Due to its location in a conservation area, external wall insulation was not a possibility, so to achieve a high level of insulation (minimum 0.15W/m²K) the Spacetherm range of aerogel thermal dry lining insulation was applied on the walls. This was returned along party walls and combined with floor and loft insulation, with Mechanical Ventilation with Heat Recovery (MVHR) system installed to provide pre-warmed, filtered, fresh air, secondary glazing, a micro CHP (combined heat and power unit) and upgraded lighting and appliances, as well as low VOC paints and natural flooring.

The house achieved a 79% reduction in carbon emissions.

External solid wall insulation

				Permissions and consents...		
Does Building Regs apply?	Does Part L1B require this? http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADL1B_2010.pdf	Disruption	Risks	Unlisted within a conservation area	Listed building	Unlisted outside a conservation area
Yes	<p>Part L1B requires improvements to thermal elements, such as walls where renovation work is taking place on more than 50% of the surface of that element (or 25% of the whole building envelope)</p> <p>Note: exemptions for buildings which are:</p> <ol style="list-style-type: none"> 1. listed 2. in conservation areas 3. of architectural and historical interest, 4. of traditional construction. <p>These buildings should 'improve energy efficiency as far as is reasonably practicable. The work should not prejudice the character of the host building or increase the risk of deterioration of the building fabric or fittings'.</p> <p>English Heritage have produced guidance on applying part L to historic buildings²²</p>	Medium	High-Specialist advice and installation required due to possible moisture and ventilation problems.	Planning permission will be needed in all cases for external wall insulation comprising or including the following: stone, artificial stone, pebble dash, render, timber, plastic or tiles ²³ . This is likely to be contentious, but may be allowed in certain circumstances such as on the rear elevation, in an enclosed situation (not part of a unified terrace) where the materials used are of a similar appearance to the existing building or extension.	Planning permission and listed building consent would be needed and this is generally not considered appropriate for listed buildings.	Central Government guidance suggests this is permitted development on the principal elevation (or other elevations) of a dwelling house (not flats) subject to the material being of a similar appearance to the existing building or extension.



Dashed line indicates different approach for flats and house

Solid wall insulation can be a way of improving the thermal efficiency of a building, and could save energy and heating bills. Most of the historic buildings in Westminster have solid masonry walls, either of brick or stone. Masonry walls are not good insulators and they often feel cold to the touch because they conduct heat. The only way to insulate them is by adding a layer of insulation either internally or externally. Most external systems consist of a layer of insulating material fixed to the wall and covered by a render, which provides a degree of protection from weather and impact damage.

The major issue to consider is that external wall insulation will have an impact visually on the relationship between the building envelope and its openings, altering the detailing around windows and doors, and also eaves and roof verges. It is possible to extend roof eaves to deal with this.

For this reason it would need to be very carefully designed, and in conservation areas planning permission is likely to be needed in most cases and it is likely to be contentious but it may be allowed in certain circumstances such as on the rear elevation, and only in an enclosed situation, not for part-only of a unified terrace, although applications to apply to the whole of a terrace would be considered. In all cases, where acceptable, the cladding would be expected to match the original facing material. In addition careful detailing is required around windows to minimise the impact of altered window reveals. Outside a conservation area, external wall insulation is likely to be permitted development as long as it uses materials of a similar appearance to the existing building

Advantages: This can improve the thermal comfort of a property and reduce energy bills substantially, as typically 35% of heat is lost through a building's walls. This does not require the property to be vacated, is simpler and easier to achieve than

internal wall insulation (although note that it may require work such as extending the eaves of a house in order to make it possible). External wall insulation works better with the thermal mass of existing walls, meaning that walls which absorb heat will be able to release it back into the interior of the building when it begins to cool. It is also generally considered a safer solution in terms of the risk of damp and moisture in a building than internal solid wall insulation. It will not reduce floorspace internally.

Disadvantages: This will probably require work to ensure the detailing around the roof and window reveals is dealt with appropriately, which may include extending the eaves of a house where there is insufficient overhang. There are inherent risks in creating thermal bridges for moisture which can result in damp and rot problems in localised areas, so professional advice is necessary. It is only likely to be acceptable in limited circumstances (see table above), and is not considered acceptable for listed buildings.

Risks: Older properties were designed to breathe, i.e. allow a certain amount of moisture in and out. Typically, they would only have heating in some rooms, and would be cooler than we typically keep them today. Modern materials including insulation and even emulsion paints are more moisture resistant and can restrict the ability of walls to breathe. The risk of water vapour passing into a wall, but not being able to escape, is that it can condense inside the fabric of the wall. This is known as 'interstitial condensation', and it may cause damage to a wall structure and finish.

Thermal bridging, where water vapour condenses on relatively cooler uninsulated surfaces can also be a problem around roofs, floor joists, windows and partition walls, although with external insulation this is less likely to be an issue.

Walls with structural problems which cannot be repaired should not be externally insulated. Any damp problems, whether through water penetration, rising damp, or any other sources must be dealt with first before considering whether external wall insulation is appropriate.

Breathability: It is vital to ensure that materials used in external insulation and weatherproofing are breathable (preventing water penetration from outside while allowing moisture inside or rising from the ground to pass out), and have similar properties to existing walls. English Heritage recommends that progressive layers of an insulated wall should become more permeable from interior to exterior enabling moisture to escape. Materials to avoid include acrylic or cement based renders or pointing, non-breathable insulation materials and vapour barriers. In addition care must be taken not to introduce any impermeable finishes such as vinyl wallpaper or emulsion paint (internally or externally), which can compromise the ability of the wall to absorb and release moisture.

Thermal Bridges: This will also need very careful detailing to ensure that there are no thermal bridges, in places where insulation coverage is incomplete or reduced which might result in water condensation at these relatively colder surfaces.

Particular care is needed around windows and doors. Specialist advice should be sought on what is most suitable.

Costs: The costs of solid wall insulation will vary significantly and are also related to property type, wall area, finish, number of installations (economies of scale may apply for example to social housing projects where a bulk number of units can be insulated). Although external solid wall insulation has a higher capital cost, and will require scaffolding, it may have less associated costs as it can be applied with residents in situ.

However, if it requires work to extend roof eaves, or alter detailing around window and door reveals, or deal with services these will add substantially to the cost. It should be noted that available data on typical costs for solid wall insulation tends to be based on a typical 3 bedroom semi detached property, and in Westminster this is not typical therefore costs for Westminster properties including the finish and scaffolding are likely to be significantly higher.

External Solid Wall Insulation	Unit	Cost (lower)	Cost (Upper)	Cost (average)	Subsidies (refer to EST website for latest info ²⁴)
Listed building ²⁵	80m ²	£7600	£13200	£10400	0-50%
Unlisted building ²⁶	80m ²	£10500	£14500	£12500	0-50%

When to do this: External wall insulation is not very disruptive to occupants, but owing to the high cost (as well as cost of scaffolding) it is something to consider when you are thinking of upgrading or replacing existing render.

For further information see:

- Factsheet produced by English Heritage:
http://www.climatechangeandyourhome.org.uk/live/insulating_solid_walls.aspx
- 'An Introduction to Low Carbon Domestic Refurbishment'
Construction Products Association (2010)
[http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20\(low%20res\).pdf](http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20(low%20res).pdf)
- Information from the Energy Saving Trust
<http://www.energysavingtrust.org.uk/In-your-home/Roofs-floors-walls-and-windows/Solid-wall-insulation>

Draughtproofing

				Permissions and consents...		
Does Building Regs apply?	Is this work a requirement triggered by Part L1B? http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADL1B_2010.pdf	Disruption	Risks	Unlisted within a conservation area	Listed building	Unlisted outside a conservation area
No	No	Low-Medium	Medium – Advice may be needed on ventilation and condensation.	Internal alterations of an unlisted property in a conservation area don't require planning permission.	Likely to be acceptable in most cases without listed building consent, although where the windows are especially important advice should be sought from design and conservation officers before proceeding.	Internal alterations of an unlisted property do not require planning permission.

Poorly fitting windows and doors, often the result of warping over time, and years of repainting can lead to significant heat loss and make rooms feel uncomfortable. There are a range of types of draught proofing systems available, from DIY foam strips which stick on to professionally fitted compression seals or carrier seals that fit within frames and suitable for different types of window. Generally foam strips, although very low cost, are not recommended for sash windows, and will need to be replaced regularly. Casement windows will be suitable for compression seals that sit within the window frame, and sash windows will typically have brush seals installed, which seal the gaps between top and bottom sashes when closed.

Generally there will be no problem with fitting these to existing windows in historic buildings. For particularly noteworthy windows in listed buildings it is advisable to check with design and conservation officers before proceeding.

Advantages: This can improve the thermal performance of existing windows and comfort at a relatively lower cost **without** a significant aesthetic impact, provided the system is installed within the window fabric.

Disadvantages: Lower cost DIY options may not be as effective, and will need to be replaced frequently.

Costs: Costs vary depending on whether it is done as a DIY job, although generally better performing results will be obtained with a professionally fitted system, which might cost £200-250 for a typical sash window for example.

Draught proofing windows	Unit	Cost (lower)	Cost (Upper)	Cost (average)	Subsidies (refer to EST website for latest info ²⁶)
Listed building ²⁷	Per window 1.36m ²	£200	£400	£300	0-50%
Unlisted building ²⁸	Per window 1.36m ²	£200	£250	£225	0-50%

When to do this: It is a good idea to undertake this either as a standalone measure, or combined with secondary glazing. Draughtproofing around skirting boards and gaps in floorboards is also advisable, as well as where pipes and cables enter the home.

For further information see:

- English Heritage research on sash windows:
http://www.climatechangeandyourhome.org.uk/live/research_generic.aspx
- English Heritage Factsheet on draughtproofing:
http://www.climatechangeandyourhome.org.uk/live/content_pdfs/892.pdf
- Centre for Sustainable Energy publication “Warmer Bath” which includes useful detail on draughtproofing windows amongst other topics:
http://www.cse.org.uk/downloads/file/warmer_bath_june2011.pdf

Secondary glazing

Does Building Regs apply?	Is this work a requirement triggered by Part L1B? http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADL1B_2010.pdf	Disruption	Risks	Permissions and consents...		
				Unlisted within a conservation area	Listed building	Unlisted outside a conservation area
Yes	No, although in certain cases where replacement windows are unable to meet required U-values due to heritage requirements for example then secondary glazing may be a solution. English Heritage have produced guidance on applying part L to historic buildings ²⁹	Medium	Medium – Advice may be needed on ventilation and condensation. Take care not to damage existing windows and shutters (if present)	Internal alterations of an unlisted property in a conservation area don't require planning permission.	Listed Building consent will be required, although this will generally be acceptable, subject to detailed design.	Internal alterations of an unlisted property do not require planning permission.

A significant amount of heat is lost through windows, both the glass and the gaps in and around the frames. As an alternative to double or triple glazing, secondary glazing is available in a variety of systems to suit different window styles. This also has benefits in terms of noise reduction. There are a variety of systems – those that are openable – hinged or sliding, fixed, and lightweight removable. In all cases careful thought should be given to how to access original windows for cleaning and maintenance.

The heritage conservation value of a building will influence the options that are available, as alterations to windows can have a significant impact on the historic value of the building. Secondary glazing will generally be possible for all types of historic property, subject to obtaining listed building consent (where relevant). For best results it should be combined with a refurbishment of existing single glazed windows.

Advantages: It can have a positive impact on reducing draughts and improving comfort, especially when combined with repairs to existing windows. It will generally be acceptable on most buildings. It can have better noise insulating properties than double glazing (due to the larger cavity), so may be suitable for windows fronting onto busy roads. It will be less expensive than replacing with double or triple glazing.

Disadvantages: It can be more expensive than simple refurbishment measures, and care must be taken when installing not to damage existing window frames, or existing shutters. Removable secondary glazing which is taken down in summer will require careful storage, and care taken to select a system which enables access to the original windows for cleaning and maintenance.

Risks: As with other measures that reduce air flow, specialist advice will be needed to deal with ventilation and condensation. Measures which reduce ventilation may not be appropriate in kitchens and bathrooms. Although the secondary glazing unit may be well sealed, the original windows should *not* be sealed, ensuring that there is still ventilation, of the cavity to the outside, preventing moisture and condensation build up within the cavity between the original window and the secondary glazed unit.

When to do this: This works as a standalone measure, but for the best results consider doing this at the same time as refurbishing existing timber windows.

Costs: Costs will vary greatly depending on the type of system, whether it is 'seasonal' (i.e. a lightweight system, removable in summer) or fixed and double glazed, the degree to which it can be opened, and 'matches' existing window

Secondary Glazing	Unit	Cost (lower)	Cost (Upper)	Cost (average)	Subsidies (refer to EST website for latest info ³⁰)
Listed building ³¹	Per window 1.36m ²	£100	£250	£175	-

For further information see:

- Factsheet produced by English Heritage on secondary glazing:
http://www.climatechangeandyourhome.org.uk/live/content_pdfs/891.pdf
- 'An Introduction to Low Carbon Domestic Refurbishment' CPA (2010)
[http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20\(low%20res\).pdf](http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20(low%20res).pdf)

Case Study

88 Lothrup Street has included secondary glazing in its strategy for whole house refurbishment under the Retrofit for the Future Programme, funded by the Technology Strategy Board. The house is located in a Conservation Area, and the windows to the front were refurbished with double glazed secondary glazing installed behind. The window also had thermal blinds installed.



Double (or triple) glazing

				Permissions and consents...		
Does Building Regs. apply?	Is this work a requirement triggered by Part L1B? http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADL1B_2010.pdf	Disruption	Risks	Unlisted within a conservation area	Listed building	Unlisted outside a conservation area
Yes - No need to notify if installer is part of a competent person scheme, e.g. FENSA approved	Part L1B requires improvements to 'controlled elements' which includes windows (where the whole of the window unit including the frame is being replaced) to meet specified U-values. Note: exemptions for buildings which are: 1. listed 2. in conservation areas 3. of architectural and historical interest, 4. of traditional construction. These buildings should 'improve energy efficiency as far as is reasonably practicable. The work should not prejudice the character of the host building or increase the risk of deterioration of the building fabric or fittings'. English Heritage have produced guidance on applying part L to historic buildings ³²	Medium	Medium—Advice may be needed on ventilation and condensation	Planning permission will be required for flats where new windows materially affect the external appearance of the building, e.g. where the frame size changes; opening mechanisms change or materials for the window change. For a dwellinghouse (not flats) this is permitted development but is subject to certain conditions. ³³	Listed Building consent will be required, and this will generally not be considered acceptable, although there are some instances where it will be considered possible, such as where installed to a modern extension or later part of the building.	Planning permission will be required for flats where new windows materially affect the external appearance of the building, e.g. where the frame size changes; opening mechanisms change or materials for the window changes. For a dwellinghouse (not flats) this is permitted development subject to certain conditions. ³⁴



Dashed line indicates difference of approach for flats and houses

A significant amount of heat is lost through windows, both the glass and the gaps in and around the frames. The heritage conservation value of a building will influence the options that are available, as alterations to windows can have a significant impact on the historic value of the building.

Modern double glazed sash windows can now achieve improved thermal performance as well as security and acoustic benefits. There are slim profile options as well as those with low emissivity coatings which improve performance and may be appropriate in some situations.

The PassivHaus standard, which aims to achieve very high levels of air tightness, common in Germany has been applied in a small number of retrofitting projects, experimentally in the UK. To meet the high levels of air tightness required a building would typically fit triple glazing rather than double glazing. Such an approach would require a whole building approach, outside the scope of this guidance. It is worth noting that at present it is difficult to achieve the necessary U values and levels of air tightness with sash windows due to the heavier weight of triple glazed units, although manufacturers and designers are working to develop a solution to this.

Advantages: Double or triple glazing will have the best thermal performance. It can have a positive impact on reducing draughts and improving comfort and will improve the U value (rate of heat loss through a material). Appropriately detailed timber double glazing may add to the value of a property.

Disadvantages: It can be more expensive than simple refurbishment measures and secondary glazing. Triple glazed options exist, but create bigger sections and heavier units, and these are more expensive than double glazing.

Risks: As with other measures that reduce air flow, specialist advice will be needed to deal with ventilation and condensation. Trickle vents (which are common on most modern windows) may sometimes be necessary to provide adequate ventilation of internal condensation and pollutants, especially in properties where there is only a single window and the space is otherwise well sealed. Care should be taken to ensure that such vents are used appropriately as when used wrongly they can become blocked and ineffective. Measures which reduce ventilation may not be appropriate in kitchens and bathrooms.

Costs: The cost of replacement double or triple glazing is a significant investment, but particularly when it returns a window to its original style material, it may add to the value of a property.

Double Glazing	Unit	Cost (lower)	Cost (Upper)	Cost (average)	Subsidies (refer to EST website for latest info ³⁵)
Listed building ³⁶	Per window 1.36m ²	£465	£525	£495	-

When to do this: This can be done as a standalone measure, but would also be beneficial to consider alongside internal wall insulation, as part of a strategy to minimise condensation and thermal bridging.

For further information see:

- 'An Introduction to Low Carbon Domestic Refurbishment'
Construction Products Association (2010)
[http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20\(low%20res\).pdf](http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20(low%20res).pdf)
- Comparison of performance of double glazing in historic buildings in Edinburgh trial:
[http://www.changeworks.org.uk/uploads/Double_Glazing_In_Listed_Building_-_Project_Report_\(Changeworks_2010\).pdf](http://www.changeworks.org.uk/uploads/Double_Glazing_In_Listed_Building_-_Project_Report_(Changeworks_2010).pdf)
- Replacing Windows in Conservation Areas guidance from Wood Window Alliance.
http://www.woodwindowalliance.com/fileadmin/docs/guides/WWA_conservation_brochure_2011_web2.pdf

Boiler upgrade

Does Building Regs apply?	Is this work a requirement triggered by Part L1B? http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADL1B_2010.pdf	Disruption	Risks	Permissions and consents...		
				Unlisted within a conservation area	Listed building	Unlisted outside a conservation area
Yes - Work must be carried out by an installer who is on the Gas Safe Register	Heating systems are a 'controlled service' under Part L1B. Work should comply with the "Domestic Heating Compliance Guide". http://www.planningportal.gov.uk/uploads/br/BR_PDF_PTL_DOMHEAT.pdf	Low-Medium	Low	<p>A flue is permitted development on a dwellinghouse (not including flats) subject to the height of it not exceeding the roof by more than 1m, and in a conservation area not fronting a highway or being on principal or side elevation.³⁷</p> <p>Will generally be acceptable on the rear of a property. If an existing flue is lawful and proposed new one is of the same dimensions it probably won't require planning permission to replace.</p>	<p>Listed building consent would be required for the flue and for any internal alterations.</p> <p>The flue should be positioned in a visually discreet location on the rear elevation. If an existing flue is lawful and proposed new one is of the same dimensions it probably won't require planning permission to replace.</p>	<p>A flue is not permitted development for flats.³⁸ Planning permission would be required for any flue that would materially affect the external appearance of the building.</p> <p>Would be permitted development for a dwellinghouse subject to it not exceeding the highest part of the roof by 1m or more.</p> <p>If an existing flue is lawful and proposed new one is of the same dimensions it probably won't require planning permission to replace.</p>



Dashed line indicates difference of approach for flats and houses

When existing boilers break down or are older than 10-15 years they should be replaced with an A-rated condensing boiler (although there are some exceptions). A condensing boiler is more efficient than a traditional combination boiler as it extracts additional latent heat from water vapour, improving its efficiency. In general all new boilers should be condensing boilers unless in exceptional circumstances an exemption is necessary due to the difficulty and cost of installation, for example where it is located far from a drain. This exemption would be determined by a points based assessment. Heating controls should be programmable on a timer, with individual room TRV (Thermostatic Radiator Valves) which switch off the heating in a room when it reaches the required temperature.

At the same time as upgrading a boiler the opportunity should be taken to install advanced heating controls (which increase the options in terms of temperatures and timing), as well as upgrading the hot water system.

As part of a refurbishment consideration could be given to the possibility of installing low carbon alternatives such as heat pumps (best suited to relatively air tight properties with good levels of insulation, and to buildings with underfloor heating systems) or micro CHP (Combined Heat and Power), which makes electricity at point of use and makes use of the heat

produced as a by-product (best suited to properties with a high and fairly consistent demand for heat) together with improved temperature/time zoning controls.

Costs

Boiler Upgrade	Unit	Cost (lower)	Cost (Upper)	Cost (average)	Subsidies (refer to EST website for latest info ³⁹)
Assumed Domestic ⁴⁰	Per installation	£2,200	£2,550	£2,375	-

For further information see:

- <http://www.planningportal.gov.uk/permission/commonprojects/boilersheating/>
- 'An Introduction to Low Carbon Domestic Refurbishment' Construction Products Association (2010) [http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20\(low%20res\).pdf](http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20(low%20res).pdf)

Heating controls

Does Building Regs apply?	Is this work a requirement triggered by Part L1B? http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADL1B_2010.pdf	Disruption	Risks	Permissions and consents...		
				Unlisted within a conservation area	Listed building	Unlisted outside a conservation area
No, although in practice usually installed together with a new boiler which is subject to building regulations approval.	Heating systems are a 'controlled service' under Part L1B. Work should comply with the "Domestic Heating Compliance Guide". http://www.planningportal.gov.uk/uploads/br/BR_PDF_PTL_DOMHEAT.pdf	Low-Medium	Low	Internal alterations do not require planning permission.	Does not require planning permission or listed building consent.	Internal alterations do not require planning permission.

Without proper programmable heating controls, the benefits of a more efficient condensing boiler will not be realised. Therefore thermostats should be programmable 'Chrono-proportional' thermostats on a timer, enabling a number of different programmable room temperature levels each day. These should be combined with TRV (Thermostatic Radiator Valves) in each room (except the room where the thermostat is located, and the bathroom) which switch off the heating in a room when it reaches the required temperature. Such systems can be wireless, which mean that no wiring or making good is required.

When to do this: It makes sense to upgrade heating controls whenever a new boiler is installed, but also when new sources of low and zero carbon heating are installed, such as heat pumps, and perhaps also if you are considering installing underfloor heating.

Costs

Heating controls	Unit	Cost (lower)	Cost (Upper)	Cost (average)	Subsidies (refer to EST website for latest info ⁴¹)
Programmable heating controller	Per typical controller	£50	£100	£75	-
Thermostatic Radiator Valves ⁴²	Per TRV installed	£35	£75	£55	-
Hot water cylinder jacket ⁴³	Per cylinder jacket self installed	-	-	£30	0-100%

For further information see:

- <http://www.planningportal.gov.uk/permission/commonprojects/boilersheating/>
- 'An Introduction to Low Carbon Domestic Refurbishment' Construction Products Association (2010) [http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20\(low%20res\).pdf](http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20(low%20res).pdf)
- <http://www.beama.org.uk/en/news/index.cfm/tacma%20publication>

Case Study

The Retrofit for the Future property at Lothrop Street is trialling an intelligent fully automatic heating controller which senses when the house is occupied, and learns heating preferences meaning that occupants do not need to programme the timer. The Wattbox is being deployed in a number of the Technology Strategy Boards Retrofit for the Future projects. It also has the capability to monitor a range of other inputs such as humidity and CO₂ levels and functions with other smart meters.



The Wattbox in Lothrop Street

Micro Combined Heat and Power (CHP)

				Permissions and consents		
Does Building Regs apply?	Is this work a requirement triggered by Part L1B? http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADL1B_2010.pdf	Disruption	Risks	Unlisted within a conservation area	Listed building	Unlisted outside a conservation area
Yes - Installer must be on the Gas Safe Register.	Heating systems are a 'controlled service' under Part L1B. Work should comply with the "Domestic Building Services Compliance Guide". http://www.planningportal.gov.uk/uploads/br/domestic_building_compliance_guide_2010.pdf	Medium-High	Low	In a conservation area, a flue for CHP on a dwellinghouse (here including flats) would be permitted development except where it is more than 1m above highest part of roof or a wall or roof slope which fronts a highway. ^{xliv}	Listed building consent would be required for the flue and for any internal alterations. The flue should be positioned in a visually discreet location on the rear elevation.	Planning permission for a flue for CHP on a dwellinghouse (here including flats) not normally required, and the flue will be permitted development up to a maximum of 1m above highest part of the roof. ^{xlv}



Micro Combined Heat and Power (CHP) is a relatively new technology which is still being trialled, but has good potential to replace domestic gas boilers. A Micro CHP system produces electricity at point of use, and makes use of the heat produced as a by-product, which would ordinarily be wasted. Because it doesn't require distribution it is highly efficient. Generally it is best suited to properties with a high heat demand, such as hotels or guest houses to make it most economic, and it could be considered as part of a major refurbishment.

When to do this: It is advisable to install this generally in properties that have a high demand for heat and hot water, as this will make it most economic.

Case Study

Micro CHP is being trialled in the Lothrop Street property to determine whether this is viable where solar thermal panels are not a possibility. It is anticipated that this will produce around 300w of electricity per hour when the unit is producing heat or hot water, which is enough to run the TV, washing machine, low energy lighting and MVHR (Mechanical Ventilation with Heat Recovery).

Costs: Although initial costs will be higher than purchase of a condensing boiler the Micro CHP can reduce fuel bills if you opt to utilise electricity when heating is on. It does also attract Feed-In Tariff payments and enables sale back to the grid of excess energy generated.

Micro CHP	Unit	Cost (lower)	Cost (Upper)	Cost (average)	Subsidies (refer to EST website for latest info ⁴⁶)
Micro CHP ⁴⁷	Per average domestic system	£4000	£5000	£4500	Enhanced Capital Allowances

For further information see:

- Combined Heat and Power Association: <http://www.chpa.co.uk>
- 'An Introduction to Low Carbon Domestic Refurbishment' Construction Products Association (2010) [http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20\(low%20res\).pdf](http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20(low%20res).pdf)

Ground source heat pumps

				Permissions and consents		
Does Building Regs apply?	Is this work a requirement triggered by Part L1B? http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADL1B_2010.pdf	Disruption	Risks	Unlisted within a conservation area	Listed building	Unlisted outside a conservation area
Yes. A competent person scheme applies.	Heating systems are a 'controlled service' under Part L1B. Work should comply with the "Domestic Building Services Compliance Guide". http://www.planningportal.gov.uk/uploads/br/domestic_building_compliance_guide_2010.pdf	Medium-High	Low	Permitted development for dwellinghouses ⁴⁸ (including buildings wholly consisting of flats)	Listed building consent would be required.	Permitted development for dwellinghouses ⁴⁹ (including buildings wholly consisting of flats)

Ground source heat pumps consist of pipes underneath the ground which extract warmth to supply heating or hot water to a building. It consists of a loop of pipes filled with water and antifreeze, laid horizontally, in a trench or vertically (up to 100m deep). The fluid in the pipes warms up and passes through a heat exchanger in the heat pump converting it to high grade heat.

Heat pumps require electricity to run, so are not strictly speaking renewable, but are a low carbon source of energy. These are best suited to buildings that are fairly air-tight, with good insulation levels, and not on the gas-grid⁵⁰, as they produce less heat than a conventional boiler. Therefore it works better with underfloor heating than with radiators (which would become

warm rather than hot). Alternatively radiators would need to be oversized. When used to heat water a backup system may be required to provide top up heat.

Ground source heat pumps are 'permitted development' for dwellinghouses, although for listed buildings, listed building consent would be required, where the works affect the building's character as one of special architectural or historical interest.

Advantages: They can achieve reductions in fuel bills, particularly for customers previously on electricity, oil fired or LPG systems. They are low maintenance once installed.

Disadvantages: They work best in well insulated properties with underfloor heating – if this is not the case additional costs will be incurred.

Carbon savings may not be significant. They also require a certain amount of space externally.

Costs: Running costs vary depending on different factors including the level of insulation and size of property. The Government's renewable heat incentive (RHI) may benefit these installations in the future although it is specifically excluded from the start of the RHI.

Ground Source Heat Pump	Unit	Cost (lower)	Cost (Upper)	Cost (average)	Subsidies (refer to EST website for latest info ⁵¹)
Ground Source Heat Pump ⁵²	Per average domestic system	£9000	£17000	£13000	Renewable Heat Incentive

When to do this: This should be installed where there is appropriate heat demand, in a well insulated property preferably with underfloor heating.

For further information see:

- 'An Introduction to Low Carbon Domestic Refurbishment' Construction Products Association (2010)
[http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20\(low%20res\).pdf](http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20(low%20res).pdf)
- http://www.energysavingtrust.org.uk/Media/node_1422/Getting-warmer-a-field-trial-of-heat-pumps-PDF

Air source heat pumps

				Permissions and consents		
Does Building Regs apply?	Is this work a requirement triggered by Part L1B? http://www.planningportal.gov.uk/uploads/br/BR_PDF_AD_L1B_2010.pdf	Disruption	Risks	Unlisted within a conservation area	Listed building	Unlisted outside a conservation area
Yes. A competent person scheme applies.	Heating systems are a 'controlled service' under Part L1B. Work should comply with the "Domestic Building Services Compliance Guide". http://www.planningportal.gov.uk/uploads/br/domestic_building_services_compliance_guide_2010.pdf	Medium	Low	Permitted development from 1/12/2011 for dwellinghouses or a block of flats, subject to certain restrictions ⁵³ including their use only for heating, and limited to 1 per building. Air Source Heat Pumps which are not permitted development must conform to UDP Policy ENV7 Controlling Noise From Plant and Machinery and Internal Activity. Those which are permitted development should minimise effect on amenity of the area. One way of doing this is by complying with the noise standards in ENV7. Seek advice from acoustics team in Environmental Health for larger/noisier systems.	Listed building consent would be required. The external unit should be positioned in a visually discreet location on the rear elevation. Noise may be an issue where planning permission is required. Air Source Heat Pumps which are not permitted development must conform to UDP Policy ENV7 Controlling Noise From Plant and Machinery and Internal Activity. Those which are permitted development should minimise effect on amenity of the area. One way of doing this is by complying with the noise standards in ENV7. Seek advice from acoustics team in Environmental Health for larger/noisier systems.	Permitted development from 1/12/2011 for dwellinghouses or a block of flats subject to certain restrictions including their use only for heating ⁵⁴ and limited to 1 per building. Air Source Heat Pumps which are not permitted development must conform to UDP Policy ENV7 Controlling Noise From Plant and Machinery and Internal Activity. Those which are permitted development should minimise effect on amenity of the area. One way of doing this is by complying with the noise standards in ENV7. Seek advice from acoustics team in Environmental Health for larger/noisier systems.

Air source heat pumps take warmth from the air and use an evaporator coil to supply heating or hot water to a building. A system consists of an external unit, usually near a wall, though it can be located away from the building (requiring a clear amount of space either side for air circulation), and an internal unit with a hot water cylinder.

Air source heat pumps require electricity to run, so are not strictly speaking renewable, but are a low carbon source of energy, providing typically up to 4 units of heat for every unit of electricity. A conventional boiler produces around 0.8-0.9 units of heat from a unit of electricity. Performance varies by model but some models can work even at temperatures as low as -15°, (although below about 7°, a defrost cycle, which would effectively reverse the heat pump, using warmth from the house to defrost ice build up would impair performance).

These are best suited to buildings that are fairly air-tight, with good insulation levels, and not on the gas-grid⁵⁵, as they produce less heat than a conventional boiler. Therefore it works better with underfloor heating than with radiators (which would become warm rather than hot). Alternatively radiators would need to be oversized. They may also be used to heat water, in which case a backup system may be required to provide top up heat. Air source heat pumps can be noisy which means they are not suitable in all instances. Air Source Heat Pumps must comply with the requirements of MCS Planning Standards in order to be permitted development.

Advantages: They can achieve reductions in fuel bills, particularly for customers previously on electricity, oil fired or LPG systems.

Disadvantages: They work best in well insulated properties with underfloor heating (which is designed for low temperature system) – if this is not the case additional costs will be incurred.

Carbon savings may not be significant.

Costs: Running costs vary depending on different factors including the level of insulation and size of property. The Government's renewable heat incentive (RHI) may benefit these installations in the future although it is specifically excluded from the start of the RHI.

Air Source Heat Pump	Unit	Cost (lower)	Cost (Upper)	Cost (average)	Subsidies (refer to EST website for latest info ⁵⁶)
Air Source Heat Pump ⁵⁷	Per average domestic system	£6000	£10000	£8000	Renewable Heat Incentive

When to do this: This should be installed where there is appropriate heat demand, in a well insulated property preferably with underfloor heating.

For further information see:

- 'An Introduction to Low Carbon Domestic Refurbishment'
Construction Products Association (2010)
[http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20\(low%20res\).pdf](http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20(low%20res).pdf)
- http://www.energysavingtrust.org.uk/Media/node_1422/Getting-warmer-a-field-trial-of-heat-pumps-PDF

Solar photovoltaic system (PV electric panels)

Does Building Regs apply?	Is this work a requirement triggered by Part L1B?	Disruption	Risks	Permissions and consents		
				Unlisted within a conservation area	Listed building	Unlisted outside a conservation area
Yes. Although there is a competent persons scheme, ensure installer is qualified to advise on roof structural and weatherproofing aspects too or contact Building Control for advice.	No, it is covered under Part P as an electrical installation.	Medium	Medium – Specialist installation advice needed and possibly a feasibility study or structural survey to ensure the roof structure will bear the weight of the panels. Have a supply of replacement roof tiles in case these are broken during installation.	<p>This is permitted development^{lviii}, even on the roofs of principal elevations of dwellinghouses and flats in conservation areas, subject to it being 'sited so as to minimise its effect on the external appearance of the building and the amenity of the area', i.e. where there are alternative options for installation, the location which minimises the visual and amenity impacts must be selected.</p> <p>Would not be permitted development:</p> <ul style="list-style-type: none"> • If it protrudes more than 20cm from the roof slope; • If it is higher than the highest part of the roof (excluding chimney). • In a conservation area, on a wall which fronts a highway 	Listed building consent will be required and this will generally be acceptable in a discreet location, where not visible from surrounding properties (e.g. internal valley roof or flat wall behind a parapet).	This will not generally require planning permission as it is permitted development ^{lix} , on any roof or wall slope of dwellinghouses and flats, subject to it being 'sited so as to minimise its effect on the external appearance of the building and the amenity of the area', i.e. where there are alternative options for installation, the location which minimises the visual and amenity impacts must be selected. Not permitted development if it protrudes more than 20cm from roof slope or is higher than the highest part of the roof (excluding chimney).

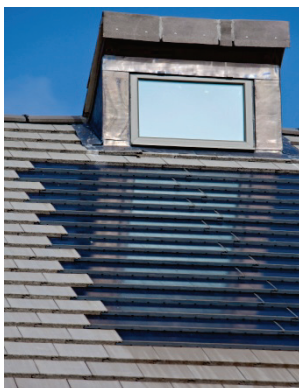
Solar PV panels convert energy from the sun into electricity. The installation of PV panels can significantly reduce CO₂ emissions, and help to reduce energy bills. The orientation of the roof is the critical factor in

determining maximum operational efficiency of solar PV panels. They should be as close to south facing as possible, and work best at an angle of 30° to the horizontal. They should not be shaded by trees or neighbouring buildings.

An alternative to conventional solar PV panels are solar roof tiles, which are designed to look similar to normal slate roofing tiles. These may be appropriate where the roof is not original – as they would replace existing roof fabric. Where historic fabric is retained solar panels would involve less loss of original roof tiles.



Panels on a roof at New Cavendish Street



Solarcentury.co.uk

For many properties, even flats in a conservation area this will be permitted development and will not require planning permission, although if you live in a listed building, this is not the case.

Costs: The original Feed in Tariff rates introduced in April 2010, offered a payback period of around 10-15 years for solar PV panels and the chance to generate income through selling excess electricity back to the national grid. Under this scheme energy suppliers make regular payments to householders and communities who generate their own electricity from renewable or low carbon sources such as solar PV panels. The scheme guarantees a minimum payment for all electricity exported to the grid, which is in addition to the bill savings made by using the electricity generated on site.

The Government has announced a significant reduction in Feed in Tariff rates, which cuts payments by around 50%. For more information see:

<http://www.energysavingtrust.org.uk/Generate-your-own-energy/Financial-incentives/Feed-In-Tariffs-scheme-FITs> and

further information available at Department of Energy and Climate Change website:

http://www.decc.gov.uk/en/content/cms/meeting_energy/Renewable_ener/feedin_tariff/feedin_tariff.aspx

Photo-voltaic (PV) electric panels	Unit	Cost (lower)	Cost (Upper)	Cost (average)	Subsidies (refer to EST website for latest info ⁶⁰)
Photo-voltaic (PV) electric panels ⁶¹		£13000	£15000	£14000	Feed in tariff

When to do this: For buildings which have an appropriate south facing roof slope the current feed in tariffs, which are open until 31 March 2012 offer payments for the next 25 years based on units generated of power generated although in November 2011 the Government announced consultation on reducing these tariffs.

Case Study: Clarence House

Client: Royal Household Property Section

Architect: BLB Architects Limited

An application was approved to install 32 solar panels on the roof of grade 1 listed Clarence House. These cannot be seen from the ground due to the roof slope and parapet walls. The purpose was both to reduce emissions of CO₂ and to raise the profile of this technology. The application notes that "Given that many other households do not have suitable roof space for a similar sized array, they are dependent on others, such as the HRH's Household, to contribute where they can towards a more sustainable, low carbon energy supply."

Case Study: 15 Passmore Street

Client: Grosvenor

Solar panels were installed at 15 Passmore Street, a property owned by Grosvenor. The solar panels cost £11.342 for a system size of 1.88KWp inclusive of installation, fees, VAT and warranty, which under the Feed-In-Tariff rate in force at the time of £0.41 would be expected to generate around £780/annum, based on an assumption that around 50% of electricity generated would power the site, with the remainder sold back to the grid. This gives a payback period of 14.5 years.



See page 54 for full case study overview

For further information see:

- 'An Introduction to Low Carbon Domestic Refurbishment' Construction Products Association (2010)
[http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20\(low%20res\).pdf](http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20(low%20res).pdf)
- http://www.climatechangeandyourhome.org.uk/live/content_pdfs/482.pdf

Solar thermal panels

Permissions and consents						
Does Building Regs apply?	Is this work a requirement triggered by Part L1B?	Disruption	Risks	Unlisted within a conservation area	Listed building	Unlisted outside a conservation area
Yes. Although there is a competent persons scheme ensure installer is qualified to advise on roof structural and weatherproofing aspects too or contact Building Control for advice.	<p>Heating systems are a 'controlled service' under Part L1B.</p> <p>Solar thermal water heating (consisting of indirect systems with a collector area of up to 20m² and a thermal store of no more than 440 litres) is covered by the "Domestic Building Services Compliance Guide", covers http://www.planningportal.gov.uk/uploads/br/domestic_building_compliance_guide_2010.pdf</p>	Medium	<p>Medium – Specialist installation advice needed and possibly a feasibility study or structural survey to ensure the roof structure will bear the weight of the panels. Have a supply of replacement roof tiles in case these are broken during installation.</p>	<p>This is permitted development⁶², even on the roofs of principal elevations of dwellinghouses and flats in conservation areas, subject to it being 'sited so as to minimise its effect on the external appearance of the building and the amenity of the area', i.e. where there are alternative options for installation, the location which minimises the visual and amenity impacts must be selected.</p> <p>Would not be permitted development:</p> <ul style="list-style-type: none"> • If it protrudes more than 20cm from the roof slope; • If it is higher than the highest part of the roof (excluding chimney). • In a conservation area, on a wall which fronts a highway 	Listed building consent will be required and this will generally be acceptable in a discreet location, where not visible from surrounding properties (e.g. internal valley roof or flat wall behind a parapet).	<p>This will not generally require planning permission as it is permitted development⁶³, on any roof or wall slope of dwellinghouses and flats, subject to it being 'sited so as to minimise its effect on the external appearance of the building and the amenity of the area', i.e. where there are alternative options for installation, the location which minimises the visual and amenity impacts must be selected. Not permitted development if it protrudes more than 20cm from roof slope or is higher than the highest part of the roof (excluding chimney).</p>

Solar thermal panels use the radiant heat of the sun to warm water in solar collectors which is pumped to a thermal store. It is most likely to be used to top up or supplement a main system, rather than meet all of a building's water heating demand. It is well suited to domestic buildings which have a demand for hot water. The minimum amount of space needed to be effective is around 2-4m², ideally between south east and south west facing, at an angle of 30° and should not be shaded by trees or neighbouring buildings. In addition to the collector panels, space is typically needed to house a large hot-water cylinder with a storage capacity of at least 120 litres, and up to 200-300 litres for larger buildings. Additional pipework will also be necessary.

There are different types of system, direct and indirect. Direct systems heat potable water in the collector panel, and pump it to a tank for use. Indirect systems are filled with fluid (often antifreeze) which passes through the collector panel and a heat exchanger transfers heat to potable water which is separate from the fluid circulating in the panels. This slightly more complex system provides freeze and overheating protection.

For many properties this will be permitted development and will not require planning permission, although if you live in a listed building, this is not the case.

Costs

Solar Thermal Panels	Unit	Cost (lower)	Cost (Upper)	Cost (average)	Subsidies (refer to EST website for latest info ⁶⁴)
Photo-voltaic (PV) electric panels ⁶⁵	Per average domestic system	£4500	£5500	£5000	Renewable Heat Incentive

When to do this: For buildings which have an appropriate south facing roof slope the renewable heat incentive, will offer a subsidy making this more financially attractive and reducing the payback period.

For further information see:

- 'An Introduction to Low Carbon Domestic Refurbishment' Construction Products Association (2010)
[http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20\(low%20res\).pdf](http://www.constructionproducts.org.uk/publications/dbfiles/Domestic%20Refurbishment%20Revised11010%20(low%20res).pdf)

Living roof

Does Building Regs apply?	Is this work a requirement triggered by Part L1B?	Disruption	Risks	Permissions and consents		
				Unlisted within a conservation area	Listed building	Unlisted outside a conservation area
No	No	Medium-High	Medium – Specialist installation advice needed and possibly a feasibility study or structural survey to ensure the roof structure will bear the weight of the substrate; permeability of roof membrane by plant roots, and that any height of balustrade is sufficient, and structure has sufficient capacity to bear the load, where it is used as amenity space, although this would be less likely to be viewed favourably.	<p>Planning permission required where depth of build up is greater than 150mm, which is fairly likely with a well designed living roof. However for dwellinghouses where the build up is less than 150mm and doesn't exceed highest part of the existing roof this is likely to be permitted development,⁶⁶ but this would be for flat roofs in a discreet location (not pitched roofs⁶⁷) but note proposals for 'intensive' living roofs which can be used as an amenity space would be less likely to receive permission.</p> <p>For flats planning permissions would be required.</p>	Listed Building Consent and Planning Permission will be required. May be acceptable on an existing flat roof in a discreet location such as behind a parapet wall.	<p>Planning permission required where depth of build up is greater than 150mm, which is fairly likely with a well designed living roof. However for dwellinghouses where the build up is less than 150mm and doesn't exceed highest part of the existing roof this is likely to be permitted development,⁶⁸ but this would be for flat roofs in a discreet location, (not pitched roofs⁶⁹) but note proposals for 'intensive' living roofs which can be used as an amenity space would be less likely to receive permission.</p> <p>For flats planning permissions would be required.</p>



Dashed line indicates difference of approach for flats and houses

Technologies have evolved to enable planted roofs – both ‘brown’ and ‘green’, ensuring they have an appropriate medium to grow in and the necessary support system. A well designed living roof will make a significant contribution to conserve and enhance biodiversity, creating green corridors. They also are beneficial in managing flood risk, as they attenuate rainwater, reducing the likelihood of flooding from surface water runoff. There is also some evidence that they act to reduce overheating (and reduce the urban heat island effect), reduce CO₂ emissions, absorb noise and trap air pollutants.

An intensive roof, which can bear the weight of people walking on it, will require a greater load bearing capacity, and this will be less achievable on historic buildings.

Costs: The cost of a living roof will vary depending on the type of roof and specification. The issue is considered in detail in the GLA technical report ‘Living Roofs and Walls: Technical Report supporting London Plan Policy’⁷⁰

Living Roof	Unit	Cost (lower)	Cost (Upper)	Cost (average)	Subsidies
Listed Building ⁷¹	For 20m ²	£2400	£6000	£4200	-

When to do this: A living roof is worth considering even when there are competing demands for roofspace, such as for solar panels. Solar PV can work very well with a living roof with the panels on a frame above a living roof. This has benefits of microclimate – the living roof helps to cool the PV panels, which can have problems if they overheat, and the shade that the panels provide on the living roof, create areas more hospitable to a wider range of biodiversity.

For further information see:

- www.livingroofs.org
- Environment Agency Green Roof Toolkit:
<http://www.environment-agency.gov.uk/business/sectors/91967.aspx>



Detail of solar array with secondary glazing visible, Grosvenor Plc

Case Study: 15 Passmore Street, SW1

Client: Grosvenor

Architect: GRA

Contractor: Grangewood

Environmental Consultant: Eight Associates

Goal: BREEAM Ecohomes 'Excellent'

The property, originally a one bedroom cottage, was extended to become a two bedroom terrace house and the whole house was retrofitted to improve its sustainability. Although situated just outside a conservation area, the boundary of which runs down the middle of Passmore Street, the property was treated as if it were in a conservation area consistent with Council draft proposal in 2008. On completion it was awarded a BREEAM Ecohomes score of 78. The retrofit strategy included:

- A solar PV array sized to supply 1.88KWp on the roof
- New insulated roof, and insulation to floor
- Internal insulation to walls
- Secondary glazing to front, double glazing to the rear
- Bath replaced with single shower room
- Low water use fittings (9L shower and low flow sanitaryware)
- Low energy lighting in 75% of the house.
- Soft landscaping and rainwater collection



Secondary glazing at 15 Passmore Street, Grosvenor Plc



The completed property achieved a BREEAM Ecohomes score of 78.94%. The investment represented an extra over cost of 5-6% compared to a Grosvenor standard refurbishment, with the additional costs coming from PV panels, insulation elements and increased low energy lighting.



Case Study: The Flagship Home

Architect: ECD Architects; Rickaby Thompson

Contractor: Beechwood Property Renovations

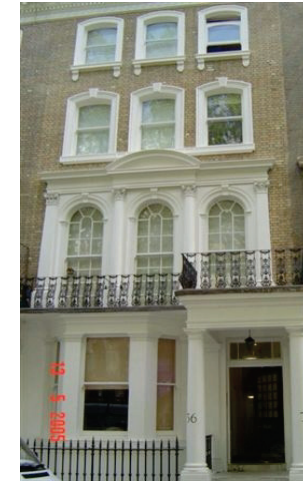
Client: SE Land and Estates with Royal Borough Kensington and Chelsea and City of Westminster

This 5 storey Victorian house, split into 23 bedsits, was in very poor condition with mould growth and damp problems. It was refurbished to improve its energy efficiency and meet space standards. The objectives included:

- To demonstrate and promote practical, cost effective energy efficiency improvements to private landlords.
- To demonstrate the potential for improving older, solid-walled properties in conservation areas.
- To encourage a closer working relationship between statutory bodies and building preservation organisations.
- To show how issues such as fuel poverty may be alleviated through improvements in energy efficiency.
- To provide an opportunity for the Royal Borough of Kensington and Chelsea and Westminster City Council to explore innovative measures, identify new ways of working and promote sustainable housing.
- To create a showcase for innovative energy efficiency solutions.



Improved interior finishes



Before and after refurbishment

The strategy included:

- Installation of 35 mm internal wall insulation to achieve a U value of $0.6\text{W/m}^2\text{K}$.
- Replacing rear windows with timber framed argon filled double glazing including low emissivity coatings and draught stripping and secondary glazing where possible at the front (not to the three arched windows).
- A new top floor incorporating a highly insulated roof enabling 3 further bedsits.
- Insulation to basement floor slab.
- Solar thermal panels to supply up to 60% of hot water.
- New condensing boilers with individually programmable room thermostats.
- Mechanical ventilation and heat recovery installed on each floor.
- Energy efficient lighting.



Installed Solar Thermal Panels on the roof

Performance

Further information on the specification is available from Energy Saving Trust⁷². Monitoring undertaken by Rickaby Thompson for a period of 19 months post completion suggests that assumptions made in the initial feasibility study about occupants' heating preferences were inaccurate. The actual consumption of electricity was 7% less than predicted, but gas consumption was 57% higher. A revised simulation model, taking into account more accurate details regarding occupancy, heating demand and internal temperature preferences demonstrated that to maintain the actual measured internal temperatures in the original unimproved building would have cost an additional £7450 and result in an additional 16.62 tonnes of CO₂. The user satisfaction ratings were also high with users feeling comfortable, with some scope for further temperature reduction.⁷³



Solid wall insulation and secondary glazing being installed at the property



Summary

Measure	Unlisted, within a conservation Area	Listed Building	Unlisted, No conservation area	See page
	For a dwellinghouse (not flats)			
Loft insulation	1	1	1	15
Floor insulation	1	2	1	18
Internal solid wall insulation	1	2	1	21
External solid wall insulation (on rear)	2	3	1	25
Draughtproofing	1	1	1	29
Secondary glazing	1	2	1	31
Double glazing	1	3	1	33
Boiler	1	2	1	36
Heating controls	1	1	1	38
Micro CHP	1	2	1	40
Ground Source Heat pumps	1	2	1	42
Air Source Heat pumps	2	2	2	44
Solar PV	1	2	1	47
Solar Thermal	1	2	1	50
Living Roof	1	2	1	52
	For flats			
Loft insulation	1	1	1	15
Floor insulation	1	2	1	18
Internal solid wall insulation	1	2	1	21
External solid wall insulation (on rear)	2	3	2	25
Draught Proofing	1	1	1	29
Secondary glazing	1	2	1	31

Double glazing	2	3	2	33
Boiler	2	2	2	36
Heating controls	1	1	1	38
Micro CHP	1	2	1	40
Ground Source Heat pumps	1	2	1	42
Air Source Heat pumps	2	2	2	44
Solar PV	1	2	1	47
Solar Thermal	1	2	1	50
Living Roof	2	2	2	52

- 1** Measure unlikely to require permission or consent; may be permitted development in some cases.
- 2** Measure likely to require planning permissions or consent and may be acceptable subject to detailed design.
- 3** Measure unlikely to be considered acceptable in most cases.

Westminster's Planning Policy

This guidance gives general advice on when planning permission is likely to be required, in order to assist homeowners in a bolder approach to retrofitting their historic buildings. Whether permission will be required in any individual case will usually depend on a number of factors, the key one being whether the building is listed.

This guide also sets out a number of permitted development rights that apply to unlisted buildings and which will enable a degree of freedom and flexibility in changes that you may make to your property. These are defined by the Town and Country Planning (General Permitted Development) Order 1995 and subsequent amendments. Remember that although these rights generally permit a householder to make changes to their property, these rights can be amended either by a planning condition or by an Article 4 direction.

Pre-application advice on the application process, likely options open to you and necessary supporting documentation can be given although there is a fee charged for this service. Contact the relevant area team for pre-application advice through the Council's website at <http://www.westminster.gov.uk/services/environment/planning/permission/>

Unitary Development Plan

The Council's UDP is being replaced by the Local Development Framework, but a number of its policies still apply. A full list of the policies which still apply may be downloaded from the Council's website:

<http://www.westminster.gov.uk/services/environment/planning/unitarydevelopmentplan/>

Those that may be of relevance to retrofitting projects include:

- STRA 34** Pollution: air, water and land
- ENV4** Planning around and on buildings
- ENV5** Air pollution
- ENV6** Noise pollution
- ENV7** Controlling noise from plant, machinery and internal activity
- ENV12** Waste and recycling storage
- ENV13** Protecting amenities, daylight, sunlight and environmental quality
- ENV17** Nature conservation and biodiversity
- DES1** Principles of urban design and conservation
- DES5** Alterations and Extensions
- DES6** Roof level alterations and extensions
- DES9** Conservation areas
- DES10** Listed buildings

The Local Development Framework

Westminster is producing its Local Development Framework to replace its Unitary Development Plan. The Local Development Framework, a 'portfolio' of documents which together provide a comprehensive local policy framework for the city. The Core Strategy is the key document in that portfolio, setting overarching policies. Further detailed policies will be set out in the City Management Plan, currently being prepared.

There are a number of key policies which are of relevance to applicants seeking to improve the energy efficiency of their property, including:

CS24 Heritage

'Recognising Westminster's wider historic environment, its extensive heritage assets will be conserved, including its listed buildings, conservation areas, Westminster's World Heritage Site, its historic parks including five Royal Parks, squares, gardens and other open spaces, their settings, and its archaeological heritage. Historic and other important buildings should be upgraded sensitively, to improve their environmental performance and make them easily accessible.'

CS27 Design

'Development must incorporate exemplary standards of sustainable and inclusive urban design and architecture. In the correct context, imaginative modern architecture is encouraged provided that it respects Westminster's heritage and local distinctiveness and enriches its world-class city environment.

Development should:

- Reduce energy use and emissions that contribute to climate change during the life-cycle of the development in line with national and regional standards as a minimum; and
- Ensure the reduction, reuse or recycling of resources and materials, including water, waste and aggregates.

This will include providing for an extended life-time of the building itself through excellence in design quality, high quality durable materials, efficient operation, and the provision of high quality floorspace that can adapt to changing circumstances over time.'

Other relevant policies include:

CS28 Health, Safety and Well-Being

CS29 Flood Risk

CS30 Air Quality

CS31 Noise

CS37 Biodiversity and Green Infrastructure

CS38 Decentralised Energy Networks

CS39 Renewable Energy

Supplementary Planning Guidance

Repairs and Alterations to Listed Buildings, (1996), Westminster City Council

Development and Demolition in Conservation Areas (1996), Westminster City Council

Roofs – A guide to Alterations and Extensions on Domestic Buildings (2004), Westminster City Council

Sustainable Buildings (2003), Westminster City Council

Notes and References

¹ Westminster Housing Condition Survey 2001

² http://www.decc.gov.uk/en/content/cms/legislation/energy_act2011/energy_act2011.aspx.

From 2018 landlords must bring all private rented housing and business premises up to an energy efficiency rating of 'E'. It will be unlawful to rent out premises which do not meet this standard.

³ Statistical release Carbon Dioxide emissions and local authority and regional level, 15th September 2011,

http://www.decc.gov.uk/en/content/cms/statistics/climate_stats/gg_emissions/uk_emissions/2009_laco2/2009_laco2.aspx

⁴ London Mayors 'Delivering London's Energy Future', Climate Change Mitigation and Energy Strategy <http://www.london.gov.uk/who-runs-london/mayor/publication/climate-change-mitigation-energy-strategy>

⁵ English Heritage, 'Conservation Principles Policies and Guidance' (2008) is available to download at <http://www.english-heritage.org.uk/publications/conservation-principles-sustainable-management-historic-environment/>

⁶ 'Energy Efficiency in Private Sector Flatted Buildings' 2010, ECD Architects on behalf of Westminster City Council and Dolphin Square Foundation. ECD Architects were commissioned to consider barriers to improving energy efficiency in private residential flatted buildings. This identified the difficulties for both lessees who may not make alterations without landlords consent, and also landlords, who cannot require lessees to make changes to their properties, or to pay for such changes. The report highlights the split incentive issue, in terms of the benefit of energy efficiency measures going to the occupant while costs are difficult to recharge to the occupant/leaseholder.

⁷ See the Energy Saving Trust website for ideas which will save energy and money at no cost:

www.energysavingtrust.org.uk

⁸ Energy Saving Trust

⁹ Energy Saving Trust

¹⁰ English Heritage, Climate Change and Your Home

¹¹ English Heritage, 'Energy Efficiency and Historic Buildings, Application of Part L of the Building Regulations to historic and traditionally constructed buildings', see www.english-heritage.org.uk/partL

¹² <http://www.energysavingtrust.org.uk/Easy-ways-to-stop-wasting-energy/Energy-saving-grants-and-offers>.

¹³ Costs Estimates from Sturgis Carbon Profiling and Samson Associates

¹⁴ Cost estimates prepared for the Committee on Climate Change by Element Energy: 'Uptake of Energy Efficiency in buildings' (2009) include capital and time costs of loft insulation installed in an 80m² property at the lower estimate represent installation on a DIY basis with upper end estimate being for installed cost.

¹⁵ English Heritage, 'Energy Efficiency and Historic Buildings, Application of Part L of the Building Regulations to historic and traditionally constructed buildings', see www.english-heritage.org.uk/partL

¹⁶ <http://www.energysavingtrust.org.uk/Easy-ways-to-stop-wasting-energy/Energy-saving-grants-and-offers>.

¹⁷ Cost estimates prepared for the Committee on Climate Change by Element Energy: 'Uptake of Energy Efficiency in buildings' (2009) include capital and time costs of floor insulation installed in an 80m² property at the lower estimate represent installation on a DIY basis with upper end estimate being for installed cost.

¹⁸ English Heritage, 'Energy Efficiency and Historic Buildings, Application of Part L of the Building Regulations to historic and traditionally constructed buildings', see www.english-heritage.org.uk/partL

¹⁹ <http://www.energysavingtrust.org.uk/Easy-ways-to-stop-wasting-energy/Energy-saving-grants-and-offers>.

²⁰ Costs Estimates from Sturgis Carbon Profiling and Samson Associates

²¹ Based on estimates from a range of sources including those prepared for the Committee on Climate Change by Element Energy of £5,600 (capital cost only) rising to £5,761 (including survey and time to empty room). Note this did not include costs of recommissioning electrics, redecorating or costs of removing/refitting a kitchen or bathroom. EST estimates a range of 5,500-8,500 and DECC estimate between £5000-7000. These all also exclude associated internal works to bathroom or kitchen and redecoration.

²² English Heritage, 'Energy Efficiency and Historic Buildings, Application of Part L of the Building Regulations to historic and traditionally constructed buildings', see www.english-heritage.org.uk/partL

²³ In line with DCLG Permitted Development for Householders Technical Guidance (January 2013)

²⁴ <http://www.energysavingtrust.org.uk/Easy-ways-to-stop-wasting-energy/Energy-saving-grants-and-offers>.

²⁵ Costs Estimates from Sturgis Carbon Profiling and Samson Associates

²⁶ Based on estimates from a range of sources including those prepared for the Committee on Climate Change by Element Energy £6,800, rising to £8,356 (which would include scaffolding costs for a two storey house), but not any recommissioning of electrics or redecorating costs. EST estimates a range of £10,500-14,500 for a three bedroom semi with gas heating.

²⁷ <http://www.energysavingtrust.org.uk/Easy-ways-to-stop-wasting-energy/Energy-saving-grants-and-offers>.

²⁸ Costs Estimates from Sturgis Carbon Profiling and Samson Associates, here based upon cost of refurbishing a sash window in a listed building.

²⁹ Based on cost estimates prepared by Keegans for the report: 'Energy Efficiency in Flatted Buildings', (ECD Architects on behalf of Dolphin Square Foundation and Westminster City Council), 2010, for professionally draughtproofing a sash window.

³⁰ English Heritage, 'Energy Efficiency and Historic Buildings, Application of Part L of the Building Regulations to historic and traditionally constructed buildings', see www.english-heritage.org.uk/partL

³¹ <http://www.energysavingtrust.org.uk/Easy-ways-to-stop-wasting-energy/Energy-saving-grants-and-offers>.

³² Costs Estimates from Sturgis Carbon Profiling and Samson Associates, here based upon cost of fixed lightweight seasonal secondary glazing taped for the lower estimate or a system with an independent frame with a sash style opening at the upper end of the estimate.

³³ English Heritage, 'Energy Efficiency and Historic Buildings, Application of Part L of the Building Regulations to historic and traditionally constructed buildings', see www.english-heritage.org.uk/partL

³⁴ As set out at Town and Country Planning (General Permitted Development) (Amendment) (No 2) (England) Order 2008 SI 2362, Part 1 Class A.3

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- ³⁵ Town and Country Planning (General Permitted Development) (Amendment) (No 2) (England) Order 2008 SI 2362, Part 1 Class A
- ³⁶ <http://www.energysavingtrust.org.uk/Easy-ways-to-stop-wasting-energy/Energy-saving-grants-and-offers>.
- ³⁷ Costs Estimates from Sturgis Carbon Profiling and Samson Associates, here based upon cost of refurbishing a sash window in a listed building.
- ³⁸ Town and Country Planning (General Permitted Development) (Amendment) (no.2) (England) Order 2008, SI 2362, Part 1 Class G.1
- ³⁹ Town and Country Planning (General Permitted Development) (Amendment) (No 2) (England) Order 2008 SI 2362, Part 1 Class A, A.1(i)(iii) and Part C, C.1(c)(i)
- ⁴⁰ <http://www.energysavingtrust.org.uk/Easy-ways-to-stop-wasting-energy/Energy-saving-grants-and-offers>.
- ⁴¹ Sturgis Carbon Profiling and Samson Associates
- ⁴² <http://www.energysavingtrust.org.uk/Easy-ways-to-stop-wasting-energy/Energy-saving-grants-and-offers>.
- ⁴³ Sturgis Carbon Profiling and Samson Associates.
- ⁴⁴ Sturgis Carbon Profiling and Samson Associates.
- ⁴⁵ Town and Country Planning (General Permitted Development) (Amendment) (England) Order 2011 SI 2056, Part 40, Class F
- ⁴⁶ Town and Country Planning (General Permitted Development) (Amendment) (England) Order 2011 SI 2056, Part 40, Class F
- ⁴⁷ <http://www.energysavingtrust.org.uk/Easy-ways-to-stop-wasting-energy/Energy-saving-grants-and-offers>.
- ⁴⁸ Sturgis Carbon Profiling and Samson Associates.
- ⁴⁹ Town and Country Planning (General Permitted Development) (Amendment) (England) Order 2011 SI 2056, Part 40, Class C
- ⁵⁰ Town and Country Planning (General Permitted Development) (Amendment) (England) Order 2011 SI 2056, Part 40, Class C
- ⁵¹ See the results of the EST field trial of heat pumps:
<http://www.energysavingtrust.org.uk/Generate-your-own-energy/Heat-pump-field-trial>
- ⁵² <http://www.energysavingtrust.org.uk/Easy-ways-to-stop-wasting-energy/Energy-saving-grants-and-offers>.
- ⁵³ Energy Saving Trust figures
- ⁵⁴ Subject to the restrictions and conditions set out at Class G.2 and G.3 in The Town and Country Planning (General Permitted Development) (Amendment) (England) Order 2011. In a conservation area this may not be on a wall or roof fronting a highway, and may not be sited so that it is nearer to any highway than the part of the dwellinghouse or block of flats which is nearest to the highway. It should be used for heating only, and should minimise its impacts on the external appearance and amenity of the area.
- ⁵⁵ Outside a conservation area an air source heat pump is not permitted development where it is installed on a wall which fronts a highway and is above ground level.
- ⁵⁶ See the results of the EST field trial of heat pumps.
- ⁵⁷ <http://www.energysavingtrust.org.uk/Easy-ways-to-stop-wasting-energy/Energy-saving-grants-and-offers>.
- ⁵⁸ Energy Saving Trust figures
- ⁵⁹ Town and Country Planning (General Permitted Development) (Amendment) (England) Order 2011 SI 2056, Part 40 Class A

⁶⁰ Town and Country Planning (General Permitted Development) (Amendment) (England) Order 2011 SI 2056, Part 40 Class A

⁶¹ <http://www.energysavingtrust.org.uk/Easy-ways-to-stop-wasting-energy/Energy-saving-grants-and-offers>.

⁶² Sturgis Carbon Profiling and Samson Associates.

⁶³ Town and Country Planning (General Permitted Development) (Amendment) (England) Order 2011 SI 2056, Part 40 Class A

⁶⁴ Town and Country Planning (General Permitted Development) (Amendment) (England) Order 2011 SI 2056, Part 40 Class A

⁶⁵ <http://www.energysavingtrust.org.uk/Easy-ways-to-stop-wasting-energy/Energy-saving-grants-and-offers>.

⁶⁶ Sturgis Carbon Profiling and Samson Associates.

⁶⁷ Schedule 2, Part 1, Town and Country Planning (General Permitted Development) (amendment) (No 2) (England) Order 2008, 'Development within the curtilage of a dwellinghouse', Class C 'Any other alteration to the roof of a dwellinghouse'.

⁶⁸ Schedule 2, Part 1, Town and Country Planning (General Permitted Development) (amendment) (No 2) (England) Order 2008 Class A 'The enlargement, improvement or other alteration of a dwellinghouse' A.3 (a) states that the materials used in any exterior work shall be of a similar appearance to those used in the construction of the exterior of the existing dwellinghouse. The CLG technical guidance offers some clarity suggesting that this would probably only apply to pitched roofs and that flat roofs would not need to accord with this, meaning that a pitched roof would not be permitted development.

⁶⁹ Schedule 2, Part 1, Town and Country Planning (General Permitted Development) (amendment) (No 2) (England) Order 2008, 'Development within the curtilage of a dwellinghouse', Class C 'Any other alteration to the roof of a dwellinghouse'.

⁷⁰ See note 67

⁷¹ <http://static.london.gov.uk/mayor/strategies/sds/docs/living-roofs.pdf>

⁷² Sturgis Carbon Profiling and Samson Associates.

⁷³ CE192 Making Private rented housing energy efficient – the Flagship Home case study, Energy Saving Trust (2006)

⁷⁴ Performance of the Flagship Home, Rickaby Thompson Associates, August 2007

Further Information

Contact **020 7641 2531** or see the planning permissions section of the council's website at www.westminster.gov.uk/services/environment/planning/permission for information on obtaining pre-application advice.



City of Westminster

