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## APPENDIX A: Extensions and external alterations - issues to consider

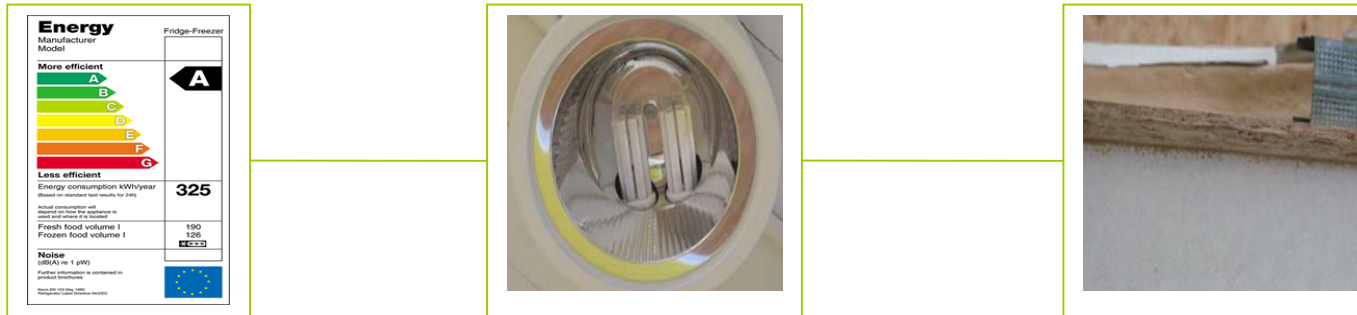
### *Building design and construction professionals*

If you have decided to make your construction project sustainable by design, you may wish to appoint an architect or builder with 'green' credentials.

Topic	Design consideration/ measure	Further information/ support
Building design and construction professionals	<ul style="list-style-type: none"><li>Find an architect or builder that has knowledge and understanding of sustainable building design and construction</li></ul>	<p><b>Useful organisations:</b> The following organisations and associations provide registers and advice:</p> <ul style="list-style-type: none"><li>The Association for Environment Conscious Building (AECB) Tel: 01559 370908 <a href="http://www.aecb.net">www.aecb.net</a></li><li>The Green Register of Construction Professionals Tel: 020 7582 9191 <a href="http://www.greenregister.org">www.greenregister.org</a></li><li>The Royal Institute of British Architects (RIBA) Client Services Tel: 020 7307 3700 <a href="http://www.riba.org">www.riba.org</a></li></ul>

## Energy efficiency

One quarter of the UK's carbon dioxide emissions every year originate from the energy we use to heat and light our homes. When building an extension or converting your loft, you have the opportunity to exceed building regulation standards for energy efficiency, thereby saving carbon dioxide and money on fuel bills, and creating a more comfortable living environment.



Left to right: Energy performance label, low energy lighting, foam insulation

The Energy Saving Trust manages the Energy Efficiency Best Practice Programme for Housing. This programme has produced a range of reference materials that provide up to date information on energy efficiency for domestic projects. Many of these publications are referred to in the table below and can be downloaded at [www.est.org.uk/housingbuildings/professionals/](http://www.est.org.uk/housingbuildings/professionals/).

Topic	Design consideration/ measure	Further information/ support
Overall building form (domestic extensions)	<ul style="list-style-type: none"> <li>Reduce ratio of heat loss area (e.g. exposed elements) to floor area</li> <li>Aim to make extension 'renewables-ready' (e.g. south-facing pitched roof will permit use of solar technologies)</li> </ul>	<p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li><i>Energy efficient domestic extensions (CE122)</i> <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></li> </ul>

Topic	Design consideration/ measure	Further information/ support
<b>Glazing proportions (domestic extensions)</b>	<ul style="list-style-type: none"> <li>• Avoid excessive glazing to prevent heat loss and overheating<sup>1</sup></li> <li>• Rooms with southerly orientation should be designed with shaded glazing (to exclude high-angle summer sun) and good ventilation (to remove summer heat gains)</li> </ul>	<p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>• <i>Energy efficient domestic extensions (CE122)</i> <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></li> </ul>
<b>Conservatories</b>	<ul style="list-style-type: none"> <li>• Consider construction of a 'sun room' space (in place of a conservatory) with an opaque, well insulated roof (perhaps incorporating some roof windows) and partly glazed walls</li> </ul> <p>Where a conservatory is to be constructed:</p> <ul style="list-style-type: none"> <li>• Do not provide heating to it</li> <li>• Ensure that the conservatory is separated from the main building and that its elements are well insulated</li> </ul>	<p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>• <i>Energy efficient domestic extensions (CE122)</i> <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></li> </ul>
<b>Insulating roofs, walls, floors, windows, doors and rooflights (domestic extensions)</b>	<p>Good elemental U-value standards for exposed elements should be achieved.</p> <p>The <b>U-value</b> of a construction is its thermal transmittance, in W/m<sup>2</sup>K.</p> <p>The more insulation a construction contains, the lower the U-value; in other words a building incorporating elements with low U-values will be more energy efficient than one with high U-values.</p> <p>Thus thermal insulation standards for building elements are usually expressed as maximum permissible U-values.</p>	<p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>• An example specification for masonry walls achieving a U-value of 0.25W/m<sup>2</sup>K would be:</li> </ul> <p>Brick outer leaf, 110mm cavity filled with mineral wool, 115mm high performance insulating block (conductivity 0.11W/m<sup>2</sup>K) and plasterboard on dabs (partial fill)</p> <p>Or:</p> <p>Brick outer leaf, 110mm cavity (50mm clear, 60mm rigid phenolic insulation), 115mm high performance insulating block (conductivity 0.11W/m<sup>2</sup>K) and plasterboard on dabs. Apply 50mm (minimum) of compressed mineral wool over the wall and ensure that loft insulation meets wall insulation.</p>

<sup>1</sup> While excessive glazing should be avoided, inadequate glazing (i.e. windows that are too small) can lead to rooms that are gloomy and excessive use of lights during the day. An energy efficient extension will include an appropriate amount of glazing, and the proportion of glazing on sides facing in different directions will need to be different.

Topic	Design consideration/ measure	Further information/ support																				
	<p>Preferable:</p> <ul style="list-style-type: none"> <li>Achieve Energy Saving Trust Best Practice elemental U-value standards for exposed elements:</li> </ul> <table border="1" data-bbox="483 488 1099 759"> <thead> <tr> <th>Exposed element</th> <th>Maximum U-value (W/m<sup>2</sup>K)</th> </tr> </thead> <tbody> <tr> <td>Roofs</td> <td>0.13</td> </tr> <tr> <td>Walls</td> <td>0.25</td> </tr> <tr> <td>Floors</td> <td>0.20</td> </tr> <tr> <td>Windows, doors and rooflights</td> <td>1.80 (weighted average for all openings)</td> </tr> </tbody> </table> <p>Mandatory:</p> <ul style="list-style-type: none"> <li>Achieve maximum elemental U-value standards for exposed elements as outlined in Building Regulations.</li> </ul> <table border="1" data-bbox="483 991 1099 1278"> <thead> <tr> <th>Exposed element</th> <th>Maximum U-value (W/m<sup>2</sup>K)</th> </tr> </thead> <tbody> <tr> <td>Roofs</td> <td>0.20</td> </tr> <tr> <td>Walls</td> <td>0.30</td> </tr> <tr> <td>Floors</td> <td>0.22</td> </tr> <tr> <td>Windows, doors and rooflights</td> <td>1.80 windows &amp; rooflights 2.2 doors (weighted average for all openings 2.2)</td> </tr> </tbody> </table>	Exposed element	Maximum U-value (W/m <sup>2</sup> K)	Roofs	0.13	Walls	0.25	Floors	0.20	Windows, doors and rooflights	1.80 (weighted average for all openings)	Exposed element	Maximum U-value (W/m <sup>2</sup> K)	Roofs	0.20	Walls	0.30	Floors	0.22	Windows, doors and rooflights	1.80 windows & rooflights 2.2 doors (weighted average for all openings 2.2)	<ul style="list-style-type: none"> <li>Example specifications for walls and all other building elements, including roofs, floors and windows, can be found in:  <i>Energy efficient domestic extensions (CE122)</i> <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></li> </ul>
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<p><b>Insulating roofs, walls (existing and new), windows and rooflights (loft conversions)</b></p>	<p>Good elemental U-value standards for exposed elements should be achieved.</p> <p>The <b>U-value</b> of a construction is its thermal transmittance, in <math>W/m^2K</math>.</p> <p>The more insulation a construction contains, the lower the U-value; in other words a building incorporating elements with low U-values will be more energy efficient than one with high U-values.</p> <p>Thus thermal insulation standards for building elements are usually expressed as maximum permissible U-values.</p> <p>Preferable:</p> <ul style="list-style-type: none"> <li>Achieve Energy Saving Trust Best Practice elemental U-value standards for exposed elements:</li> </ul> <table border="1" data-bbox="481 917 1099 1182"> <thead> <tr> <th>Exposed element</th> <th>Maximum U-value (<math>W/m^2K</math>)</th> </tr> </thead> <tbody> <tr> <td>Roofs</td> <td>0.13</td> </tr> <tr> <td>Walls</td> <td>0.25</td> </tr> <tr> <td>Floors</td> <td>0.20</td> </tr> <tr> <td>Windows, doors and rooflights</td> <td>1.80 (weighted average for all openings)</td> </tr> </tbody> </table>	Exposed element	Maximum U-value ( $W/m^2K$ )	Roofs	0.13	Walls	0.25	Floors	0.20	Windows, doors and rooflights	1.80 (weighted average for all openings)	<p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>For advice on achieving Best Practice U-values for domestic roof space conversions:</li> </ul> <p><i>Energy efficient loft extensions (CE120)</i>  <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></p>
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<p><b>Limiting thermal bridging and air leakage</b></p>	<p>A <b>thermal bridge</b> is created when materials that are poor insulators come in contact, allowing heat to flow through the path created.</p> <p>Insulation around a bridge is of little help in preventing heat loss or gain due to thermal bridging; the bridging has to be eliminated, rebuilt with a reduced cross-section or with materials that have better insulating properties, or with an additional insulating component (a thermal break).</p> <p>Broadly speaking, the fabric of the dwelling should be constructed so that:</p> <ul style="list-style-type: none"> <li>There are no gaps or significant thermal bridges/ heat</li> </ul>	<p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li><i>Limiting thermal bridging and air leakage: robust construction details for dwellings and similar buildings</i> <a href="http://www.est.org.uk/housingbuildings/regulations/englandandwales/installersbuilders/">www.est.org.uk/housingbuildings/regulations/englandandwales/installersbuilders/</a></li> </ul>										

Topic	Design consideration/ measure	Further information/ support
	<p>leaks in the insulation layer(s) that could potentially compromise the integrity of the insulation;</p> <ul style="list-style-type: none"> <li>• There are no significant thermal bridges at junctions between elements (i.e. between the wall and floor or wall and roof) and around openings such as windows and doors</li> <li>• Request that your appointed architect and builder adopt the ‘accredited (formerly robust) construction details’ illustrated in Limiting thermal bridging and air leakage: robust construction details for dwellings and similar buildings</li> </ul>	
<p><b>Windows and doors</b></p>	<p>The British Fenestration Rating Council (BFRC) energy performance label (graded from A to G, with A being the highest performing) can help you determine how well a product will perform the functions of:</p> <ul style="list-style-type: none"> <li>• Helping you contain and conserve heat within your building in the winter</li> <li>• Cooling it in summer</li> <li>• Keeping out the wind</li> <li>• Resisting condensation</li> </ul> <p>Recommended practice:</p> <ul style="list-style-type: none"> <li>• Select windows with an energy rating of ‘A’, ‘B’ or ‘C’ as determined by the British Fenestration Rating Council (BFRC)<sup>2</sup></li> <li>• Windows rated ‘C’ or above will typically have the</li> </ul>	<p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>• <i>Windows for New and Existing Housing: a summary of Best Practice (CE66)</i> and <i>Benefits of Best Practice: Glazing (CE14)</i> <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></li> <li>• The Energy Saving Trust manages a labelling scheme for products of proven energy efficiency, including windows. Endorsed products can be found at <a href="http://www.est.org.uk/myhome">www.est.org.uk/myhome</a>.</li> <li>• For further explanation of energy ratings for windows and doors and to find windows with high energy ratings visit <a href="http://www.bfrc.org">www.bfrc.org</a></li> </ul>

<sup>2</sup> Timber framed windows (where the wood comes from a certified sustainable source) are preferred. See *Sustainable Materials Specification* section for further information.

Topic	Design consideration/ measure	Further information/ support
	<p>following specification (available from the manufacturer): double or triple glazed, argon filled and have a U-value of 1.5 or lower</p> <ul style="list-style-type: none"> <li>• Ensure windows and external doors are weather-stripped and equipped with good quality locking mechanisms which ensure that seals are compressed when they are closed.</li> </ul>	
<b>Ventilation</b>	<p>Provide ventilation only when and where needed. For wet areas consider:</p> <ul style="list-style-type: none"> <li>• Extract ventilation fans controlled by humidistats, or wired to operate with light switches (with timed 'run on')</li> <li>• Energy efficient low power fans incorporating DC motors</li> <li>• Heat recovery room ventilators</li> <li>• Passive stack ventilation</li> </ul>	<p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>• <i>Energy efficient ventilation in housing: a guide for specifiers on the requirements and options for ventilation (GPG 268)</i> <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></li> </ul>
<b>Heating system and controls</b>	<p>Adopt recommended Energy Saving Trust Best Practice U-values in order that existing boiler has adequate capacity to heat the enlarged house. Where a new boiler is required:</p> <ul style="list-style-type: none"> <li>• Install a boiler of seasonal efficiency grade A or B (i.e. at least 90% efficient)<sup>3</sup></li> <li>• As per the building regulations: <ul style="list-style-type: none"> <li>○ Upgrade system to 'fully pumped' circulation if it is not already fully pumped</li> <li>○ Upgrade heating controls to include a programmer, a room thermostat and a thermostat on any hot water storage cylinder</li> <li>○ The room thermostat must be 'interlocked' to</li> </ul> </li> </ul>	<p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>• The seasonal efficiency (and efficiency grade) of a boiler may be obtained from the public boiler efficiency database at <a href="http://www.boilers.org.uk">www.boilers.org.uk</a></li> <li>• <i>Central heating system specification (CheSS) year 2005 (CE51)</i> <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></li> <li>• <i>Domestic heating by gas: boiler systems (CE30)</i> <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></li> </ul>

<sup>3</sup> Attention should also be paid to the Nitrous oxides (NOx) ratings for the boiler. NOx are emitted from the burning of fossil fuels and contribute to both acid rain and to global warming in the upper atmosphere. At ground level, they react to form ozone, a serious pollutant and irritant at low level.



Topic	Design consideration/ measure	Further information/ support
	<p>the boiler so that the boiler does not fire when there is no demand for heat</p> <ul style="list-style-type: none"> <li>• Ensure that rooms with internal or solar heat gains (i.e. bathrooms or rooms with south-facing glazing) have responsive heating controls, such as Thermostatic Radiator Valves (TRVs)</li> </ul>	
<p><b>Lighting</b></p>	<ul style="list-style-type: none"> <li>• Design lighting according to the use of the room</li> <li>• Consider the use of Compact Fluorescent Lamps (CFLs), a large range of which is available, including spot lamps, candle lamps and coloured lamps</li> </ul> <p><b>Compact fluorescent lamps:</b></p> <ul style="list-style-type: none"> <li>• CFLs last twelve times longer than conventional tungsten lamps</li> <li>• They use as little as 25 per cent of the energy used by tungsten bulbs</li> <li>• Good quality CFLs with ‘high-frequency ballasts’ light up instantly, don’t flicker, and produce full brightness quickly.</li> </ul> <p><b>Fluorescent tubes:</b></p> <ul style="list-style-type: none"> <li>• Contain high-frequency ballasts as standard, which avoids flicker</li> <li>• Dimmable high-frequency ballasts are available.</li> <li>• Slimline 26mm diameter fluorescent tubes give energy savings of around 8-10 per cent compared with older 38mm fluorescent tube for the same colour rendering, and are cheaper to buy.</li> <li>• They are suitable for kitchens, workshops and garages</li> </ul> <p><b>Tungsten halogen:</b></p> <ul style="list-style-type: none"> <li>• Only suitable for spotlighting/task lighting, and should not be used for general household lighting.</li> </ul>	<p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>• <i>Energy Efficiency Primer (CE101), Cost benefit of lighting (CE56), Low energy domestic lighting – summary guide (CE81), Energy efficient lighting – a guide for installers and specifiers (CE61) and Domestic lighting innovations (CE80)</i> <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></li> <li>• The Energy Saving Trust manages a labelling scheme for products of proven energy efficiency, including lighting fixtures and fittings. Endorsed products can be found at <a href="http://www.est.org.uk/myhome">www.est.org.uk/myhome</a>.</li> </ul>

Topic	Design consideration/ measure	Further information/ support
	<ul style="list-style-type: none"> <li>• They are 50-100 per cent more efficient than standard type bulbs and last about twice as long.</li> <li>• Often used for security lighting.</li> <li>• Many tungsten halogen lights operate at 12 volts and require a small transformer.</li> </ul>	
<b>Energy efficient appliances</b>	<ul style="list-style-type: none"> <li>• Where appliances/ white goods are being installed, choose 'A' rated energy efficient appliances</li> </ul>	<p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>• The Energy Saving Trust manages a labelling scheme for products of proven energy efficiency, including washing machines, fridges, freezers, dish washers and tumble dryers. Endorsed products can be found at <a href="http://www.est.org.uk/myhome">www.est.org.uk/myhome</a>.</li> </ul>

## Integration of renewable energy technologies

Renewable energy is energy derived from renewable or replaceable resources, such as the sun, wind, water and plant material. The building of a large extension may present an opportunity for the installation of renewable energy technologies. The table below lists these technologies. Information on indicative costs of systems and the grants available are provided in section 2.3.1.

Renewable energy should be integrated with energy efficient design and technologies for maximum benefit.



Left to right: Solar thermal collector, building-mounted wind turbine, ground loop for heat pump, solar PV panels, wood fuel heating

### Important:

- The potential to integrate renewable energy technologies is site specific (the presence of trees and other buildings can dramatically impair system performance) and expert advice should be sought from a consultant or qualified installer before proceeding with an installation.
- The installation of renewable energy technologies may be subject to planning permission. Contact the Council's planning department on 0845 612 2660 to find out whether your proposed scheme requires planning permission.

Topic	Design consideration/ measure	Further information/ support
Solar water heating	A solar thermal heating system used the sun's energy to heat fluid that can then be used to heat a hot water cylinder. Such a system may provide 100% of hot water requirements in the summer months and 50-70% of total annual demand.	<b>Useful organisations:</b> <ul style="list-style-type: none"> <li>• <i>Sunrise</i>, a not for profit scheme operated by Creative Environmental Networks (CEN) and endorsed by Richmond Council, can provide impartial advice and support with the installation of solar water</li> </ul>

Topic	Design consideration/ measure	Further information/ support
	<ul style="list-style-type: none"> <li>• Consider installation of solar water heating to provide 50 – 70% of annual hot water requirements               <ul style="list-style-type: none"> <li>○ Minimum 4m<sup>2</sup> unshaded roof area</li> <li>○ Solar thermal collectors should be ideally mounted on a roof with a tilt angle of 30 to 40 degrees</li> <li>○ In case of a flat roof, flat plate solar collectors can be mounted on A-frames. Alternatively, evacuated tube collectors can be installed</li> <li>○ Roof should ideally be south-facing, but systems facing southeast or southwest will also perform well</li> </ul> </li> </ul>	<p>heating systems Tel: 020 8683 6683</p> <p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>• <i>Renewable energy sources for homes in urban environments (CE69)</i> <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></li> <li>• <i>Solar water heating systems - conventional indirect models (CE131)</i> <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></li> </ul>
<b>Photovoltaics (PV)</b>	<p>Solar PV panels convert the light of the sun into electrical energy that can be used in the home or exported to the national grid.</p> <ul style="list-style-type: none"> <li>• Consider installation of a PV system (solar electricity) to provide a proportion of your home's electricity               <ul style="list-style-type: none"> <li>○ Minimum 8m<sup>2</sup> unshaded roof area</li> <li>○ PV panels should ideally be mounted at tilt angle of 30 to 40 degrees</li> <li>○ In case of a flat roof, PV panels can be mounted on A-frames</li> <li>○ Roof should ideally be south-facing, but systems facing southeast or southwest will also perform well</li> <li>○ There should be no overshadowing of the PV panels (for example by trees, other buildings or a satellite dish)</li> </ul> </li> </ul>	<p><b>See Appendix A for information on indicative costs and grants and the design parameters for the installation of a PV system.</b></p> <p><b>Useful organisations:</b></p> <ul style="list-style-type: none"> <li>• <i>Sunrise</i>, a not for profit scheme operated by Creative Environmental Networks (CEN) and endorsed by Richmond Council, can provide impartial advice and support with the installation of PV systems Tel: 020 8683 6683</li> </ul> <p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>• <i>Renewable energy sources for homes in urban environments (CE69)</i> <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></li> </ul>

Topic	Design consideration/ measure	Further information/ support
<p><b>Biomass heating</b></p>	<p><b>Biomass</b> refers to living and recently dead biological material that can be used as fuel.</p> <ul style="list-style-type: none"> <li>• Consider the installation of a stand-alone stove for space-heating of a room or a biomass boiler to supply central heating and hot water (only where primary heating system is being replaced) <ul style="list-style-type: none"> <li>○ For small-scale domestic applications of biomass the fuel usually takes the form of wood pellets, wood chips or wood logs</li> <li>○ Local fuel supply is critical (where system is to be truly renewable fuel should come from a sustainable source)</li> <li>○ Flue will be required for emissions</li> <li>○ For larger systems, significant fuel storage space may be necessary (dependent on fuel type)</li> <li>○ For primary heating systems, large space may be required for boiler (e.g. in garage/ utility room)</li> </ul> </li> </ul>	<p><b>See Appendix A for information on indicative costs and grants and the design parameters for the installation of a stove or woodfuel heating system.</b></p> <p><b>Useful organisations:</b></p> <ul style="list-style-type: none"> <li>• Creative Environmental Networks (CEN) can provide impartial advice and support with the installation of woodfuel heating systems Tel: 020 8683 6683</li> </ul> <p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>• <i>Renewable energy sources for homes in urban environments (CE69)</i> <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></li> <li>• Information on wood as a fuel and a list of suppliers of stoves, boilers and fuel can be found at: <a href="http://www.nef.org.uk/logpile/">www.nef.org.uk/logpile/</a></li> </ul>
<p><b>Ground source heat pump</b></p>	<p>A <b>heat pump</b> is a device that moves heat from one place to another. Generally, heat is moved from a low temperature source (in this case the heat stored in ground at a relatively constant temperature) to a higher temperature heat sink, for example, a domestic heating system.</p> <p>Typically, one unit of energy can be used to move three units of energy to a heating system, so the amount of energy needed to heat the building is a lot less than it would usually be.</p>	<p><b>See section 2.3.1 for information on indicative costs and grants and the design parameters for the installation of a ground source heating system.</b></p> <p><b>Useful organisations:</b></p> <ul style="list-style-type: none"> <li>• Creative Environmental Networks (CEN) can provide impartial advice and support with the installation of a ground source heating system Tel: 020 8683 6683</li> <li>• The National Energy Foundation (NEF) operate the ground source heat pump association <a href="http://www.nef.org.uk/gshp/index.htm">www.nef.org.uk/gshp/index.htm</a></li> </ul>

Topic	Design consideration/ measure	Further information/ support
	<ul style="list-style-type: none"> <li>• Consider the installation of a ground source heat pump (GSHP) to provide space and water heating to your home (only suitable where major refurbishment works are being undertaken, as GSHP works most efficiently with underfloor heating) <ul style="list-style-type: none"> <li>○ Requires underfloor heating</li> <li>○ Area of open ground for burial of ground loop in horizontal trench needed (typically over 500m<sup>2</sup> for a house with a floor area of 160m<sup>2</sup>).</li> <li>○ This area will be smaller if the ground loop can be housed in a vertical borehole, although the area will need to be accessible to a drilling rig for this to be feasible</li> <li>○ Economic and environmental case is currently only strong in off mains gas areas</li> </ul> </li> </ul>	<p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>• <i>Renewable energy sources for homes in urban environments (CE69)</i> <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></li> <li>• <i>Domestic Ground Source Heat Pumps: Design and installation of closed loop systems (CE82 / GPG339)</i> <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></li> </ul>
<p><b>Air source heat pump</b></p>	<p>Air source heat pumps use air outside the building as a source for heat. An air source heat pump can be fitted in a roof space or to the outside of a building.</p> <p>One unit of energy can be used to move a greater number of units of energy to a heating system (this number will drop as air temperature decreases), so the amount of energy needed to heat the building is a lot less than it would usually be.</p> <p>Consider the installation of an air source heat pump (ASHP) to provide space and water heating to your home (only suitable where major refurbishment works are being undertaken, as ASHP works most efficiently with underfloor heating)</p> <ul style="list-style-type: none"> <li>○ Requires underfloor heating</li> </ul>	<p><b>Useful organisations:</b></p> <ul style="list-style-type: none"> <li>• Creative Environmental Networks (CEN) can provide impartial advice and support with the installation of a ground source heating system Tel: 020 8683 6683</li> <li>• The National Energy Foundation (NEF) operate the ground source heat pump association <a href="http://www.nef.org.uk/gshp/index.htm">www.nef.org.uk/gshp/index.htm</a></li> </ul> <p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>• <i>Generate your own energy (EST)</i> <a href="http://www.energysavingtrust.org.uk/generate_your_own_energy">http://www.energysavingtrust.org.uk/generate_your_own_energy</a></li> <li>• <i>Heat Pump Network</i> <a href="http://www.heatpumpnet.org.uk">http://www.heatpumpnet.org.uk</a></li> </ul>

Topic	Design consideration/ measure	Further information/ support
	<ul style="list-style-type: none"> <li>○ Economic and environmental case is currently only strong in off mains gas areas</li> <li>○ Can be mounted on external wall</li> </ul>	
<b>Wind turbine</b>	<p>A wind turbine can be installed to harness the energy of the wind, converting it into electrical energy. Turbines can be mounted on a building or on a mast away from a building if sufficient space is available.</p> <p><b>Important:</b> It should be noted that the performance of building-mounted wind turbines is not proven and great caution should be exercised when considering installing one.</p> <ul style="list-style-type: none"> <li>• Consider the installation of a building-mounted wind turbine <ul style="list-style-type: none"> <li>○ Building structure must be sufficient to support the forces exerted by a wind turbine. Liaison with structural engineers is required</li> <li>○ There should be no obstruction to the south-west prevailing wind (e.g. by trees or other buildings).</li> <li>○ The speed of the wind arriving at a building-mounted turbine can be increased through a 'roof acceleration factor', which is maximised by designing a pitched rather than flat roof</li> </ul> </li> </ul>	<p><b>See section 2.3.1 for information on indicative costs and grants and the design parameters for the installation of a wind turbine.</b></p> <p><b>Useful organisations:</b></p> <ul style="list-style-type: none"> <li>• Creative Environmental Networks (CEN) can provide impartial advice and support with the installation of wind power systems Tel: 020 8683 6683</li> </ul> <p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>• <i>Renewable energy sources for homes in urban environments (CE69)</i> <a href="http://www.est.org.uk/housingbuildings/professionals/">www.est.org.uk/housingbuildings/professionals/</a></li> <li>• The British Wind Energy Association (BWEA) has published guidance on small scale wind <a href="http://www.bwea.com/small/index.html">www.bwea.com/small/index.html</a></li> </ul>

## Indicative costs and grants for renewable energy technologies

The indicative costs of renewable energy technologies and the grants available are correct at time of writing. The availability, source and value of grants will vary over time. For up to date information on costs of and grants for renewable energy technologies, contact the Energy Saving Trust ([www.est.org.uk](http://www.est.org.uk)):

**Tel:** 0800 512 012

The DTI's Low Carbon Buildings programme (LCBP) currently (at time of writing) provides grants for microgeneration technologies for householders, community organisations, schools, the public sector and businesses. The aim of the LCBP is to give a more holistic approach to reducing carbon emissions by demonstrating combinations of both energy efficiency measures and micro-generation products in a single development. For more information about the programme, contact CEN on 020 8683 6683.

Technology	Indicative cost	Typical payback period	% Grant available
Solar water heating	<b>£3,400, reducing to £1,500 for DIY. ('DIY' installations are not eligible for a grant)</b>	<b>Approx. 20 years (assumes grant)</b>	<b>Maximum £400 regardless of size subject to an overall 30% limit of the installed cost (exclusive of VAT)</b>
Solar photovoltaics (PV)	<b>£6,000-£7,000 per kWp</b>	<b>Approx. 35 years (assumes grant)</b>	<b>Maximum £3,000 per kWp installed, up to a maximum of £15,000 subject to an overall 50% limit of the installed cost (exclusive of VAT)</b>
Biomass (Wood fuel) heating - <b>Room heater/stoves (automated wood pellet feed) and Wood fuelled boiler systems</b>	<b>From £2,000 for a log stove to £6,000 - £10,000 for a pellet boiler</b>	<b>N/A - Too many variables to calculate 'typical' payback</b>	<b><u>Room Heater/Stoves automated wood pellet feed:</u> Maximum £600 regardless of size subject to an overall 20% limit of the installed cost (exclusive of VAT)</b> <b><u>Wood fuelled boiler systems:</u> Maximum £1,500 regardless of size subject to an overall 30% limit of the installed cost (exclusive of VAT)</b>



Technology	Indicative cost	Typical payback period	% Grant available
Ground source heat pump	<b>From £6,000 - £9,000 (or more if new heat distribution system is required)</b>	<b>N/A - Too many variables to calculate 'typical' payback</b>	<b>Maximum £1,200 regardless of size subject to an overall 30% limit of the installed cost (exclusive of VAT)</b>
Wind turbines (roof mounted)	<b>From £1,500 - £5,000 (roof mounted)</b>	<b>N/A - Too many variables to calculate 'typical' payback</b>	<b>Maximum £1,000 per kW installed, up to a maximum of £5,000 subject to an overall 30% limit of the installed cost (exclusive of VAT)</b>

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## **Water conservation**

The South East of England is one of the driest parts of the country and experiences high levels of water demand. In some areas the existing balance of supply to demand is very sensitive, with demand close to exceeding currently available sustainable supply. This issue can be addressed through use of water efficient sanitaryware and through installing simple measures such as a rainwater butt.



*Left to right: Low flow kitchen and bathroom taps, rainwater butt connected to drainpipe, dual flush WC*

30 - 40% of highly treated drinking water is flushed down the toilet. Rainwater harvesting systems capture rainwater from the roof of your home and once filtered the water collected can be channelled to your WC, washing machine or used for landscape watering. Grey water recycling systems collect waste water from sinks, baths, basins, showers and washing machines for reuse for non-potable purposes, usually for flushing WCs.

Covering driveways, gardens and patios with hard surfacing is increasingly popular, yet it prevents rainwater seeping into the ground, forcing the water to run off quickly into drains, or to pool on the surface. The cumulative effect of many small areas of impermeable surfacing has become an increasing problem across the borough. Sustainable Urban Drainage Systems (SUDS) allow rainwater to permeate safely into the ground, helping to maintain groundwater levels and reduce flooding.

**Important:** From October 2008, you may require planning permission to lay impermeable hard surfacing outside your home. Contact the Council's planning department on 0845 612 2660 to find out whether you need to submit a planning application for your proposed works.

Topic	Design consideration/ measure	Further information/ support
<b>WC</b>	<ul style="list-style-type: none"> <li>• Install 6/3 litre (or lower) dual flush WCs</li> </ul>	<p><b>Useful organisations:</b></p> <ul style="list-style-type: none"> <li>• Construction Resources is an ecological building centre based in London that stocks water efficient WCs 020 7450 2211 <a href="http://www.constructionresources.com">www.constructionresources.com</a></li> <li>• Green Building Store is an online resource selling water efficient WCs Tel: 01484 854898 <a href="http://www.greenbuildingstore.com">www.greenbuildingstore.com</a></li> <li>• <b>Further reference material:</b> The Environment Agency has produced a number of guides on water efficient sanitaryware and also lists suppliers on their web site <a href="http://www.environment-agency.gov.uk/subjects/waterres/286587/286911/548861/?version=1&amp;lang=_e">www.environment-agency.gov.uk/subjects/waterres/286587/286911/548861/?version=1&amp;lang=_e</a></li> </ul>
<b>Taps</b>	<ul style="list-style-type: none"> <li>• Consider use of a Tapmagic insert, which can be fitted to most taps with a round outlet hole or standard metric thread, or water-saving cartridges for single-lever mixer taps</li> <li>• Tapmagic unit converts the flow of water into a spray reducing the flow from a standard tap outlet to 2 litres per minute in the low flow mode. However, unlike other water saving devices, it also enables the user to receive a full flow of water as the tap is turned on further. <ul style="list-style-type: none"> <li>○ Replace the standard tap insert: the tap itself is not replaced</li> <li>○ DIY; No plumber is required</li> <li>○ Typically 52% water saving</li> </ul> </li> </ul>	<p><b>Useful organisations:</b></p> <ul style="list-style-type: none"> <li>• Green Building Store is an online resource selling water efficient taps Tel: 01484 854898 <a href="http://www.greenbuildingstore.com">www.greenbuildingstore.com</a></li> <li>• <b>Further reference material:</b> The Environment Agency has produced a number of guides on water efficient sanitaryware and also lists suppliers on their web site <a href="http://www.environment-agency.gov.uk/subjects/waterres/286587/286911/548861/?version=1&amp;lang=_e">www.environment-agency.gov.uk/subjects/waterres/286587/286911/548861/?version=1&amp;lang=_e</a></li> </ul>

Topic	Design consideration/ measure	Further information/ support
<b>Shower</b>	<ul style="list-style-type: none"> <li>Install reduced flow showers (&lt;10l per minute) with thermostatic mixers</li> </ul>	<p><b>Useful organisations:</b></p> <ul style="list-style-type: none"> <li>Green Building Store is an online resource selling water efficient showers Tel: 01484 854898 <a href="http://www.greenbuildingstore.com">www.greenbuildingstore.com</a></li> </ul> <p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>The Environment Agency has produced a number of guides on water efficient sanitaryware and also lists suppliers on their web site <a href="http://www.environment-agency.gov.uk/subjects/waterres/286587/286911/548861/?version=1&amp;lang=e">www.environment-agency.gov.uk/subjects/waterres/286587/286911/548861/?version=1&amp;lang=e</a></li> </ul>
<b>Rainwater harvesting</b>	<ul style="list-style-type: none"> <li>Consider the installation of a rainwater harvesting system for internal and external tasks where mains water would normally be used but water processed to meet strict drinking water standards is not required (e.g. WC flushing, landscape watering and washing machines)<sup>4</sup></li> </ul>	<p><b>Useful organisations:</b></p> <ul style="list-style-type: none"> <li>Construction Resources is an ecological building centre based in London that supplies rainwater harvesting systems 020 7450 2211 <a href="http://www.constructionresources.com">www.constructionresources.com</a></li> </ul> <p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>The Environment Agency has produced guidance on rainwater harvesting systems <a href="http://www.environment-agency.gov.uk/subjects/waterres/286587/511050/?lang=e">www.environment-agency.gov.uk/subjects/waterres/286587/511050/?lang=e</a></li> <li>The developer Gusto Homes has incorporated rainwater harvesting systems into many of its developments. Visit <a href="http://www.gustohomes.co.uk">www.gustohomes.co.uk</a> to find out more</li> </ul>

<sup>4</sup> There is unlikely to be an opportunity to install a rainwater harvesting or grey water recycling system unless major refurbishment and extension works are being carried out

Topic	Design consideration/ measure	Further information/ support
<b>Grey water recycling</b>	<ul style="list-style-type: none"> <li>Consider the installation of a grey water recycling system to collect waste water from sinks, baths, basins, showers and washing machines for reuse for non-potable purposes, usually for flushing WCs<sup>5</sup></li> </ul>	<p><b>Further reference material:</b></p> <ul style="list-style-type: none"> <li>The Environment Agency has produced guidance on grey water recycling systems <a href="http://www.environment-agency.gov.uk/subjects/waterres/286587/286911/548861/565687/?!ang=_e">www.environment-agency.gov.uk/subjects/waterres/286587/286911/548861/565687/?!ang=_e</a></li> </ul>
<b>Rainwater butts</b>	<ul style="list-style-type: none"> <li>Install rainwater butts to reduce mains water demand by collecting rainwater for landscape watering</li> </ul>	<ul style="list-style-type: none"> <li>N/A</li> </ul>
<b>Sustainable Urban Drainage Systems (SUDS)</b>	<ul style="list-style-type: none"> <li>If you are thinking of paving, or replacing your driveway, garden or patio, consider sustainable drainage by laying permeable paving that is simply designed with spaces between each block, to allow rainwater to pass through into the ground, rather than traditional impermeable surfacing.</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>

## ***Sustainable materials specification***

The maintenance of a healthy economy requires an adequate supply of minerals and related products to support housing and commercial development and key infrastructure projects. However, materials used for construction of buildings frequently cause environmental damage during their production. For example, quarrying damages landscape; wood can come from unsustainable sources; metals use significant amounts of energy in their production and PVC production results in atmospheric pollution. Reclaimed materials and products made from recycled material cause less environmental damage than new products and can also reduce refuse and land fill.

In order that the impact of construction materials on the environment is minimised, the following procurement hierarchy is often applied (where 1 is most desirable):

1. Reclaimed from on site demolition (e.g. reusing bricks as bricks)
2. Recycled from on site demolition (e.g. crushing bricks for sub-base use)
3. Reclaimed from other sites
4. High recycled content
5. Sustainable materials sources (e.g. natural insulation, certified timber, etc)
6. Materials with an “A” rating in the BRE Publication ‘Green Guide to Housing Specification’

This hierarchy can be applied to all manner of building projects, from large-scale housing developments to small-scale projects undertaken by homeowners.

Topic	Design consideration/ measure	Further information/ support
<b>Reclamation from on-site demolition</b>	<ul style="list-style-type: none"> <li>• Where a structure is being demolished as part of the construction process, consider whether any materials can be salvaged and reused on site (e.g. bricks as bricks)</li> </ul>	<ul style="list-style-type: none"> <li>• Discuss this opportunity with your architect and builder</li> </ul>
<b>Recycling from on site demolition</b>	<ul style="list-style-type: none"> <li>• Where a structure is being demolished as part of the construction process, consider whether any materials can be recycled and used on site (e.g. crushing bricks for sub-base use)</li> </ul>	<ul style="list-style-type: none"> <li>• Discuss this opportunity with your architect and builder</li> </ul>
<b>Reclamation from</b>	<ul style="list-style-type: none"> <li>• Investigate use of materials reclaimed from other sites</li> </ul>	<b>Useful organisations:</b>

Topic	Design consideration/ measure	Further information/ support
<b>other sites</b>	(e.g. procure materials from salvage yards)	<ul style="list-style-type: none"> <li>For reclaimed building materials and architectural salvage visit the Salvo Network's web site <a href="http://www.salvo.co.uk">www.salvo.co.uk</a></li> <li>Your builder should be able to source good quality used bricks</li> </ul>
<b>New materials with a high recycled content, preferably from local suppliers</b>	<ul style="list-style-type: none"> <li>Aim to use materials with a high recycled content (e.g. tiles, guttering, bricks and timber)</li> </ul>	<p><b>Useful organisations:</b></p> <ul style="list-style-type: none"> <li>London Remade manages the sustainable product directory, which provides a comprehensive database of sustainable products and suppliers with information on nearly 300 products, including building and construction materials <a href="http://www.londonremade.com/product/product_directory.asp">www.londonremade.com/product/product_directory.asp</a></li> <li>Construction Resources is an ecological building centre based in London 020 7450 2211 <a href="http://www.constructionresources.com">www.constructionresources.com</a></li> <li><a href="http://www.ecoconstruction.org">www.ecoconstruction.org</a> has a searchable database of recycled products with details of product manufacturing processes, their composition and suppliers.</li> <li>Ecomerchant Ltd in Kent is an environmental builder's merchant Tel: 01795 530130 <a href="http://www.ecomerchant.co.uk">www.ecomerchant.co.uk</a></li> <li>Green Building Store is an online resource selling environmentally friendly building materials Tel: 01484 854898 <a href="http://www.greenbuildingstore.com">www.greenbuildingstore.com</a></li> </ul>
<b>New materials from sustainable sources</b>	<p>Investigate use of natural materials for:</p> <ul style="list-style-type: none"> <li>Insulation</li> <li>Gutters/ facia</li> <li>Floorings</li> <li>Walls</li> <li>Paints</li> </ul> <p><b>Window and doors</b></p> <ul style="list-style-type: none"> <li>Avoid PVC window frames and doors</li> </ul>	<p><b>Useful organisations:</b></p> <ul style="list-style-type: none"> <li>Construction Resources is an ecological building centre based in London 020 7450 2211 <a href="http://www.constructionresources.com">www.constructionresources.com</a></li> <li>Ecomerchant Ltd in Kent is an environmental builder's merchant Tel: 01795 530130 <a href="http://www.ecomerchant.co.uk">www.ecomerchant.co.uk</a></li> <li>Green Building Store is an online resource selling environmentally</li> </ul>

Topic	Design consideration/ measure	Further information/ support
	<ul style="list-style-type: none"> <li>Choose timber windows and doors and ensure that the timber derives from a sustainably managed forest. Look for timber that complied with a government approved scheme or ask that your architect or builder specify timber of this kind Look for the Forest Stewardship Council's (FSC) 'tick tree' logo. This proves the timber or wood product comes from a well-managed forest. It is the only independently certified wood mark for sustainability. <a href="http://www.fsc-uk.info">www.fsc-uk.info</a></li> </ul> <p><b>Other timber products</b> Choose timber certified as being from a sustainably managed forest (e.g. FSC)</p>	<p>friendly building materials Tel: 01484 854898 <a href="http://www.greenbuildingstore.com">www.greenbuildingstore.com</a></p> <ul style="list-style-type: none"> <li>For natural and eco-friendly paints and other decorating materials visit: <a href="http://www.auro.co.uk">www.auro.co.uk</a> <a href="http://www.nutshellpaints.com">www.nutshellpaints.com</a> <a href="http://www.greenshop.co.uk">www.greenshop.co.uk</a></li> </ul> <p><b>Further reference material:</b> At present, the following schemes meet UK government requirements on legal and sustainable timber:</p> <ul style="list-style-type: none"> <li>The Canadian Standard Association (CSA)</li> <li>Forest Stewardship Council (FSC)</li> <li>Programme for the Endorsement of Forest Certification (PEFC)</li> <li>Sustainable Forestry Initiative (SFI)</li> </ul> <p>The Forest Stewardship Council (FSC) was one of the first independent labelling systems to be established and they provide guidance on their website of suppliers who have achieved full chain of custody approval (<a href="http://www.fsc-uk.info">www.fsc-uk.info</a>).</p>
<p><b>Materials with an "A" rating in the BRE Publication 'Green Guide to Housing Specification'</b></p>	<ul style="list-style-type: none"> <li>Aim to use materials rated 'A' or 'B' in the BRE <i>Green Guide to Housing Specification</i><sup>5</sup></li> </ul>	<ul style="list-style-type: none"> <li>The Building Research Establishment (BRE) has produced the <i>Green Guide to Housing Specification</i> - a simple reference guide to the environmental impacts of construction materials. This guide can be purchased through the BRE <a href="http://www.brebookshop.com">www.brebookshop.com</a></li> </ul>

<sup>5</sup> The BRE Green Guide provides environmental ratings for a range of common building materials. These ratings are based on the BRE Life Cycle Assessment and take into account issues such as energy and water used in manufacturing processes. The ratings are provided for new products only and not for materials with high recycled content.



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## **Green/ brown roofs**

Green or brown roofs are, in short, vegetated roofs, or roofs with vegetated spaces. They are also referred to as eco-roofs and roof gardens. They bring many benefits including:

- Reducing and managing rainwater run-off (thereby helping to prevent overloading of drainage systems and flooding)
- Improved thermal performance of building
- Reduction in sound transmission
- Improvement in air quality
- Reduction in the urban heat island effect
- Provision of habitat for native flora and fauna.

Topic	Design consideration/ measure	Further information/ support
Green/ brown roof	<ul style="list-style-type: none"><li>• Consider the installation of a green or brown roof</li></ul>	<p><b>Useful organisations:</b></p> <ul style="list-style-type: none"><li>• livingroofs.org is the first independent UK website to specifically promote green roofs: <a href="http://www.livingroofs.org/">www.livingroofs.org/</a></li></ul> <p><b>Further reference material:</b></p> <ul style="list-style-type: none"><li>• English Nature has developed a guidance note on Living Roofs. It covers not just the why and the how but also what wildlife you can hope to attract to a living roof on a domestic or garden building. A copy of this document can be downloaded from the livingroofs.org web site: <a href="http://www.livingroofs.org/livingpages/greenroofsdomestic.html">www.livingroofs.org/livingpages/greenroofsdomestic.html</a></li><li>• The following web sites also provide information on green and brown roofs: <a href="http://www.greenroofs.com">www.greenroofs.com</a> <a href="http://www.greenroof.co.uk">www.greenroof.co.uk</a></li></ul>