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| Building Control Guidance Note | Subject | HOUSEHOLDER GUIDE TO SUSTAINABLE DESIGN AND CONSTRUCTION OF BUILDING EXTENSIONS AND LOFT CONVERSIONS. | | | | | | 19 |
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WHY BOTHER?

As well as thinking about what materials to use and their impact on the environment, the emissions produced from energy we consume are also an important factor to consider.

Power stations burning fossil fuels to generate power generate greenhouse gases, which contribute to global warming.

Saving energy reduces energy demands and therefore reduces greenhouse gas emissions.

1. EXTENSIONS – LOCATION AND POSITIONING.

- a. Position your extensions so as to avoid cutting out of natural sunlight to both the rest of your home and your neighbour's home.
- b. Wherever possible use skylights and windows on southerly facing elevations, this brings more light and free warmth into your extension.
- c. Minimise windows on northerly elevations or make them smaller, which will help keep out the colder northerly winds and reduce the chance of greater heat loss.
- d. Provide shading in the form of blinds and curtains to avoid summer overheating and reduced heat loss in the winter.
- e. The smaller the external surface area of the building and its window area the less the heat loss the building will generate. You can reduce the exposure of the extension to the external environment by employing unheated intermediate spaces (thermal buffer), such as conservatories, porches, garage or draught lobby between the heated area and the outside.
- f. 'Passive Solar Energy' design involves designing buildings, so that they make the optional use of the energy freely available from solar heat, daylight and wind. So minimising the need to provide heating, lighting, ventilation and cooling by artificial means.

2. CONSERVATORIES USED AS A THERMAL BUFFER.

- a) Conservatories can help reduce heat loss from existing walls and windows that they cover.
- b) However, they can be a major source of energy loss, particularly if they are used for extended living accommodation in the winter and in the summer they can be a major source of overheating. To avoid this happening always separate with doors and insulate the conservatory from the main dwelling.
- c) Constructing your conservatory with at least double-glazing, insulated walls/ floors and insulated roof sheeting, will lengthen the time in the day and year, which it is comfortable to use it without heating.
- d) If heating is provided, it has been proved in certain circumstances to **double heating bills** of a well-insulated new dwelling. Ensure you have isolators on your conservatory heating system if running off the house heating system to allow it to be shut off or reduced in the winter to reduce energy wastage.

3. IMPROVING YOU WINDOWS.

If you have single glazing you are wasting money on heating, almost a 25% of heat lost from a home can be through poor insulated windows.

Double or triple glazing helps cut this heat loss; helps reduce condensation and outside noise, as well as saving your money on energy bills.

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If you are replacing your windows the Building Regulations require you to use insulated windows, double or triple glazed with low 'E' (low emissivity) glass to give a U-value of 1.6 w/m²K (*refer to our replacement windows guide note No. 5*).

On an un-insulated 3-bedroomed house you could make savings of £25 - £30 per year. www.est.org.uk (2002)

INSULATING PROPERTIES OF FRAMES

Picking the right window frame is important as it contributes to the overall insulating effectiveness of your windows and prevents condensation arising from thermal (cold) bridging.

Timber Frames - from a certifiable timber source are the best all round ecological solution. Timber is a sustainable resource if taken from properly managed forests and care is taken to pick ecological stains/paints.

UPVC Frames - are low maintenance but are difficult to repair and are difficult to dispose of. They are high in pollutants during manufacture and disposal.

Metal Frames - Conduct heat quickly and should be avoided unless they have a thermal break.

Remember - Planning Controls can restrict the use of UPVC / metal frames, for instance in conservation areas and listed buildings.

4. INSULATION.

Insulating your home is the most important of all energy conserving measures and it will have the best effect on your energy bills. By insulating a house properly, you can reduce by half the amount of heat loss. Besides the environmental benefits, there will be increase comfort and provide a more even temperature around your home. Also, it can allow your heating system to be scaled down.

By adding insulation to your existing house, especially if you go beyond the minimum requirements of the Building Regulations, when planning an extension, it could mean that you will not need to install expensive heating in your extension or loft conversion.

INSULATING MATERIALS

Current Building Regulations set minimum 'u' value requirements for all external elements of buildings (as well as requirements for elements separating the heated from the non-heated areas i.e. garages).

All new works must comply with these Standards (Refer to Guide Note series 24 for Building Regulations thermal insulation requirements). The type of insulation selected is equally as important in contributing to minimising the environmental impact.

The ecological problems associated with conventional insulation materials such as foamed glass, glass wool, mineral / rock wool, expanded / extruded polystyrene, rigid urethane foams, vermiculite, are numerous from their manufacturer through to their disposal. Natural alternatives are available for most situations, alternatives that set them apart from conventional materials and their impact on the environment is much less. For example, all natural insulation materials are made from renewable plant or animal sources, produced with low energy use, using natural additives, are biodegradable and have the ability to breathe (meaning they can absorb airborne moisture).

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ALTERNATIVE INSULATING METHODS:

Cellulose fibres (Warmcel) - made from processed waste paper, which is made into a fluff that can be placed by hand or sprayed. It is treated with fire retardant (borax).

Wool – renewable source just beginning to be used in buildings. Flax can be used in walls, roofs, floors and ceilings. Fibres are bound together with potato starch and has borax added for fire / insect protection.

Homatherm – board insulant made from recycled newspaper and jute sacking. Treated with borax to resist decomposition and to make it fire resistant.

METHODS OF INSULATING YOUR HOME.

WALL INSULATION.

Walls lose more heat than any other part of your home, anything up to 35% of all your lost heat.

Before insulating your walls, determine what sort of walls you have; are they solid or are cavity construction?

CAVITY WALL INSULATION.

Easy to do by reputable contractors for existing cavity wall construction, where insulation is injected from outside into the cavity by drilling small holes in the outer wall skin.

Installation causes little disruption and is relatively inexpensive considering the energy savings made. Can reduce heat losses by up to 60% on old cavity walls without insulating blocks in their construction. ***Please make sure you use a Competent Persons Scheme member for your installation.***

For new build walls – insulation materials are built into the walls as they are constructed. Always check and follow the manufacturer's recommendations on any installation.

NOTE: Professional installers will provide a 25-year guarantee and the work should be carried out by a qualified Energy Efficiency Installer who follows strict codes of practice. Consult www.est.org.uk

SOLID WALL INSULATION

Can be done externally or internally, but is usually more difficult and expensive to carry out.

Insulation can be fixed to the external face of the building and then a render coat to finish the walls off and provide a waterproof covering.

For internal applications, insulation is applied to the existing inner face of the wall, which will mean new wall finishes, skirtings, decoration, etc.

INSULATING YOUR ROOF.

Most buildings now have some degree of loft insulation, but many will be inadequately insulated.

Building Regulations now require a minimum of 270mm of fibreglass to roof voids, 100mm of quilt between the ceiling joists and 170mm over the top at 90° to lower insulation. It can easily be done as a DIY project, ***but a word of caution, ensure you maintain roof ventilation to the void above the insulation or you will have serious condensation problems.***

Various types of insulation can be used – mineral wall, slab insulation, even wool flax.

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Remember on insulating your roof:

- Insulate adequately all pipes and tanks in your loft, as the void will be that much colder as heat from below will not enter the roof void to prevent water freezing.
- Never insulate under a water tank, only around and above it, to assist in preventing it freezing.
- Remember to insulate your ceiling hatch and place draught sealing to its perimeter.
- By installing roof insulation you could save around 20% of your heating costs.

| Loft Insulation | Adding 200mm to existing 50mm of loft insulation | 25mm loft insulation where none present |
|-----------------------------|---|--|
| Cost of fitting (Installer) | £210 - £230 | £225 - £250 |
| Cost of fitting (DIY) | From £150 | From £200 |
| Annual saving | £20 - £30 | £80 – 100 |
| Cost recovered (Installer) | 7 – 11 years | Around 2 years |

Source: Energy Savings Trust – www.est.org.uk. (2002)

FLOOR INSULATION.

By sealing gaps between floorboards and skirting with mastic, this can help reduce your heating costs.

If you can access under your ground floors, you could save up to £25 per year by applying insulation between the floor joists; it will also make the floors feel warmer. **Remember do not block any under-floor airbricks in your outside walls to avoid rot in the floor construction.**

If you have floors over unheated areas, for example a bedroom over a garage, consider applying insulation between the floor joists. **Remember not to affect the floors fire resistance.**

5. DRAUGHT PROOFING.

Draughts entering your home in gaps around doors, windows, floors, can account for up to 20% of lost heat. Wherever you feel cold air coming in, warm air is going out.

So seal any gaps –

- Apply draught excluding tape to doors and windows.
- Fit draught excluder to base of doors and to the letterbox.
- Stripped wooden floors can be draughty in winter, so use large rugs.
- Seal gaps at base of skirtings at junction with floor with mastic – before carpeting.
- Seal around any pipes entering your house.

NOTE – Do not seal any air vents necessary for fire or boilers safe operation.

In addition to draught excluders, there are many ways that windows can be insulated at night.

- Use thick curtains and do not drape them over radiators, as this will funnel the heat out through the windows.
- Blinds/shutters also work well if fitted tight to the window opening.

You can get further advice from the Draught Proofing Advisory Association.

NOTE: If you draught proof and insulate your home, the risks of condensation problems can increase, so it is important that you have adequate ventilation. Fit bathroom / kitchen fans and trickle vents to your windows in accordance with the current Building Regulations to vent the warm moisture-laden air out of the home.

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6. HOT WATER TANKS AND PIPES.

By insulating your hot water tank and pipes, you will retain hot water for longer and save money on heating it. Insulate as many pipes as you can, especially below ground floors and between the boiler and the hot water cylinder.

If your tank has less than 75mm of insulation you will save energy if you fit another jacket over the existing one or replace it.

Insulate pipes in the loft to stop them freezing and bursting in cold weather. **NOTE: Always do this if you are insulating the roof.**

| | Fitting a Jacket to Hot Water Tank | Insulating Hot Water Pipes |
|-----------------------------|---|-----------------------------------|
| Cost of Fitting (DIY) | From £10 | From £10 |
| Annual Saving on Fuel Bills | £10 - £15 | Up to £5 |
| Cost Recovered | Up to 1 year | 2 years |

Source: Energy Savings Trust – www.est.org.uk

Monetary Savings from Insulation:

| | |
|------------------|------------------------|
| Loft Insulation | Savings of £35/year |
| Wall Insulation | Savings of £75/year |
| Hot Water Tank | Savings of £20/year |
| Hot Water Pipes | Savings of £5/year |
| Draught Proofing | Savings of £15-25/year |

Annual savings for average (uninsulated 3-bed semi) Source - Energy Savings Trust

Further Information on Insulation and Materials:

- Energy Savings Trust – www.est.org.uk
- Ecological building materials – Construction Resources Ltd., Tel: 020 74502211
Email: sales@ecoconstruct.com
- Draught Proofing Advisory Associations - Tel: 01428 654011

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7. HEATING SYSTEMS.

Heating our homes and hot water accounts for the vast majority of energy that is used domestically and also represents one of the greatest wastes of energy.

Outdated, oversized and inefficient heating systems do not make best use of the energy they use.

By considering replacing your heating system could save you money in the long run. But before making your decision consider the following: -

- (a) First insulate your houses roof and cavity walls, the greater the amount of insulation the smaller the heating system needs to be, thereby reducing its cost.
- (b) Our heating appliances / systems are not the only sources of heat within our homes. Other sources of heat such as lights, cookers, fridges, hot water and appliances can contribute to heating your home. If your home is insulated all this heat can be conserved and these additional sources then begin to provide a larger contribution to heating your home.
- (c) Consider solar heating as an option on you heating system (*see solar heating notes below*).
- (d) Boilers over 12 years old are likely to be losing 35p of every £1 spent on fuel, leaving less than $\frac{2}{3}$ rds in useful heat. Therefore it may be more economic to replace your old boiler.

BOILERS.

Picking the right boiler will make a big difference in terms of the environmental impact and on money you could save.

If you boiler is over 15 years old, replacing it with a modern boiler could save you 20% of your fuel bills, if you install a modern condensing boiler you could save around 32% of your fuel bills straight and up to 40% if you upgrade to modern heating controls i.e. thermostatic radiator valves / boiler stats / thermostats. If your extension or alteration works involve refitting bathrooms / kitchens why not minimise cost and disruption by fitting a new boiler. (Refer to Leaflet 23 – Condensing Boilers)

What type of system - Instant or stored water heating system?

This depends on the characteristics of the building and your family's life style e.g. number of people, frequency of use and how uneven the usage is.

INSTANTANEOUS WATER SYSTEMS.

- Basically there is no stored water i.e. hot storage cylinder and all hot water is heated as required by the boiler, typically called a combi boiler (combination boiler). The heating is switched on or ignited when water begins to flow through the unit.
- Requires less pipework, no space is needed for hot water cylinder and they require no cold-water tanks.
- Boilers are slightly more expensive, but payback is quicker as you do not heat water you do not require there and then.
- Good for small houses with small number of people.
- Good where system use is uneven and there is little requirement for multiple use i.e. when 2 or 3 people want to use hot water at same time.

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STORED WATER SYSTEMS.

- Traditional systems, with a hot water storage cylinder.
- Requires more pipework and equipment and usually costs more to install.
- Good for multiple usage at the same time and can be used for heat recovery technology.
- Can be used with solar panels / heat recovery systems.
- You are paying to heat water to stand there losing energy.
- More space and pipe work required for cylinders and tanks.
- The opposites of the instantaneous systems are true.

CONDENSING BOILERS.

These are the most efficient type of boilers and you will recoup your money back by lower fuel bills - even if they do cost more initially to purchase.

These are around 90% efficient, so 90% of fuel is converted into heat compared to 72% for a newer conventional boiler. Significantly less for older types).

They generally can be fitted to most new and old heating systems and are of a comparable size to the traditional types, though their flues need siting for the condensate exhaust not to re-circulate into the house.

Typical annual fuel costs.

| | Seasonal efficiency | Bungalow £ | Terrace £ | Semi £ | Detached £ |
|-----------------------------|---------------------|------------|-----------|--------|------------|
| Old boiler (heavy weight) | 55% | 324 | 337 | 381 | 541 |
| Old boiler (light weight) | 65% | 274 | 285 | 323 | 458 |
| New boiler (non-condensing) | 75% | 237 | 247 | 280 | 397 |
| New boiler (condensing) | 88% | 202 | 211 | 239 | 338 |

Source - www.est.org.uk

BOILER RATINGS.

Boilers are rated giving an average seasonal efficiency rating from **A - G** on how your boiler performs over the year. **Before buying a boiler check this rating.**

There is also a Building Regulation requirement special rating scheme called SEDBUK (Seasonal Efficiency or Domestic Boilers in the UK).

'A' rated boilers are the best at over 90% efficiency. Building Regulations require at least 88% efficiency.

Remember that regular annual servicing will prolong the useful and efficient life of your boiler and can prevent disasters.

Remember also all gas heating systems must be installed by a GasSafe registered installer.

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MAKING EFFICIENT USE OF HEAT AND HOT WATER SYSTEMS.

- Installing heating controls that allow you to control the temperature in different parts of your home makes sense. Controls such as electric timers (to control operation of both hot water and heating separately), room thermostats /thermostatic radiator valves (controls temperature in each individual room), zone control valves (allows zones with different heating demands such as living areas and bedrooms to have separate control) and boiler control interlocks (which switch off boiler when no heating is required).
- Insulate the pipes and the water tank.
- Reducing the temperature of the stored hot water by using a water tank thermostat and setting the lower temperature that will give you the hot water that you need.
- Savings on amount of water used by having spray fittings on taps and an adjustable showerhead.
- Insulate your bathroom to reduce heat loss when bathing.
- Recycling waste hot water through a heat pump to extract the heat before it is lost down a drain.

By having heating and hot water system controls you could save £60 to £120 per year depending on your boiler efficiency. Further information contact your local Energy Efficiency Advice Centre ring 0800 512 012.

Remember - new installations require Building Regulation applications.

8. SOLAR HEATING.

If you are thinking of replacing your heating, hot water or energy system why not consider solar energy as an environmentally sound alternative.

Two types could be considered: -

- (a) **Solar water heating** - fluid collections which are heated and then the fluid is circulated.
- (b) **Photovoltaic cells** - converts light energy to an electrical supply.

a) Solar Water Heating.

If you have a southerly facing roof then it might be worth considering solar water heating (subject to obtaining any necessary planning permissions).

A solar system can preheat water entering your conventional heating system and cut your fuel bills.

- A 3-5m² area will be needed for the average household.
- Solar heating systems can supply 50% of the hot water used.
- Typical savings are £50 - £150 per year.
- Current cost for installation are in region of £3000 - £4000 per system and it is possible for competent DIY persons to install one for approximately £1500.

Useful reference is - www.sustainable-energy.org.uk

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b) Solar Photovoltaic (PV).

This technology generates electricity from light and requires only daylight to work.

Being clean energy installing a Solar PV tiled roof, you could prevent over 34 tonnes of greenhouse gas emissions during its lifetime, helping to protect generations to come.

They are silent and maintenance free also forms part of your roof, and reduces your electricity bills.

Currently this technology is expensive and payback over its lifetime may not yet be achieved. However as more people use PV the prices will fall and some power companies may consider buying back any excess or off-peak electricity generated by PV roofs.

Planning Permission

For any roof installation always check whether or not planning permission is required for the installation.

9. LIGHTING AND HOUSEHOLD APPLIANCES.

A quarter of the UK's CO² emissions every year originate from the energy we use to heat and light our homes.

a) LIGHTING.

In most homes lighting accounts for 10-25% of the electricity bill - simple tasks like switching off lights can save energy and money.

Using energy saving bulbs / tubes, even though they have a higher initial cost, because of their longer life span to that of an equivalent regular bulb and lower running costs/energy used, you can see payback for the purchase within 6-9 months.

NOTE - Energy saving bulbs don't work with electronic seasons, dimmers and timers - always check with the manufacturers instructions first.

There are cheaper economy bulbs available, but they are not as efficient - choose good quality energy efficient bulbs or light fittings (look for Energy Efficiency Recommended logo when you buy).

Ensure that all you external lighting has controls that turn the lights off in daylight and shut them off after a specific period of time.

b) APPLIANCES.

Refer before purchasing for their energy efficiency recommended logo (European Energy Labels), these help you to choose more efficient products and save you money.

Most appliances are rated on a scale of 'A' to 'G' with 'A' being most efficient and 'G' the least. Normally these labels will show the energy/water consumed.

Not all appliances use the same energy to do the same job, older appliances will be less efficient than newer appliances that they would replace.

Energy efficient models use less power and costs less to run and help to save greenhouse emissions.

For further information consult Energy Efficiency Advice Centre 0800 512 012.

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10. DRAINAGE.

Generally your property will have one of the two following types of below ground level drainage systems.

- (i) **Combined** - Both foul and surface water are drained into the same drain i.e. only 1 pipe.
- (ii) **Separate** - Foul and surface water systems are drained to separate pipes - foul usually connects foul sewers going for treatment at the sewerage works. Surface water - usually connecting to pipes leading to natural water courses i.e. rivers, streams, ponds etc.

By connecting foul water to surface water drains on a separate system can lead to the pollution of the watercourses. ***Always make sure you connect foul water appliances to the foul drain.***

By connecting surface water drains to foul water drains on a separate system only results in the treatment of clean water.

Refer to guide note 12 - Drainage and waste disposal - Part H

SOAKAWAYS .

Consider the use of soakaways for small roof areas / paving areas that need to be drained.

NOTE: not all sites would allow the use of soakaways due to impervious ground conditions, also soakaways need careful positioning so as not to cause damage or nuisance. Always carryout a percolation test and speak to Building Control to check for their suitability.

RAINWATER BUTTS.

By collecting your roof water to water your garden it will not only save you money if you are on a water meter, it will also save the waste of valuable clean drinking water. Special rainwater pipe adaptors exist for under £10 that allows rainwater to be bypassed into rainwater butts and once full continues to discharge excess water into the drains.

11. SAVING WATER.

Water is a valuable asset and although it always seems to be plentiful, there are problems that are affecting all of us.

- Increasing contamination of ground water, lakes, rivers etc.
- Over use of water, leading to lowering water tables and reservoir levels.
- Changing climate conditions resulting in less rain.
- Many people now have metered water supplies so reducing water consumption will save money.

THINGS TO DO.

- (a) Household appliances - washing machines, account for about 14% of the water used in dwellings / kitchen sink / dishwashers account for approximately 8%. By considering purchasing new water saving appliances, water can be saved. Always check water efficiency EU labels on appliances.
- (b) Collect your rainwater water for garden use (see 'rainwater butts' above).

GREY WATER.

Every day a person uses on average 150 litres of water, of this 50 litres is used for the w.c. (1/3 rd of water used in the household consumption).

Grey water recycling systems now exist for single dwelling houses, which allow recycled grey water (waste water discharged from WHB's, baths, showers - but not w.c.'s) to be used for flushing the w.c.'s, thereby saving up to 1/3 rd of water used in the house.

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W.C. CISTERNS.

W.C. cisterns dams can be fitted inside the cistern of older w.c.'s, which usually have a higher flushing water capacity than modern w.c.'s.

Many low cost products exist, are easy to fit and reduce the amount of cistern space, thereby reducing the amount of flushing water used. Payback is usually very quick if you are on a water meter, but consider the environmental impact of the water you can save.

Enquiry at your local plumbers merchants for the available products or with your local water supplier.

New cisterns are generally smaller and they may not be suitable for these dams as they may affect their flush performance. To save water with modern cisterns pick a dual flush action - 3 litres and a 6 litre flush as against a 9 litre flush.

Waterless w.c.'s do exist, for example composting or incinerating w.c.'s - although they may not be suitable for urban environment usage.

WASH HAND BASINS / BATHS / SHOWERS

Wash hand basins - spray tap heads on basins save up to 80% of water and energy used against that of standard pillar tap.

Sensor and push taps can save water where taps may constantly be left on.

Showers use a 1/3 rd of water of a bath - BUT NOTE - power showers can use more water than a bath in less than 5 minutes.

Remember always fix dripping taps - this could save as much as 90 litres a week.

12. MATERIALS.

Always choose environmentally friendly materials to carryout your extensions or alterations.

WHAT MATERIALS TO USE TO MAKE AN ECOLOGICAL APPROACH?

90% of the internal surface area of buildings may be covered with a synthetic petrochemical covering.

Studies have shown that the indoor environment can be up to 10 times more polluted than the external environment, yet we spend up to 80% of our lives inside.

Some of the simplest ways of reducing your impact on the environment is by using sustainable products when decorating your home, which will reduce this pollution.

Choose your materials carefully, so that they do not harm your health and health of the planet.

Consider the following criteria when choosing:

- **Clean or non-polluting.**
- **Healthy (to humans and domestic animals)**
- **Renewable**
- **Abundant**
- **Natural**
- **Recyclable**
- **Energy efficient**
- **Locally obtained**
- **Durable**
- **Design efficient**

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GENERAL TIPS.

- Reduce quantities of materials you actually use. Be careful with your estimating to avoid waste.
- Obtain and recycle materials to reduce material use. Try to recycle the materials generated from the works you are carrying out. For example, use bricks removed from existing walls either for new internal walls or broken down as hardcore for floors or paving. Re-using sound timbers for studding, etc.
- Dispose materials in appropriate recycling outlets.
- Avoid using materials that have to be transported long distances, using lots of fuel to get it to you.
- Use materials from local suppliers and use products made from recycled materials.
- Avoid burning of materials removed as part of the works.
- Minimise the amount of concrete used as it has a poor environmental record.

COMMONLY USED MATERIALS.

- (a) **Paints and Finishes** - Use water-based products, which are less harmful to you and the environment. Brushes are easy to clean without chemicals. Natural paints let the building breathe, reducing condensation, moulds and related problems.
- (b) **Wood** - Avoid tropical hardwoods (including plywood) unless they are from a sustainable source (Forestry Stewardship Council certified). <http://www.fsc.org/>. Use European softwoods – such as pine and birch plywood from sustainably managed forests.

Check to see if you can re-use your existing wooden floorboards.

Wood can be used that is unfinished (not painted or varnished) and can be treated using natural oil and wax finishes, which also allows the wood to breathe, helping to stabilise building relative humidity.

- (c) **Flooring** - Consider using timber products, such as lino, cork, rubber and cellulose insulation from newspapers. Also natural products such as grasses, straw and bamboo, line and coir. Be aware most woollen and synthetic carpets are dyed with synthetic dyes, made from variety of chemicals.

(d) **Building Materials.**

Stone - Use stone and aggregates sparingly as there are environmental problems associated with their extraction. If you have rubble or hardcore, use it rather than new stone, provided it is clean of contaminants and timber and is suitably broken up to allow it to compact properly.

Bricks - Brick production is energy intensive industry, therefore consider using old bricks where possible. Dress and clean for re-use existing bricks you may remove during your alteration works.

Cement - As bricks an energy intensive industry, so use cement sparingly.

Lime Mortars - These are a viable alternative to cement and have been used for centuries. Lime mortars never set hard and one of its big advantages is that it is easily cleaned off bricks when re-used.

Plastics - Materials such as doors, windows, cabling, contain plastic. Plastic is environmentally damaging from its production to disposal. It requires hazardous chemicals in production, releases harmful additives and creates toxic waste. Avoid using plastic items when paper or wood products can serve the same purpose. Useful website: <http://www.greenpeace.org/>

Decking – choose environmentally sound options from sustainable sources (see notes on timber).

Paving – stone paving - consider the source, it will often be possible to recycle paving from salvage yards. Avoid large areas of paving draining into the drainage systems. Consider porous materials on pavings with holes in it for drainage. Lay surfaces to gradients to allow them to drain into soft landscaping areas.