

Green Design 1 - Use Less Energy

The best way to reduce the fuel bills for a building is to design or alter it so that it uses less energy.

Insulation

Increasing the insulation to as high a level as is practical is the first energy efficiency measure that should be used. Unless the building is already very well insulated, this is very cost effective. If the existing walls already have a cavity that is uninsulated it is not expensive to have it filled. Under floor insulation is also possible if it is built from timber.

Double Glazing

Replacement double glazing is only worth considering if the existing windows are single glazed, in poor condition and in need of replacement. Otherwise it is more of a luxury, since it will take decades to pay back the cost in energy savings. If upvc is used this requires a lot of energy to be manufactured, a process that also causes pollution.



Airtight Construction

After increasing the insulation thickness, the second most cost effective measure for an old house is to reduce the air flow through it. Once a house is highly insulated, the energy efficiency benefits of adding more layers will not justify the cost. If it is quite draughty, sealing up the gaps around windows, doors and through chimneys will have a big effect, for a relatively small outlay.

Low Energy Fittings

A simple, cheap and often cost-effective way of reducing the electricity bill is to use electrical fittings and appliances that have a low energy demand. Low energy light bulbs easily cover their extra cost in the energy they save in a few months, when compared to old fashioned standard light bulbs.

Efficient Boilers and Heating System

It makes sense to replace an older boiler with a modern high-efficiency model. Modern condensing boilers recover most of the heat that would otherwise be lost in the exhausting gases and recycle it back into the system. Combi boilers heat up water instantaneously 'on demand' and are very efficient for couples, smaller families or people living on their own. Ensuring that all the main radiators in the house have thermostatic radiator valves will help to reduce fuel bills. They allow room temperatures to be set lower in some rooms, such as bedrooms, without the need for expensive programme controls.

Daylight

By designing any new rooms to allow maximum daylight, the need for electric lighting can be reduced in the evening. If the time that you have to switch your lights on in the evening is later, you will be saving energy.

Use Biomass Fuels

"Biomass" usually means wood, either in its natural form as logs, or manufactured wooden pellets. Wood is considered more environment-friendly because wood can be easily regenerated in a few decades in the form of trees, which extract the carbon back out of the atmosphere as they grow. Also far less carbon is released into the atmosphere when it burns compared to fossil fuels.

Lifestyle

Equally effective as all the above is setting the thermostat a degree or two lower and wearing jumpers more often.



Green Design 2 - Generate Your Own

Most people do not have much option as to how energy is supplied to their property. The standard choice is mains electricity plus either mains gas or stored fuel such as oil, gas or coal. It is usually prohibitively expensive to avoid these altogether, but it is possible to use alternative methods to supply some of the energy needs of a building that are cheaper than the traditional sources.



Photovoltaic Panels

These are relatively sophisticated panels that are designed to generate electricity, on cloudy days as well as in direct sunlight. In the UK large surface areas are necessary to generate significant levels power and they are expensive relative to the energy that they produce. However, they have been made more economic by the introduction of 'Feed-in Tariffs'. Without a subsidy and a good, south facing roof to mount them on, they are of relatively little use.

Solar Thermal Collector

Possibly the simplest and oldest form of energy efficiency device solar collectors consist of pipes, painted black under a panel of glass. Water or other liquids run through the pipes and heat up. This heat energy is directed to a cylinder and used to 'pre-warm' cold water. In other words cold water is made lukewarm before it is heated by a boiler. This doesn't sound like much, but it can save a significant amount of energy. The problem is that their peak of efficiency occurs in the middle of the summer, which is when the heat is least needed, so a lot of the potential benefits are wasted. Without a subsidy, such a system could take 10 to 15 years to recover its cost in energy savings. This is one area where a DIY system of a radiator painted black under a sheet of glass could be more cost-effective than an off-the-shelf product.

Passive Solar Gain

When the sunlight passes through glass, it heats up the surfaces of a room. Heat cannot pass so easily through glass as light and cannot escape, so it builds up as the sun continues to shine. This 'greenhouse' effect can be a benefit, particularly in winter when the location, orientation and design of the windows can provide free heating. In summer, the problem is the reverse – the heat is an unwanted nuisance. By careful design of shading to the windows, the heat from the high summer sun can be excluded, whilst allowing the low level winter sun to reach the glazed areas.

Ground Source Heat Pumps

These systems are effectively a fridge in reverse, in that they extract heat from a liquid, pump the liquid underground, where it is warmed by the natural heat of the subsoil and then sent back to have this heat extracted again. They produce up to three units of energy for every one unit taken to run them. The hotter the water in the heating system has to be the less efficient the heat pump, so they work better with systems that require lower temperatures, such as underfloor heating. If used to heat water to the level required by a hot tap, the heat exchanger usually needs more back up from electric heating, hence the drop in efficiency. If mains gas is not available to a house, they are worth considering seriously as an alternative to oil or electricity for space heating.

Wind Turbines

These are a waste of money on houses in urban and suburban areas because the streets and buildings land causes low wind speeds near to ground level, in gusts, with many changes of direction. Turbines rely on a strong, consistent wind to be efficient and you are only likely to get this in a rural area. With feed-in tariffs to subsidize them, they may be more cost effective, and certainly larger group schemes in the countryside can pay their way.



Green Design 3 - Costs

It is notoriously difficult to generalise about the cost effectiveness of energy efficiency measures particularly when dealing with existing properties, which each have a different potential depending on their construction. Also, lifestyle and location affects the relative benefits of each option.

The following is for a typical 1950's three bedroom house, 2010 prices.

1. Increase insulation levels in roof: £200 - £400. Sheep's wool and recycled plastic can be used as well as the more traditional mineral wool insulation.
2. Add cavity wall insulation. £300- £600. Houses built after 1928 are likely to have a cavity, allowing up to 40% reduction in heat loss by filling them with mineral wool or polystyrene.
3. Draught proofing. £80 - £150. Very effective and can be a DIY job.
4. Energy efficient lighting. £30 - £50. Very quick payback and easily done.
5. More efficient boiler. £1,500 - £2,000. An important step if the existing is old and not a condensing boiler.
6. Solar hot water system. £3,500 - £4,000. Can provide up to a third of your water heating demand. Pay back very long without subsidy and roof has to have right orientation.
7. Biomass Boiler. £7,000 - £9,000. Boiler and fuel storage will need more space than a compact gas boiler.
8. Double glazing. £6,000- £10,000. Only worth doing if there is existing single glazing in poor condition.
9. Photovoltaics. £5,000 - £10,000. As with a hot water system, orientation is important. Poor payback compensated by feed in tariffs in the UK.
10. Wind turbine. £3,000 - £5,000. Pointless unless you are in a very exposed location e.g. on a high hill or on the coast.



Feed In Tariffs

These government initiatives work by paying householders a subsidy for generating energy on-site. They were necessary because otherwise the small scale makes it hard to justify the costs. For example, under a scheme introduced by the UK government in 2009, the first householders who installed photovoltaic panels on their house were initially paid 41.3p for every KWh generated for their own use, although this amount reduces over time. Financial experts say that this is the equivalent of 8% return on the money invested. Any excess electricity is fed into the grid. Similar schemes will be available for ground source heat pumps and solar panels and wind turbines in 2011.

The downside is that feed in tariffs are paid for by increasing the electricity bills of those who do not enter the scheme, as an incentive for people to join.



Green Design 4 - Products & Materials

Recycle Building Materials

There is a huge range of commercially available recycled building materials, including chipboard, newspaper-based insulation and rubber floor coverings. A few buildings are built from the material without any processing, such as 'earthships', which are made from discarded rubber tyres filled with earth. There is also a thriving trade in architectural salvage, where period features such as fireplaces, wrought iron gates and even doors are sold at a premium. In addition to building with recycled materials, you can also build in such a way that allows the construction to be recycled at the end of its useful life.

Water Recycling

Surface water, such as the rain that drains off the roof, can easily be collected and re-used for the garden by the traditional water butt. If you want to go the next level, you can channel all the rainwater into an underground tank and pump it up whenever it is needed, using it to flush toilets as well. 'Grey' water, from sinks, baths and washing machines can also be used to flush toilets, but requires relatively expensive treatment for any other use. It is possible to treat surface water to make it drinkable, but this may be too elaborate for most homeowners.



Natural Building Products

Many people believe that the modern, highly manufactured materials used in homes are unhealthy. There is evidence to show that the paints and plastic products used give off small quantities of gas, although it has not been proven that they pose a significant health risk apart from to those who suffer from allergies. Natural building materials require less processing and place a greatly reduced demand on energy and resources. It is possible to build extensions out of straw bales, cob (straw and mud), rubber tyres or rammed earth. All of these have a reduced impact on the environment. Timber locks up carbon and is suitable for building with very little processing beyond cutting it to shape. Preservative treatments can involve some fairly noxious chemicals, but these are not needed if the wood is protected from becoming damp once it is in place.

Local Suppliers

If you are genuinely trying to build sustainably, you should take account of the energy and resources taken to manufacture and transport products and materials to the site. A highly energy efficient component, such as argon-filled triple glazing will undoubtedly reduce the heating cost of the house. However, in terms of the energy cost to the whole planet, the saving once it is in use may be completely offset by the huge amount of energy required to make the glass and frames, manufacture the product and then ship it from Sweden to your home. This problem is insurmountable for most homeowners, although some may be fortunate enough to have local supplies of building materials such as claypits used for bricks or stone quarries.

Green Roofs

These are increasing being used in urban areas, where they help to promote bio-diversity i.e. encourage butterflies and other creatures. Some use grass but it needs significant maintenance so a plant called sedum, which requires less maintenance, is very popular. These type of roofs need a strong structure to support them, as well as an effective waterproof membrane underneath to prevent leaks. This means that they are quite expensive compared to a normal flat roof and have a much thicker construction. If the planners will not allow a flat roof because they don't like the appearance, a green roof may be acceptable to them as an alternative.

