TRAINREBUILD
Training for Rebuilding Europe

Training Package (Speakers Notes To Accompany Slides)

Supported by
INTELLIGENT ENERGY EUROPE

Slide 1

Welcome to the TrainRebuild presentation on improving energy efficiency in buildings.

The aim of this presentation is to provide you with information about the measures which you can take to improve the energy efficiency of your properties and help you to decide which are the most appropriate for your circumstances.

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Let us start with why improving the energy efficiency of property is important by looking at the problem of Climate Change, the EU response and how this is being implemented in your member state

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The Kyoto Protocol is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC or FCCC), aimed at fighting global warming. The UNFCCC is an international environmental treaty with the goal of achieving the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.“

The Protocol was initially adopted on 11 December 1997 in Kyoto, Japan, and entered into force on 16 February 2005. As of April 2010, 191 states have signed and ratified the protocol.

Under the Protocol, 37 countries ("Annex I countries") which includes **all EU member states plus the EU** itself commit themselves to a reduction of four greenhouse gases (GHG) (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride) and two groups of gases (hydrofluorocarbons and perfluorocarbons) produced by them, and all member countries give general commitments.

Annex I countries agreed to reduce their collective greenhouse gas emissions by 5.2% from the 1990 level. Emission limits do not include emissions by international aviation and shipping, but are in addition to the industrial gases, chlorofluorocarbons, or CFCs, which are dealt with under the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer.

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Based on current data, these are the predicted changes in temperature and precipitation by 2050 and 2080 though recent research suggest that 7C rise is possible. While this might seem relatively insignificant, it is the consequences on the melting of glaciers and the ice caps leading to rising sea levels making parts of the world uninhabitable with the possibility of mass emigration to more temperate areas, such as Europe, that is the problem.

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In March 2011 the EU put in place a roadmap to a low carbon economy with a requirement for 20% reduction in Carbon and 20% renewables across the EO by 2020, to so called 20:20:20 leading to major reductions of at least 80% by 2050.

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A look at the key sectors for reduction shows that residential is one of the major emitters of carbon and requires significant reductions to meet the 2050 target.

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Looking at more detail at the residential sector we can see that:

- **Buildings** account for some 40 - 50% of European energy consumption.
- **Two thirds** of energy used in European buildings is accounted for by households and their consumption is growing every year due to rising living standards.
- **30-50 %** of lighting energy could be saved in offices, commercial buildings and leisure facilities by using the most efficient systems and technologies.
- **Half** of the projected increase in energy needed for air conditioning – expected to double by 2020 – could be saved through higher standards for equipment.
- **10 million** boilers in European homes are more than 20 years old; their replacement would save 5% of energy used for heating.
- **Building Services** such as Lighting, heating and cooling and hot water consume more energy than either transport or industry.

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The new EU plan or 'roadmap' sets out the cost-effective route for transforming Europe into a competitive 'low-carbon' economy by mid-century.

This would involve cuts to the EU's greenhouse emissions by 80% by 2050 (compared with 1990 levels) entirely through measures taken within Europe. Intermediate cuts of 25% by 2020, 40% by 2030 and 60% by 2040 would be needed.
Improving **energy efficiency,** for instance by investing in energy-efficient buildings and transport, can make the biggest contribution to reducing emissions. **Clean electricity** – produced almost entirely without greenhouse emissions – will also have a major role to play, partly replacing fossil fuels for heating and transport (e.g. electric cars).

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Developing low-energy technologies, such as renewable energy sources and electric vehicles, and investing in low carbon infrastructure will stimulate growth and help create **new jobs** and **save existing jobs**. Refurbishing buildings, for instance, will provide big opportunities in the construction industry.

The EU would **halve oil and gas imports**. This would improve Europe's energy security, strengthen our resilience to future oil price increases and cut our fuel import bill by a considerable amount.

Air pollution would be drastically reduced, leading to big savings in health costs and pollution control

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Member State data on CO_2 emissions

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Title slide for EU directives and initiatives

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The key EU legislation that started the journey to a low carbon future is the Energy Performance of Buildings Directive which introduced the need for Energy Performance Certificates.

The Directive 2002/91/EC of the European Parliament and Council published 4 January 2003 and designed to improve the energy efficiency of buildings in order to reduce carbon emissions as agreed in the *Kyoto Protocol*.

‘cost effective saving potential of 22% of current consumption by 2010’

Key features

- Introducing agreed measurements of relative energy performance
- Regular inspections and re-evaluations
- Improved standards for new buildings
- Higher standards for upgrading larger buildings
- Introduction of a mandatory requirement for Energy Performance Certificates produced by ‘experts’

Contains 17 Articles

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- Tightening Building Regulations for energy efficiency be based on integrated energy calculations
  - *to apply to new buildings and major renovations (useful floor area >1000m2)*

- Energy Performance Certification on construction, sale or rent - Energy certificates and recommendations incentivise improvements through comparison, sale & rental values

- Regular inspection of boilers or advice campaign and mandatory air-conditioning systems inspection

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As the original EPBD was published in December 2002, the European Commission it was felt it needed a refresh and a tightening of the requirements.

The aim of the recast is to clarify, strengthen and extend the scope of the current directive, as well as to reduce the large differences between Member States' practices in the building sector. Overall, its provisions cover energy needs for space and hot water heating, cooling, ventilation and lighting for new and existing, residential and non-residential buildings.

The recast will not require more from MSs other than what is economically feasible (cost-optimal and cost effective). Nevertheless, MSs can set more ambitious targets (as the UK has done).

Legislation alone cannot achieve the full energy saving potential of buildings. The recast recognises that it needs to be accompanied by efforts to change behaviour and attitudes to energy use in buildings.

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The main provisions of the recast directive are that:
All new buildings to be ‘nearly zero energy’ by the end of 2020
Building standards to set minimum energy performance requirements for all building elements and systems which are retrofitted or replaced (e.g. roof, wall insulation, windows, lighting, heating, cooling, etc.)
Minimum energy performance requirements for buildings undergoing “major” renovation (25% of the value or building envelope).
high efficiency alternative systems and renewables to be considered where feasible
Member States encouraged to put in place fiscal incentives such as the Green deal in the UK

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- Mandatory use of EPCs in advertisements (when selling or renting)
- EPCs to include recommendations on how to improve cost-effectively the energy performance
  - can also include indications on where to obtain information about financing possibilities
  - may include estimate for paybacks or cost-benefits
- Regular inspection of boilers and AC systems
  - Inspection reports issued after each inspection and handed over to the owner or tenant (may include recommendations for efficiency improvements)
  - Certificates and inspections to be carried out by independent and qualified and/or accredited experts (=>random checks and penalties for non-compliance!)

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Many countries have already included a renewable energy quota for use in buildings to achieve the goals of the directive. Examples are:
DE: 15 – 50% - depending on type of building and RES
NO: 40% - district heating included
UK: 10%
SI: 25%
IT (Lombardia): min 50% of the energy used for district hot water (DHW)
DK: demand for more thermal solar if DHW consumption exceed more than 20 m3/day
NL gives credit for renewable energy use
Other countries are investigating the issue (BE, HU).

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EU Energy Services Directive http://ec.europa.eu/energy/efficiency/end-use_en.htm

The Energy End-Use Efficiency and Energy Services Directive (ESD 2006/32/EC) provides a framework for ensuring that when energy is finally consumed, it is done so in a more efficient and economic way. The Directive applies to providers of energy efficiency improvement measures, energy distributors, distribution system operators and retail energy sales companies, as well as final customers. This covers the retail sale, supply and distribution of grid-based energy carriers, such as electricity and natural gas, and energy types such as district heating, heating oil, coal and lignite, forestry and agricultural energy products and transport fuels.
The main provisions of the Directive include:
Setting the framework and conditions for the development and promotion of a market for energy savings and the delivery of energy-saving programmes and measures to end-users
An indicative energy savings target of 9% between 2008 and 2016 which is to be outlined by every Member State via national energy efficiency action plans (NEEAPs).
Public sector requirements to improve energy efficiency and provide information to the public and businesses via:
Financial instruments designed for energy savings, e.g. third-party financing contracts and energy performance contracts
Energy-efficient equipment and vehicles
Switch to low-energy products
Purchase, replace, retrofit or rent energy-efficient buildings
Requirements on energy suppliers to promote greater efficiency and provide information to final customers on efficiency programmes
Provision of individual metering and informative billing to end users to give an accurate picture of energy use.

Member States are required to submit NEEAPs to the European commission in mid 2007, 2011 and 2014.
The residential and tertiary sectors are covered under the Directive as eligible areas for energy efficiency improvement measures. These include heating and cooling systems, insulation and ventilation and lighting.

http://www.euroace.org/LinkClick.aspx?fileticket=ZFYg0lJCcY8%3d&tabid=158

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Energy Efficiency Directive
http://ec.europa.eu/energy/efficiency/eed/eed_en.htm

Strong impetus to energy savings and energy efficiency
On 22 June 2011, a new set of measures for increased Energy Efficiency is proposed by the European Commission to fill the gap and put the EU back on track. This proposal for this new directive brings forward measures to step up Member States efforts to use energy more efficiently at all stages of the energy chain – from the transformation of energy and its distribution to its final consumption.
The Commission proposes simple but ambitious measures:

- Legal obligation to establish energy saving schemes in all Member States
- Public sector to lead by example
- Major energy savings for consumers

Citizens' summary – EU proposals for cutting energy consumption through greater efficiency
WHAT'S THE ISSUE?
Current estimates show the EU is **not on track** to achieve its target of **reducing its estimated energy consumption for 2020 by 20%.**
As a result, new measures on energy efficiency are now being proposed for implementation throughout the economy to bring the EU back• on track to achieve its objective by 2020.
WHAT EXACTLY WOULD CHANGE?
• **Public bodies** would need to buy energy-efficient buildings, products and services, and refurbish 3% of their buildings each year to drastically reduce their energy consumption.
• **Energy utilities** would have to encourage end users to cut their energy consumption through efficiency improvements such as the replacement of old boilers or insulation of their homes.
• **Industry** would be expected to become more aware of energy-saving possibilities, with large companies required to undertake energy audits every 3 years.
• **Consumers** would be better able to manage their energy consumption thanks to better information provided on their meters and bills.
• **Energy transformation** would be monitored for efficiency, with the EU proposing measures to improve performance if necessary, and promoting cogeneration of heat and electricity.
• **National energy regulatory authorities** would have to take energy efficiency into account when deciding how and at what costs energy is distributed to end users.
• **Certification schemes** would be introduced for providers of energy services to ensure a high level of technical competence.
WHO WOULD BENEFIT AND HOW?
• **Consumers** would benefit from having better information available to control their energy consumption and influence their energy bills.

The **environment** would benefit from reduced greenhouse gas emissions.
• **Public bodies** could reduce their spending for energy consumption by using more efficient buildings, products and services.
The **EU economy** would benefit from a more secure energy supply and economic growth through the creation of new jobs, particularly in building renovation.
WHAT HAPPENS NEXT?
Once the proposal is adopted by the European Parliament and the Council, EU countries will have to transpose the rules into national law• within one year. Progress made in achieving EU's 20% energy saving target in 2020 will be reviewed in 2014.
• If it is insufficient, mandatory national energy efficiency targets will be proposed.

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Ecodesign: http://ec.europa.eu/energy/efficiency/ecodesign/eco_design_en.htm

Apart from the user's behaviour, there are two complementary ways of reducing the energy consumed by products: labelling to raise awareness of consumers on the real energy use in order to influence their buying decisions (such as labelling schemes for domestic appliances), and energy efficiency requirements imposed to products from the early stage on the design phase.
The production, distribution, use and end-of-life management of energy-using products (EuPs) is associated with a considerable number of important impacts on the environment, namely the consequences of energy consumption, consumption of other materials/resources, waste generation and release of hazardous substances to the environment. It is estimated that over 80% of all product-related environmental impacts are determined during the design phase of a product. Against this background, Eco-design aims to improve the environmental performance of products throughout the life-cycle by systematic integration of environmental aspects at a very early stage in the product design. The Council and the European Parliament therefore adopted a Commission proposal for a Directive on establishing a framework for setting Eco-design requirements (such as energy efficiency requirements) for all energy using products in the residential, tertiary and industrial sectors. Coherent EU-wide rules for eco-design will ensure that disparities among national regulations do not become obstacles to intra-EU trade. The directive does not introduce directly binding requirements for specific products, but does define conditions and criteria for setting requirements regarding environmentally relevant product characteristics (such as energy consumption) and allows them to be improved quickly and efficiently. It will be followed by implementing measures which will establish the eco-design requirements. In principle, the Directive applies to all energy using products (except vehicles for transport) and covers all energy sources.

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Eco-Label: http://ec.europa.eu/environment/eco-label/

The European eco-label is a voluntary scheme, established in 1992 to encourage businesses to market products and services that are kinder to the environment. Products and services awarded the eco-label carry the flower logo, allowing consumers - including public and private purchasers - to identify them easily. Today the EU eco-label covers a wide range of products and services, with further groups being continuously added. Product groups include cleaning products, appliances, paper products, textile and home and garden products, lubricants and services such as tourist accommodation.

While the logo may be simple, the environmental criteria behind it are tough, and only the very best products, which are kindest to the environment, are entitled to carry the EU eco-label.

What is more, this is a label that consumers can genuinely trust. The criteria are agreed at European level, following wide consultation with experts, and the label itself is only awarded after verification that the product meets these high environmental and performance standards.

The EU eco-label is a rapidly growing brand. Many producers wanting to sell their products across Europe have realised the benefits that the European eco-label brings. Products bearing the Flower logo can be marketed throughout the European Union and the EEA countries (Norway, Iceland and Liechtenstein).

The voluntary nature of the scheme means that it does not create barriers to trade. On the contrary - many producers find that it gives them a competitive advantage.

eco-label criteria are not based on one single factor, but on studies which analyse the impact of the product or service on the environment throughout its life-cycle, starting from raw material extraction in the pre-production stage, through to production, distribution and disposal.

The flower logo helps manufacturers, retailers and service providers gain recognition for good standards, while helping purchasers to make reliable choices.

The EU eco-label is part of a broader action plan on Sustainable Consumption and Production and Sustainable Industrial Policy adopted by the Commission on 16 July 2008.

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Title slide: Member State Legislation and Regulation

Slides 23 – 42 Example of UK legislation and regulation

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Title Slide: Review of Member State Property Stock – typical buildings by age and type

Slide 44 – 47 Example of UK Property types

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Title slide: energy efficiency measures

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Title slide: Building Fabric

Most heat energy is lost through the fabric, the floor, walls and roof so making the fabric of the building more energy efficient will, in most cases, dramatically improve the energy efficiency of a building.

Loss of heat through the fabric is measured using the U value, with the lower the figure the more efficient the material.

Definition: The U-value is a measure of how many watts (representing the rate of flow of energy) pass through one square metre (m2) of construction for every degree difference in temperature between the inside and the outside. Temperature is measured in Kelvin, where 1K = 1°C.
As an example, a U-value of 6.0W/m2K (that of a single glazed window) means that six watts will be escaping through each square metre of glass when the temperature difference is one degree. If it is 20°C in the house and 0°C outside, then the heat loss is 20 x 6 = 120 watts per square metre.

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Definition: Draught proofing is the process of filling in unwanted gaps in the fabric of a building to reduce the heat loss and discomfort they cause. Common sources of draughts are gaps round window and door frames, places where pipes enter the building, ill-fitted floorboards, letter boxes and even keyholes. Materials used include foams, brushes and thin sections of rubber, plastic or metal.

In 2005 NASA carried out some test on its various buildings and found that 50% of the heat lost from a building could be attributed to gaps in insulation amounting to 5% of the surface area. In their report they likened the gaps in insulation to a pin prick in a balloon – the temperature difference inside to outside means that heat escapes more quickly through a small hole than it does through a big hole, but ultimately the same amount of heat escapes.
In the typical UK house draughts will account for at least 10% of the total heat loss. If there is an unused open fireplace that figure will rise to over 50%. There are all the obvious places to seal – gaps around sash windows and under doors, floor to wall joints, ceiling to wall joints, gaps between floor boards – but the real culprits tend to be penetrations. Where pipes and cables are brought through

walls or floors there is often a gap around the pipe or cable that can be simply sealed with mastic.

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You'll find draughts at any accidental gap in your home that leads outside. These are the most common places:

- windows
- doors
- loft hatches
- electrical fittings on walls and ceilings
- suspended floorboards
- pipework leading outside
- ceiling-to-wall joints

You should block most of these – but be careful in rooms that need good ventilation, such as bathrooms or kitchens.

Which rooms don't need draught proofing?
You should be careful about draught proofing rooms that need good ventilation, including:
• areas where there are open fires or open flues – It is essential that areas like this have adequate ventilation.
• rooms where a lot of moisture is produced, such as the kitchen, bathroom or utility room. Good ventilation helps reduce condensation and damp.

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Windows
For windows that open, buy draught-proofing strips to stick around the window frame. These fill the gap between the window and the frame. There are 2 main types:

- Self-adhesive foam strips – the cheapest option, and easy to install, however may not last as long as other methods.
- Metal or plastic strips with brushes or wipers attached – these are long-lasting, but cost a little more.

Make sure your strip is the right size to fill the gap in your window. If the strip is too big it will get compressed and damaged and you may not be able to close the window. If it's too small there will still be a gap. For sliding sash windows it's best to fit brush strips or consult a professional. Foam strips do not work well. For windows that don't open you can use a silicon sealant.

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Doors
Draught proofing for outside doors can save a lot of heat and will only cost you a few pounds. There are 4 main things to think about:
1. The gap at the bottom – use a brush or hinged flap draught excluder
2. Gaps around the edges – fit foam, brush or wiper strips like those used for windows
3. The keyhole – buy a purpose-made cover that drops a metal disc over the keyhole
4. The letterbox – use a letterbox flap or letterbox brush. Remember to measure your letterbox before you buy.

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Fitting Door Draught Seals
Sealing doors and windows from the weather is more demanding than it may seem. Strong winds create 'pressure drops' at door and window positions, where the air pressure difference between inside and outside literally sucks water and cold air into the building or forces warm air to leak outside through any gaps and cracks.
Typical Door Draught Seals
A typical unsealed single leaf external door has a gap of approximately 2mm, between the door style and the door frame. At the threshold, it has a gap of 6mm and quite often there is no water bar. The air leakage effect of this is equivalent to a circular hole in a standard door of 139mm diameter. Many doors are misaligned with larger gaps than in this example. In general terms, an unsealed single leaf external door has gaps equivalent to or greater than a permanently open letter plate.
In a double door assembly, assuming a 2mm gap around each door and a 6mm gap at the threshold, the air leakage is equivalent to a circular hole of 183mm diameter. As the result of misalignment, a double door will have gaps equivalent to, or greater than, a permanently open cat flap.

Door Draught Seals for All Door Actions
There is a variety of door draught seals to fit different door actions. The most common external doors are inward-opening single leaf but excluders are also available for outward-opening single leaf doors, inward and outward opening double leaf doors and sliding doors.
Weather Strip Door Seals
Weather strip door draught seals are available in a variety of designs for use on existing doors. In their basic form they are seals fixed into plastic or aluminium holders which can be fixed to the sides and top of door or window frames. They are relatively straight forward to fix and are popular for DIY applications.
Brush Door Draught Seals
Brush strip door draught seals are suitable for use on external doors which have irregular gaps that are difficult to seal. Lighter types consist of siliconised nylon

pile in self adhesive strips. More robust types comprise strips of nylon or polypropylene bristles fitted into a metal or plastic holder which is fixed directly to the door frame. Brush excluders are suitable for sliding patio doors and single leaf external doors that open inwards or outwards.

Flexible Tube Door Draught Seals

Flexible tube strip door draught seals, suitable for external doors, are generally in the form of small diameter synthetic rubber tube, held in a plastic or metal holder, which is fixed directly to the door frame. When the door is closed the tube compresses to close the gap between the door and the frame.

Flexible Blade Door Draught Seals

Blade strip door draught seals are suitable for use on external doors with irregular gaps that are difficult to seal with some types of seal. They consist of a flat strip of synthetic rubber, shaped like a car windscreen wiper, that is fitted into a metal or plastic holder and fixed directly to the door frame. Blade strip door draught seals are suitable for sliding patio doors and single leaf external doors that open inwards or outwards.

High Performance Door Draught Seals

High performance door draught seals, as the name suggests, are much more efficient and constitute better value for money in the long term. High performance seals are designed in two parts and are suitable for new and existing doors. The holder which accommodates the basic seal section is screw fixed to the surface of the door frame. The screw fixings are then hidden by the cover section which is available in a choice of designs and finishes to suit the door design and to match the draught proof threshold section.

Single Leaf Door Draught Seals

Surface mounted door draught seals with concealed fixings are available for inward or outward opening single leaf doors. They are fitted onto the jambs and heads of door frames and can be used in conjunction with door threshold seals to provide high performance draught proofing. The door seal assemblies can be butt jointed or mitred at the the corners.

External Double Door Draught Seals

High performance door draught seals are also specified for use on double doors with rebated meeting styles. These are primarily for french doors or other situations where the door leaves close flush. These draught seals are used in conjunction with other door frame and threshold seals where control of air leakage is important.

Door Threshold Draught Seals

Compatible high performance door threshold seals are available for use with high performance door draught excluders in order to provide an airtight seal all around the door.

Draught Seals for Windows

Window draught seals are generally produced in smaller section sizes and most of the door seal types shown can be used for draught proofing windows. These seals are generally most appropriate for use on single action casement windows.

If a comprehensive draught proofing scheme is being carried out it is important to make sure controllable ventilation is provided in bathrooms,

kitchens and laundry rooms to remove water vapour and prevent damaging condensation

Source: http://www.lowenergyhouse.com/door-threshold-seals.html

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Internal doors need draught proofing if they lead to a room you don't normally heat, like your spare room or kitchen. You should keep doors to unheated rooms closed as much as possible to stop the cold air from moving into the rest of the house. If there is a big gap at the bottom of the door then you could make a draught excluder stuffed with used plastic bags or bits of spare material. Inside doors between two heated rooms don't need draught proofing – it's ok to let warm air circulate between different rooms.

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Chimneys and Fireplaces
If you don't use your fireplace, your chimney is probably a big source of unnecessary draughts. There are 2 main ways to draught proof a chimney:
1. fit a cap over the chimney pot – this might be better done by a professional.
2. buy a chimney balloon – an inflatable cushion which blocks up the chimney.
Remember to remove the draught proofing if you decide to light a fire!

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Floorboards and Skirting boards
You can block cracks using filler that you squirt into the gap. Floorboards and skirting boards often contract, expand or move slightly with everyday use, so you should use a filler that can tolerate movement – these are usually silicon-based. Look for:

- Flexible fillers
- Decorator's caulk
- Mastic-type products

Fillers block gaps permanently so be careful when you apply them and wipe off any excess or mess with a damp cloth before it dries. Fillers may break down over time, but can easily be re-applied. Fillers come in many different colours, and for indoor and outdoor use.

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Draught proofing the loft hatch is essential, since hot air rises and is lost into the cold space in the loft. Cold air can also blow in through the gaps around the loft hatch.
Loft hatches can be draught proofed by using strip insulation, like a door.

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Larger gaps should be filled with expanding polyurethane foam. The foam can be sprayed into the gap. As it dries it will expand and fill the hole, then set hard.

How to use
Ensure surfaces are clean and free from grease and loose material. Do not apply in very cold or hot (Below 5 or above 25 degrees C) conditions. Ensure good ventilation.
Cover furniture, carpets and surroundings areas before use.
Mask off wood and brickwork.
Moisten surface to help the foam cure and expand, e.g. use a plant spray.
Remove cap carefully, holding can away from face on a flat horizontal surface.
Shake can vigorously approx. 20 times to mix contents.
Select applicator nozzle, dependant on bead size required and carefully screw onto valve, taking care not to activate the valve. Do not over-tighten.
Hold can upside-down away from face.
Use applicator nozzle as shown
Apply light pressure to nozzle to test. Vary pressure to adjust rate of foam.
Start filling at the lowest point shaking can from time to time during use.
If using more than one layer of foam, spray lightly with water between layers.
Do not overfill - the foam will expand 2.5 times the initial volume extruded.
Foam will be tack free in about 20 minutes. It can be cut, sanded, plastered, or painted after twelve hours and will be fully cured in 12 -24 hours.
If exposed to sunlight, the foam should be painted or coated.

Further information
Tools required
Gloves, water spray, knife.
Storage
Always store can vertically, in a cool place, on a low shelf to avoid risk of accidental dropping. Store away from frost.
Available in the following sizes
300ml, 500ml and 825ml aerosols
Cautions
Fresh foam spillage must be removed immediately with nail varnish remover (Test on a concealed area first). Cured foam can only be removed mechanically, except on skin where it should be allowed to come off naturally

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Old extractor fans
Old extractor fan outlets may need to be filled with bricks or concrete blocks and sealed from the outside and inside of the building. You should contact a good builder for this kind of work.

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Cracks in walls
You can fill cracks in walls using cements or hard setting fillers – but if it's a large crack, there may be something wrong with your wall. Consult a surveyor or builder to see what caused the crack in the first place.

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Cost effective
• Installed cost may be subsidised (landlords energy saving allowance)
• Reduce fuel poverty
• Makes property more attractive to prospective tenants
• Beneficial to tenants health
• Improved housing stock reduces condensation
• Improving thermal comfort for tenants
• Doing bit for the environment
• Socially correct thing to do
• Improved energy efficiency is reflected in the Energy Performance Certificate (EPC) highlighting the benefits for prospective tenants

No significant environmental impact
Be careful about draught proofing rooms that need good ventilation, including:

- areas where there are open fires or open flues – It is essential that areas like this have adequate ventilation.
- rooms where a lot of moisture is produced, such as the kitchen, bathroom or utility room. Good ventilation helps reduce condensation and damp.

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http://www.which.co.uk/terms-and-conditions/general-terms/

Cavity walls are external walls that are made of two layers with a small gap or `cavity' between them. Cavity wall insulation can usually be applied from the outside of a property through small holes that are drilled in the external brick wall. work must only be carried out by a professional installer. The insulation process is inexpensive and causes minimal disruption, taking less than a day to complete.

Installation procedure
The installation of cavity wall insulation must be carried out by a specialist contractor, who should provide a Cavity Insulation Guarantee Agency (CIGA) guarantee which is the industry wide guarantee scheme for this type of work.

In a typical installation small holes are drilled into the mortar between the brick courses of the outer leaf at approximately one metre intervals. The insulating material is blown or injected into the cavity through these holes which are subsequently filled to leave no sign of the work that has been carried out.
If replastering of the internal walls is planned then it may be preferable to inject the insulation material through holes drilled in the internal walls, which are then covered when the wall is plastered.

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Blown Mineral Fibre
Blown mineral fibre consists of strands of fibreglass or mineral wool that are forced into the cavity using compressed air. This material can be used in any part of the country and is covered by British Board of Agrement (BBA) certificates..
2. Polystyrene beads or granules
Polystyrene beads may be supplied loose or in a light sticky resin to hold them together. Polystyrene granules will stick together of their own accord due to their rough shape. Both types of material are blown into the cavity using compressed air. Both types of materials are covered by British Board of Agrement (BBA) certificates.
3. Urea Formaldehyde Foam
Urea formaldehyde foam is created within the wall cavity by injecting and simultaneously mixing two chemical components to form the foam which then expands to fill the cavity. This type of insulation is covered by British Standards BS:5618 for the material and BS5617 for the application.

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1. Check property suitability. Arrange for a professional to carry out a pre-installation check on both the inside and outside of the property. This should take around one hour. They should be looking for things like cracks or defects in the walls, the condition of the wall cavities, the position of the boiler and surrounding ventilation as well as any evidence of damp.

2. Visit http://www.direct.gov.uk/en/Environmentandgreenerliving/Energyandwatersaving/Energygrants/DG_10018661 to see if you eligible for financial support.

3. Always opt for insulation that carries the 'Energy Saving Trust Recommended' stamp. Only the most energy efficient products carry this logo, making it quick and easy for you to find products that will contribute to savings on your energy bill and help you do your bit for the environment.

Before you embark on the job check out thinkinsulation's 'How to' video which helps to guide you through the installation process: http://www.thinkinsulation.co.uk/Videos-2.htm

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Dampness problems caused by cavity wall insulation do not generally occur in properties where the insulation was built-in from new. It occurs in properties which have subsequently been filled (referred to in the industry as "retro fill"). The material which has attracted most complaints is blown mineral-wool fibre. This material consists of loose mineral- or glass-fibres which - as the name suggests - are blown in through holes drilled in the brick outer leaf.

Exposure zones and rain penetration. The Building Research Establishment has found that it can cavity wall insulation can allow rainwater to cross the cavity. BRE Good Building Guide 44: part 2: "Insulating masonry cavity walls - principal risks and guidance" (available from www.brebookshop.com) states, "There can be an increased risk of rain penetration if a cavity is fully filled with insulation, i.e. moisture is able to transfer from the outer to the inner leaves resulting in areas of dampness on internal finishes. Rainwater, under certain driving rain conditions, can penetrate the outer leaf of masonry leading to wetting of the cavity insulation, a reduced thermal performance and damage to internal finishes."

Wall tie corrosion. Wall ties are vital for the structural integrity of a cavity wall, as they hold the inner and outer leaves of masonry together. Being made of iron or steel, they will inevitably rust eventually, but in dry conditions they should last for many years. When persistently damp, however, they can corrode much quicker, and replacing them is a costly and time-consuming process, involving cutting out dozens of individual bricks from the outer leaf. Replacing corroded wall ties becomes much more difficult in a building with cavity wall insulation, as the insulation itself has to be removed around each tie, and then replaced afterwards.
The condition of a home's wall ties should be assessed using the method described in BRE Digest 401, which specifies that two bricks should be removed

on each elevation (at high and low levels) and tested for corrosion. Inspecting ties by drilling a hole in the outer leaf and looking through a boroscope is not a satisfactory way of assessing their condition, as the most serious corrosion is likely to be where the ties are embedded in the mortar.

Homes most at risk of wall tie corrosion are those built with wrought-iron "fish-tail" ties prior to 1920, and those built with galvanised steel "butterfly" ties between 1964 and 1981.

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Cost effective
• Installed cost may be subsidised (landlords energy saving allowance)
• Reduce fuel poverty
• Makes property more attractive to prospective tenants
• Beneficial to tenants health
• Improved housing stock reduces condensation
• Improving thermal comfort for tenants
• Doing bit for the environment
• Socially correct thing to do
• Improved energy efficiency is reflected in the Energy Performance Certificate (EPC) highlighting the benefits for prospective tenants

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Photo source: http://www.homeheatingguide.co.uk/loft-insulation.html

Loft insulation

In an un-insulated home a quarter of the heat is lost through the roof. Insulating the loft is a simple and effective way to reducing heating bills and which can be undertaken even as a do it yourself project

How loft insulation works
It acts as a blanket, trapping heat rising from the house below. You should also consider lagging your pipes at the same time for optimum efficiency.

The savings
If there is currently no loft insulation, installing the recommended 270mm depth you could save around £205 a year on heating bills and around 1 tonne of carbon dioxide (CO 2) per year.
The following table gives approximate costs, savings and paybacks for loft insulation.
The Government, energy suppliers and local authorities all provide grants or offers to help you implement energy saving measures in a home.

The installed cost includes the subsidy available from the major energy suppliers under the Carbon Emissions Reduction Target (CERT); the typical unsubsidised installed cost is around £500 for loft insulation to 270mm from either 0mm or 50mm.

How the savings add up

If everyone in the UK topped up their loft insulation to 270mm, over £700m would be saved each year. That's enough money to pay the annual fuel bills of around 550,000 families.

How it is installed

Insulation is simply laid over the floor of the loft, between and then over the joists if they are visible. Protective clothing, gloves and masks should be worn. Care must be taken not to insulate below the cold water tank, if one is present, and not to compress the insulation in tight corners or eaves. Walk boards can then be laid over the joists to provide safe access from the loft hatch to any water tanks (if present).

Loft insulation can be carried out as a DIY task or by a professional installer.

There are grants and offers available to help you pay for loft insulation.

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Internal solid wall insulation usually involves fitting ready-made rolls or boards of insulating material over the inside walls of the property

Fitting internal solid wall insulation can be disruptive – you need to relocate plug sockets, radiators and fitted furniture.

Your walls will need to be carefully prepared before internal insulation can be fitted. Any damaged plaster needs to be either repaired or removed, and bare brickwork should be treated to eliminate areas where air can escape.

You'll also experience a slight reduction in floor space due to the extra thickness of insulated walls. However, it's usually cheaper than external solid wall insulation and can be installed on a rolling, room-by-room basis.

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Directly applied internal insulation board

· This can be in the form of a plasterboard sheet laminated to an insulation board, or the insulation board may be separate.
· Rigid insulation boarding is a composite board made of plasterboard with a backing of insulation.
· The insulation backing comes can be specified in a variety of thicknesses.
· Insulation in excess of 60mm will typically be required to achieve best practice levels of performance.
· Up to 100mm of insulation can be included.
· Rigid insulation boards are usually fixed to the wall surface using continuous ribbons of plaster or adhesive, plus additional mechanical fixings.
· The joins between boards should be lapped and sealed to help prevent air leakage.
· The insulation is fitted to all outside interior walls of the property.
· Electrical components (e.g. sockets, switches) need to be extended through the insulation.
· Window reveals need to be insulated. This can reduce the 'open' area for daylight.
· Before installation the surface of the wall must be carefully prepared.
· Where existing plaster is removed and the brick is uneven, the wall must be levelled using render to provide an even surface for fixing.

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Insulated studwork
· The insulation is held between a metal or timber framed system and finished with a vapour control layer and plasterboard.
· This approach allows a variety of insulation thicknesses to be installed.
· Internal studwork should be used where internal insulation has been specified for a wall that has previously suffered from damp.
· This allows the creation of a cavity between the internal wall surface and the insulation.
· Studwork is also an effective solution where the wall is bowed or uneven and space is not at a premium.

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Flexible Insulation Lining
· Flexible thermal linings are insulation on a roll specifically for use in solid wall homes, mansard roofs and dormer ceilings.
· The lining is 10mm thick and supplied in rolls one metre wide, 12.5 metres long.
· The material is made from a natural product (latex) in an open and closed cellular construction and has a durable fibreglass face that can be decorated with emulsion, wallpaper or tiles.

· Flexible insulating linings are cheaper and less disruptive to install, though savings on your energy bill are lower.

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Fixing an insulating material to external walls with a protective render or decorative cladding over the top.
The thickness of the insulation needs to be between 50mm and 100mm. It's usually installed when a building has severe heating problems or already requires some form of repair work providing the opportunity to add insulation.
External insulation is generally more expensive than internal solid wall insulation. However, it's usually the most suitable option as the installation process does not disrupt the internal design and decoration of a home.
Decorative coatings can also be used to improve the appearance of the outside of your home. External insulation can also match a wide variety of home designs, such as Georgian, Victorian and Edwardian-style properties.

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The parge coat for the external insulation has been applied and application of the external insulation has commenced. The grey parge coat is a Polymer-modified cement based levelling coat and is applied directly to the existing face of the external walls prior to the external insulation to ensure that no draughts penetrate the envelope of the building. The graphitized, 'grey bead' Expanded Polystyrene (EPS) is adhered directly to this parge coat.

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Installation
External wall insulation – it is preferable to employ an approved installer in order to ensure professional work especially in the detailing (finishing around external services, pipe work, windows, etc.). Insulated render and cladding systems can be applied on average in about three working days. Because it is applied to the outside of external walls, there fewer disturbances to the household in the process.
Internal wall insulation – can be carried out either using a qualified installer or as a DIY job. Only part of the house can be done at one time. Nevertheless, comfort in the chosen rooms is very likely to be disturbed and therefore it is best to coordinate with a redecorating job.

External walls - together with windows - are generally the largest cooling surface of the building. Therefore the insulation of these walls can significantly reduce the heat loss and increase the comfort. From building physics point of view the

optimal solution is to install the insulation on the external face of the building envelope: this way the risk of interstitial condensation is minimized, the existing structural walls also get thermal protection and the heat storage capacity of the massive walls are utilised.
However, in certain cases the external application of an insulation layer is not possible, or the internal use of an insulation layer has more benefits. When upgrading existing buildings it is not always possible to apply the insulation externally, especially if the outside appearance of the façade must be retained. In the case of existing walls with direct contact to the ground, the internal wall insulation is often the only way to improve thermal insulation. Internal insulation has significant advantages in rooms for temporary use, not heated permanently: those can be heated with minimum energy consumption.

The correct design of an internally insulated façade wall always needs exact information about the existing, un-insulated wall construction. Since the insulation is applied on the inner, warm side, the wall structure will be exposed to more severe temperature changes. The brickwork, stonework or concrete wall should be frost resistant in its entire thickness as the internal insulation will lower the temperature in the wall structure, with potentially greater risk during freeze/thaw cycles.

With internal insulation, thermal bridges should get increased attention. Insulating the adjoining structures (walls, floor slabs perpendicular to the facade walls) can help to reduce the negative effects.
The internally insulated rooms also require careful attention to regular and efficient ventilation.
The insulation boards are glued with cement based adhesive mortar by "spot-mop" or full surface to the wall and/or fixed mechanically. The surface is finished with traditional thick plaster or gypsum board. The joints between the boards and between other construction parts must be closed to prevent risk of condensation. When installing plasterboards, joints must be finished according to the manufacturer's instructions.

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External solid wall insulation –The cost of insulated render/cladding is around £45 to £65 per square metre, depending on the selected product, installer, the condition of the exterior surface and its complexity. Since the whole house needs to be insulated using this method, minimum costs start around £2000. A typical semi-detached house with some 80 m2 of walls is likely to cost between £3,500 and £5,500.
Internal solid wall insulation – to insulate a whole 3-bedroom semi-detached house would cost approximately £650 if done by a professional or £450 if done as a DIY job. Prices vary by product and installer.
Payback

External solid wall insulation - typical annual savings are between £85 and £120 on the fuel bills. Payback period is 12+ years with an installation life of 25-30 years.
Internal solid wall insulation - typical annual savings are between £75 and £100 on the fuel bills. Payback period is 3 years for DIY installations and 6-7 years for professional installations.

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External wall insulation

The design and installation of external wall insulation is a specialist job.
It is strongly recommended to use certified materials and components. The typical method includes attaching standard size insulation boards to the wall and finishing with a reinforced render or cladding. The boards are between 40-90 mm thick, fixed to the wall with adhesive and mechanical fixings. The total thickness of the insulation is 50mm to 150mm. For most cost-effective results this should be done as part of other renovation work.
External insulation requires a planning permission since it changes the appearance of a house. This is particularly relevant in conservation areas. You should call your local council to check on local policy.

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Existing wall will be colder than before as it will no longer receive the direct heat from the inside and potentially will be damper, as no moisture will escape internally and condensation may be formed between the insulation and the internal face of the wall and as it is unheated this can cause frost damage in areas with low winter temperatures

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The photo above shows a geotextile membrane hung between the floor joists holding 150mm of mineral wool insulation – this detail was designed to offer high levels of insulation whilst maintaining a ventilated floor cavity and enables fast installation of the insulation so that the residents are disturbed for as short a duration as possible. The air-tightness in this area is maintained by installing 18mm chip board boards above the insulation which are then taped at all junctions (between boards and between the boards and the wall).

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Pipework
You can fill small gaps around pipe work with silicon fillers, similar to the fillers used for skirting boards and floorboards.
Larger gaps should be filled with expanding polyurethane foam. The foam can be sprayed into the gap. As it dries it will expand and fill the hole, then set hard.

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Energy Efficient Glazing – the basics
All properties lose heat through their windows. Installing energy efficient glazing is an effective way of reducing your energy bills and keeping your home warmer and quieter.
Double glazed windows use two sheets of glass with a gap between them which creates an insulating barrier, whilst triple glazed windows have three sheets of glass. Both options can deliver a high level of energy efficiency. It is not the case that you have to use triple glazing to gain the most energy efficient window.
Energy efficient windows are available in a variety of frame materials and styles. They also vary in their energy efficiency; depending on how well they stop heat from passing through the window, how much sunlight travels through the glass and how little air can leak in or out around the window.
Some window and door manufacturers helpfully use a window energy rating scheme to show the energy efficiency of their product. This is similar to the one you may have seen on appliances such as your fridge, or washing machine. A-rated windows are the most efficient. To check a window's energy efficiency before you buy, look at the energy label.

The benefits of double glazing
Smaller energy bills: replacing all single glazed windows with energy efficient glazing could save you around £135 per year on your energy bills.
A smaller carbon footprint: by using less fuel, you'll generate less of the carbon dioxide (CO_2) that leads to global warming.
A more comfortable home: energy efficient glazing reduces heat loss through windows and means fewer draughts and cold spots.

Peace and quiet: as well as keeping the heat in, energy efficient windows insulate your home against unwanted outside noise.

Reduced condensation: energy efficient glazing reduces condensation build-up on the inside of windows.

The costs and savings of double glazing will be different for each home and each window, depending on the size, material and installer.

Choosing the right replacement windows

Replacement windows come in a range of styles and designs and there are particular features you should look out for to increase energy efficiency.

To find the right windows for your home, ask yourself these questions:

How energy efficient are the windows?

When choosing replacement windows, you can check its energy efficiency by looking at the Energy Saving Trust Recommended logo and BFRC energy label. The Energy Saving Trust endorses any windows rated B or above. The higher the energy rating, the more energy efficient it is. Unfortunately, at the moment there is no obligation for window manufacturers to label their products, however by opting for a high rated window you know you will be buying the most efficient.

How many layers of glass do you need?

Double glazing has two layers of glass with a gap of around 16mm between them. There's also the option of triple glazing, which has three layers of glass. Both A rated double and tripled-glazed windows are available.

What type of glass is best?

The most energy efficient glass for double glazing is low emissivity (Low-E) glass. This often has an unnoticeable coating of metal oxide, normally on one of the internal panes - next to the gap. It lets sunlight and heat in but cuts the amount of heat that can get out again.

What's between the panes?

Very efficient windows might use gases like argon, xenon or krypton in the gap between the 2 sheets of glass.

What keeps the panes apart?

All double glazed windows have pane spacers set around the inside edges to keep the two panes of glass apart. For a more efficient window, look for pane spacers containing little or no metal – often known as "warm edge" spacers. The BFRC window energy rating scheme checks all the components to ensure the final window achieves the energy efficient standard claimed. This means that you just need to look for the A-G ratings and remember A is best! Alternatively, just look for the Energy Saving Trust Recommended logo which will only be found on glazing that is B rated or above.

Which frame suits your home?

The frame you choose will depend on your home and your personal taste. For all frame materials there are windows available in each energy rating.

uPVC frames are the most common type. They last a long time and can be recycled.

Wooden frames can have a lower environmental impact, but require maintenance. They are often used in conservation areas where the original windows were timber framed.
Aluminium or steel frames are slim and long-lasting. They can be recycled.
Composite frames have an inner timber frame covered with aluminium or plastic. This reduces the need for maintenance and keeps the frame weatherproof

Do you need ventilation?

Because replacement windows will be more airtight than the original single glazed frames, condensation can build up in your house due to the reduced ventilation.
If there is not a sufficient level of background ventilation in the room some replacement windows will have trickle vents incorporated into the frame that let in a small amount of controlled ventilation.
Condensation can sometimes occur on the outside of new low-e glazing. This is because low-e glass reflects heat back into the home and as a result the outside pane remains cool and condensation can build up in cold weather – this isn't a problem.

Installation and maintenance

When you plan an installation, you need to know about building regulations and what to do if double glazing doesn't suit your property, as well as how to maintain your windows.
When you think about replacement glazing, you need to make sure your windows are installed correctly and comply with all the relevant regulations.

Building regulations

Under building regulations in England and Wales new and replacement windows must meet certain energy efficiency requirements:
New & replacement windows in existing homes
In England & Wales must be at least WER band C or U-value 1.6 In Scotland must be at least WER band C or U value 1.6 In Northern Ireland must be at least WER band E or U value 2.0 or centre pane U value 1.2.
However, if you live in a conservation area, have an article 4 direction on your property or have a listed building, additional regulations are likely to apply. Before you do any work, make sure you check with your local planning office.
- an article 4 direction removes the right of permitted development, meaning that you will have to apply for planning permission before replacing any windows. This is often applied in Conservation areas.

How to comply with regulations

To make sure regulations are complied with, there are certain rules about the way you can install windows:
for DIY installations you must apply for building control approval before installing the windows. See how to apply for building control approval
for professional installations, your installer should be registered with a competent persons scheme or register the installation through Local Authority Building Control.

Competent Persons schemes in England and Wales are the Fenestration Self-Assessment Scheme (FENSA), the British Standards Institution (BSI) or Certass Glazing Scheme

Find registered installers

FENSA guarantees that its installers and frames comply with building regulations. To find a FENSA registered installer, visit the FENSA website.

Certass is another scheme that registers and approves installers. To find a Certass registered installer visit the Certass website.

Ask your installer when you will get a certificate when installation is completed, which demonstrates the installation has been completed in compliance with building regulations.

Other options for your windows

If you can't install double glazing – for example if you live in a conservation area or in a listed building – you have other options:

Heavy curtains

Curtains lined with a layer of heavy material can reduce heat loss from a room through the window at night and cut draughts.

They will save some energy, but should only be used as a short term measure.

Secondary glazing

Secondary glazing works by fitting a secondary pane of glass and frame, inside the existing window reveal.

This is likely to be less effective than replacement windows. The units tend to be not as well sealed, however it is considerably cheaper than double glazing.

It is also an ideal solution if you are unable to fit double glazing because you live in a conservation area or in a listed building.

Low emissivity glass is available for secondary glazing, which will improve the performance.

£ / yr kgCO2/yr Secondary glazing £85 420

These savings above also assume installing secondary glazing on all windows in a typical 3 bedroom semidetached home, heated by gas. Savings will vary depending on how much you pay for heating fuel.

Maintaining and replacing windows

As double glazing should last for more than 20 years or more, you're unlikely to upgrade often so it's worth installing windows with a good energy rating straight away. Looking for the Energy Saving Trust Recommended logo is an easy way to ensure you are buying windows with a good energy rating.

Sometimes your windows will need maintenance, for example if the seal within the unit between the two sheets of glass fails. This leads to a build-up of condensation between the panes, and you may need to replace the glass unit – but you can usually do this without replacing the frame.

As with installation, windows should only be replaced by registered installers or checked through the building control process.

Getting help and advice

Advice on saving energy

We offer free, expert, impartial advice on all kinds of energy saving measures. We can help you choose double glazing, find installers and see if any grants are available. Just call the Energy Saving Trust helpline on 0800 512 012.

Double glazing products

Energy Saving Trust Recommended accredits double glazing products which are B rated or above - better than the current building regulations standard.

The British Fenestration Ratings Council (BFRC) rates all energy efficient windows in the UK. To find out more visit the BFRC website.

Registered installers in England and Wales

The Fenestration Self-Assessment Scheme (FENSA) can help you find registered installers. To find out more visit the FENSA website.

Always use an installer who is a member of a Trade Association.

This has two benefits: Firstly, it will protect your consumer rights and secondly it will ensure that the company replacing your windows and doors is competent to do the job.

Go to the Glass and Glazing Federation who can provide details of installers at your location.

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How many layers of glass do you need?

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The frame you choose will depend on your home and your personal taste. For all frame materials there are windows available in each energy rating.

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Do you need ventilation?

Because replacement windows will be more airtight than the original single glazed frames, condensation can build up in your house due to the reduced ventilation.
If there is not a sufficient level of background ventilation in the room some replacement windows will have trickle vents incorporated into the frame that let in a small amount of controlled ventilation.
Condensation can sometimes occur on the outside of new low-e glazing. This is because low-e glass reflects heat back into the home and as a result the outside pane remains cool and condensation can build up in cold weather – this isn't a problem.

Installation and maintenance

When you plan an installation, you need to know about building regulations and what to do if double glazing doesn't suit your property, as well as how to maintain your windows.
When you think about replacement glazing, you need to make sure your windows are installed correctly and comply with all the relevant regulations.

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The costs and savings of double glazing will be different for each home and each window, depending on the size, material and installer.
The table below shows the potential saving on energy bills that can made when going from single to double glazing. It assumes all windows are replaced with B rated double glazing in a typical house (three bedroom semi detached home). Savings will also vary depending on how much you currently pay for your heating fuel, these savings are based on a gas heated home. More information on the assumptions can be found on our energy saving assumptions page.
£ / yr kg CO2/yr Single glazing to double (B-rated) £135 680 **Want to find out how much you can save on your bills by replacing your windows?**
If you want to find out how much you could save replacing your windows, use the Glass & Glazing Federation's (GGF) Energy Saving Calculator, developed in collaboration with the Energy Saving Trust.

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The benefits of double glazing
Smaller energy bills: replacing all single glazed windows with energy efficient glazing could save you around £135 per year on your energy bills.
A smaller carbon footprint: by using less fuel, you'll generate less of the carbon dioxide (CO2) that leads to global warming.
A more comfortable home: energy efficient glazing reduces heat loss through windows and means fewer draughts and cold spots.
Peace and quiet: as well as keeping the heat in, energy efficient windows insulate your home against unwanted outside noise.
Reduced condensation: energy efficient glazing reduces condensation build-up on the inside of windows.

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Depending on the material used for the framing can be low environmental impact for timber framing higher with uPVC

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This is a design of boiler which can have an increased efficiency over the more traditional boiler. 100% efficiency is not possible with any burning appliance. This is mainly due to the fact that products of combustion carry away some of the heat given off by the burning fuel up the chimney and into the atmosphere. The actual efficiency of a boiler varies considerably depending on a number of factors. some of which may be listed as follows: the age of the appliance. whether it is oversized in relation to the scheme it is heating and whether or not it has a permanent pilot or is fitted with electronic (spark) ignition. A modern boiler of the conventional type is said to be approximately 75 per cent efficient. the remaining 25 per cent of the heat passing up the flue. To achieve greater efficiency some of this heat must be reclaimed. but this poses a serious problem The efficiency of a typical non-condensing boiler is around 75%, whereas with condensing boilers it can be over 87%. This increased efficiency is due to the extraction of heat from the otherwise wasted flue gases. Most boilers have a single combustion chamber enclosed by the waterways of the heat exchanger through which the hot gases can pass. These gases are eventually expelled through the flue, located at the top of the boiler, at a temperature of around 180°C.

Condensing boilers, on the other hand, are designed first to allow the heat to rise upwards through the primary heat exchanger; when at the top the gases are rerouted and diverted over a secondary heat exchanger. These can reduce the flue gas temperature to about 55°C. This reduction of temperature causes the water vapour (formed during the combustion process) to condense and, as the droplets of water form, fall by gravity to collect at the base of the flue manifold. The remaining gases are expelled to the outside environment through a fan-assisted balanced flue. The condensation produced within the appliance should be drained as necessary into the waste discharge pipework or externally into a purpose-made soakaway.

The second difficulty is that water vapour is formed during the process of combustion. and if the flue temperature is lowered significantly the vapour will condense and turn to water. The first problem can be overcome by using a flue extractor, indeed some non-condensing boilers already use this method to reduce flue sizes. The difficulty of disposing of the condensate (water) has to some degree been overcome by allowing it to collect in the base of the boiler where it can be disposed of into the drainage system. Although the condensate is acidic in nature containing traces of nitric and sulphurous acids.

Combustion gases pass through the primary heat exchanger in a similar way to boilers of a traditional pattern, but at this point the similarity ends. Instead of passing the combustion products directly into the flue, bearing in mind they are at a temperature of approximately 200-250 °C, they are circulated around the secondary heat exchanger where more heat is given up to the cooler return water entering the boiler. Heat is extracted from the combustion products in two ways.

(a) In the form of sensible heat. i.e. the transmittance of heat from a hotter medium (in this case the combustion products) to the cooler return.
(b) By the latent heat of evaporation.

The initial cost of condensing boilers is more than that of conventional types, and

although the 92-94 per cent efficiency claimed by manufacturers is attractive, as already explained this depends largely on operating temperatures as illustrated by the graph in Fig. 5.9. Dewpoint is the term used to signify the temperature at which the water vapour condenses and reverts to water. The ideal temperature at which this occurs is 59 °c when the air-to-gas ratio is just sufficient to cause complete combustion of the gas. In practice, however, to ensure safe working conditions, a quantity of air in excess of the ideal requirements must be provided which has the effect of lowering the combustion temperature and the dewpoint of the combustion products. Despite this it will be seen that with a dewpoint of approximately 53-54 °C very high efficiency can be obtained with low return-water temperatures. With regard to the viability of changing an existing boiler for a condensing type, several factors must be considered. If the existing boiler is of the old pattern with an open burner, giving efficiencies of only 60-65 per cent, and taking into account its remaining service life, it will be an economic proposition. If, however, it is of the new pattern with a closed combustion chamber giving an average efficiency of 75 per cent, despite the savings on operating costs, the initial cost of the condensing boiler would not be viable, bearing in mind that a modern conventional boiler is likely to be operating a heating scheme where the return temperature is relatively high. Condensing boilers are, however, an economic alternative to a conventional boiler in terms of running costs
when fitted with new installations designed to give a 20-22 °C drop between the flow and return temperatures. Radiant heating schemes employing a system of pipework embedded in walls, floors or ceilings, operating at lower temperatures and heated by a condensing boiler, would show significant savings on heating costs.

When upgrading an existing boiler one of the practical aspects that must be considered is the position of the flue outlet. Due to their efficiency the flue gases from condensing boilers tend to produce a greater degree of 'plumbing' than those of the traditional type. Flue termination under windows or adjacent to doors, car ports or opposing walls, must be avoided.

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Many people are unaware that when it comes to heating your home efficiently a full set of Heating Controls is as equally important as investing in a high efficiency condensing boiler. Heating controls enable ultimate control of your central heating and hot water system. Using the appropriate controls will grant you control of when your heating and hot water will be switched on and off. Heating Controls allow you to make the most of your central heating system, allowing it to only ever be in use when necessary. This will lead to having a highly efficient home with lower fuel bills. An efficiently controlled central heating system should include:

- Central Heating Programmer (or Central Heating Timer)
- Central Heating Room Thermostat

OR:

- Programmable Room Thermostat (Central Heating Programmer and Room Thermostat combined into one unit)

Cylinder Thermostat (ONLY if your home is fitted with a Regular Conventional Boiler with a separate Hot Water Cylinder)
Motorised Valves (Mid-Position or Zone Valves)
Thermostatic Radiator Valves

Wireless Central Heating Controls / Wireless Digital Room Thermostat / Wireless Programmer / Wireless Timer Switch / Wireless Programmable Thermostat

Wireless Central Heating Controls are generally required if your boiler is sited in an area that isn't easily accessible, e.g. loft areas or garages. Wireless Central Heating Controls operate in the same way as hard-wired central heating controls, however they require a separate receiver unit that transmit wireless signals from the main control unit, which is hard wired to an area within the household. Therefore if your boiler is located in the garage area, you will be able to control it from within the property. The added bonus of using wireless controls means there is no need to chase walls to conceal unsightly cables, when retro fitting to a pre-installed system.

For a more advanced controlled heating system, Wireless Central Heating Controls can offer more flexibility to control temperature in one or more location of your choice. This is generally referred to as zoning, where different rooms within your property can be individually controlled from one central control point. Wireless Central Heating Controls are becoming increasingly more popular as they enable you to upgrade your system, with minimal disruption.

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Image: http://www.sbsa.gov.uk/html/radiators.html

Thermostatic Radiator Valve / TRV

A Thermostatic Radiator Valve is most commonly referred to as a TRV. A TRV can be fitted to your radiator to give you ultimate control of your heating system. TRVs enable you to control the heat output from your radiators on a room-by-room basis. A TRV uses a sensor to establish the surrounding air temperature. The TRV will close down the flow to the radiator, thereby cooling the radiator and generally regulating the room temperature.

TRVs allow you to set the room temperature as required. You also can turn the TRV down completely if you are not occupying the room in question, thus conserving energy and saving you money on your heating bills.

PlumbNation Heating Supplies offer a range of TRVs from the market leading manufacturers such as Danfoss, Honeywell and Drayton. Thermostatic Radiator Valves can be purchased individually, if you are looking to fit to an already

installed radiator, or they can be purchased in a “Combi Pack”, which contains the TRV and Lockshield Valve (to close off the other end of the radiator). These are ideal if you are installing/replacing radiators in your home. Thermostatic Radiators Valves are also available for the more design conscious, offering all chrome models that will blend in wonderfully with any decor.
It is also necessary that you choose the correct size TRV, which is dependent on the size of the pipe work on your radiators, generally 8mm, 10mm or 15mm. Some TRV packs include adaptor sizes to fit all, or they are individually sold in the one size.

Improve the comfort levels in a property by fitting thermostatic valves to the radiators. They work by sensing the air temperature in the room and adjusting the heat accordingly, saving money and cutting CO_2 emissions.
Most central heating systems are controlled by an electronic thermostat, but by fitting thermostatic valves to each individual radiator the temperature can be varied according to the room - so the whole house does not have to be heated just to get the living room warm. For the average home, you can save around 90kg of CO_2 - that saves about as much CO_2 as switching your gadgets off standby - and around £10 a year.

How does it work?
TRVs contain a valve that determines the hot water flow into the radiator. Usually a wax plug linked to the valve expands or contracts according to changes in room temperature and controls the valve via a connecting pin.
Wall-mounted thermostats is very commonly in the hall, so TRVs should not be fitted there as the radiator's thermostat will shut the radiator off when the temperature is reached, only for the wall thermostat to fire up the boiler and compensate for the cool radiator. And so on, and so on. But otherwise the two systems work very effectively together. The wall thermostat determines the maximum temperature for the house and the radiator valves will allow the limit to be set room by room - people generally don't want their bedroom as warm as their living room, for example.
It also means you don't have to waste money and energy warming rooms you seldom use just so you can be comfortable in the ones you do.
One thing to note: if you turn a TRV down low in one room, keep the door to that room closed. Otherwise the radiators in adjacent areas will just work overtime to heat the air in there too.
DIY will cost £8 per valve - (around £56 for the whole house) add around £100 if you're getting a plumber to fit them. This should pay back in between five and ten years.
They don't work like a dimmer switch! TRVs are most effective if kept at a constant level
Heat the rooms you use most, rather than the whole house. Carbon consultant Chris Goodall recommends setting your thermostat to 18°C and keeping half the house (possibly the upstairs if that's where your bedrooms are) about three

degrees lower than the main living rooms. Or you could simply try turning off radiators in bedrooms
Don't cover radiators with curtains or block them with nearby furniture or they may not work properly

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Central Heating Room Thermostat
A Central Heating Thermostat measures the air temperature around itself, which enables the Room Thermostat to regulate the heating system to consistently maintain the desired temperature. So when the temperature falls below the setting, the thermostat switches on the central heating and once the desired temperature is reached it switches it off again. Room Thermostats should ideally be installed in a colder area of the house, i.e. in a hallway near to a front door. It is important not to fit a room thermostat close to another heat source like a radiator or gas or electric fire as this will affect the performance. It is also worth noting that it is recommended that a thermostatic radiator valve should not be fitted in a room with a room thermostat. A Room Thermostat will only work when a central heating programmer or timer switch is turned on.
For optimum energy saving results, a Room Thermostat should be installed in the coldest room and the TRVs should be installed in every other room containing a radiator.Domestic Central Heating Controls - Domestic Central Heating Controls - Room Thermostat

Programmable Room Thermostat / Programmable Thermostat
A Programmable Room Thermostat is a Room Thermostat and Central Heating Programmer combined into one component. Programmable Room Thermostats therefore work in the same way as a regular Room Thermostat and Central Heating Programmer, except the controls for both time and temperature can be controlled from one unit. You can program your heating and hot water to switch on and off at independently varying times of the day, and also set the temperature at which you want your rooms heated.
A room thermostat continually monitors the air temperature of the room in which it is located. It is usually pre-set at about 20ºC and by switching the heating source on and off at appropriate times maintains that pre-selected temperature. As room thermostats should not be used in conjunction with thermostatic radiator valves, it is usual to locate the room thermostat in a circulation area like the hallway of a dwelling.

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Cylinder Thermostat
A Cylinder Thermostat operates in the same way as a Room Thermostat, except that instead of controlling the central heating, the Cylinder

Thermostat keeps a constant check on the temperature of the water in the hot water cylinder. The Cylinder Thermostat will switch the boiler on and off, in order to maintain the required water temperature. When the desired temperature is reached, the boiler will then rest if no other control is calling for heat, until some hot water is used, or the cylinder cools down naturally.

Domestic Central Heating Controls - Hot Water Storage Cylinder Thermostat
To make economic use of the boiler, separate thermostatic controls are necessary for the central heating water and the domestic hot water. The cylinder thermostat ensures that the water supplied to the sink, washbasin and bath taps is at a safe temperature. Domestic hot water is usually stored at 60ºC-65ºC. The thermostat is strapped to the outside of the cylinder where it opens and closes a motorised valve as necessary to maintain a safe temperature.

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A Central Heating Programmer / Central Heating Timer Switch will allow you to control when the heating and hot water should be switched 'On' and 'Off', therefore allowing you to only heat your home and hot water as and when necessary, which of course will save energy and lower fuel costs.
Central Heating Programmers are available as a Single Channel Central Heating Programmer, which only allows single control of the heating or hot water or a Twin Channel Central Heating Programmer, which enables separate control for heating and hot water.
Central Heating Programmers can provide 24 Hour settings for any day of the week or for weekdays and weekends only, depending on which type of Central Heating Programmer system:
5/2 Day Central Heating Programmer – enable differing settings for weekdays and weekends.
7 Day Central Heating Programmer – enable differing settings for every day of the week.

Programmable Timer
Timers are very important devices for saving energy as they switch the central heating and hot water systems on and off at pre-determined intervals. Digital programmers are the most flexible as they can allow for seven day, or longer, functions to be pre-set.

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Motorised Valve
Motorised Valves are used to divert the flow of water from the boiler to (a) the direct hot water cylinder (b) the central heating radiators or (c) both. Motorised Valves are available as either 22mm or 28mm valves, which will be established by that of your pipe work of your home. Motorised Valves can be used with a

Central Heating Programmer to provide zone control, which can change temperatures for different rooms at different times.

Two Port Motorised Valve

A Two Port Motorised Valve has 2 pipe connections (Inlet and Outlet ports) that permit or block flow between the ports depending on whether it is actuated or not. Flow is permitted when the valve is started (usually when the boiler is on) and blocked when the valve is off. Two Port Valves are only designed to control the flow for hot water or central heating, at one time. Two Port valves may also be referred to as Zone Valves.

Three Port Motorised Valve

A Three Port Motorised Valve has 3 ports (one inlet and two outlet) and can divert the water flow to either or both of the outlet ports. This allows one Motorised Valve to control heating and hot water, instead of two separate Two Port Motorised Valves. Most Three Port Motorised Valves have a mid position option which allows flow to both circuits simultaneously, but some Diverter Valves allow flow to only one or the other at any one time. Three Port Valves are commonly referred to as Mid-Position Valves.

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Central Heating Controls - Frost and Low Limit Thermostat

A frost thermostat is usually installed on the outside of the north wall of the dwelling to protect the home's plumbing system from frost. It operates independently of the central heating programmer and can override it and turn on the heating if the outside temperature falls below 2ºC.

Central Heating Controls - Motorised Valves

Motorised valves are electrically operated and are used to facilitate the independent temperature control of heating and hot water systems.

Domestic Central Heating Controls - Thermostatic Radiator Valves

Thermostatic radiator valves allow the heat output from central heating radiators to be manually controlled ensuring that the room does not become overheated, thus saving energy. A thermostatic radiator valve is a combined thermostat and water valve fitted with a dial with a range of settings that can be operated manually to pre-select an operating temperature. As the temperature in the radiator rises the water valve closes and reduces the flow of water to the radiator. Thermostatic radiator valves are ideal for providing background heating in rooms that are not used regularly.

Central Heating Controls - Optimum Start Controller

Air temperature varies from day to day throughout the heating season. In view of this, it is not necessary for the boiler to turn on at the same pre- programmed time every day. On warm days the boiler can start up later to attain the pre-set temperature. An optimum start controller is a computer device that receives information from thermostats inside and outside the dwelling and calculates the most appropriate time for the central heating to start-up.

The likely payback period for a domestic central heating control system is approximately three years

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Water based underfloor heating uses water heated to a lower temperature than conventional water central heating, which makes it perfect for use with a high efficiency condensing boilers.
The water temperature to the heating pipe is controlled by mixing the water in the pipes with hot water from the boiler to get the required temperature, this is then distributed to the various zones. A conventional boiler will generally suit underfloor heating, overall comfort levels are greatly increased over radiator systems and running costs are comparitvely lower.

Different flooring
In new builds with solid floors, the heating pipe/cable is normally embedded in the floor screed.

When being installed in existing buildings with solid floors, the pipe/mat (see note) is normally laid on the surface and covered by a timber, laminate or tile surface - this lifts the level of the floor which will mean that doors, skirting boards etc will also need to be lifted.
Note: Where the electric element is to be laid on a surface rather than embedded in screed, electric ufh normally uses heating mats which are usually just the cable attached to a flexible, mesh backing - this ensures that the cable remains adequately spaced.
Where the floor is tiled, the pipe/cable is embedded in flexible tile adhesive - most tile adhesives are flexible.
Suspended wooden floors can also be heated by pipes/cables mounting between the joists. However, timber is a very good heat insulator so special attention needs to be paid to the installation. The options normally offered to improve the transfer of the heat through the timber are:
Using aluminium plates under the floorboards to spread the heat - more expensive in materials than the other options.
Using a mortar filler between pipe/cable and floorboards - very labour intensive during installation - also very heavy (can be 25kg per sq.metre of flooring) so the strength of the joists needs to be considered.
or
Clipping the pipe/cable under the floorboards (normally less than 25mm (1 inch) from the underside) - fairly cheap and quick but not as effective as the other options.
The effect of the heat on timber flooring should also be considered, timber with a moisture content of less than 10% should be specified to reduce the risk of the flooring drying out then shrinking, twisting or warping.

The effect of the heating on other types of flooring (e.g. laminates, vinyls) should also be considered and the manufacturer/supplier consulted if in doubt. The method of installing the flooring may need to be adjusted, i.e. thick underlays should not be used with laminates as they will act as a heat insulator.
With all ufh, consideration needs to be given to any floor covering, using a heavy carpet underlay and carpet will act as a heat insulator and reduce the heating effect.

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Many new builds now feature electric underfloor heating and also, because it is simple to retrofit onto existing flooring with minimal mess, it is increasingly popular in property updates. If you too are contemplating electric floor heating, read on before hitting any stores.

Underfloor heating leaves you free to maximise wall space and to enjoy your floors more fully

What is electric underfloor heating?

Electric underfloor heating is a modern take on the ancient concept of warming rooms from below the floors. Instead of slow-burning fires that heat the ceiling and in turn the floor of the room above, the system has evolved to become electrically-powered heaters that are installed beneath a floor covering, often directly so. They are usually wires on a reel or pre-positioned on a mat, although some systems also take the form of panelled sheets. Electric floor heating works on the principle of rising heat, thus it warms the room from ground up. This kind of heating, known as radiant heat, emits warmth that is even and ideally suited for the human physiology – the feet are warm while the air at head-level remains comfortably cool rather than stuffy, as is often the case with other forms of heating. With radiant heat, comfort tends to be felt sooner and at a lower temperature so energy savings are achieved.

What benefits can I expect to gain from my electric underfloor heater?

Electric underfloor heating is advantageous in many ways, including the following:

Luxuriate in extra comfortable warmth thanks to the gentle method of radiant heating

Potentially lower heating bills thanks to targeted usage, optimal energy efficiency and sustainability

Take advantage of free wall space for uninhibited interior design

With the heater well insulated and hidden underground, there is no risk of burns

Enjoy a healthier environment with reduced drafts and airborne allergens

Be free of regular maintenance as required by conventional gas-fuelled radiators

Where can electric floor heating be fitted?

Electric floor heating is usually installed indoors and can be fitted in any rooms from kitchens to bathrooms. It is also excellent for conservatories where traditional wall-mounted radiators are less practical. The systems are operated by individual zones, which means you can choose to install the heater in an entire room or just a section of it as required.

Which system should I go for?

Electric underfloor heaters come in various forms and which type you choose would depend on the specifications of your project. An irregularly shaped room with many units to work around would benefit from the flexibility of a loose cable heater. Big areas, on the other hand, could be covered more conveniently with a pre-spaced matting heater that is simply rolled out over the floor. Fully earthed systems such as the Warmup Foil Heater also makes shorter work of installation in wet areas as the integrated safety mechanism eliminates the need for additional grounding nets.

Your final floor finish could also affect the system you could use, as some products are intended solely for installation under certain materials such as tiles. If you are not in a position to confirm the floor covering yet, but need to have the heating installed nonetheless perhaps to adhere to a project schedule, Warmup offers ultimate versatility in the form of their inscreed heater that is compatible with all floor surfaces. Because it is fitted within concrete, the heating system will stay protected until the floor covering is ready to be put down.

What should I do about installation?

Installation of electric floor heating systems is relatively straightforward and can for the most part be taken on by a competent DIY-er or experienced tradesman. It is however recommended that a qualified electrician connect the thermostat and for manufacturers' instructions to be followed closely. If in any doubt, always contact the manufacturer for clarification. It is also worthwhile considering the use of insulation boards in conjunction with your underfloor heating system as they can significantly reduce heat-up times.

How do I know if a particular brand is reliable?

When shopping around for a system, it is more advisable to make your selection based on overall value rather than a direct price comparison.

First and foremost, check that the heating element is insulated with high quality fluoropolymers and not cheap PVC plastic that will become brittle over time.

Look for accreditations. Safety marks such as BEAB, GS and DEKRA are based on some of the most stringent standards in Britain and Europe so you can be assured of high quality.

The length of a product's warranty is often an indication of the manufacturer's confidence in its durability, so the longer the better. Market leader Warmup even offers a SafetyNet Installation Guarantee whereby a heater damaged accidentally during fitting will be replaced for free.

Ascertain the level of support you will be entitled to pre and post-purchase, including useful services like free quotes, rapid delivery and technical help along the way. A consumer-oriented company offering both telephone assistance and online resources that you can conveniently access around the clock is best. Ideally, choose a company that has dedicated service engineers as they will have both the technical know-how and the ability to respond quickly in the unfortunate event of a system malfunction.

Ask for precise running costs of their systems. A company that is heavily committed to research and development would be able to tell you that.

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It gives a very even temperature over the floor area, with very few cold spots. Because the floor temperature is much lower than a conventional radiator, convection currents are minimised and there are less draughts.
Efficiently installed, it should run at 35 degrees Celsius, compared to radiators which run at 75 degrees. This makes it a good match for alternative heating systems such as heat pumps.
Underfloor heating works well with a condensing boiler, because the boiler runs more efficiently with low return temperatures.
The radiant heat given off by the floor results in very high comfort levels. In our experience this means that, in practice, you can run it at lower temperatures – so saving energy. It should be possible to have the house at a temperature 2 or 3 degrees lower than with conventional radiator use.
There will be no radiators taking up wall space.
It's very good for rooms with high ceilings: heat from an underfloor system goes up the centre of the room giving the occupants a greater sense of warmth for much less energy input than with radiators (where heat tends to go up the walls and collect in the roof space)
Comfort conditions are improved as we are sensitive to radiant heat, so it is possible to have the house at a 2 or 3 degrees lower temperature than with conventional radiator use.

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Mechanical ventilation is any method of using a power-driven fan to move air in a desired direction. These types of systems are commonly installed in bathrooms, on or near the ceilings, to remove moist air when showering or bathing. Mechanical ventilation systems are also installed above stovetops to remove water vapor, cooking smells and to exhaust the by-products of combustion for gas stoves. They are also installed in attics to increase the amount of air exchange with the outside, reducing moisture buildup and mitigating the chances of mold.

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Disadvantages
The more you ventilate a home the more its heating and cooling efficiency is reduced. When you bring in the exterior air you increase the workload for your HVAC system. However, you can install heat recovery ventilators (HRV) to recover the energy lost through ventilation. Another disadvantage of mechanical ventilators is that they can depressurize a home. The modern home is so airtight that when you force air to the exterior it can lower the interior pressure. This can

cause problems for natural vent appliances like furnaces and hot water heaters that need positive pressure to exhaust their combustion products out of the home. The negative pressure pulls these gasses into the living environment and are potentially very dangerous for the occupants.

Read more: Advantages & Disadvantages of Mechanical Ventilation Systems | eHow.co.uk http://www.ehow.co.uk/info_8602703_advantages-disadvantages-mechanical-ventilation-systems.html#ixzz1ZKLmgZvm

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Advantages
Ventilation reduces the amount of moisture in the interior of a home. This moisture comes from people breathing, bathing and sweating, as well as from plants, cooking and stored firewood. As the moisture content of the air rises, the likelihood of mold and fungus taking hold increases as well. If the moisture content of a wooden structure exceeds 18 percent it can begin to deteriorate through rot. Your home needs a much dryer environment than you do, so trying to find the correct humidity is always a balance. Ventilating the house also brings fresher, cleaner air into the living environment. Common household cleaners and products evaporate and can create indoor air pollution.

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Heat Recovery Ventilation System
The Problem
Modern well insulated homes with central heating suffer air pollution up to 10 times worse than outside, according to a 'Which' report.

Surveys by the (Department of Environment Transport Region) DETR and the Building Research Establishment (BRE) have Carbon Dioxide levels in one in ten British homes above World Health Organisation guidelines.

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Current Building Regulations call for extractor fans in all wet areas of the property including the kitchen, bathroom, utility, en-suite, WC and trickle vents in all the windows to allow air back into the property, at a cost to the homebuilder.
The Solution - Heat Recovery Systems with quiet operation levels
The Villavent® Heat Recovery system is designed to completely change all the air in the property at least once every two hours, continually replacing the stale damp air with fresh, warmed, clean, filtered air.

The Villavent® Heat Recovery Ventilation unit recovers 60-70% of the heat normally lost through trickle vents and other breakout points in the building structure. Systems can recover 70% (crossflow) 80% (rotary wheel) or 90% (counterflow).

By installing a Villavent® Heat Recovery system you are providing filtered fresh air thus creating a healthier indoor environment alleviating allergy sufferers.
Generally the Villavent® Heat Recovery unit is of Scandinavian construction. The casing is constructed from double skinned galvanised steel sheet with thermal insulation and is very quiet in operation. The large cross flow heat exchanger is manufactured from aluminium giving both higher efficiency and longevity. The British Allergy Approved EU7 pollen bag filter and electric heater battery are fitted as standard in our VX - E/EV range of units.
Our systems comply with the current Building Regulations 2006 Part F and in Scotland standard 3.14 and therefore no noisy extractor fans or draughty trickle ventilators in windows are required.
By negating the need for trickle ventilators in the windows noise pollution and heat loss is greatly reduced.
British Allergy Approved filtered fresh air - alleviating asthma and hayfever sufferers
Our heat recovery ventilation units are very quiet in operation
Excellent heat recovery and enhancement of energy efficiency
1 electrical connection and low voltage control panel
Constant change of air without draughts removing indoor pollution
No unsightly trickle ventilators in windows
Quiet extractor fans
No overrun timers
Fewer breakout points through the building structure
Condensation control
Ventilation system is operational as soon as power is available reducing drying times and speeding decoration
Easy to install

Heat Recovery Ventilation System - How It Works

Villavent® offer a wide range of Quiet Heat Recovery Ventilation units that can be sited either in the roof space; above a Villavent® cooker-hood in the kitchen; at high level in a cupboard or alternatively the unit can be wall mounted.

Ducting connects the stale air exhaust grille to the Heat Recovery Unit and extracts via ducting to all the wet areas of the property. The stale air passes through the cross-flow heat exchanger and 65-70% of the heat normally lost via trickle vents is recovered.

Fresh air is brought into the property via a separate external grille, passes though the heat exchanger and picks up the heat recovered from the stale air.
There is no mixing of air flows - only the transfer of heat.
The warmed fresh air is then ducted to all the habitable rooms within the property.

Our electronic (E) loft mounted and wall mounted (VE) range of Heat Recovery units incorporate the most innovative user friendly controls available on the market today. From the Control panel you can see what is happening within the HRV unit.

Fan speed selection can be made from minimum, normal or maximum with a unique option to select a low medium or a high medium setting to suit individual requirements.

Supply air temperature can be adjusted in cold external conditions to ensure supply air temperature between 15°C and 20°C. A light indicates the heater is in operation.

Service indicator is illuminated on the controller when the filters require cleaning/replacement. This is usually factory set to 9 months but can be adjusted to either 6 or 12 months dependent upon the likely contamination/cleanliness of the air required.

With the electronic controls only a low voltage wire (supplied in 12m cable) is required and additional controllers may be purchased for different areas of the house. The last activated controller will be the command.

The pollen filter is approved by The British Allergy Foundation and awarded its Seal of Approval on products supplied with EU7 filter.

Cookerhoods

Dependant upon the type of installation Villavent® can offer a range of Heat Recovery Ventilation systems suitable for use with a cooker-hood.

Units are made to site above the cooker in the kitchen or to be sited remotely in a roofspace. Telescopic and a choice of stainless steel cookerhoods are available.

Optional Extras

Summer By-pass Block

In all our Heat Recovery Ventilation units the heat exchanger block can be replaced by a summer by pass block when heat recovery is not required. This will increase the air flow and may give a cooling effect on hot summer days.

Comfort Cooling® - Villacool™

The Villavent® Comfort Cooling unit can be fitted onto our Heat Recovery system on installation or at a later date. (However, the supply air ducting must be fully insulated to accommodate the cooling unit.) Rather than being an expensive thermostatically controlled air conditioning system the Villacool™ unit will cool and dehumidify the supply air by 8-12°C on outside air temperature, resulting in a 2-3°C temperature drop within the room. This reduction in temperature will vary dependent on the amount of heat gain within the building and the amount of air provided by the ventilation system.

The Villavent® ELFI electrostatic filter

With ever increasing concern given to the quality of the air we breathe, an additional filter can be supplied. The ELFI electrostatic filter takes out 97% of airborne particles as small as 0.1 micron i.e. pollen, bacteria, smoke, viruses, country odours and traffic fumes, thus making it a sound investment for those who suffer from allergies and who have young children.

Compliance

Villavent® Heat Recovery systems are designed to completely change all the air in the property at least once every two hours, continually replacing the stale damp air with fresh, clean filtered air. Our systems comply with the current Building Regulations 2006 Part F and in Scotland standard 3.14 and therefore no noisy extractor fans or draughty trickle ventilators in windows are required.

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Most boilers, even high efficiency SEDBUK "A" rated condensing boilers, still lose a substantial amount of heat through the flue outlet. The GasSaver captures this heat and uses it to help generate hot water for domestic use. The result is a **typical annual saving of 37%** of energy required to deliver hot water.

Or to put it another way, the GasSaver delivers more usable hot water than a typical solar hot water system, just by extracting all the energy **from the gas that you have already paid for.**

The GasSaver is a patented energy saving device which saves upto 40% of the energy required for generating hot water.

The GasSaver is manufactured in the UK to the highest quality standards, is approved under the Water Regulations Advisory Scheme (WRAS), and is recommended by the Energy Savings Trust.

The GasSaver is also recognised under the Government's SAP scheme and can be used to count towards the energy rating of a dwelling. These energy savings can help a dwelling reach the various standards under the Code For Sustainable Homes

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Flue Gas Heat Recovery Systems (FGHRS) recover some of the heat from exhaust gases from boilers and use it to heat domestic hot water, so reducing the amount of energy required for water heating. However, in some cases adding FGHRS to a dwelling may make almost no difference to the DER. For example, a house without FGHRS may get 3.6% under TER, whilst the same house with FGHRS may get only 4.0% under TER. Why does it make so little difference (0.6% of TER)?

The key is not the FGHRS, but the treatment of efficiency adjustments arising from weather or enhanced load compensators in Table 4c of SAP 2009.

Normally, the effective space heating efficiency of a condensing boiler will increase by 3% if a weather compensator or enhanced load compensator is fitted. However, as note (a) to Table 4c requires, those adjustments are ignored if a FGHRS is fitted. So if a 90% efficient boiler with a weather compensator was fitted, the house *without* the FGHRS would have an adjusted space heating efficiency of 93%, while the boiler in the house *with* FGHRS would only have a space heating efficiency of 90%. The reduction in emissions resulting from that 3% difference in efficiency almost balances the reductions achieved by recovering heat from the exhaust gases.

Taking the weather compensator out of the calculation for the dwelling examples above, leaves the FGHRS dwelling at 4% under TER, but the non-FGHRS dwelling now gets only 1.6% under TER, showing the FGHRS makes a 2.4% improvement in performance (4 - 1.6 = 2.4). But without FGHRS the weather compensator makes a 2% improvement (3.6 - 1.6 = 2).

The balance between the two systems will vary with the configurations of dwellings, but the underlying message is that other items in the specification may mean FGHRS does not give a significant level of benefit.

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INCANDESCENT Incandescent bulbs function by running electricity through a tungsten filament, which glows when it gets hot, producing what many people consider a pleasingly warm light. They are inefficient; around 90 percent of that energy is emitted in the form of heat rather than light.
HALOGEN A form of incandescent lighting, halogen also uses tungsten filaments. But in halogen bulbs, the filaments are contained in a small glass capsule along with halogen gases, which trap evaporating tungsten and redeposit it on the filament, enabling halogen bulbs to last twice as long as traditional incandescent bulbs. This process makes halogens more efficient and also allows them to reach higher temperatures, thereby producing a whiter light.

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What are halogen bulbs?
A halogen bulb is an ordinary incandescent bulb, with a few modifications. The fill gas includes traces of a halogen, often but not necessarily iodine. The purpose of this halogen is to return evaporated tungsten to the filament. As tungsten evaporates from the filament, it usually condenses on the inner surface of the bulb. The halogen is chemically reactive, and combines with this tungsten deposit on the glass to produce tungsten halides, which evaporate fairly easily. When the tungsten halide reaches the filament, the intense heat of the filament causes the halide to break down, releasing tungsten back to the filament.
This process, known as the halogen cycle, extends the life of the filament somewhat. Problems with uneven filament evaporation and uneven deposition of tungsten onto the filament by the halogen cycle do occur, which limits the ability of the halogen cycle to prolong the life of the bulb. However, the halogen cycle keeps the inner surface of the bulb clean. This lets halogen bulbs stay close to full brightness as they age.

In order for the halogen cycle to work, the bulb surface must be very hot, generally over 250 degrees Celsius (482 degrees Fahrenheit). The halogen may not adequately vaporize or fail to adequately react with condensed tungsten if the bulb is too cool. This means that the bulb must be small and made of either quartz or a high-strength, heat-resistant grade of glass known as “hard glass”. Since the bulb is small and usually fairly strong, the bulb can be filled with gas to a higher pressure than usual. This slows down the evaporation of the filament. In addition, the small size of the bulb sometimes makes it economical to use premium fill gases such as krypton or xenon instead of the cheaper argon. The higher pressure and better fill gases can extend the life of the bulb and/or permit a higher filament temperature that results in higher efficiency. Any use of premium fill gases also results in less heat being conducted from the filament by the fill gas, meaning more energy leaves the filament by radiation, meaning a slight improvement in efficiency.

Lifetime and Efficiency of Halogen Lamps

A halogen bulb is often 10 to 20 percent more efficient than an ordinary incandescent bulb of similar voltage, wattage, and life expectancy. Halogen bulbs may also have two to three times as long a lifetime as ordinary bulbs, sometimes also with an improvement in efficiency of up to 10 percent. How much the lifetime and efficiency are improved depends largely on whether a premium fill gas (usually krypton, sometimes xenon) or argon is used.

Halogen Bulb Failure Modes

Halogen bulbs usually fail the same way that ordinary incandescent bulbs do, usually from melting or breakage of a thin spot in an aging filament.

Thin spots can develop in the filaments of halogen bulbs, since the filaments can evaporate unevenly and the halogen cycle does not redeposit evaporated tungsten in a perfect, even manner nor always in the parts of the filament that have evaporated the most.

However, there are additional failure modes.

One failure mode is filament notching or necking. Since the ends of the filament are somewhat cool where the filament is attached to the lead wires, the halogen attacks the filament at these points. The thin spots get hotter, which stops the erosion at these points. However, parts of the filament even closer to the endpoints remain cool and suffer continued erosion. This is not so bad during continuous operation, since the thin spots do not overheat. If this process continues long enough, the thin spots can become weak enough to break from the weight of the filament.

One major problem with the “necked” ends of the filament is the fact that they heat up more rapidly than the rest of the filament when the bulb is turned on. The “necks” can overheat and melt or break during the current surge that occurs when the bulb is turned on. Using a “soft-start” device prevents overheating of the “necks”, improving the bulb’s ability to survive “necking”. Soft-start devices will not greatly extend the life of any halogen bulbs that fail due to more normal filament “thin spots” that run excessively hot.

Some halogen bulbs may usually burn out due to filament end necking, and some others may usually burn out from thin, hot spots forming in the filament due to uneven filament evaporation/recovery. Therefore, some models may have a significantly extended life from “soft-starting” and some other models may not.

It is generally not a good idea to touch halogen bulbs, especially the more compact, hotter-running quartz ones. Organic matter and salts are not good for hot quartz. Organic matter such as grease can carbonize, leaving a dark spot that absorbs radiation from the filament and becomes excessively hot. Salts and alkaline materials (such as ash) can sometimes “leach” into hot quartz, which typically weakens the quartz, since alkali and alkaline earth metal ions are slightly mobile in hot glasses and hot quartz. Contaminants may also cause hot quartz to crystalize, weakening it. Any of these mechanisms can cause the bulb to crack or even violently shatter. If a quartz halogen bulb is touched, it should be cleaned with alcohol to remove any traces of grease. Traces of salt will also be removed if the alcohol has some water in it.

Since the hotter-running quartz halogen bulbs could possibly violently shatter, they should only be operated in suitable fully enclosed fixtures.

Use of Halogen Bulbs with Dimmers

Dimming a halogen bulb, like dimming any other incandescent lamp, greatly slows down the formation of thin spots in the filament due to uneven filament evaporation. However, “necking” or “notching” of the ends of the filament remains a problem. If you dim halogen lamps, you may need “soft-start” devices in order to achieve a major increase in bulb life.

Another problem with dimming of halogen lamps is the fact that the halogen cycle works best with the bulb and filament at or near specific optimum temperatures. If the bulb is dimmed, the halogen may fail to “clean” the inner surface of the bulb. Or, tungsten halide that results may fail to return tungsten to the filament. Halogen bulbs have sometimes been known to do strange and scary things when greatly dimmed.

Halogen bulbs should work normally at voltages as low as 90 percent of what they were designed for. If the bulb is in an enclosure that conserves heat and a “soft-start” device is used, it will probably work well at even lower voltages, such as 80 percent or possibly 70 percent of its rated voltage. However, do not expect a major life extension unless soft-starting is used. Even with soft-starting, do not expect to more than double or possibly triple the life of any halogen bulb already rated to last 2,000 hours or more. Even with soft starting, the life of these bulbs will probably not continue to improve much as voltage is reduced to less than about 90 percent of the bulb’s voltage rating.

Dimmers can be used as soft-start devices to extend the life of any particular halogen bulbs that usually fail from “necking” of the ends of the filament. The bulb can be warmed up over a period of a couple of seconds to avoid overheating of the “necked” parts of the filament due to the current surge that occurs if full voltage is applied to a cold filament. Once the bulb survives starting, it is operated at full power or whatever power level optimizes the halogen cycle (usually near full power)

The dimmer may be both “soft-starting” the bulb and operating it at slightly reduced power, a combination that often improves the life of halogen bulbs.

Many dimmers cause some reduction in power to the bulb even when they are set to maximum.
(A suggestion from someone who starts expensive medical lamps by turning up a dimmer and reports major success in extending the life of expensive special bulbs from doing this.)

Ultaviolet from Halogen Lamps

There is some common concern about the ultraviolet output of halogen bulbs, since they operate at high filament temperatures and the bulbs are made of quartz instead of glass. However, the filament temperature of halogen bulbs rated to last 2,000 hours or more is only slightly greater than that of standard incandescent lamps, and the UV output is only slightly higher. Halogen fixtures typically have a glass or plastic shield to confine any possible bulb explosions, and these shields absorb the small traces of shortwave and mediumwave UV that gets through the quartz bulb.

Higher temperature photographic and projection bulbs are different. The much higher filament temperature of shorter life bulbs results in possibly significant hazardous UV. For maximum safety, use these bulbs in fixtures or equipment designed to take these bulbs, and in a manner consistent with the fixture or equipment instructions.

For those who want to take special precautions against UV, a UV blocking clear filter gel such as the GamColor no. 1510 may be a practical solution. This filter gel withstands use moderately close to halogen lamps and withstands heat to maybe 100 to 150 Celsius or so. This filter gel can be placed immediately outside the glass shield of most fixtures, although the tubular shield in many popular 300 watt torchiere lamps gets too hot for the filter gel.

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FLUORESCENT The light in fluorescent bulbs is produced by running electricity through a glass tube (either straight or, in compact fluorescent light bulbs, curled) that contains mercury vapor and argon. The electricity activates the mercury vapor, creating ultraviolet radiation that causes a phosphor coating on the inside of the glass to produce light. Fluorescent bulbs last a long time and require far less electricity than incandescent or halogen bulbs. Engineers are experimenting with phosphor coatings that improve the color of the light the bulbs cast.

One drawback is the toxicity of the mercury they contain, which means they should be disposed of properly or recycled. Ikea is among the few national retailers with a recycling program (the company accepts compact fluorescent bulbs purchased from any retailer and has bins in every store). The Environmental Protection Agency is working to expand recycling and disposal options.

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Why LED Light Bulbs?

An LED light bulb can last you up to 30,000 hours. That averages out to 6 hours of light per day for 12 years.
LED light bulbs are so energy efficient that, depending on how often you have them on, they'll actually pay for themselves in just over a year.
The best way to conserve energy is to use less of it. LED light bulbs are directional - which means that they only put the light where you aim it or where you need it. Incandescent bulbs, on the other hand, just sit there and throw their glow all over the place - wasting electricity and generating heat.
LED light bulbs run cool, so they're safer to use than fragile, burning hot halogen and incandescent bulbs.
LEDs turn on instantly - which has been a big benefit in car brake lights and is also a welcome feature when testing lights in a dark basement.
LEDs do not use mercury like CFLs - so disposal concerns aren't the same.

LED Light Bulb Benefits

Save money on electricity
Light the color of daylight
Use only 2-10 watts of electricity (1/3rd to 1/30th of Incandescent or CFL)
Long lasting - up to 30,000 hour bulb life
Cool running (warm to the touch) - little heat compared to standard bulbs
Instant on/off
Works in cold weather
Can sustain moderate power surges
Durable bulbs with no fragile filaments to break from shaking and rattling
Directional lighting generates less wasted light
Works with sensor activated lights

LED Energy Efficiency

Here's how LED light bulbs compare to ordinary bulbs: A regular 40 Watt incandescent bulb burns through a lot more energy than it needs to produce the light you see. Remember those toy ovens that used an incandescent light bulb to bake brownies? A large percentage of the energy that goes into a 40 Watt bulb is wasted as heat - great for baking brownies, not so great for conserving electricity and saving money. LED light bulbs, on the other hand, generate very little heat as they glow, instead transferring most of their energy directly into light.
The latest LED light bulbs now produce about the same amount of light per watt as compact fluorescent bulbs (CFL). However, unlike incandescent bulbs and CFLs, which splash light in all directions, LED bulbs are directional. They drive their light in one direction, so that you have light exactly where you want it. This directional lighting equals savings in yet another fashion. LEDs don't waste light (energy) on areas you don't need illuminated, which is also why they're perfect task lights.
Prior to the introduction of LED light bulbs, if you wanted to use a low watt (less than 4 watts) bulb for ambient lighting, you had to settle for a hard-to-find, expensive, incandescent light or an unsightly florescent. Current LED bulbs are designed to fit standard bases, range from 0.85 to 7.3 watts, and are made for

low light situations. In addition to low wattage, you get the bonus of long life and energy efficiency, which all adds up to a 90% savings over standard bulbs.

If each U.S. household replaced just **one** standard 60 watt bulb with a CC Vivid LED Light bulb, the energy savings would be greater than the amount of energy produced by one of the largest power plants in the U.S.

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Life Span & Energy Consumption Benefits of LED Light Bulbs vs. Incandescent Light Bulbs Incandescent 60 Watt Light Bulb CC Vivid 2 Watt LED Light Bulb

Life Span

How long will the light bulb last?1,000 hoursUp to 30,000 hours

Number of bulbs used

over 30,000 hour period301

Bulb Cost

Per 30,000 hours$20.10

(30 bulbs at 67¢ each)$34.95

Electricity Usage

kWh of electricity used over 30,000 hours1800 kWh60 kWh

Cost of Electricity

30,000 hours at 10¢ per kWh$180.00$6.00

Total Cost

After 30,000 hours**$200.10$40.95**

Total Savings:

Money saved by installing **one** CC Vivid LED Light Bulb**Save $159.15 Per Bulb!**National Energy Savings:

If every U.S. household replaced just one standard 60 watt bulb with a CC Vivid LED bulb, we could save **24,184,400,000 watts or 24,184.4 mega (million) watts per day**.
National savings information based on 103,000,000 households with an average use of 4 hrs per day per house. Based on gross watts.

A Cool, New Color of Light
LED light bulbs bring a white light into a room. Unlike the yellow light we're so used to seeing from incandescent bulbs, the white light cast by LEDs is closer to the color temperature of daylight. The white light of LEDs is easier on your eyes and also provides the added benefit of lifting your mood in the summer and winter time. The white light also mixes in wonderfully with ordinary lights around your home or workplace, and it's a great light to read by.
Vibration Resistant
In a garage or basement under heavy foot traffic, incandescent bulbs are just too fragile to last very long. Too much vibration and the filament breaks and you're left with darkness or the hassle of changing another bulb. Not so with LED light bulbs. Since LED light bulbs have no filament, there's nothing to rattle apart and break. So they'll not only save you money in the cost of bulb replacement, they'll save you the trouble of climbing onto a chair or rickety ladder to swap out that incandescent bulb that keeps burning out.

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The most obvious form of lighting control is the light switch or a manual dimmer. An alternative, which many argue is better, is to switch the lights automatically in response to presence detection. PIR occupancy sensors can be hard wired into either the luminaires or the marshalling box that provides power for a group of luminaires.

Maximum savings are realised by using daylight linking to dim the lights up and down in response to the natural light levels.

The technology has moved on, so PIR sensors are now sensitive to even the smallest of movements. They also have a far greater range and a good design will ensure that neighbouring sensors overlap so that there are no “dead” areas.

Even greater savings can be realised when such occupancy sensing is combined with daylight linking. Systems exist for both switch start and high frequency lighting. With switch start systems, the lights are simply turned on or off in response to occupancy and natural light levels. These systems have a delayed off to avoid constant switching in response to the sun going behind a cloud.

Maximum savings are realised by using daylight linking to dim the lights up and down in response to the natural light levels. This needs a digital lighting control solution and high frequency lighting for fluorescents.
Such systems also maximise lamp life, since typically they do not turn off in response to bright light, but dim down to say 10%. They can also have a delayed off setting, so for instance if no occupancy is detected for 20 minutes they dim down to a set level, 15% for example, and then after a further hour they turn off. So there is much that can be done to make a lighting installation more energy efficient. If you are worried about the extra cost of installing high frequency control gear or lighting control, then take a look at what funding is available.

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Energy-efficient hot water
Looking for ways to save energy?
Looking for ways to save energy?
If you're looking for more ways to save energy, take a look at our range of energy-saving products.
Hot water accounts for around 10% of the average energy bill. It's not something we can do without, so use this guide to find energy-efficient ways of getting your hot water, and tips to help you use less of it.
What methods of heating water are available and what do they cost?
How much of my energy consumption is used for heating my water?
What types of shower are there?
What type of shower is the most cost-effective?
What can I do to lower my water heating costs?
Top tips to save on your water heating that are FREE
Top tips to save on your water heating, for just a small investment
Top tips to save on your water heating, moderate to high investment
How does solar water heating work and should I install it?
What methods of heating water are available and what do they cost?
Although there are different ways of heating water, the main supply is usually heated by the central heating system, either 'stored' within a cistern (tank), or 'on demand' if you have a combi boiler.
Generally speaking, modern combi boilers are more energy-efficient than a hot water system with a tank or cistern.
There are several other ways of heating water, including solar hot water systems, immersion heaters, electric showers and (of course) kettles.
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How much of my energy consumption is used for heating my water?
It is difficult to be exact about the energy that is used for heating water because it is hard to measure, and difficult to separate out from the energy your boiler uses for heating. But, in a typical home, the cost of heating water is likely to exceed 10% of the energy bill, or approximately a quarter of the fuel used by the boiler. This may seem high, but remember you need hot water all year round, whereas heating is seasonal.

The true cost of hot water should also take account of the cost of the water supply itself, which in some cases can be as high as the cost of heating it. Some people can save by switching to a water meter - as a rough guide, if you have more bedrooms than you have people living in your home a meter is worth looking into.

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What types of shower are there?

We're often told to take a shower rather than have a bath, to save energy and water. But what types of shower are there, and are they all really better than taking a bath?

Showers fall into three broad types:

electric showers are widespread and use electricity to instantly heat water as it passes through the unit at mains pressure.

mixer showers draw on both hot and cold water supplies and mix them together. Some are gravity-fed, in this case the hot water cistern and cold water tank have to be appropriately positioned to create flow, alternatively if the hot water cylinder is unvented, the water will be stored at mains pressure, and this pressure is used to drive the shower. Less common, but an option worth considering, is where the cold water pressure is used to draw the hot water from its source, without the need for a pump.

power showers generally use stored hot water, which is then mixed with cold water; this is pumped out using an electrically powered pump. The flow rate is higher than with an electric or mixer shower.

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What type of shower is the most cost-effective?

Given the cost of gas is only about 40% that of electricity (for each unit of heat provided), in theory, a mixer or power shower might be more cost efficient than an electric shower. However, electric showers usually use less water and therefore require less energy, so a lot depends on how long you are showering for. In addition, electric showers are efficient due to the fact that the water is heated at the point of use, whereas with power and mixer showers heat is lost (and wasted) through the cistern and pipes before it even reaches the shower.

Power showers also use so much water that the traditional advice of taking a shower rather than a bath to save energy and water may not apply, if the shower lasts more than a few minutes. Water costs will also be higher for power and mixer showers if you are on a water meter.

If you are having a new shower installed, the costs will vary depending on which type of shower you choose. Electric showers are cheap to buy, but they only have a short lifespan. They are also expensive to install as they require considerable electrical work. Mixer showers tend to have lower installation costs and longer reliability, although they can be expensive to purchase. Power showers need some electrical work, but this isn't as extensive as with an electric shower. All three will typically need a plumber to install them.

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What can I do to lower my water heating costs?
There are some straightforward ways to lower your water heating costs, and some of these cost nothing at all. In principle you need to do the following:
Choose carefully how you heat water.
Be sensible about **when you heat hot water**.
Use less hot water.
Heat your hot water to a **lower temperature**.
Don't let hot water cool down before you have used it.
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Top tips to save on your water heating that are FREE
Turn down the **thermostat** on your cistern to 60-65°C.
If you have an old central heating system, the **temperature** of the hot water will be determined by the internal circulatory system, as set on the boiler, so turn that down. It might also benefit from being turned down, even if you have a cylinder thermostat.
Use a **kettle** for the times you need very hot water.
Check the **timings** and other controls on your boiler for your water heating, which on an older boiler will often be integrated with the timings of your central heating. You may be able to reduce the length of time that the water heating is turned on, especially in the summer.
Check to see if your power shower pump has **flow controls**, and if so, you can look to reduce the flow.
With any type of shower, check to see if you can adjust the **shower head** spray pattern, as using the right one may mean you can reduce the flow of water.
If you wash up by hand, don't **rinse** the dishes under running hot (or cold) water, rather use a separate bowl. Find out if it's greener to wash-up by hand or use a dishwasher.
If you have an older boiler, then it is a good idea to use an **immersion heater** in the summer, however, if you have a modern combi-boiler, then you won't need to.
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Top tips to save on your water heating, for just a small investment
If you have an old cistern (tank) that isn't insulated, then fit a **tank jacket**, this should pay for itself in just a few months. You can add to the insulation effect by storing bedding, pillows and towels around the cistern.
Insulate the 'downpipes', these are the pipes that lead from the cistern to the taps, where they are accessible. This will mean less of a wait for the hot water to come through, which is more energy-efficient. It is particularly useful where small amounts of water are used frequently, such as in a hand basin or a kitchen sink, and it's an easy and inexpensive job to do. (It's also a good idea to insulate cold water pipes where there is a danger of frost, to prevent burst pipes).
If you have a mixer or power shower, fit a **shower head flow regulator**, or a shower head that aerates the flow. Both reduce the flow of water, cutting water and energy use.

If your hot water is solely or often heated using an immersion heater, and you don't already have a **timer** (timeswitch) on it, it's a good idea to fit one. This is particularly useful if you have an Economy 7 supply, as it means you will be able to heat your water using overnight cheap electricity. A timer can also be useful on old style central heating systems.
Fix **dripping** taps. If you don't feel confident putting new washers in your taps, you could ask your plumber to do it.
Buy a **shower timer** to check how long you are really spending in the shower. Aim for 6 to 7 minutes, perhaps a couple of minutes extra if you are washing long hair.
Make sure your shower is in good condition, including the showerhead, the hose and the wall mounting. Replace parts if necessary and **de-scale** your showerhead regularly if you live in a hard water area, otherwise scale build up will affect the water flow.
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Top tips to save on your water heating, moderate to high investment
If your **hot water cistern** is very old, consider replacing it with a modern insulated one. Water can stay warm for up to two days, and they perform much better even compared to an old-fashioned tank with a jacket on it.
If you are thinking of installing a solar hot water system in the future, it may be worth installing the **larger-sized tank** with the required two heat inputs (one for the central heating, and one for the solar panel).
If your **boiler** is over fifteen years old, it could be time to replace it. A modern combi-boiler, which provides instant hot water, is generally considered to be more energy efficient than a 'stored' hot water system.
You could install **solar water heating** (SWH), also known as solar hot water (SHW). This is an expensive measure, but the introduction of the Renewable Heat Incentive (RHI) by the government will help you to recoup some of the upfront costs over time.
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How does solar water heating work and should I install it?
Solar water heating works by circulating a liquid through a panel on an approximately south facing roof (or occasionally a wall or some kind of ground-mounted system). There are two types of panel, a 'flat panel', and the more expensive but more efficient 'evacuated tube'. The liquid is warmed by sunlight, even in cloudy weather and this liquid is circulated through the hot water cistern, transferring its warmth to the water there.
A solar system can only work with a larger cistern with two heat inputs - one from the boiler and one from the solar panel.
From an energy efficiency and cost saving perspective, it makes sense to have installed all other energy efficiency measures in your home, including a modern boiler, insulation and low energy lighting, before you consider investing in solar water heating.

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Water efficient showerheads
New technology water-efficient showerheads can produce water flows that feel as though they are far higher than they actually are. Water efficient showerheads save both water and energy in one simple device. However, they cannot be fitted to electric showers and are most effective on power and mixer showers with a high flow rate.

Water saving shower heads

Showers aren't always water efficient
You might assume that a shower is a more water-efficient way to wash than taking a bath, but that's not necessarily the case.
While a quick shower is usually more water efficient than a bath, some high-volume power showers use more water in less than five minutes than to fill a bath. The amount of water you use depends on the type of shower and shower head you have, and the length of time you spend in the shower.
Showers and water saving
Here are some of the main shower types:
Bath and shower mixers
This is the type of shower where the hose and spray are attached to your bath. The temperature and amount of water are adjusted through the taps, letting you better control the amount of water you're using.
Manual mixer showers
This is a popular and cost-effective shower, where the hose and spray come out of a wall unit and there is a temperature control that mixes the hot and cold water supply.
Electric shower
An electric shower is essentially a water heater, which rapidly heats cold water as it flows towards the shower head. Electric showers are economical as you only heat the water you need.
Power shower
This uses an electric pump which allows you to adjust the pressure and water temperature. This type of shower is the worst for water saving, and can quickly use more water than a bath.

The Ecocamel claims to reduce water use

Water-saving shower heads
The shower head controls the flow and spray pattern of water. They come in a range of shapes and sizes, and the design can directly affect water consumption. We've tested two shower heads that claim to save water, the Ecocamel and Nordic Eco Galant shower heads. You can see if we think they're worth investing in by reading our water-saving shower heads review.
Here are some other things to consider:

Check if a low-flow or water-saving shower head will benefit you by putting a two-litre container in the shower floor. If it takes less than 12 seconds to fill when the shower's running on full, it could help cut your usage.
A larger shower head with bigger holes uses more water, but isn't necessarily more powerful than a smaller one – that depends on water pressure and the type of shower you have.
Aerating shower heads mix water with air, reducing the overall amount of water that's needed.
Other water-saving shower heads reduce the flow rate, 'pulsate' the water or include a flow restrictor to the shower hose to save water.

Water-saving shower gadgets
The amount of time you spend in the shower also affects the amount of water you use – and waste. But how long is too long? There are plenty of water saving gadgets on the market for your shower that time how long you're taking and alert you to when your time is up. We've tested a couple of them:
the Eco Showerdrop alerts you when you've used 35 litres of water – the amount recommended by water efficiency group Waterwise.
the Efergy Showertime is a combined clock and timer that you can pre-program so it tells you when you've reached your limit.
Your water company may also supply free water-saving gadgets for your shower. These gadgets include:
a shower flow reducer that screws into the bottom of your shower hose.
simple shower timers in the shape of an egg timer that attach to your shower walls with a suction cup.
Check with your water company to see what freebies it offers.

The Eco showerdrop times showers and saves water

Top water-saving tips for showers

Time your shower
Keep your showers to no longer than five minutes, or use a water-saving timer that lets you know when you've exceeded 35 litres of water.
Don't leave your shower running
Try not to run your shower before you get in – keep your shower set at your preferred temperature so you don't have to spend time adjusting before use.
Adjust your shower power
Use a less powerful setting to reduce your water use, or select the eco shower setting if your shower has one.
Fix drips
Over time, the water that escapes from a dripping shower adds up – get it fixed to avoid needless water waste.

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Reduced capacity baths
A standard bath has a capacity of around 80 litres, so, even when it's less than half full, it uses a substantial amount of water. Baths with a much lower capacity are now available to buy if you're looking to purchase a new bath. Remember, you can save water and money by taking a quick shower instead of a bath.

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Lower flow taps
Taps with a low flow rate can be fitted to bathroom and kitchen sinks. Click point taps are better for kitchen sink taps, whilst aerated or regulated flow taps are more suitable for a bathroom sink. Both work very well, but remember to always turn off the tap if you're not using it.
Flow tap aerators and regulators
Where sink taps or shower units are not being replaced, it is still possible to save water by fitting suitable flow regulators to showers or a tap aerator. Flow devices often contain precision made holes, filters or flow aerators to better regulate flow, are easy to install and do not compromise on experience. If you have an electric shower you should not fit a flow regulator otherwise it may damage performance.

Aerated flow (Picture 1)
Aerated flow types introduce air into the water stream. This softens the stream and reduces water splash when, for example, you are washing dishes.
Laminar flow (Picture 2)
Laminar flow types remove air to provide a clear water stream. They are commonly used in hospitals and medical clinics to prevent airborne bacteria from entering the water.
Spray flow (Picture 3)
In low flow conditions, where aerators and laminar devices would not function effectively, spray flows spread the tap's water stream over a wider area. This type of aerator ensures full coverage when washing your hands and is recommended for use in public toliets to reduce water consumption.
Installation
Installation of a tap aerator is simple. Just follow these easy steps:
Unscrew and remove your existing aerator (and washers).
Assemble your new aerator by placing the insert and washer into the housing. The type of rubber washer may vary according to your tap requirements. Most aerator packs come complete with rubber washers.
Clean the thread on your tap.
Screw your new aerator on and hand-tighten.

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Ground source heat pumps

Ground source heat pumps use a buried ground loop which transfers heat from the ground into a building to provide space heating and, in some cases, to pre-heat domestic hot water. As well as ground source heat pumps, air source and water source heat pumps are also available.

The benefits

The efficiency of a ground source heat pump system is measured by the coefficient of performance (CoP). This is the ratio of units of heat output for each unit of electricity used to drive the compressor and pump for the ground loop. Average CoP over the year, known as seasonal efficiency, is around 3-4 although some systems may produce a greater rate of efficiency. This means that for every unit of electricity used to pump the heat, 3-4 units of heat are produced, making it an efficient way of heating a building. If grid electricity is used for the compressor and pump, then you should consult a range of energy suppliers to benefit from the lowest running costs, for example by choosing an economy 10 or economy 7 tariff.

Ground source heat pumps

How it works

There are three important elements to a ground source heat pump:

The ground loop

This is comprised of lengths of pipe buried in the ground, either in a borehole or a horizontal trench. The pipe is usually a closed circuit and is filled with a mixture of water and antifreeze, which is pumped around the pipe absorbing heat from the ground.The ground loop can be:

Vertical, for use in boreholes

Horizontal, for use in trenches

Spiral, coil or 'slinky', also for use in trenches

A heat pump

In the same way that your fridge uses refrigerant to extract heat from the inside, keeping your food cool, a ground source heat pump extracts heat from the ground, and uses it to heat your home. A ground source heat pump has three main parts:

The evaporator, (e.g. the squiggly thing in the cold part of your fridge) absorbs the heat using the liquid in the ground loop;

The compressor, (this is what makes the noise in a fridge) moves the refrigerant round the heat pump and compresses the gaseous refrigerant to the temperature needed for the heat distribution circuit;

The condenser, (the hot part at the back of your fridge) gives up heat to a hot water tank which feeds the distribution system.

Heat distribution system

This consists of under floor heating or radiators for space heating and in some cases water storage for hot water supply.

Is it suitable for my home?

You should consider the following issues if you're thinking about installing a ground source heat pump. An accredited installer will be able to provide more detailed advice.
You will need space outside your house for the ground loop.
The ground will need to be suitable for digging a trench or borehole.
What fuel is being replaced? If it's electricity, oil, LPG or coal the savings will be more favourable than gas. Heat pumps are a good option where gas is unavailable.
The type of heat distribution system. Ground source heat pumps can be combined with radiators but these will normally be larger than with standard boiler systems. Under floor heating is better as it works at a lower temperature.
Want to further reduce your home's carbon dioxide emissions? Install solar PV or some other form of renewable electricity generating system to power the compressor and pump.
Is the system for a new building development? Combining the installation with other building works can reduce costs.
Have you installed insulation measures? Wall, floor and loft insulation will lower your heat demand and make the system more effective.

Air and water source heat pumps
Air and water source heat pumps use air or water respectively. They do not rely on a collection system and simply extract the heat from the source at the point of use.
Air source heat pumps can be fitted outside a house or in the roof space and generally perform better at slightly warmer air temperatures. Water source heat pumps can be used to provide heating in homes near to rivers, streams, lakes and lochs for example.
Click here for more infomration on air source heat pumps.
Costs and savings
A typical 8 - 12kW system costs £6,000 - £12,000 (not including the price of distribution system). This can vary with property, system size and location. Vertical ground loop systems are significantly more expensive to install than horizontal ground loops, due to the higher cost of drilling a borehole. When installed in an electrically heated home a ground source heat pump could save as much as £1000 a year on heating bills and almost 7 tonnes of carbon dioxide a year. Savings will vary depending on what fuel is being replaced.
Fuel Displaced £ Saving per year CO2 saving per year Gas £410 1.2 tonnes Electricity £1000 7 tonnes Oil £750 1.8 tonnes Solid £350 6.5 tonnes
Savings above assume ground source heat pump installed in a detached property and provides up to 50% of domestic hot water as well as 100% of space heating.
Where can I find out more about installation?
Ground source heat pump savings assume installation in a fully insulated detached house located off the gas grid.
The BERR funded low carbon buildings programme provides grants to help with the costs of installing a ground source heat pump.

The Scottish Community Householder Renewables Initiative (SCHRI) provides grants for properties in Scotland. This is funded by the Scottish Government and managed by the Energy Saving Trust. If you live in Scotland you can choose to have a SCHRI or a low carbon buildings programme grant. However, you can only apply for one grant per technology from either of these programmes
To be eligible for a grant you will need to use a certified installer and products

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an earth connection (also known as ground or ground-water loops) that extracts heat from the earth or discharges heat to the earth;
a heat pump that transfers heat between the distribution system and the ground or ground-water loops; and
a distribution system to deliver the heating or cooling to the building's various spaces

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But this may be reduced by not having all the equipment needed for a conventional heating system in the building

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Quiet
Low maintenance
Year round efficiency – ground temperatures don't vary enormously even in places like Canada

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Dr Lawn's installer and architect worked together closely to ensure that his new house was designed to maximise the efficiency of the heat pump. As heat pumps run at a lower temperature than normal central heating systems, he was advised that the foundations should be made of concrete,
and that he would need under floor heating combined with the right insulation in the walls, floors and loft. To maximise savings further, the windows were positioned to absorb passive heat from the sun into the house and a solar water heating system, also funded by the Energy Saving Trust, was installed.
The location of Dr Lawn's home was ideal for a ground source heat pump as he has plenty of ground space which allowed him to dig horizontal trenches for the ground loops. However, the installation process took longer than expected because large rocks were discovered when the trenches were being dug. This also increased the cost of the installation by several thousand pounds, making it more expensive than a normal system of this size.

Key points
• Heat output: 10kW
• Type of ground loop: horizontal 'slinky'
• Electrical input to power heat pump: 2.5kW
• Proportion of heating met by heat pump: 100 per cent
• Fuel being replaced: electricity
• Estimated fuel savings: approximately £460/yr
• Estimated carbon savings: approximately 7,000kg CO2/yr
Cost
Total installation cost: £13,942
Energy Saving Trust grant: £3,823

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Benefits
The benefits of air source heat pumps are similar to ground-source heat systems. Firstly, neither type of system requires the use or storage of external fuel. The systems instead run on electricity, which eliminates the need for a gas connection or storage of oil/solid fuel. Air source heat pumps present an advantage over ground source heat pumps because they require less space to install. Instead of requiring the installation of buried underground coils, air source systems can be fitted using much less space and are therefore, more suited for an urban home.
How it works
In the same way that a fridge uses refrigerant to extract heat from the inside, keeping your food cool, and air source heat pump extracts heat from the outside air, and uses it to heat your home and hot water. An air-source heat pump has three main parts:
The **evaporator coil** absorbs heat from the outside air;
The **compressor** pumps the refridgerant through the heat pump and compresses the gaseous refridgerant to the temperature needed for the heat distribution circuit;
The **heat exchanger** transfers the heat from the refridgerant to air or water.
In an air-to-water system, the heat produced is used to heat water, which can be used to pre-heat water in a storage tank or circulate through underfloor heating or radiators. Heat pumps produce hot water that is a lower temperature (typically 35-45C) than standard boiler systems, which makes underfloor heating the most effective option. In an air-to-air system, this heat is used to produce warm air, which is circulated by fans to heat a building.
The efficiency of air source systems is measured by a coefficient of performance (CoP). CoPs for air source systems are comparable with ground-source heat pumps, and generally range between 3 and 4. This means that for every unit of electricity used to power the pump, 3-4 units of heat are produced, making it an efficient way of heating a building.

It is even possible for air source heat pumps to extract useful heat from air at temperatures as low as minus 15 oC.

Is it suitable for my home?

You should consider the following issues if you're thinking about installing an air source heat pump.

You will need space on an external wall outside your house to fit the evaporator coil.

An air source heat pump should cover the heating requirements of a well insulated property. Due to the lower temperature compared with traditional boilers, it is essential that your home is insulated and draught proofed. These measures will lower your heat demand and make the system more effective.

Consider what fuel is being replaced: if it's electricity, oil, Liquid Petroleum Gas (LPG) or coal, the payback will be more favourable than gas. Heat pumps are a good option where gas is unavailable.

The type of heat distribution system. Air source heat pumps can be used to heat water that is circulated through radiators but under floor heating is more effective due to the lower temperature of the air/water produced.

Is the system for a new building development? combining the installation with other building works can reduce costs.

If you want to further reduce your home's CO 2 emissions you can purchase a green electricity tariff or install solar PV or some other form of renewable electricity generating system to power the compressor and pump.

Costs and savings

A typical 6kW domestic system, suitable for a well insulated detached property, costs in the range of £7,000 to £10,000 installed.

When installed in an electrically heated home, an air source heat pump could save around £870 a year on heating bills and almost 6 tonnes of carbon dioxide a year. Savings will vary depending on the fuel replaced.

Fuel Displaced £ Saving per year CO2 saving per year Gas £300 830 kg Electricity £870 6 tonnes Oil £580 1.3 tonnes Solid £280 5 tonnes *All savings are approximate and are based on an air source heat pump providing 100% of space heating in a detached property.*

Grants

Grants are now available from the Low Carbon Buildings Programme.

At the moment grants for air source heat pumps are available in Scotland under the Scottish Community and Householder Renewables Initiative (SCHRI).

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He is particularly interested in the small ASHP units, which are rated at 3kW output. The one in the photo I took is the larger 5kW one, so you can imagine that the 3kW one is almost half this size. Crucially, it is small enough to fit through the average loft hatch, and this in itself opens up a whole new market for heat pumps — small houses without gardens. The unit can get plumbed into the loft where the air temperature will, in any event, be a little higher than outdoors, and in about two hours a day it will be capable of delivering 150lits of hot water, enough for a couple of people. It's not a renewable power source, as it uses electricity, but because the way heat pumps work, it will use about a third of the electricity an electric immersion heater would use, so it will deliver 6kWh of heat energy for just 2kWh of juice burned.

Will it catch on? Well, it may do. The one thing that makes Ferguson very bullish about his ActivAir heat pumps is that he can sell them for £695 + VAT. Compare that with solar panels (at around £2,500), or indeed any of the other renewable or carbon-lite technologies, and you can see that his ASHP units may well find a new market.

The downsides are that the units are a little on the noisy side to be happily operating indoors. And the recovery rate, the time taken to replenish your hot water cylinder, is rather slow. The 3kW unit would take over two hours to recover, as compared with 30 minutes for a similar-sized cylinder heated by a conventional boiler.

There is also the cost calculation to run through. Although ASHP will deliver three units the heat output for every one unit of electricity required to operate it, that electricity is always going to be more expensive than mains gas. And if the mains gas is a third of the price of mains electricity, then your cost saving vanishes. As it stands, mains gas is rather more expensive than this at the moment, but not by a lot, so the running cost saving is there, but only just. Unless of course you manage to run your ASHP unit on Economy 7, in which case it becomes very cheap to run indeed. But then you'd have it whirring away for a couple of hours every night whilst you slept. If you mounted it correctly, you wouldn't hear a thing, but it would always be a concern that it could keep you awake.

Trianco's ASHP units are available in larger sizes. As well as the 3kW output, there are 5kW, 7kW and 12kW. This largest size is capable of taking on GSHP as a whole house space heating solution. Many people feel that it's got to be less efficient than GSHP because outside air temperatures are habitually lower than winter ground temperatures, but Ferguson's units work at good efficiencies down to —3°C, which is about as cold as it gets in southern England these days. And at £1895, it is way cheaper than any GSHP unit I have come across.

At the moment, Ferguson is importing his ActivAir units from China

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ASHP's can be used to provide space heating to a wide range of building types. They are used in houses and community buildings across the country. The technology has, in the first instance, been developed with the housing market in mind so smaller systems up to 12kW have so far been developed. Heat pumps are most suited to energy efficient buildings and are most efficient when supplying low temperature distribution systems such as underfloor heating.

These pumps are particularly cost effective in areas where mains gas is not available. An ASHP typically costs in the region of £3,500 (6kW) and £6,000 (12kW), excluding the cost of the distribution system eg radiators.

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Photo: Two types of solar-thermal collector: Left: A flat-plate collector. Photo by Alan Ford. Right: An evacuated-tube collector. Note the grey manifold at the top and the white water pipe flowing through it. Photo by Kent Bullard, US National Park Service. Both photos courtesy of US Department of Energy/National Renewable Energy Laboratory (DOE/NREL).

A typical household solar heating system consists of a solar panel (or solar collector) with a heat transfer fluid flowing through it to transport the heat energy collected to somewhere useful, usually a hot water tank or household radiators. The solar panel is located somewhere with good light levels throughout the day, often on the roof of the building. A pump pushes the heat transfer liquid (often just treated water) through the panel. The heat is thus taken from the panel and transferred to a storage container.

A well designed solar thermal system can supply 50-70% of a buildings hot water needs and prevent 0.5 tonnes of CO_2 emissions

- Solar thermal systems can be easily retrofitted and interfaced with existing hot water supplies, so all buildings should be future proofed for solar
- Collectors can be flat plate or vacuum tubes and Panels can be roof integrated or above roof mounted
- Use intelligent controls to optimise solar gain
- In domestic situation use solar rated dual coil cylinder and in commercial situations use thermal stores to protect against Legionella

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1. In the simplest panels, Sun heats water flowing in a circuit through the collector (the panel on your roof).
2. The water leaving the collector is hotter than the water entering it and carries its heat toward your hot water tank.
3. The water doesn't actually enter your tank and fill it up. Instead, it flows into a pipe on one side of the tank and out of another pipe on the other side, passing through a coil of copper pipes (the heat exchanger) inside the tank and giving up its heat on the way through.
4. You can run off hot water from the tank at any time without affecting the panel's operation. Since the panel won't make heat all the time, your tank will need another source of heating as well—usually either a gas boiler or an electric immersion heater.

5. The cold water from the heat exchanger returns to the panel to pick up more heat.
6. An electric pump (powered by your ordinary electricity supply or by a solar-electric (photovoltaic) cell on the roof keeps the water moving through the circuit between the collector and the water tank.

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According to property manager Chris Tattersall, one of the best investments he ever made at his Devon family home was the installation of two solar panels.
"They cost £3,500 to install on the roof a year last February and I reckon we are saving around £20 a month on our gas bills now," he said.
"We don't heat the water in the summer months and in winter the solar heating still manages to pre-heat the water. It really is absolutely fantastic.
" I did it for environmental reasons but it is saving us money too."
Chris, 48, managed to obtain two grants to purchase his solar system. One for £300 from his local district council and another for £400 from the Government.
" But for Chris, its his solar heating system that's his pride and joy. " It really is amazing and I think the Government should make solar thermal panels compulsory for all new housebuilding," he enthused.
Around 20,000 homes have fitted solar thermal panels in the UK, according to industry estimates and the technology is now established and proven and a reliable buffer against gas and electricity price rises.
Sales and marketing manager John Spencer, 57, from York, only recently purchased two solar thermal roof panels but in a matter of months, estimates he is saving between £40 and £60 a month on gas. This will bring a saving of around £400 a year taking into account the winter.
"It's fabulous. There are three of us in the house and I have not needed to use any gas to heat water for the last 15 days. These panels are fantastic. The panels are 2m by 2m and I feel very smug about them.
"Yes, they cost me around £3,500 initially, but with all the gas price rises this has got to be better than putting your money in a high interest building society account.

"It will probably be between 7 and 8 years for a payback time for the panels. If I had to wait 25 years to get my money back, the wife wouldn't have let me bought them!!"

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The typical installation cost for a domestic system is £3,000 - £5,000. Evacuated tube systems are more advanced in design than flat plate, and so tend to be more expensive.
Solar water heating systems generally come with a 5-10 year warranty and require little maintenance. A yearly check by the householder and a more detailed check by a professional installer every 3-5 years should be sufficient (consult your system supplier for exact maintenance requirements)
The maintenance of a solar power heating system would typically consist of annual check by the homeowner and a more detailed check by a professional installer every 3-5 years

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The Earth receives 174 petawatts (PW) (petawatt (10 to the power of 15) of incoming solar radiation (insolation) at the upper atmosphere.[1] Approximately 30% is reflected back to space while the rest is absorbed by clouds, oceans and land masses. The spectrum of solar light at the Earth's surface is mostly spread across the visible and near-infrared ranges with a small part in the near-ultraviolet.[2]
The absorbed solar light heats the land surface, oceans and atmosphere. The warm air containing evaporated water from the oceans rises, driving atmospheric circulation or convection. When this air reaches a high altitude, where the temperature is low, water vapor condenses into clouds, which rain onto the earth's surface, completing the water cycle. The latent heat of water condensation amplifies convection, producing atmospheric phenomena such as cyclones and anti-cyclones. Wind is a manifestation of the atmospheric circulation driven by solar energy.[3] Sunlight absorbed by the oceans and land masses keeps the surface at an average temperature of 14 °C.[4] The conversion of solar energy into chemical energy via photosynthesis produces food, wood and the biomass from which fossil fuels are derived.[5]

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The photovoltaic process converts sunlight – the most abundant energy source on the planet, directly into electricity. The sun emits photons (light), which generate electricity when they strike a photovoltaic cell. So in the same way a photovoltaic cell, made from a semi-conducting material, is a device that converts light into electricity.
Solar cells are made of silicon, a special type of melted sand, consisting of two or more thin layers of semi conducting material, usually silicon. The layers are given

opposite charges – one positive, one negative. When sunlight strikes the solar cell, electrons are knocked loose and move toward the treated front surface of the solar cell. This creates an electron imbalance between the front and back of the cell and causes electricity to flow – the greater the intensity of light, the greater the flow of electricity.

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typical domestic system would produce between 1.5 and 2kWp and cost around £4,000 to £9,000 per kWp installed, with most domestic systems usually between 1.5 and 2 kWp. You could save up to 1.1 tonnes of CO_2 a year and this could mean £150 to £200 off your electricity bill.

Solar tiles cost more than conventional panels, and panels that are integrated into a roof are more expensive than those that sit on top.
Grid connected systems require very little maintenance, generally limited to ensuring that the panels are kept relatively clean and that shade from trees has not become a problem. The wiring and components of the system should however be checked regularly by a qualified technician.

Stand-alone systems, those not connected to the grid, need maintenance on other system components, such as batteries.
"Britain is losing out to countries that have created a large home market, by introducing market stimulation measures and low manufacture costs."
BRITISH PV ASSOCIATION
PV technology has a long way to go before establishing itself competitively with conventional electricity and other Renewables. Photovoltaic technology costs typically range from 60-70p/kWh and is viewed by the government as a long term project with anticipated price by 2020 of 10–16 p/kWh based on the current learning rate and market growth rate, with the possibility of becoming cost competitive with retail electricity in the UK around 2025 - current costs for onshore wind in good sites are in the region of from 2.5–3.0 p/kWh and around 8p/kWh for energy crop.
The British Photovoltaic Association aims to increase the market penetration of PV to 15% by 2010, by installing a 300MWp capacity within the UK, how much of this – if any would be planned for Scotland is unknown.
However, if such a venture were to prove successful there would be potential for

- Potential turnover of £1.2 billion
- Employment increase in the PV sector to around 19,000 by British companies

See http://www.pv-uk.org.uk/ for more information
A typical domestic system is around 1.5-2kWp, comprising of 20-30 modules depending on the technology used and the orientation with respect to the sun. Such a system would typically occupy between 12-20m2 of surface area, depending on the efficiency of the array – amorphous silicon would require nearly

50m2. The costs of a 2kWp system can range from £8,000 - £15,000. At such prices it can be assumed that PV is not going to play an significant part in the near future, but as interest and development improves this could change. Each system will produce between 750kWh and 1500kWh of electricity per year, depending on the orientation.
If we consider the use of integrated PV within buildings, prices compare unfavourably with £50-100/m2 for domestic roofing, with £150-800/m2 for curtain walling. Installed costs of integrated PV are in the range of £500-1000/m2 this is comparable with high quality facades used on prestige buildings where marble and other polished stones can cost £1000/m2. In this way PV panels on commercial buildings, are already cost-effective when compared with prestige cladding materials.
The client has to be convinced that not only is he paying for a high quality finish but is also getting some added value with electricity being generated in conjunction with the impressive new façade. It is unlikely that photovoltaics will benefit from the Renewables Obligation in the period to 2010 unless costs fall more rapidly than is currently anticipated but this is not to say it they could not play an important future role in reducing atmospheric pollution.

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No CO_2 emissions in use – 1kWp of solar cells displaces 1000 kg of CO_2.
- No moving parts – requiring minimal maintenance and predicted life spans of 15-20 years, comparable with that of fossil fuel plants.
- Operation is virtually silent – unless very large transformers are required.
- Generation is at point of use, thus avoiding transmission and distribution costs.
- Cost effective in remote locations where grid connection is to expensive.

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It has been highlighted that there is a vast resource available and PV technology is one of the most feasible renewable energy's for electricity generation within the urban environment. Successful deployment of PV cells on building facades or roofs will greatly reduce the need for additional land for electricity generation from new generation stations.
The Government is committed to expanding its supporting programme for renewables including research, development, demonstration and dissemination. The main current hurdle preventing large-scale manufacture in the UK is the current market or lack of it. The understanding and potential of photovoltaics is improving, but further Research and Development is required to capture cost-reductions. It is important that strong partnerships are established between industry and government.
Increasing environmental concerns and the need to achieve emission reduction targets should help the technology to become further established as a marketable and economically viable product. The British Government signed up

to Agenda 21, a global environment and development action plan, at the Rio Earth Summit in 1992. One of the key areas addressed by Agenda 21 was the issue of sustainable development; installing PV systems could be one way to encourage such progress. PV produced clean electricity can displace power generated from fossil fuels; it is this benefit that could lead to its future success.
Embodied Carbon
Transport carbon
Predicted replacement life – 30 years
Payback period – Payback depends upon location – More southerly the better
Cost of recycling – (some panels use Cadmium which is toxic

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Biomass fall into two main categories:
Woody biomass includes forest products, untreated wood products, energy crops and short rotation coppice (SRC), which are quick-growing trees like willow.
Non-woody biomass includes animal waste, industrial and biodegradable municipal products from food processing and high energy crops. Examples are rape, sugar cane, maize.
For small-scale domestic applications of biomass the fuel usually takes the form of wood pellets, wood chips or wood logs

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Pellets are produced by compressing the wood material which has first passed through a hammer mill to provide a uniform dough-like mass. This mass is fed to a press where it is squeezed through a die having holes of the size required (normally 6 mm diameter, sometimes 8 mm or larger). The high pressure of the press causes the temperature of the wood to increase greatly, and the lignin plastifies slightly forming a natural 'glue' that holds the pellet together as it cools.
Pellets conforming to the norms commonly used (DIN 51731 or Ö-Norm M-7135) have less than 10% water content, are uniform in density (density in excess of 1 ton / cubic meter, so they do not float if placed in water), have good structural strength, and low dust and ash content. Because the wood fibres are broken down by the hammer mill, there is virtually no difference in the finished pellets between different wood types. Pellets can be made from nearly any wood variety, provided the pellet press is equipped with good instrumentation, the differences in feed material can be compensated for in the press regulation.
Pellets conforming to the above norms cannot contain any recycled wood or outside contaminants. Recycled materials such particle board, treated or painted wood, melamine resin-coated panels and the like are particularly unsuitable for use in pellets, since they may produce noxious emissions and / or uncontrolled variations in the burning characteristics of the pellets.
New pellet mills are being opened in the United Kingdom every month, lowering the price of a tonne of pellets to as low as £140 per tonne. The scarcity and

unreliable supply that used to come with the dependence on wood pellets has vanished.
With the high efficiency burners developed in recent years, other emissions such as NOx and volatile organic compounds are very low, making this one of the most non-polluting heating options available. One remaining problem is emission of fine dust in urban areas due to a high concentration of systems. Electrostatic particle filters for pellet heaters have however been developed and considerably reduce the problem when installed as standard.
The energy content of wood pellets is approximately 9.8 MWh/ton (or about 17 million BTU/ton).
The climate impact of wood pellets is disputed. Some argue that there is a low net carbon footprint because trees are a renewable resource. Others counter that the source sawdust would not otherwise have contributed to greenhouse gases, and that burning fuel pellets releases a large amount of CO_2 into the air. The fact is, wood is made up of mostly carbon (and water), that carbon came from the atmosphere through the process of photosynthesis, and its carbon gets returned to the atmosphere when the wood is either burned or left to decompose. While it is true that in burning, most of the carbon joins with oxygen and returns to the atmosphere as carbon dioxide, left to decompose, the carbon still returns to the air in the form of [[1]]methane, which has over 20 times more heat trapping characteristics than CO_2 does.
Europe
Pellet Use (ton)[1]Land2006 Sweden1 400 000Italy550 000Germany450 000Austria400 000Denmark *n. 400 000Finland*n. 50 000*Households 2005.[2]Pellets are most widely used in Sweden - mainly as an alternative to oil-fired central heating. In Austria, the leading market for pellet central heating furnaces (relative to its population), it is estimated that 2/3 of all new domestic heating furnaces are pellet burners. In Italy, a large market for automatically-fed pellet stoves has developed. Although in the U.S., the inexpensive way of burning wood pellets is with pellet baskets in your existing fireplace or wood stove. Pellets are shoveled manually into the basket.

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- In the UK Biomass is usually wood as logs or   chips / pellets produced from compressed sawdust or crushed pallets. Pellets have a higher specific heat capacity than wood chip.
- Most sources burn cleanly and are almost CO_2 neutral (0.025kg/CO_2/kWh) but must be burnt dry to reduce SO_2 and NOx pollutants.
- Use a wood chip boiler for commercial buildings or district heating schemes and wood pellet stoves with back boilers for domestic situations
- Underdeveloped market in supply of pellets at present in UK but wood chip from coppiced woodland increases bio diversity in woodlands and helps to regenerate the rural economy

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Energy crops are important as a renewable energy technology as they can be grown to meet the needs of the market. They may be grown specifically for use as a fuel and can provide long-term secure resources. This sets them apart from other renewable resources that must be harnessed where they occur. They require very little input of herbicides and pesticides, and when established on agricultural land usually result in an increase in bio-diversity.
134. The most advanced energy crop for northern European conditions is coppiced willow, grown on a rotation of 2-4 years, and commonly referred to as Short Rotation Coppice, or SRC. The crop is established by planting up to 18,000 cuttings per hectare. After 1 year these are cut back close to the ground which causes them to form multiple shoots (i.e. to coppice). The crop is then allowed to grow for 2 to 4 years, after which time the fuel is harvested by cutting the stems close to the soil level. The cut stems again form multiple shoots which grow on for a further 2 to 4 years to become the next harvest. This cycle of harvest and re-growth can be repeated many times. The shoots can be harvested as chips, short billets or as whole stems of 25-50mm diameter and 3-4 metres length.
135. For short rotation coppice, the area of land required to support the fuel consumption for each MW of power generation at 20% efficiency would typically be of the order of 630 hectares. This might fall to less than 350 hectares at the higher conversion efficiency available from 'gasification'. Agricultural land which is taken out of food production under the European Community Arable Areas Payments Scheme, and is therefore 'set aside' for at least five years, is considered to have particular potential for short rotation coppice. Opportunities may also exist on derelict land undergoing restoration.
("Establishing Short Rotation Coppice" Forestry Commission Practice Note 7. 1999.)
136. Apart from the visual impact of growing coppice, there may be an impact on the local water table. Growing coppice willow and poplar results in an increase in the number of species of plants and wildlife compared to normal farmland. This effect is enhanced when the planting is close to woodland. Energy crops are tall (up to 7m) compared with normal crops, so some sensitivity should be exercised when designing the planting so as not to obstruct viewpoints. There are a number of Forestry Commission publications on SRC.

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Stand alone room heaters generally cost £2,000 to £4,000 installed. Savings will depend on how much they are used and which fuel you are replacing. A biomass stove which provides a detached home with 10% of annual space heating requirements could save around 840kg of carbon dioxide when installed in an electrcially heated home. Due to the higher cost of biomass pellets compared with other traditional heating fuels, and the relatively low efficiency of the stove compared to a central heating system it will cost more to run.

The cost for boilers varies depending on the system choice; a typical 15kW (average size required for a three-bedroom semi detached house) pellet boiler would cost around £5,000 - £14,000 installed, including the cost of the flue and commissioning. A manual log feed system of the same size would be slightly cheaper. A wood pellet boiler could save you around £470 a year in energy bills and around 6 tonnes of C0 2 per year when installed in an electrcially heated home.

Unlike other forms of renewable energy, biomass systems require you to pay for the fuel. Fuel costs generally depend on the distance from your supplier and whether you can buy in large quantities.

Fuel. Before considering a pellet appliance, please check availability and prices for pellet fuel. In Scotland currently we are aware of three manufacturers of pellet fuel, producing, small, expensive quantities. Imported fuels are available but prices of £200 to £300 per tonne are not uncommon. Check fuel quality. Pellet appliances are constructed to burn fuels with specific moisture contents (<6%), which in our climate will most probably mean that the fuel should be supplied bagged, not loose. Ask for refined fuel. A dusty product will create a cloud of dust as the appliance is refuelled.

Pellet appliances require a specific fuel diameter, 6mm in the case of most pellet stoves

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What is micro CHP?

'Micro-CHP' stands for micro combined heat and power. This refers to a heating technology which generates heat and electricity simultaneously, from the same energy source, in individual homes or buildings.

The main output of a micro-CHP system is heat with some electricity generation, at a typical ratio of about 6:1 for domestic appliances.

Any electricity generated and not used in the home can be exported back to the grid.

A typical domestic system is expected to have the potential to generate up to 1kW of electricity per hour once warmed up. This would be enough to power the lighting and appliances in a typical home. The amount of electricity generated ultimately depends on how long the system is running.

Most domestic micro-CHP systems today use mains gas or LPG as a heating fuel, although they can also be powered by oil or bio fuels. While gas and oil are not renewable energy sources (they are fossil fuels), the technology is still considered to be a 'low carbon technology' because it is more efficient than just burning the fossil fuel for heat and getting electricity from the national grid.

Micro-CHP systems are comparable in size and shape to an ordinary, modern, domestic boiler and can be wall hung like most boilers, or floor standing.

Servicing costs and maintenance are estimated to be similar to a standard boiler – although a specialist will be required.

The only difference to a standard boiler is that they are able to generate electricity while they are heating water.

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How does micro CHP work?
There are 3 main micro-CHP technologies. The difference is the way in which they generate electricity, which can be done in the following ways:
Stirling engine
Fuel cell
Internal combustion engine
Stirling Engine micro-CHP is new to the market, although the principal of the Stirling engine is well established. Generally Stirling engine micro CHP requires a short warm up period before they start producing electrical power.
Stirling engines are typically for buildings with smaller heat demands and would be appropriate for domestic applications in the UK. The latest Stirling engine based micro CHP units allow electricity to be generated sooner after being turned on, and are more efficient at producing heat.
Stirling engine micro-CHP appliances are now being installed in homes in the UK.
Fuel cell CHP technology is new to the market in the UK and globally. Fuel cells work by taking energy from fuel at a chemical level rather than burning it. The technology is still at developmental stage and not currently available to consumers.
Internal combustion engine CHP is the most proven technology. These are essentially, and sometimes literally, truck diesel engines modified to run on natural gas or heating oil, which are connected directly to an electrical generator. Heat is then taken from the engine’s cooling water and exhaust manifold. Generally they produce twice as much heat as electrical power and have, to date, been primarily used in larger commercial-scale applications in the UK.

CHP plant can be gas, oil, wood chip or pellet fired. Most run on natural gas
Metering of sites for electricity and heat is key
When no space heating demand CHP plant produces excess heat so unit is sized to match base heating load with conventional stand by boilers to meet peak thermal loads
Micro CHP units are boilers that produce electricity but their overall carbon efficiencies are the same as a gas condensing boiler and using electricity from the grid
Domestic micro CHP are currently being trialled in 40 locations across the UK

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Getting the most out of a micro CHP
Micro-CHP systems should always be installed and run to meet the heating needs of the building, rather than to generate more heat than is needed just to

meet electricity demand. The electricity generated should be treated as a useful by-product of heat generation. For this reason, electricity will only be generated when there is a heat demand.

Most domestic micro CHP systems will have two burners, one small (engine burner) and one large (supplementary burner). Electricity will be produced whist using a small burner, so managing the use of your heating and hot water will make sure you get the best ratio of heat to electricity as possible. For example, if you heat hot water alone then the boiler will only use the small burner and generate electricity.

However, if you want to heat hot water and water for space heating at the same time the boiler may have to use the larger burner so use more gas and not produce any additional electricity than if you were only using the small burner alone. If the heat output increases beyond 6kW the micro-CHP will not produce additional electricity above 1kW.

For hard to treat properties, such as older buildings, which have a higher than normal heat load and where it's very difficult to treat then a micro-CHP unit may be an option.

Financial support for micro CHP

Under the new Feed-in Tariff scheme, set up by the government, it is possible to receive 10 pence per unit of electricity generated, and an additional 3 pence per unit for each unit exported.

Typical installed costs are from £5,500 Typical installed costs are from £5,500.

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Before considering micro CHP you should carefully review your annual heat consumption. Since they only generate electricity when there is a heat demand, Micro-CHP systems are most cost effective in houses with large heat demands that cannot be reduced by other means such as upgrading insulation, draught proofing and other low carbon heat technologies such as wood stoves.

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Electricity generation as a by-product of heat

When the micro-CHP is generating heat, the internal engine or fuel celll will also generate electricity to be used in your home (or exported).

Carbon savings

By generating electricity on-site you are saving significant amounts of carbon as there are minimal losses occurring as compared with the grid.

Financial income

Micro-CHP is eligible for Feed-in Tariffs and you will earn 10.5p for each kWh generated by your system. You will also receive 3.1p for each kWh you export.

Installation is easy

There is very little complexity to installing a micro-CHP unit. If you already have a conventional boiler then a micro-CHP unit should be able to replace it as it's roughly the same size. Given the electricity generated, an electrician will also be involved with the installation but this is something the installer will organise.

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Smart meters work with an in-home display to show how much energy you're using and how much it's costing in real-time. So you can see how much you're spending by leaving your phone charger plugged in all the time, or the heating on at night. And when you can really see how much you're using, you can start to make small changes to use less and save money on your bills.

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What are smart meters?
Smart meters are the next generation of gas and electricity meters. They collect information about your energy use - electronically at regular intervals.
The benefits of a smart meter:
No more meter readings – your energy supplier will receive regular information on energy usage automatically without visiting your home. And without you having to report your own meter reading.
More accurate bills - your bill will always be based on the exact energy you use, not on an estimate.
Keep track of the energy you use – smart meters will be accompanied by an in-home display, which will enable you to see how much energy is being used in your home in near real time. It will also enable you to compare your energy use between days and across different time periods.
Other benefits - the introduction of smart meters also offers other potential benefits. They may help you save money by enabling you to use energy at 'off-peak' times; when demand for electricity is lower and it is cheaper.
They may also help you to sell energy back to the grid - if you generate your own energy by using solar panels, for example. Energy suppliers may also offer other services to enable you to track your energy usage, for example online accounts or through mobile phone applications.
Why are smart meters in the news?
The government has decided that every home in England, Wales and Scotland should receive smart meters by 2020.
Around **26 million homes** will be fitted with smart meters over the next 10 years. Many other countries have started using smart meters. But the **UK will be the first** to roll them out on such a large scale.
How can a smart meter help save energy?
The in-home display connected to the smart meter will show you how much energy you are using, enabling you to monitor your usage more easily, change habits and cut down waste.
You will be able to **see instantly when you're using lots of energy** - and how much it's costing you.

It will be easier to **identify ways you could make savings.** Smart meters and displays have been trialled in countries ranging from Sweden to the US. These trials have shown that smart meters can **reduce household energy bills by 5-10 per cent.**

Find ways to cut your energy bills today

When will I get a smart meter?

The full roll out of smart meters by all energy suppliers is likely to start in mid 2012. It will take a number of years for energy suppliers to provide all of their customers with smart meters. Some suppliers may be willing to respond to requests for smart meters, while others may plan there approach differently and work through areas one at a time. British Gas has already started installing smart meters. And other energy suppliers may begin their roll out before 2012.

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Low Energy House - Small Wind Turbines

The ideal site for small wind generators is a flat hilltop with clear exposure, free from excessive turbulence caused by obstructions such as large trees, houses or other buildings. Wind speed increases with height so if there are local physical obstructions, it is advisable to mount the small wind generator on a mast or tower

Small Wind Turbines - Wind Speed Assessment

Before installing a small wind turbine, it is essential to have a good working knowledge of the wind speed at the site. The Energy Saving Trust website provides a wind speed predictor that gives estimates of the annual mean wind speeds throughout the UK. It is also essential to install monitoring equipment to assess the wind speed on the proposed site for at least three months, and preferably longer. A successful installation will require an annual mean wind speed of 5 metres per second.

Household Electricity Demand

An average house uses an estimated 4,700 kilowatt hours (kWh) of electricity per year.

Types of Small Wind Turbines

Small wind turbines vary in size and power output from a few hundred watts to two or three megawatts but a typical domestic system would be between 1 and 6 kilowatts. There are two types of electrical installation:

Roof Mounted Small Wind Turbines

Care must be taken when choosing a small wind turbine that is mounted on the roof of a home. The small wind turbine may not be high enough to stand clear of the obstructions that cause drag or turbulence and there are also potential problems of noise and vibration that must be addressed.

In the Energy Saving Trust field trials, the building mounted small wind generators monitored were primarily located in urban and suburban locations that were found to have inadequate wind speeds. The poor location of these turbines has significantly impacted on the measured performance of such generators.

Mast Mounted Small Wind Turbines

Mast mounted small wind turbines are free standing and can often be located near the building that will use the electricity. If there are a lot of obstructions within 200m of the proposed turbine location, then a mast or tower should be considered. Generally, the higher the mast, the higher the average wind speed that the small wind turbine will achieve. It is usually the case in UK conditions that a taller mast will help generate enough extra energy to justify its additional cost.

Stand-Alone - Small Wind Turbines

Small wind turbines are particularly suitable for remote off-grid locations where conventional methods of supply are expensive and impractical. Most small wind turbine systems generate direct current (DC) electricity and, in stand alone systems, this is fed into battery storage.

Mains Small Wind Turbines

Small wind turbines can also be connected to the local electricity supply network. An inverter transforms direct current (DC) electricity to alternating current (AC) at an acceptable quality and standard. No battery storage is required and any unused or surplus electricity can be exported to the local electricity supply network, via an approved import/export meter, and will be paid for by the nominated electricity supply company.

Typical Output of Small Wind Turbines

A 1.5kw small wind turbine can produce an average 3,942 kWh per year, saving 3,390 kg of CO^2 emissions a year.

A 5kw small wind turbine can produce 13,140 kWh per year, saving 11,300 kg of CO^2 emissions each year.

A 15kW small wind turbine can produce 39,420 kWh per year, saving 33,900 kg of CO^2 emissions each year.

British Wind Energy Association

The BWEA Standard has devised a technical standard for manufacturers of small wind generators who wish to supply in the British market place.

When choosing a small wind turbine that meets this standard, a user can be assured that the turbine has been designed to withstand the structural loads that the wind can impose, that it has been tested in a full range of wind speeds and that in general it meets the claims made for overall performance.

It is useful for grant giving bodies, structural engineers and green energy specifiers who wish to ensure that any small wind turbines proposed is designed to the best practices accepted in wind energy engineering.

Typical Cost of Small Wind Turbine

The price of a small wind system depends on the size and type of turbine. The Government's Clear Skies grants programme estimates that a typical small wind system costs £2,500 - £5,000 per kw capacity installed.

Planning Permission for Small Wind Turbines

Small wind turbine systems require consultation with neighbours and planning permission. Environmental issues will be the main influencing factors; principally, noise, visual impact and access to the site. National planning policies support the development of small scale wind energy. Applications for small scale developments can be approved in areas such as National Parks, Areas of Outstanding Natural Beauty and Heritage Coasts, provided there are no serious environmental factors that will be detrimental to the area concerned

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Is it suitable for my home?
Individual turbines vary in size and power output from a few hundred watts to two or three megawatts (as a guide, a typical domestic system would be 1 - 6 kilowatts). Uses range from very small turbines supplying energy for battery charging systems (e.g. on boats or in homes), to turbines on wind farms supplying electricity to the grid.
You should consider the following issues if you're thinking about small scale wind. An accredited installer will be able to provide more detailed advice.
Wind speed increases with height so it's best to have the turbine high on a mast or tower.
Generally speaking the ideal site is a smooth top hill with a flat, clear exposure, free from excessive turbulence and obstructions such as large trees, houses or other buildings.
Small scale wind power is particularly suitable for remote off grid locations where conventional methods of supply are expensive or impractical.

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Wind systems can also be connected to the national electricity grid. A special inverter and controller converts DC electricity to AC at a quality and standard acceptable to the grid. No battery storage is required. Any unused or excess electricity may be able to be exported to the grid and sold to the local electricity supply company

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Please note that the electricity generated at any one time by a wind turbine is highly dependent on the speed and direction of the wind. The windspeed itself is dependent on a number of factors, such as location within the UK, height of the turbine above ground level and nearby obstructions. Ideally, you should undertake a professional assessment of the local windspeed for a full year at the exact location where you plan to install a turbine before proceeding. In practice, this may be difficult, expensive and time consuming to undertake. Therefore we recommend that, if you are considering a domestic building mounted installation and electricity generation is your main motivation, then you only consider a wind turbine under the following circumstances:
The local annual average windspeed is 6 m/s or more. An approximate figure for your location can be checked on the BERR website

There are no significant nearby obstacles such as buildings, trees or hills that are likely to reduce the windspeed or increase turbulence
If you are in any doubt, please consult a suitably qualified professional.
Planning issues such as visual impact, noise and conservation issues also have to be considered. System installation normally requires permission from the local authority, so it's important to always check with your local authority about planning issues before you have a system installed.

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Benefits
Wind power is a clean, renewable source of energy which produces no carbon dioxide emissions or waste products.
In the UK we have 40% of Europe's total wind energy