

Eco and Energy Efficient Homes Research

Table of Contents

- Eco and Energy Efficient Homes Research..... 1**
- What makes an eco-home as opposed to just a home that is energy efficient?2**
- Reducing heating costs.....2**
 - Thermostats..... 2
 - Solar panels 3
 - Green roofs..... 3
 - Extra deep insulation 4
 - Cavity wall insulation and solid wall insulation 4
 - Cavity wall insulation 4
 - Solid wall insulation 4
 - Floor insulation 5
 - Roof and loft insulation 5
 - Underfloor heating 5
 - Air heat pumps 6
- Draught proofing6**
 - Windows, doors, and conservatories 7
 - Windows 7
 - Doors and conservatories 8
 - Insulating tanks, pipes, and radiators..... 8
- Reducing electricity usage9**
 - LED bulbs 9
 - Energy efficient appliances..... 9
- Improving water efficiency.....10**
 - Tap aerators..... 10
 - Water efficient shower head..... 10
 - Garden hose gun 10
 - Rainwater harvesting..... 10
 - Greywater recycling..... 11

What makes an eco-home as opposed to just a home that is energy efficient?

Eco-homes are not necessarily energy-efficient homes; they are two distinct concepts. An eco-home is built from sustainable materials, but it does not necessarily have features that will lower the energy bill, unless energy efficient features are added. The building techniques that are used are designed to have the minimum impact on the surrounding environment, but it does not mean that the operation of the home is built with the same minimised impact.

Energy efficient homes aren't necessarily built using environmentally friendly materials or using processes that minimise impact on the environment, however they are built so that living in the homes will use less energy by using less energy and water compared to a traditional home, therefore minimising environmental impact over time. Any house can become an energy-efficient home with the correct improvements.

Building an eco-house was once a niche within the homebuilding sector but has now become the focus for many new builds, especially for self-builders.

In summary, an eco-home is primarily concerned with environmental responsibility in the home's construction process, whereas an energy-efficient home is primarily concerned with environmental responsibility once the home is occupied.

Energy efficient homes are arguably the greener choice in the long run as they utilise methods intended to conserve natural resources and lower the occupier's energy bill for years to come.

<https://www.synergyhomesfl.com/blog/energy-efficient-homes-vs-eco-friendly-or-green-homes/>

<https://homebuilding.thefuntimesguide.com/green-homes/>

<https://www.homebuilding.co.uk/advice/what-is-an-eco-home>

Reducing heating costs

Thermostats

Thermostats help to reduce carbon monoxide emissions, as well as heating costs through efficient use of its controls.

The Energy Saving trust predict that the average household could save £60 and 310kg of carbon dioxide by turning down the thermostat by just one degree. They also say that by installing and

correctly using a programmer, room thermostat and thermostatic radiator valves, a further £75 and 320kg of carbon dioxide could be saved a year.¹

Thermostats make it possible to schedule heating and hot water to go on and off at certain times, and room thermostats also make it possible to select areas of the home to heat, rather than heating the whole house. This is particularly beneficial for those who are working from home and are concerned about the increased costs of doing so. Smart thermostats go one step further and allow the heating to be controlled from anywhere.

Thermostats can be installed without replacing your boiler, so homeowners can easily benefit from the new room thermostat technology and the accuracy of modern thermostats without having to invest in entire new systems.

<https://www.realhomes.com/advice/sustainable-home-improvements>

Solar panels

Solar is a green, renewable energy which harvests sunlight and converts it into energy. Solar panels and installation can be expensive but can drastically reduce electricity costs and carbon dioxide emissions. Direct sunlight is not needed, so electricity is still generated on a cloudy day, however as the system will be working at its peak during the daytime, so it is sensible to plan domestic activities such as washing, dishwashing and ironing to occur during the day. This may be suitable for those who are typically home during the day and less suitable for those who are not.

If you generate more electricity than you use, then it may be possible to receive payments for the surplus energy that is generated.

<https://www.realhomes.com/advice/sustainable-home-improvements>

Green roofs

- Green roofs add insulation to the home and are cooling in the summer and warming in the winter.
- The combination of soil, plants, and trapped layers of air can also act as a sound barrier.
- Green roofs also encourage biodiversity as they provide a refuge for wildlife, which is especially beneficial in urban areas.²

¹ <https://energysavingtrust.org.uk/new-research-finds-96-of-uk-homeowners-are-concerned-about-their-home-energy-efficiency-yet-one-in-five-arent-taking-simple-steps-to-improve-it/>

² <https://www.realhomes.com/advice/sustainable-home-improvements>

Cavity wall insulation and solid wall insulation

Cavity wall insulation

- Around a third of heat loss in an uninsulated home escape through the walls.
- Generally, houses built from the 90s onwards will have wall insulation but houses older than that may not have any insulation at all.
- Houses in the UK typically have either solid walls or cavity walls.
- Houses built after the 1920s are likely to have cavity walls, where there is a gap in between the outer layer of brick and the inner layer of brick/concrete block.
- Pre-1920 properties are more likely to have solid brick or stone walls with no cavity.
- Cavity walls are insulated by injecting insulation material into the cavity from the outside, before sealing the holes with cement.
- Proper cavity wall insulation will save energy and reduce your heating bill.
- Typical installation costs of cavity wall insulation for a semi-detached house are £1200, and energy bill savings typically amount to approximately £285 a year.

<https://energysavingtrust.org.uk/advice/cavity-wall-insulation/>

Solid wall insulation

- Although solid walls have no gaps, it is still possible to insulate them and cut heating costs considerably.
- Solid walls can be insulated either internally or externally.
- It costs more to insulate a solid wall than a standard cavity wall, however the savings on heating bills will be bigger. For a typical 3-bedroom semi-detached house in the UK, external wall insulation costs approximately £14,000, compared with internal wall insulation which costs approximately £10,000.
- A typical semi-detached house in the UK can save around £390 a year on their heating bill.

<https://energysavingtrust.org.uk/advice/solid-wall-insulation/>

Floor insulation

- Insulating the ground floor of your property or any floors above unheated spaces such as garages will help with heat retention.
- Newer properties typically have concrete ground floors, whereas older properties will often have suspended timber floors.
- Timber floors can be insulated by laying mineral wool insulation underneath the floorboards, saving the average property £75 a year, or up to £130 a year for detached houses.
- Alternatively, a recent innovation where a robot sprays the underside of the floorboards with foam insulation, eliminates the need to take up the floorboards altogether.

Roof and loft insulation

- Roof and loft insulation can bring significant savings on energy bills and is one of the easiest and quickest ways of retaining heat within the home. With a quarter of heat lost through the roof of an uninsulated home, the cost of insulating the loft or attic should be recouped many times over during its 40-year lifespan.
- In properties that have no damp or condensation issues, it is often possible for those with basic DIY skills to insulate their loft themselves. Rolls of insulation are laid out between the joists and another layer covers the joists, bringing the insulation up to the required depth.
- Installing 0mm-270mm of loft insulation would save the typical semi-detached house around £255 a year on their energy bill, or by boosting the thickness of existing loft insulation to between 120mm-270mm, the average semi-detached home could save around £25 a year on their energy bill.

Underfloor heating

- Underfloor heating is one of the most energy efficient methods of heating the home.
- Unlike central heating with traditional radiators which use convection, underfloor heating mixes heat radiated from the floor and convection.

There are two different systems:

1. Wet systems which can be run using a conventional gas, oil or solid fuel boiler, or with a biomass boiler. Renewable technologies such as heat pumps can also be used and are more efficient.
2. Dry underfloor heating uses electric wires that heat up. They come as ready-made mats or wires that need to be fitted

Air heat pumps

- Unlike traditional boilers, air heat pumps give out heat at lower temperatures over longer periods.
- Air heat pumps require electricity to operate but extract renewable heat from the environment and so the heat output is greater than the electricity input, reducing energy bills and carbon emissions.
- An existing central heating system is required for a heat pump to work.

<https://www.realhomes.com/advice/sustainable-home-improvements>

Draught proofing

- Draught-proofing is a cheap and easy way of saving energy and money and involves blocking up unwanted gaps that let in cold air and allow warm air to escape.
- Draught-proofing can save around £45 a year on the energy bill of the typical gas fuelled home. For homes with an open chimney, this saving can increase to around £65 a year.
 - **Windows:** Draught-proofing strips adhere around the window frame and fill the gap between the window and the frame.
 - **Doors:** Keyhole covers, and letterbox flaps or brushes stop draughts coming through open gaps. Gaps at the bottom of the door can be improved with a brush or hinged flap draught excluder. Gaps around the edges of doors can be improved with foam, brush, or wiper strips like those used on windows.
 - **Chimneys:** Draughts caused by unused open fireplaces can be prevented by having a cap installed over the chimney pot. A chimney draught excluder can also be fitted around the inside of the chimney or around the fireplace.

Important safety note: Draught proofing must be removed if you decide to light a fire.
- **Floorboards and skirting boards:** Cracks in between floorboards can be sealed with a suitable filler.

- **Loft hatches:** Strip insulation can be used to block draughts.
- **Pipework:** Small gaps around pipework can be filled with silicone fillers and larger gaps can be filled with expanding polyurethane foam.
- **Cracks in walls:** small cracks can be filled using cements or fillers. Large cracks should be checked over to make sure that there is not an underlying problem.

<https://energysavingtrust.org.uk/advice/draught-proofing/>

Windows, doors, and conservatories

Making doors, windows, and conservatories more energy efficient will reduce energy bills and lower the carbon footprint of the property.

Windows

- Energy efficient glazing includes both double and triple glazing, which are windows with two or more panes of glass within a sealed unit. The gaps in between the glass panes are filled
 - **Glass:** The most energy efficient glass used in double and triple glazing is low emissivity (low-E) glass, which has a microscopically thin coating of metal oxide on one of the internal glass surfaces. This coating reflects heat back into the home, without stopping light from entering from the outside.
 - **Gaps in between the glass:** The size of the gap between the panes of glass influence the performance. A thickness of 16mm is generally believed to be optimum. Performance can be improved by filling the gaps with an with an inert gas such as argon, xenon, or krypton, which are more insulating than air.
 - **Frame materials:** uPVC frames do not require maintenance and can be recycled. Wooden frames have a lower environmental impact but require maintenance. Aluminium or steel frames are slim, long lasting and recyclable. Composite frames have an inner timber frame which is then covered with aluminium or plastic, reducing the need for maintenance.
- Double glazing costs vary depending on the materials and style, with uPVC windows tending to be cheaper and hardwood frames the most expensive. Typically, a set of A-rated windows for the average semi-detached house will cost around £7,500 and save£145 a year on heating costs. This saving can be increased further by installing A++ windows.

- It may not be possible to install double glazing in properties in conservation areas, period properties or listed buildings, however secondary glazing can be used to improve energy efficiency. This involves fitting a secondary pane of glass or transparent material inside the existing window.
- Energy efficiency can be further improved by installing thermal lined curtains which reduce heat loss. Fitted blinds and sealed shutters can also help to cut draughts and retain heat.

Doors and conservatories

- A professionally installed new external door should include effective draught-proofing. Modern external doors now typically contain integrated insulation to reduce heat loss and comply with building regulations.
- Draughts can be reduced from existing doors by fitting draught-proofing strips around the seals and the letterbox. Draught-proofing a door can save the typical household approximately £45 a year.
- Conservatories are not thermally efficient because even the best quality glazing loses more heat than an uninsulated cavity wall.
- Conservatories can act as an additional insulating layer outside of the house. The conservatory must never be heated and the doors must be kept closed during the cold months. Heating the conservatory will eliminate an insulating benefit, and although double glazing, blinds, and shutters can improve heat retention, it is not possible to bring a conservatory up to the thermal standard of an averagely insulated room.

Insulating tanks, pipes, and radiators

- Insulating hot water tanks, pipes and radiators is an easy way to save money on energy bills. It is possible to spend less money on heating water up and keeping hot water hotter for long by lagging water tanks and pipes and insulating behind radiators.
- Hot water jackets are available for as little as £12³ and they are easy to fit. Pipe insulation can also be fitted to reduce the heat escaping from exposed pipes between the hot water cylinder and the boiler, keeping the water hotter for longer. Hot water tank insulation can save the average semi-detached property £145 a year on their

³ https://www.screwfix.com/p/hot-water-cylinder-jacket-18-x-80mm-x-1219mm/43483?tc=WA9&ds_kid=92700055281954514&ds_rl=1249404&gclid=CjwKCAjwx46TBhEiwArA_DjP2q9oY8xyebAEI892NRMfS0UOMJw9ogew3cmdjcurv3UrXZ93kqkBoC55YQAvD_BwE&gclsrc=aw.ds

energy bills. Topping up existing insulation and adding pipe insulation could save £35 a year.⁴

- Radiator reflector foil is available for around £7 a roll⁵ and is beneficial for use behind radiators on *external* walls. Heat is reflected from the radiator back into the room instead of escaping out of the wall.

Reducing electricity usage

LED bulbs

- LED (or light emitting diode) bulbs are the most energy efficient and environmentally friendly light bulb option, using 90% less energy than the traditional incandescent bulbs which were phased out in 2009.
 - **Longer lifespan:** As a rule, good quality LEDs can last more than 25 times longer than traditional light bulbs and up to 20 times longer than incandescent bulbs or halogen bulbs. This has a positive effect on the environment as fewer bulbs need to be produced and fewer resources will be needed for manufacturing, packaging, and transportation.
 - **Less energy wastage:** LED bulbs can be up to 80% more energy efficient than conventional bulbs. For example, fluorescent lights convert around 95% of their energy into heat and the remaining 5% into light. LED lights convert 95% of their energy into light and the remaining 5% into heat.
 - **LEDs are non-toxic:** fluorescent lighting contains toxic chemicals and elements including mercury, and so specialist waste disposal is required. LED lights do not contain hazardous materials and are therefore much safer for the environment and do not require specialist disposal.

<https://www.moneysupermarket.com/gas-and-electricity/energy-saving-tips/>

Energy efficient appliances

- Choosing appliances with a high energy-efficiency rating will help to reduce energy usage.

⁴ <https://energysavingtrust.org.uk/advice/insulating-tanks-pipes-and-radiators/>

⁵ https://www.screwfix.com/p/radiator-reflector-foil-470mm-x-4m-1-88m-/88629?tc=WA9&ds_kid=92700055281954514&ds_rl=1249404&gclid=CjwKCAjwx46TBhBhEiwArA_DjE_x2bZ9ooZL_DsfWglZ5hSOC8pf17SwAjHWcHuwTsYAstKjK4K6EYxoC9ZcQAvD_BwE&gclsrc=aw.ds

- An A+++ rated washing machine, with an estimated lifespan of 11 years, will use £65 less energy over its lifespan.
- An efficient dishwasher will cost approximately £7 a year less to run compared to an older model.
- An A+++ fridge freezer will save approximately £320 over its lifespan compared to an A+ model.

<https://www.moneysupermarket.com/gas-and-electricity/energy-saving-tips/>

Improving water efficiency

Tap aerators

- Aerators fit onto an existing kitchen tap and could help to save up to 40 litres of water a day.⁶
- Aerators reduce the amount of water coming out of the tap by mixing air into the flow, reducing the amount of water passing through the tap, seemingly without affecting the flow pressure.⁷

Water efficient shower head

- A regulated shower head reduces the amount of water that is used by minimising the flow rate without impacting the pressure, so you won't feel any difference. They can reduce water usage by around 40 litres a day but are not suitable for electric showers.⁸
- By replacing an inefficient shower head with a water efficient one, they could save £55 off their gas bills and around £45 off their water bills (if they have a water meter) each year. That's a total saving of around £100.⁹

Garden hose gun

- Fitting a hose gun attachment can help to control where and when you use water in your garden. Hosepipe spray guns use up to 50% less water per use.

Rainwater harvesting

⁶ <https://energysavingtrust.org.uk/top-seven-water-saving-products-to-help-you-cut-water-use/>

⁷ <https://www.savemoneycutcarbon.com/learn-save/what-are-tap-aerators-and-how-do-they-work/>

⁸ <https://energysavingtrust.org.uk/top-seven-water-saving-products-to-help-you-cut-water-use/>

⁹ <https://energysavingtrust.org.uk/advice/saving-water-at-home/>

- A rainwater harvesting system works by collecting rainwater from the roof via the gutter, outlet or siphonic drainage system.
- Before the water enters the storage tank, it is filtered to remove debris such as leaves, twigs, and moss. The water is then pumped to the serviced appliances.
- A professionally installed rainwater harvesting system will deliver water quality that is more than adequate for non-potable applications such as toilet flushing and laundry.

Greywater recycling

- Greywater refers to the waste water from baths, sinks, washing machines, as well as other kitchen appliances.
- In a greywater recycling system, the greywater passes through a coarse filter to remove large dirt particles such as hair. This filtered water then enters a buffer tank where it is aerated, before it finally passes through a membrane and into a clear water storage tank, where it is pumped to the serviced appliances.
- If there is no greywater available, then the unit will automatically revert to using mains water.¹⁰

¹⁰ <https://www.aqua-lity.co.uk/greywater-recycling>