Ecology
Building Society

THE ECOLOGY GUIDE TO ECO RENOVATION

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ANY QUESTIONS? ASK DAN...

With passion for building physics and energy efficient technologies, no-one knows more about self-build, conversion and renovation projects that help tackle climate change and promote sustainable construction and retrofitting of the UK's housing stock.

Disclaimer

This Guide is for information only and should only be seen as a first step towards any house renovation or conversion. Ecology Building Society has made every attempt to ensure the accuracy and reliability of the information provided. This information is provided 'as is' without warranty of any kind. Ecology Building Society will not be liable for any special, incidental, indirect, or consequential damages whatsoever arising out of or in connection with the use of this Guide or the contents of this Guide. We strongly recommend that anyone considering a home renovation or conversion should seek advice from an appropriately qualified expert before undertaking any work.

Are you thinking about an environmentally friendly barn renovation? Perhaps you are considering retrofitting a Victorian terrace to improve its energy efficiency?

Starting a renovation project can seem a little daunting at first. This guide, brought to you by Ecology Building Society, will help you with these projects. We'll not only help you with the basics such as setting your goals and taking a 'fabric first' approach but also discuss the benefits of renewable heating systems and solar energy, and how to improve your home's insulation and reduce heat loss through windows and doors; all of which can increase your home's energy efficiency. We also discuss planning and financing your project to make the necessary changes.

FROM RENOVATION TO RETROFIT...

Renovation means altering or refurbishing your house or flat where there is no change of use when the work is done. Any renovation work that makes the building more energy efficient and reduce its impact on the environment we call **retrofit**. Retrofitting helps improve the building while also being good for the planet.

The growing impact of climate change and the rising cost of gas and electricty means there's never been a more urgent time to improve the energy efficiency of our homes. Many new houses are not built with sufficient insulation, wasting energy and money. Heat pumps and solar panels are rarely fitted as standard. **Home energy use accounts for 17% of the UK's total carbon emissions, yet over a third of heat loss in the home occurs through walls due to poorly fitted windows and little or no wall insulation.** Retrofitting your home can improve its energy efficiency and reduce the environmental impact by using more efficient forms of heating and better insulation and also making use of recycled, repurposed and non-toxic materials.

BENEFITS OF RETROFITTING...

- **Comfort of a well-insulated, energy-efficient home**
- **Adds value to your home**
- **Reduces running costs**
- **Increased energy-efficiency can lower mortgage interest rates with Ecology Building Society (see chapter 6 - Financing Your Project With Ecology)**
- **Reduces carbon emissions and minimises environmental impact**

THE ECOLOGY DIFFERENCE

Established in 1981, Ecology exists to create positive benefits for people and the environment, supporting ecological homes and sustainable communities through the flow of ethical finance between savers and borrowers.

Helping You to Help Yourselves and the Planet

Housing accounts for a significant amount of the UK's carbon emissions. To help combat climate change, we encourage householders, renovators, and house builders to be more energy efficient. One way to achieve this is to provide a range of innovative mortgage products that encourages sustainable and energy efficient homes. (See page 39 for more information on how we can help you finance your project.)

Our Impact

Our impact isn't about the profit we make – it's about the difference we make to the environment and to communities across the UK. As well as offering financial help, we are experts in retrofitting, energy efficiency and sustainable building projects. Unlike other lenders we guide and support our customers throughout the whole project.

We hope *The Ecology Guide to Eco Renovation* will be the first step to help you realise your sustainable living ambitions.

DID YOU KNOW....

"We lent £69.4 million across 371 sustainable properties and projects in 2021."

1 RENOVATION

ECO RENOVATION: A FABRIC FIRST APPROACH

So where exactly you do you start on your dream home renovation project?

Before you even start planning your work, it is essential that you get to know your building to ensure that the design or the changes you have in mind are appropriate for the actual fabric of the place.

This **fabric first** approach means you start improving the integrity of the building by selecting and integrating the right materials that enhance its energy efficiency. This would include: the walls (e.g. external or internal insulation), roof, floors, doors, and windows (e.g. secondary, double or triple glazing). Getting a **home energy audit** will help you understand what is required.

Whole House Retrofit - Reducing Your Bills

The goal of a 'fabric first' approach is to create a well-insulated, airtight and properly ventilated building that minimizes energy consumption and provides comfortable indoor living while minimising the environmental impact. Combine this approach with the right mix of renewable energy and heating sources, such as solar panels, home battery and heat pump (what we call 'whole house retrofit') could also significantly reduce your annual running costs. Indeed, some energy companies are already offering zero bills for five years for customers who fulfill the right criteria.

“...it is essential that you get to know your building to ensure that the design or the changes you have in mind are appropriate for the actual fabric of the place. This fabric first approach means you start by improving the integrity of the building...”

PLANNING YOUR RENOVATION

Spending time thinking ahead about what you want to achieve, setting specific goals, developing budgets, and a schedule of work and getting the right mortgage for your new eco home project will, in the end, save you time, effort, money and a lot of stress!

We suggest you follow this simple plan when getting started on your eco renovation project:

1. Think about what you want to achieve
2. Set specific goals and targets, for instance:
    - Improving your home's energy performance certificate (EPC) rating
    - Reducing household bills by installing solar panels and/or a heat pump
    - Increasing the value of your home
    - Minimising the impact on the environment through choice of building materials
    - Cutting down on the use of plastics and other toxic materials
3. Plan your budget and schedule of work
4. Understand your building and get a builder with experience of energy efficient building techniques on board
5. Get the right finance in place
6. Take a fabric first approach:
    a) Get a home energy audit
    b) Appropriate insulation of walls, floors and roof etc
    c) Install doors and glazing to improve airtightness and ventilation

BUILDING RENOVATION PLANS

Building Renovation Plans (BRPs) - known as Building Renovation Passports (BRPs) - offer homeowners comprehensive information on ways to reduce carbon emissions from their properties. They provide a bespoke and user-friendly method for organizing retrofit projects, consolidating all pertinent data related to the property, such as energy consumption information, into a single, easily accessible document.

These plans typically include a digital logbook detailing the property's historical and contemporary construction details and operational performance. Additionally, BRPs provide a roadmap for long-term renovations, outlining future retrofits and installations aimed at decarbonizing the property. The plans also facilitate connections with contractors, service providers, and financing options.

FINDING THE RIGHT BUILDER

The success of any eco renovation project will depend on two things: understanding your building (fabric first); and getting a trusted builder with experience and knowledge of environmentally sensitive and energy efficient building techniques on board. Alternatively, a Retrofit Coordinator is qualified to identify, assess, and manage the technical processes associated with retrofit projects. Under PAS 2035 standards all retrofit projects must have a retrofit coordinator.

The building trade is notoriously conservative and finding a builder with the right eco credentials can be difficult. Word of mouth is certainly a strong recommendation but there are a number of organisations that can help point you in the right direction.

- Association of Environment Conscious Building
- Trustmark – Government endorsed quality scheme
- Retrofit Coordinators
- MCS Installers (search for certified contractors)

FINANCING YOUR PROJECT

Getting the right finance for a renovation or conversion project can be a big challenge. Many High Street mortgage lenders will not fund buildings that are uninhabitable or derelict, or properties made from non-standard construction materials (e.g. timber-framed structures or thatched roofs). **Ecology is one of the few lenders that offers finance and expertise to people who want to renovate homes that need significant work or are deemed 'unmortgageable'.**

How does it work?

We assess every eco-friendly building project on an individual basis. There are no hardened rules about the properties we lend on or the state of repair they are in. It could be a barn for conversion, a derelict farmhouse, a fire-damaged terrace house or a listed building. Our primary stipulation is that you improve the building's EPC rating by at least one band and that we receive a full details of any building works you intend to carry out.

If your renovated property is more energy efficient we can lower your interest rate through our C-Change mortgage discounts as your EPC rating improves. We can also help with additional borrowing if your initial plans change, for instance, if you want to add an extension.

A big house renovation project can be both exciting and terrifying. But with careful planning and expert financial support, you can turn that tired or derelict property into a comfortable and energy-efficient home that's a sure fit for modern living.

For more information, see chapter 7 of this Guide >

MEMBER'S TIP...

Many of our borrowers tell us that they were daunted at the start of their renovation.

> *When you phone them [Ecology], you actually speak to someone friendly who knows who you are – you don't just feel like a name and number; they were really interested in what we were doing...*

Ecology members Isabel & Andrew on their Farm Cottage Renovation

2 INSULATION

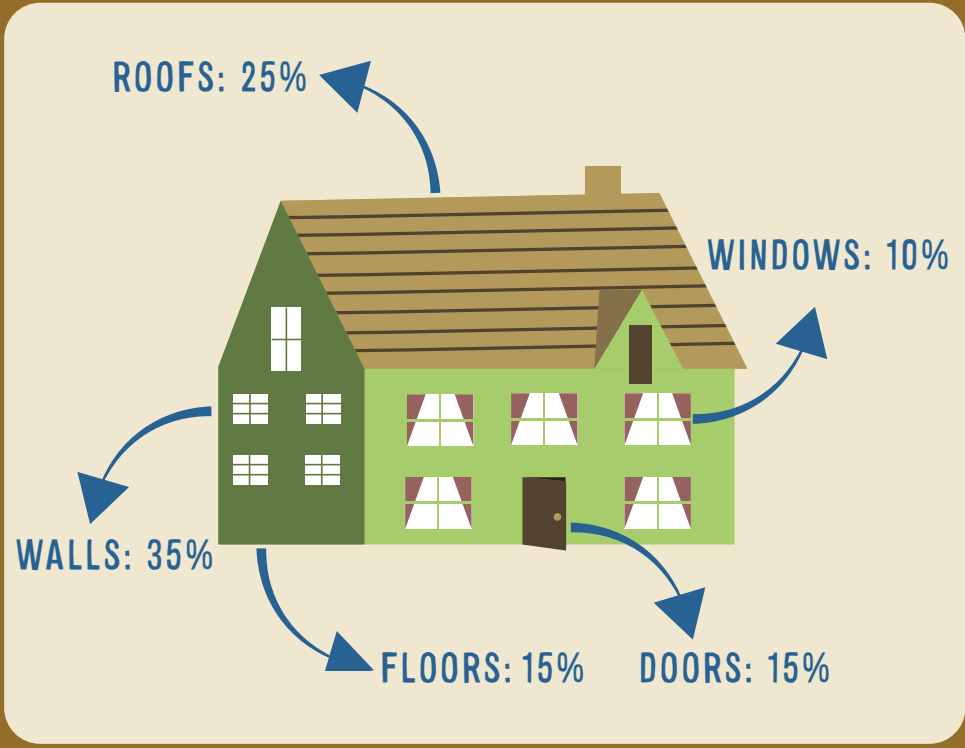
RETHINKING INSULATION

In the UK the heating sector accounts for nearly a third of the UK's annual carbon footprint; and, according to the UK Government, in 2019 17% of heating emissions from buildings came from homes. Improving your home's insulation will, therefore:

- Help lower your fuel bills
- Help improve your home's energy performance certificate (EPC) rating. This could also improve your renovation mortgage rate – learn more in Chapter 7 of this Guide
- Reduce your home's carbon footprint
- Contribute to a healthier and cosier home environment

This section will focus on the environmental impact of using mineral and oil-based insulation materials and consider the benefitsof using natural and sustainable insulation materials such as those derived from wood fibre, hemp, straw, wool, cellulose, cotton and flax.

WHERE DOES ALL THE HEAT GO IN THE HOME?



Around 60% of heat is lost through inadequate wall and loft insulation and may also contribute to problems with damp. To ensure greater energy efficiency and home comfort, good quality, and preferably organic, insulation should be at the very heart of any renovation or retrofit project.

MAKING YOUR HOME MORE ENERGY EFFICIENT

There are several relatively simple ways of improving your home's energy efficiency through insulation, including:

- Draught-proofing
- Thermal underlay beneath floors and carpets
- Roof and loft insulation
- Cavity wall insulation
- Solid wall insulation
- Insulating pipes, water tanks and radiators
- Triple glazed windows and doors

Before you shoot off to your local DIY store, please consider the environmental impact of the material used in insulation. This might include:

- The nature of the material itself (i.e. what it's made of: is it natural, sustainable? etc)
- How energy-efficient is the material used?
- What is the Carbon footprint in its manufacture and distribution (also known as **embodied energy**)?

WHAT IS EMBODIED ENERGY?

Embodied energy is the sum of all the energy required to produce a material or product. This would include the extraction of raw materials (e.g. mining, quarrying), manufacture and transportation. For instance, a 2014 study concerning the environmental impact of rockwool insulation material noted:

> *the main pollutant in the rockwool supply chain is the utilization of electrical energy during the manufacturing processes, which is responsible for 64% of the total carbon footprint, while transportation of the raw materials and final products contributes by 12% to the total greenhouse gas emissions.*[1]

An important aspect of embodied energy, in terms of net zero, is the carbon released by using fossil fuels in the manufacturing and supply chain process. Although it is difficult to assess any individual product's use of fossil fuels versus renewables, in general we may regard a higher embodied energy as having a more negative impact on the environment. As we shall see, mineral and oil-based insulation materials tend to have a higher embodied energy than organic-based materials.

1. Aivazidou, Eirini & Toka, Agorasti & Iakovou, Eleftherios & Vlachos, Dimitrios (2014). 'Assessing the Carbon Footprint of the Rockwool Supply Chain: A Real-world Case Study'

TYPES OF COMMON INSULATION

Rock Wool
One of the most commonly used materials for home insulation is rock wool. It is made from a mixture of molten rock, such as basalt, & recycled steel slag. This is melted at very high temperatures (around 1600oC) and spun into wool packages using oils and resins to bind it and make it waterproof. Its embodied energy is relatively high and can also produce harmful emissions such as carbon monoxide, phenol and formaldehyde. Quarrying of the raw materials can also lead to land degradation. Rock wool can include between 16%-40% recycled material and it is possible to recycle but has very poor biodegradability so there are issues in terms of its end-of-life environmental impact as it is not suitable for landfill. Dust particles may be hazardous and it is essential that a mask is worn during installation.

Glass Wool
Glass wool insulation fibres are produced in a similar way to rock wool but uses sand, recycled glass, limestone and soda ash as its base constituents. Its embodied energy is also high, posing issues regarding its overall carbon footprint. On the plus side glass wool generally includes between 30-60% recycled glass and is possibly recyclable or re-usable in certain conditions. However, quarrying the raw material has its own environmental impact, and glass wool can also include toxic metals such as boron to improve moisture tolerance.

Foamed Glass
Foamed glass insulation is made from a mixture of crushed glass and carbon and heated to extreme temperatures. It is particularly useful for flat roofing. As with glass wool it uses up to 60% recycled glass waste but suffers from the same manufacturing issues as rock and glass wool in terms of emissions. Its bitumen content also makes it problematic for safe disposal.

Oil-Based Insulation Materials
Oil-based insulation includes expanded polystyrene (EPS), extruded polystyrene (XPS) and rigid polyurethane (PUR/PIR). All are derived from the petrochemical industry with its potential pollution risks, resource depletion, noxious gas emissions and relatively high embodied energy. The fire retardant used in this kind of insulation is regarded as a hazardous material. It is possible to recycle and reuse many of these oil-based material, but it is not sustainable and, as with all plastics, highly problematic to dispose of at end-of-life use.

NATURAL FIBRE AND ORGANIC INSULATION

Cellulose
Suitable for using between rafters and joists, cellulose insulation is made from up to 90% recycled newspaper. Recyclable and reusable, its embodied energy is also relatively low compared to mineral insulation production. However, we should be mindful that newsprint production can produce hazardous waste. This material also contains boron and biocide and there are possible risks associated with paper dust inhalation, so a mask is required during installation.

Cork
Often used for flat roofs, cork insulation is made from bark which is grated and expanded into blocks. Reusable and recyclable, if managed properly, cork is manufactured from renewable resources that supports indigenous wildlife and helps sustain rural communities. Tree growth also sequesters CO2. Again, as with cellulose, there are possible risks through dust inhalation so always wear a mask.

Wood Fibre
Wood fibre insulation is made from forestry thinning and sawmill waste and can be used as rigid insulation for roofs, ceilings and floors. Manufactured from renewable resources and using a large amount of waste material, wood fibre is reusable, recyclable and compostable. However, it does contain a petrochemical binder which is non-renewable and ammonium phosphate as a fire retardant. Currently in the UK a lot of wood fibre is imported, so this can significantly add to its overall embodied energy and the resulting carbon footprint.

Hemp
Hemp or a hemp mixed with recycled cotton or wood fibres is used for insulating pitched roofs, ceilings and floors. Hemp is recyclable, reusable and compostable. As with wood-based insulation hemp sequesters CO2 during growth. Most hemp insulation will include a non-renewable polyester binder, most of which is recycled but, along with the fact that most hemp is imported, all this does add to its embodied energy. As with other natural insulation material, hemp contains boron and a fire retardant such as ammonium phosphate.

Flax
Similar to hemp in its uses, flax insulation is made from flax plus a polyester binder and fire retardant. A by-product of the linen industry, flax is a sustainable material, renewable, recyclable, reusable and compostable. It is space efficient and longlasting with an estimated service life of 75 years. At the current time, most flax insulation is sourced from countries such as the Netherlands and which all adds to its embodied energy.

Sheep's Wool

Sheep's wool insulation is made from wool with a polyester binder and fire retardant and can be used to insulate between rafters, joists and timber studs, walls and floors. Wool comes from a renewable resource and is reusable and safe to dispose after use. Wool also has properties that moderate temperatures throughout the year, warming in winter, cooling in summer. It is breathable and has excellent acoustic properties.

The downsides are the added materials: polyester, fire retardant and biocides. Cheap imported wool adds to embodied energy as well as potentially raising issues of animal welfare and use of pesticides. There should, of course, be no reason to import wool as here in the UK sheep are plentiful and there are UK manufacturers who only use locally sourced wool. One caveat, however: it is estimated that 37% of the UK methane output comes from sheep and cattle.

CONCLUSION

There are pros and cons for all insulation materials. However, as we can see in the previous table, natural fibre insulation tends to use less embodied energy in the manufacturing process. It is generally more reusable, recyclable and sustainable. Energy efficiency performance is on a par with mineral and non-organic insulation materials if not better. In fact, 1kg of natural fibre stores 1.8kg CO^2 and sheep's wool has a similar acoustic performance as rock wool but at 70% density.

Natural materials also generally tend to be more breathable and deal with humidity and moisture in a way that maintains better air quality, producing a healthier home environment.

In choosing low carbon windows and doors a balance has to be struck between creating a thermally efficient home and the reduced embodied energy of the products you install. If you want to improve your EPC value then triple glazing is recommended and using wooden frames expertly installed will also reduce the embodied energy.

Ecology has long advocated a national retrofit strategy; and this would include, where possible, low-carbon home improvements such as fitting sustainable natural and organic insulation.

DAN SAYS...

> ***A lot of organic insulating material available in the UK is imported from overseas. This has a significant impact on its carbon footprint.***
>
> ***If we are to hit net zero, this must be addressed. We can do this by promoting and developing local sustainable crops where possible and improving supply chain energy efficiency.***
>
> ***Think locally, act sustainably!***

3 WINDOWS AND DOORS

DOUBLE GLAZING AND U-VALUES

Around 20-25% of heat lost in many houses is through inadequate or badly fitted windows and doors. For a low carbon, energy efficient home it is therefore essential to combine good quality insulation and draught-poofing with thermally efficient windows and doors. At the very least, install double or secondary glazing. Ideally, if feasible, you should consider opting for triple glazing throughout the home.

The Importance of U-Values

The U-value measures the thermal efficiency of a window or door's glass or other materials. A lower U-value signifies that the material is more effective at impeding the passage of heat; by reducing heat flow it is more energy efficient and contributes significantly to a warmer and more comfortable living environment. Older single-glazed windows typically exhibit high U-values, whereas modern double and triple-glazed windows tend to feature low U-values (see table, right).

Window Energy Rating

Whereas the U-value assesses a window's effectiveness in preventing heat loss, the Energy Rating considers various factors, including the amount of the sun's heat passing through the window and the window's draft resistance and airtightness, to provide an overall energy efficiency score.

A higher Energy Rating indicates that the window is better at maintaining warmth and insulation within a property.

INDICATIVE U-VALUES FOR WINDOWS WITH WOOD OR PVC-U FRAMES

Glazing type	U-value / Wm^{-2} K^{-1}
Single-glazing	4.8
Double-glazing (normal glass, air-filled)	2.7
Double-glazing (hard coat low-e, emissivity = 0.15, air-filled)	2
Double-glazing (hard coat low-e, emissivity = 0.2, argon-filled)	2
Double-glazing (soft coat low-e, emissivity = 0.05, argon-filled)	1.7
Triple glazing (soft coat low-e, emissivity = 0.05, argon-filled)	1.3

Source: The Open University (open.edu/openlearn/nature-environment/energy-buildings/content-section-2.2.2)

TRIPLE GLAZING

Triple Glazing
High performance triple glazing will generally lose less than half the heat of typical double glazed windows and doors.

Comfort and Well-Being
Triple glazing will also create a more comfort living space in your home. The additional glass pane creates an extra layer of thermal protection, reducing heat loss and minimizing cold spots near windows. This enhanced insulation not only helps maintain a consistent indoor temperature but also leads to significant energy savings by reducing the need for heating during colder months.

Furthermore, triple glazing is highly effective in sound insulation, providing a quieter and more peaceful environment. Triple glazing can also enhance home security. The multiple layers of glass make it more challenging for potential intruders to break through, adding an extra layer of protection to your property.

Embodied Energy
Although highly thermally efficient and more likely to reduce your home's carbon emissions, triple glazed windows and doors aren't necesarily the lowest carbon option. Triple glazing includes an additional layer of glass and a second pocket of gas between the glazing panes and all this increases the embodied energy of manufacture. Other factors inlude th type of frame you use and the ratio of frame to glass area. Aluminium frames have the highest embodied energy and PVCu next. As you'd expect, wooden frames as the lowest embodied energy option as excellent insulating properties.

4 RENEWABLE HEATING SYSTEMS

RENEWABLE HEATING SYSTEMS

The Problem with Gas Boilers
It is estimated that 15% of the UK's total carbon emissions comes from gas generated home heating. The problem with gas is that when it is burned it releases carbon dioxide. On average, a UK household's gas boiler emits 2.2 tonnes of CO2 per year. That's roughly equivalent to seven transatlantic flights or leaving a 10w bulb on for 139 years!

The most effective way to cut home heating carbon emissions is to stop using gas and replace it with electricity.

By using renewable sources such as wind or solar energy, electricity is easier to produce without generating carbon. In fact, in the last ten years the UK has decarbonised the electricity grid faster than any other country, almost halving its carbon intensity. Of course, more needs to be done, but the future of cutting carbon emissions in domestic heating ultimately lies in cutting its dependency on fossil fuels to zero. We believe heat pumps are the solution to a carbon-neutral, highly energy-efficient way of using electricity to heat your home.

WHAT IS A HEAT PUMP?

There are two kinds of heap pump:

- **a Ground Source Heat Pump (GSHP)**
- **an Air Source Heat Pump (ASHP)**

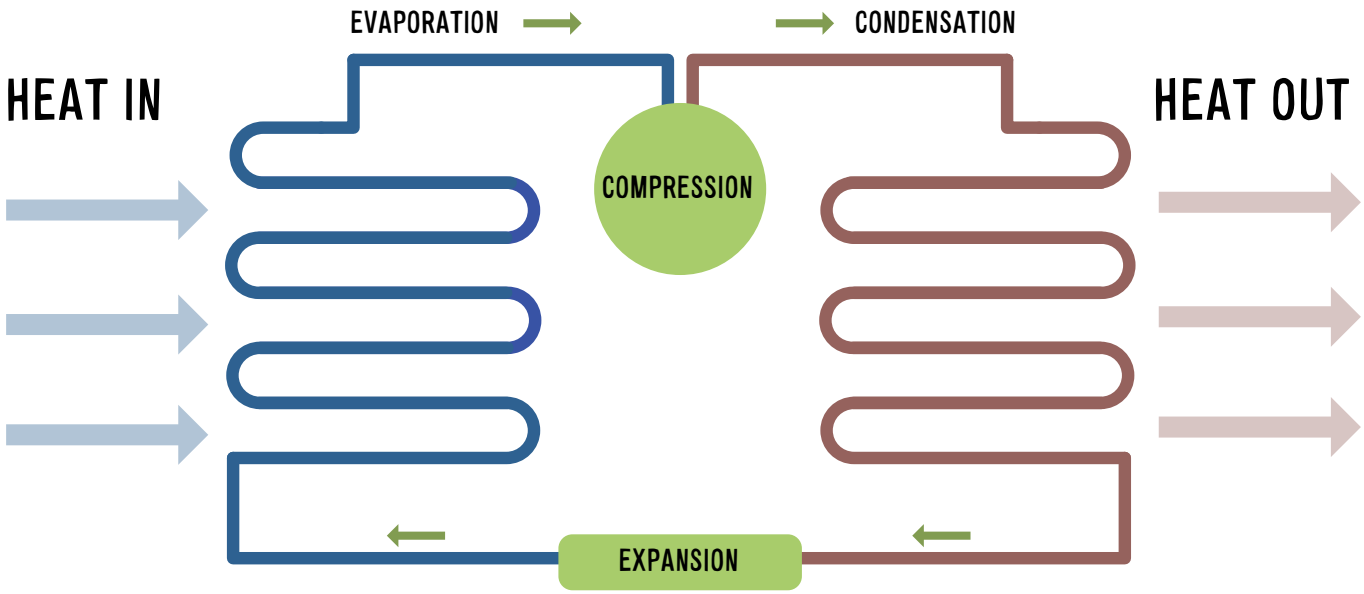
Although ground source heat pumps are ultimately more efficient, they are more expensive to install and require a detailed understanding of the local geology. More headway has been made in air source heat pump technology which is cheaper and easier to install.

We will therefore concentrate on air source heat pumps in this section.

How They Work

Heat pumps work by taking air from the outside, cooling it down and converting it into a gas. This gas is then compressed creating more heat which, in turn, is transferred to your central heating system. It works very much like a fridge but in reverse.

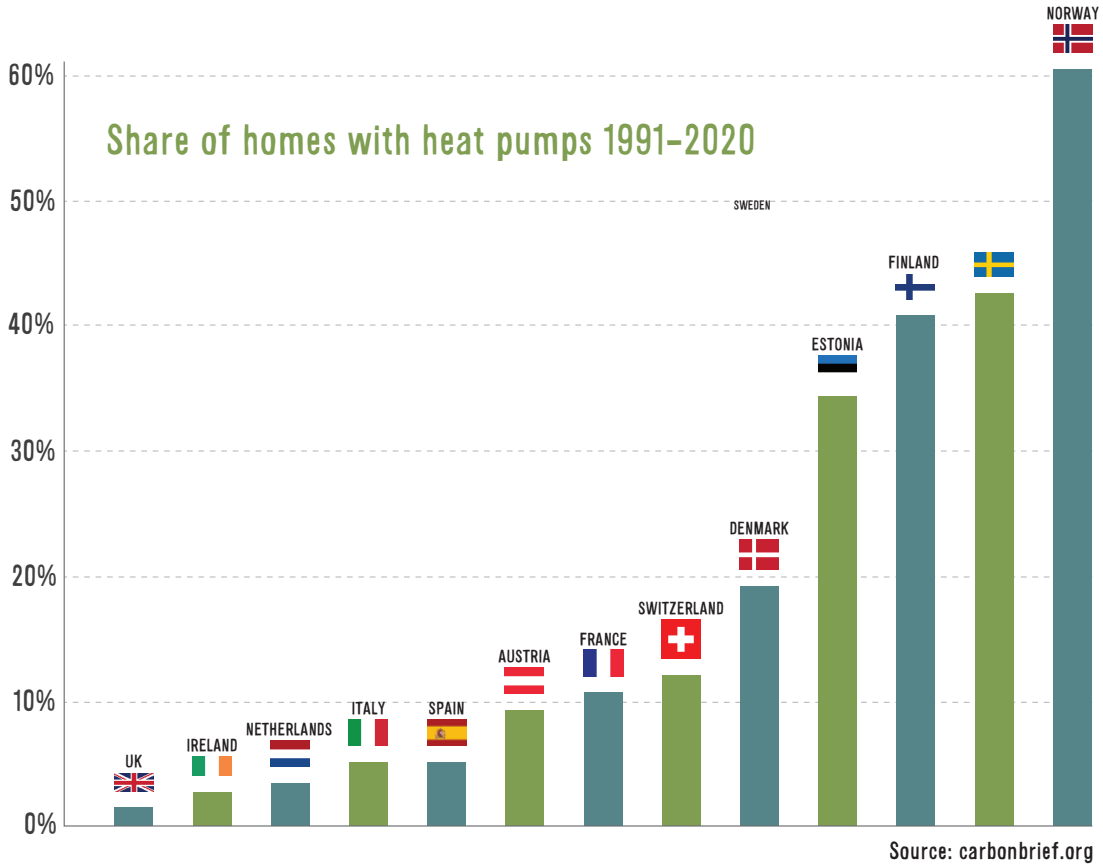
AIR SOURCE HEAT PUMPS



Because heat pumps collect heat, rather than generate it, they are highly energy efficient, producing more energy than they consume: up to three or four units of heat for every unit of electricity used.

Take up of heat pumps in the UK has been relatively slow, but internationally the market is growing rapidly.

Around 177m heat pumps had been installed globally by 2020. They are particularly popular in Scandinavian countries. For instance, around 60% of households in Norway use a heap pump, 43% in Sweden, and 41% in Finland. It certainly proves that cold weather is no barrier to the efficiency of this type of domestic heating!



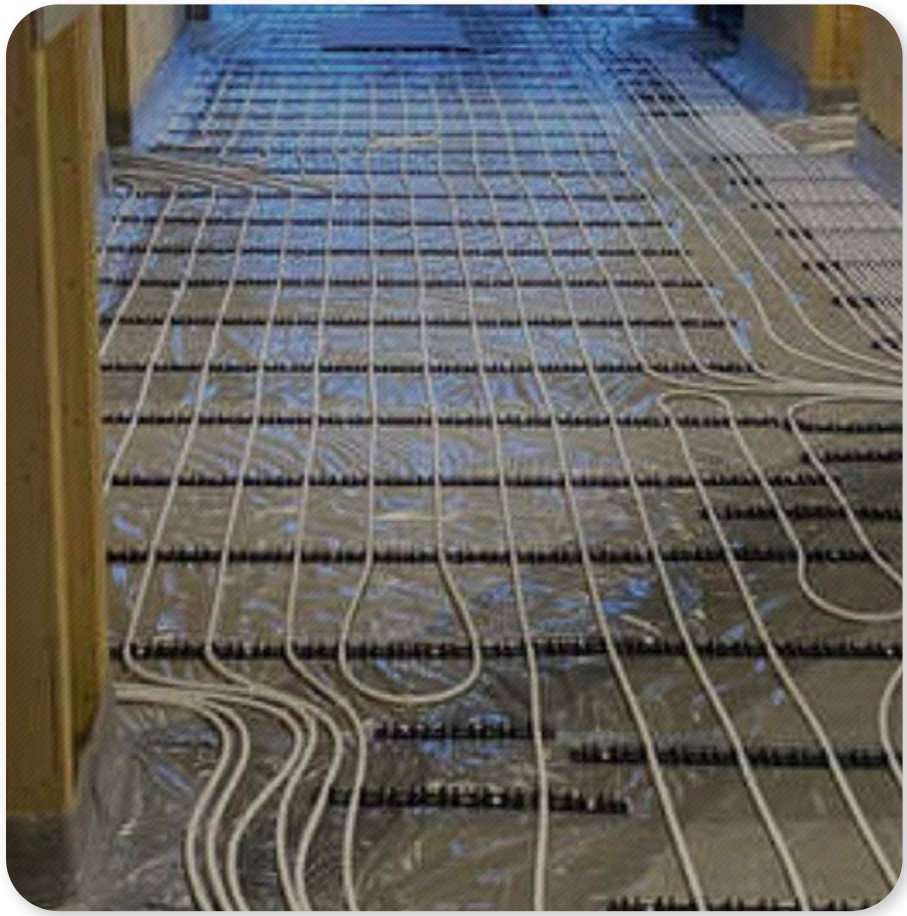
THE DIFFERENCE BETWEEN HEAT PUMPS AND TRADITIONAL BOILERS

Unlike traditional gas or oil-fired heating, air source heat pumps do not deliver heat quickly and work best building up heat over a longer period of time. The heat they produce is also slightly lower which means you need to spread it over a larger surface area to produce the same ambient temperature as you'd get with traditional central heating systems.

Underfloor heating works best with heat pumps.
If you have existing radiators you'll probably need to buy bigger ones than you currently use. You'll also need to invest in a larger water tank for the hot water. Heat pumps work best maintaining a constant level of heat over time and you need to think seriously about how that heat is transferred around the house as you can't simply flick a switch or 'boost' up the heat as you can with a traditional boiler.

Thermostatic Controls
Thermostats activate or deactivate the heat pump according to predefined parameters such as room temperature or time of day. For instance, if the indoor temperature drops below the designated threshold, the thermostat activates the heat pump. Once the set temperature is attained, indicating that your home is adequately heated, the thermostat turns off the heat pump.

A more energy-efficient approach would be to use **a zoned system** that enables individual thermostats to independently regulate heating, warming specific areas of your home rather than the entire house.



Underfloor heating works best with heat pumps

FITTINGS AND COSTS

Air source heat pumps must be fitted by qualified installers after a comprehensive energy survey.

The size of your heat pump depends on a number of factors, including:

- The size of your home
- Required indoor temperature
- Quality of insulation
- Average outside temperature
- The pump's performance and efficiency

Costs for heat pump installation are still relatively high compared to standard gas boilers and vary depending on the size of your property and type of heat pump you require. For a detached house costs may vary from £8,000 to £16,000 whereas a flat may cost between £6,000 to £8,000. Prices and running costs will inevitably come down as technology improves and the market expands.

Investing in an air source heat pump today as part of a whole house retrofit is a way of future-proofing your home for the time we no longer use fossil fuels for home heating. Heating controls will help by allowing greater control of energy demand and directing heat only where it is needed; and implementing smart controls will ensure that the building's power, ventilation, heating and cooling systems interact and operate as effectively as possible.

DAN SAYS...

"Remember, take a **fabric first approach**.

Ensure your home is fully insulated and as energy efficient as possible. Without appropriate insulation all the benefits of an air source heat pump will become negligible or, even worse, the system will be inadequate to your heating needs.

If you are considering installing a heat pump it is worthwhile getting a home energy audit and advice from a qualified retrofit assessor as a first step."

ADVANTAGES & DISADVANTAGES OF HEAT PUMPS

As with all new technology, there are advantages and disadvantages installing heat pumps, especially within a built environment such as we have in Britain with a diverse range of homes from Georgian and Victorian terraces to post-war semis and city apartments.

Advantages

- Highly energy efficient at delivering heat around your home
- Low maintenance, easy to repair, long service life
- Net zero carbon (if used with a renewable energy tariff)
- Running costs will be a lot less than standard boilers
- Air source heat pumps easier to install than ground source
- Future proofing your home heating system

Disadvantages

- Initial installation time and costs
- Best at creating ambient warmth throughout the house rather than 'boosting' heat
- Requires a well-insulated built environment
- Space required outside for the pump and inside for the water tank
- Electricity is currently more expensive than gas
- Pumps can be noisy and look a little unsightly

CONCLUSION

We believe that heat pumps, along with improved home insulation and renewable energy sources, is the future of tackling carbon emissions associated with domestic heating.

Climate change inevitably means we must reduce the use of fossil fuels such as gas and oil and develop ways of heating our buildings using electricity generated by renewable energy sources. Although take up in the UK is relatively low, countries like Norway, Sweden, Finland and Estonia have demonstrated that heat pumps are a viable alternative to traditional central heating systems.
The technology will evolve, of course, and become cheaper and more efficient.

Heat Pump Cashback
If you are thinking about upgrading the heating system to a heat pump, you can claim for a £500 or £1000 cashback when you apply for a new renovation mortgage at Ecology.

You can claim £500 cashback when you install an air source heat pump and £1,000 cashback for when install a ground source heat pump. To be eligible your installer must be Microgeneration Certification Scheme (MCS) accredited. The MCS is a UK-based certification scheme for renewable energy and low-carbon products and installations. Also, your property must have existing loft and cavity wall insulation. You can find out more about our heat pump cashback on our website at .

DAN'S TIP...

Is your boiler costing you the earth?

You can measure the impact of your gas heating with Nesta's carbon calculator:

Nesta Carbon Calculator

5 RENEWABLE ENERGY

RENEWABLE ENERGY: AN INTRODUCTION

Around 17% of the UK's carbon emission comes from homes, so the benefits of using low-cardon technologies such as heat pumps or installing renewable energy sources such as solar panels are clear:

- reduces fuel bills
- a renewable resource that allows you to sell electricity back to the grid
- increases the value of your home
- emission-free energy
- reduce carbon footprint

A recent report from the WWT and Scottish Energy suggested solar panels would likely increase a property's value between 0.5% - 2.0%; installing a heat pump could increase the value up to 3.0% and adding a car charging point could add another 2.75%. Combining low carbon technologies with renewable energy sources not only makes long- or medium-term financial sense for homeowners but could move us all significantly towards our goal of net-zero carbon emissions.

SMART EXPORT GUARANTEE

The Smart Export Guarantee (SEG) is a government-backed initiative designed to ensure small-scale generators are paid for the renewable electricity they export to the grid.

A typical south-facing 3-bed Victorian mid-terrace, with no shade, and fitted with a 4 kW solar panel system could potentially net up around £200-300 annually in fuel bill savings plus payments from SEG.

About the Smart Export Guarantee (SEG) ›

HOW DO SOLAR PANELS WORK?

A solar photovoltaic (PV) panel is made up of a great number of layers of semi-conducting cells, usually made from silicon. When sunlight falls onto these cells they produce a flow of direct current (DC) electricity. An inverter is installed to convert the DC flow to AC used by household appliances. Although most solar panels do not require direct sunshine to work, the stronger the sunlight the more electricity is produced, up to around 355W per panel. A typical system may contain 15 panels but the size of any system will depend upon the individual household's requirements, the angle of the roof's slope; shading (e.g. trees); and direction (e.g. it is south facing etc).

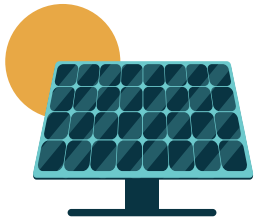
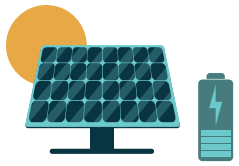
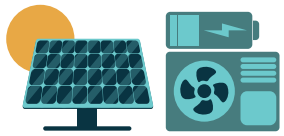
There are **three main types of solar panels** commercially available for domestic use: **Monocrystalline solar panels** are the most commonly used solar panels on the market today. **Polycrystalline solar panels** have a lower carbon footprint and cheaper to produce. However, they require a larger amount of space to the produce the same amount of electricity and are generally not as long-lasting as other panels. **Thin-film solar panels** are relatively inexpensive to manufacture, have a lower carbon footprint, are more lightweight and flexible, though they are also much less efficient

DAN'S TIP...

If you would like to know more about how much money you could save, try the Solar Energy Calculator at the Energy Saving Trust:

Solar Panel Calculator at Energy Saving Trust

BENEFITS OF RENEWABLE ENERGY

	Financial Benefit Per Year*	Emission and environmental impact and other benefits of PV electricty†
Solar Panels 	£586	• Typically save over 900kg of CO^2 • Typically takes around 6 years to pay back its energy cost • Contributes up to 98% fewer emissions than electricity generated from 100% coal • Uses less water, lower toxicity to humans, contributes up to 97% less acid rain
Solar Panels + Battery 	£713	• Reduce carbon emissions by a further 40% • Become more energy independent from the grid • Get paid to export energy back to the grid (SEG) • Uptime - most batteries kick into action in the event of a power cut
Solar Panels + Battery + Heat Pump 	£904	• Reduce running costs even further • Fossil-fuel free, contributing to Net Zero • Future-proofing against rising fuel costs

**Financial benefits under a standard variable tariff †Source: renewableenergyhub.co.uk/main/solar-panels/solar-panels-carbon-analysis*

6 CASE STUDIES

FIONA & KEVIN'S STORY: BUILDING THE GOOD LIFE

When Fiona and Kevin first bought the building that is now their home, they took on a mammoth renovation project.

Finance
One of the first steps for Fiona and Kevin was sourcing the funds to enable them to begin work. They struggled to find a mortgage provider prepared to lend on the property due to its dilapidated condition and the extent of the works required – the absence of a functioning kitchen or bathroom meant that the building was deemed uninhabitable. Their search eventually led them to Ecology, which was the only lender prepared to offer a mortgage for such an extensive renovation.

The home they now live in is a far cry from the damp-riddled building they bought back in 2010, but it didn't come easy. Fiona and Kevin spent three hard winters in a static caravan, gradually working on the project while both having full-time jobs. The house was reduced to a shell – floors were removed, the roof taken off, and walls stripped back to bare brick. That first stage proved the toughest as it was hard to see any progress. But once the demolition and clearance was complete, work could begin on re-building the property and their new home began to take shape.

Energy Efficient
Throughout the project, Fiona and Kevin sought to ensure their finished home would be energy efficient. When they first purchased the house it was in such poor condition that it was effectively on the lowest possible energy-performance rating. As well as enabling them to reduce their environmental impact and save money on future bills, an improved energy rating would enable them access to a discount on their mortgage rate through Ecology's C-Change scheme:

KEY DETAILS

Location:
North West England

Features:
Renovation of a dilapidated Cheshire cottage, incorporating ground-source heating solar panels and a high-level of insulation.

Energy Standards Rating: EPC B

We knew that we needed to get a C or above in order to enhance our mortgage rate," explains Fiona. "Any work that we did was going to improve the rating, but we did invest in a lot of green technology too.

Today, the house is transformed. The property has been extended to incorporate the adjacent animal barn, which now serves as a kitchen and dining area. Original features – like the timber beams – have been restored, while newer additions – like ground source heating, solar panels and high quality insulation – mean the house is performing well in terms of its energy efficiency. Having purchased some additional land with the house, there is also ample room for the couple's free-range flock of ducks and chickens!

It's been worth it! It's ours – we know every layer of it down to the brick and down to the soil; that's a very heartening and satisfying feeling.

- Fiona

ANDY & LORNA'S STORY

Andy, an architectural designer, and Lorna, a charity development manager, wanted to improve the energy efficiency of their home, an old railway cottage in Hereford, as well as creating more space to accommodate their growing family.

The original cottage was built by a railway carriage inspector in 1869, with solid brick walls and a slate roof. Before the project, the cottage was cold and draughty, suffered from mould growth, and had high energy bills and CO_2 emissions.

From Finance to a Flower Meadow

With a mortgage from Ecology, Andy and Lorna added a south facing extension to the property, with large windows to capture solar energy and a new super-insulated hot water cylinder. They insulated the existing, solid wall house with external insulation and added triple glazed windows and doors, a ventilation system with heat recovery and a very small, efficient natural gas boiler. The new upstairs windows overlook the extension's green roofs, planted with a wild flower and meadow mix, and a salvaged railway carriage in the garden which Andy uses as his home office. Since the work was originally completed, Andy and Lorna have also installed photovoltaic solar panels on the roof of their home.

Passivhaus EnerPHit

Andy and Lorna achieved their target of reaching the Passivhaus EnerPHit standard, an energy efficiency standard based on high levels of insulation and airtightness. As a result, they have reduced the building's CO2 emissions by more than 50%.

KEY DETAILS

Location:
West Midlands

Features:
Passivhaus EnerPHit renovation influenced by AECB CarbonLite principles and including solid wall insulation, MVHR, triple glazing and photovoltaic roof panels to achieve a CO2 reduction of more than 50%

Energy Standards Rating: EPC B

A Low-Carbon Comfortable Home

Lorna loves that their home is now draught free and all of their rooms remain a consistent comfortable temperature all year round. Andy delights in the knowledge that they have reduced their carbon emissions, that they're saving money on their energy bills, and that their home will have a positive benefit on their family's health and wellbeing.

This example of a retrofit shows how new technologies can be incorporated into a traditionally built property without altering its fundamental character. Although their home has been transformed in terms of its energy efficiency, its street-facing appearance remains in keeping with the local vernacular – inspiring proof that, with the right care and attention, energy-saving technologies can transform almost any home.

Read more case studies...

7 FINANCING YOUR PROJECT WITH ECOLOGY

FINANCING YOUR PROJECT WITH ECOLOGY

We are experts in providing mortgages for unique renovation projects and we don't have a 'tick box' approach to assessing projects – in many instances, we'll welcome projects that standard lenders may not accept. Here are a few questions answered about how our mortgages work, how to apply and what you'll need.

WHAT BUILDINGS QUALIFY?

Some High Street lenders can only offer a mortgage on habitable properties. At Ecology, we're not put off by the condition as long as the works required improve the energy efficiency of your building, we'll consider lending. We'll look at:

- Buildings in a derelict condition
- Historic or listed buildings
- Fire damaged buildings
- Non-standard construction types, such as timber framed or thatched roofs

Our mortgages are available in the UK (England, Scotland, Wales and Northern Ireland).

HOW DOES THE MORTGAGE WORK?

Normally, we'll release up to 90% of the purchase price or value of the property and subsequently, the money required for the renovation costs. As you continue with your renovation, staged payments of up to 90% of your increased property value will be released – this will help you keep tabs on your budget and planning.

This type of mortgage may be suitable if you are able to make a cash deposit on your property and fund the early stages of the build. We normally recommend 15% to 20% of your total budget as a good starting point to begin your renovation. Once your renovation is complete and the energy efficiency of your property is improved, we can lower your interest rate through our C-Change discounts.

HOW DO I GET IN TOUCH?

To get the ball rolling just fill in our and one of our qualified mortgage advisers will be in touch to discuss your options. Alternatively, you can **call our renovation mortgage team on 01535 650 770.**

WHAT ARE C-CHANGE DISCOUNTS?

C-Change discounts **reduce your mortgage interest rate based on the energy efficiency of your property** and are applied for the lifetime of your mortgage with us. Any discount for which you're eligible will be applied upon completion of your project. You could be eligible for one of our C-Change discounts if you are: constructing an energy-efficient self-build; converting a redundant building; renovating a dilapidated property; or purchasing an energy-efficient new build. Discounts include:

- ⇨ **Retrofit Discount**
- ⇨ **Energy Improvements Discount**

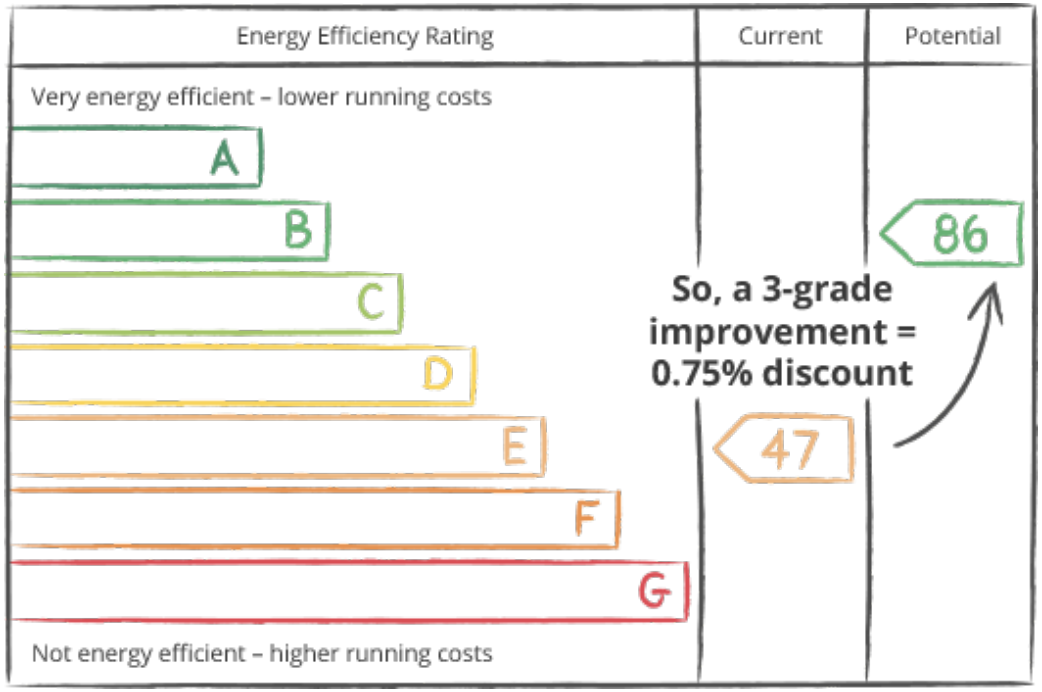
WHAT IS A RETROFIT DISCOUNT?

This applies to renovations that will improve energy efficiency. Provide a final Energy Performance Certificate (EPC) for your property once all your renovation works are completed, we'll then compare it to the original EPC to determine your discount.

HOW DOES THE DISCOUNT WORK?

A 0.25% discount will be awarded for each grade improvement made to your property.

We'll then reduce your mortgage interest rate by the appropriate amount for the rest of the mortgage term held with Ecology.



WHAT IS AN ENERGY IMPROVEMENTS DISCOUNT?

This discount is for existing home owners wanting to carry out energy-efficient home improvements.

You will be eligible for the discount on completion of the works and when you provide supporting invoices that show these works are completed. We will then confirm your discount and what your reduced mortgage repayments will be.

HOW DOES THE DISCOUNT WORK?

The amount spent on the qualifying works will be eligible for a 1% reduction from our standard variable interest rate. The remaining amount of your mortgage will be charged at our standard variable interest rate.

The discount is payable for the duration of your mortgage term held with Ecology.

HOW DO I APPLY?

1. DOCUMENT CHECKLIST

- Building Contract
- Planning Permission & Plans
- Energy Report (EPC)
- Payslips (or SA302s if self-employed)
- 3 month bank statements

2. MORTGAGE APPLICATION

Apply via a broker or direct to Ecology:

- Ecology Direct: **01535 640770** or **mortgages@ecology.co.uk**
- Intermediaries: **www.ecology.co.uk/mortgages/intermediary-hub**

3. APPLICATION SUBMISSION AND VALUATION

This includes:

- Credit and Financial Checks
- Property Valuation (assessing current and completed value of the property)

4. OFFER OF LOAD AND COMPLETION

This includes:

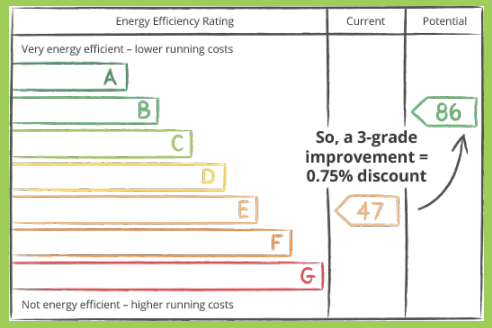
- Offer of Loan
- Mortgage Completion - solicitor triggers completion date, funds released, building work begins

5. MORTGAGE DRAWNDOWN

- Retentions drawn to fund renovation, revaluations

6. BUILD COMPLETION

- C-Change discount awarded on completion of project and production of improved EPC
- 0.25% discount for each EPC grade improvement achieved to the property



OTHER FAQS

WHAT INFORMATION DO I NEED TO PROGRESS MY RENOVATION MORTGAGE APPLICATION?

You'll need to have a specific property renovation in mind and provide details of material and labour costs, the current Energy Performance Certificate (EPC) of the property and the projected EPC rating when you complete your renovation. The property should be improved by a minimum of two EPC bandings to qualify for our renovation mortgage.

WHAT DEPOSIT DO I NEED FOR MY RENOVATION?

You need a 10% minimum deposit to purchase the property and a further 15% – 20% of total build costs to start your renovation.

DO I STILL NEED A DEPOSIT FOR MY RENOVATION IF I ALREADY OWN THE PROPERTY?

No, you don't always need a deposit; we can lend based on the value of your property to start the renovation, providing you already own the property and it's mortgage-free.

Also, we can help you repay any outstanding finance on the property if you need it.

DO I NEED TO SHOW HOW I PLAN TO IMPROVE THE PROPERTY'S ENERGY EFFICIENCY?

Any project we support needs to show details of the proposed renovation with an indication of the Energy Standards you are renovating to, and how the renovation costs are expected to be funded with savings and mortgage finance. We don't just lend on the property purchase.

HOW LONG DO I HAVE TO COMPLETE THE RENOVATION?

We allow a maximum of 2 years for you to complete the renovation, although we encourage you to complete earlier to benefit from our C-Change retrofit discount which is applied to our Variable Rate from the date we receive evidence that both the work has been completed and the Energy Standard rating required has been achieved.

DO YOU OFFER STAGE PAYMENTS FOR A RENOVATION?

Yes, we release funds as and when the renovation progresses and release up to a percentage of the increased value of the property.

DOES THE RENOVATION PROPERTY HAVE TO BE MY MAIN RESIDENCE?

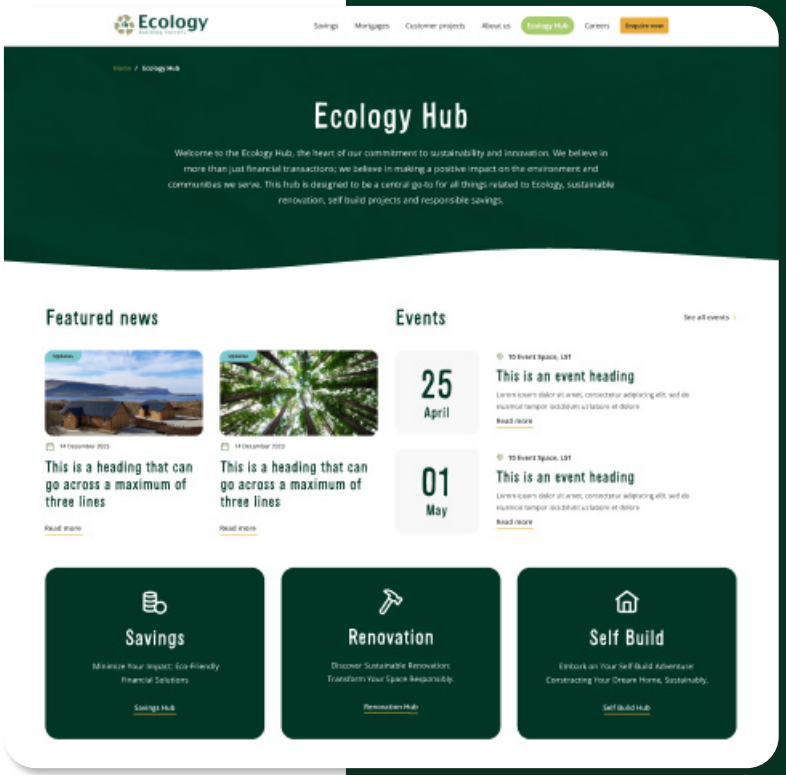
Yes, although we do offer a buy-to-let mortgage. Please bear in mind that we don't offer mortgages for second homes, holiday homes or homes classed as mobile planning.

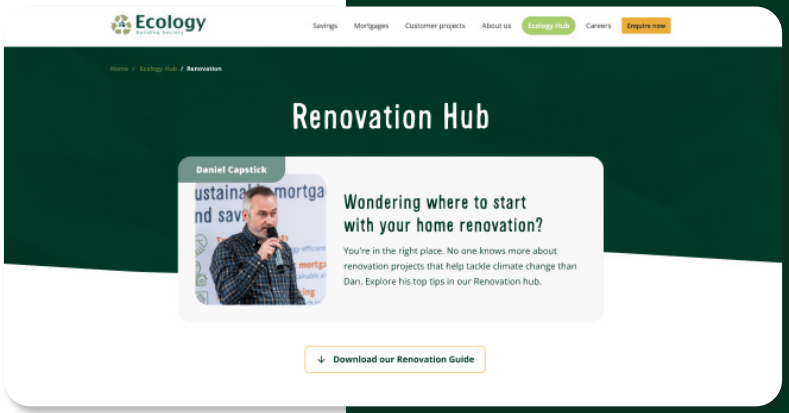
STAY UP-TO-DATE WITH OUR ONLINE RENOVATION HUB

The **Ecology Renovation Hub** is *the* go-to online resource and support centre for all things in sustainable renovation.

- Keep abreast of the latest in environmentally friendly construction techniques, insulation and renewable energy and heating.
- Sign up to our exclusive webinars from industry experts
- Read our latest articles and case studies

Ecology Renovation Hub





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