The Green Home Guide

How to create environmentally sustainable homes

Rochford District Council

Contents

Designed and published by Building Control Communications (part of zinc media), Kings House, Royal Court, Brook Street, Macclesfield, Cheshire SK11 7AE

Tel: (01625) 613000 www.zincmedia.com Ref BGL 2022

Introduction

Climate change is one of the biggest challenges facing the planet. The greenhouse gases we produce through our everyday activities are contributing to climate change.

In the UK we are seeing more frequent and extreme weather conditions. This includes very hot days, drier summers, heavy rain, storms and rising sea levels. There are also times when our water supplies are stretched to the limit. These changes in our climate mean that our homes are becoming more susceptible to the consequences of climate change, such as the increased risk of flooding, and when it is very hot, homes overheating.

We all need to do our bit to help tackle climate change and by making changes in the way we live and reducing the amount of CO_2 that our homes produce will ensure they remain comfortable, efficient and cost-effective in the long term.

Cutting fuel bills

Reducing CO_2 emissions from your home will also help cut your fuel bills. With fuel prices rocketing, it has never been a better time to improve the energy efficiency of your home and make it environmentally sustainable.

What is a sustainable home?

A sustainable home incorporates design features like correct orientation, thermal mass, insulation, shading and glazing to take advantage of natural sources of heating and cooling. When incorporated in the right way for our climate, they can keep a home's occupants comfortable throughout the year.

Sustainable homes maximise the use of energy-efficient products and environmentally durable materials for long-term lifestyle benefits. This can reduce ongoing household costs due to lower energy bills and reduced maintenance costs. Other benefits may include improved indoor air quality, thermal comfort and a sense of wellbeing, thus reducing ongoing health costs.

Aimed at people who have plans to buy a new house, build a new home or looking to improve their existing properties, the Green Home Guide helps homeowners understand the principles of sustainable design and how they can be practically applied, outlining the key sustainability features and improvements that will make a home more affordable and comfortable over its life span.

Why choose local authority building control?

Choosing your local authority building control team for your new extension will give you peace of mind and is a positive choice for many reasons:

- We act in your best interest, protecting you the homeowner. Our number one priority is the safety and comfort of residents in their home.
- We'll work with you to ensure your building works are safe, healthy, inclusive and efficient, and meets the standards set by the building regulations.
- We'll provide an independent, impartial overview of the key stages of the project, giving you the reassurance that your project is on track.
- Because we are a not-for-profit organisation, we offer homeowners value for money by doing a really good job without compromising on safety.
- We will provide a prompt, professional service, offering same-day site inspections where possible.
- We have been providing building regulations services for longer than anyone else so have extensive knowledge of the local area, including ground conditions and drainage.
- We can advise your builder by highlighting any unforeseen technical issues. We'll provide practical advice throughout which can help cut both short and long term costs.
- We are always ready to help, even when things get difficult or the unexpected happens.
- With local authority building control, the support doesn't stop when the project does, we're always on hand to provide assistance. If you require a copy of a completion certificate in 5 years' time for example, you can rest assured we will still be around.
- We are backed up by a national network of local authority building control teams (LABC), a 3,700 strong network of professional building surveyors and technical support staff. LABC constantly reviews surveyor competence, ensuring the performance and standards of our teams is of the highest level. LABC also works with manufacturers, trade bodies, professional institutions and other recognised bodies, giving us access to national expertise when required.
- Local authority building control is the biggest building control provider in the country, working on the majority of construction projects in the area.

Affordability and finance

The process of buying, renovating or building a home provides opportunities to improve affordability. Affordability is not just about the upfront cost of the home, but how much it will cost to run and maintain over the long term.

Homes constitute a major part of living costs for everyone in the UK. Many of the factors influencing the costs of a home are outside the control of individual households, but many decisions made when buying, building, renovating and maintaining a home can affect affordability over its lifespan.

For example:

- The size of home can have a major impact on construction and operating costs.
- The way the building envelope (walls, roof and floor) is designed and constructed influences energy costs, maintenance costs and comfort.
- Choice of appliances, fixtures and technologies will affect operating costs, particularly in the context of rising energy and water costs.
- Choice of home location can influence car dependency and fuel costs.

Well-designed, climate-appropriate sustainability features and improvements make a home more affordable and comfortable over its life span. Lower ongoing costs may also offer 'insurance' against future rises in energy, water or other costs, or against fluctuations in household income.

Upfront versus ongoing costs

The cost of housing has two considerations: the upfront cost of buying, renovating or building; and ongoing running and maintenance costs. When buying, renovating or building, think about affordability both now and in the long term.

Some of the advanced materials, construction methods and technologies associated with sustainability can increase upfront costs (for example, advanced glazing, solar photovoltaic (PV) systems, battery storage), but nearly always deliver a better financial outcome in the medium to longer term.

Affordability assessment

In determining whether a home or any related product is affordable, there are several ways to assess the combination of upfront and ongoing costs. You should also look at other economic considerations, such as the higher market value of energy-efficient homes and the potential cost of later renovations.

Payback period

A common way of evaluating the value of investment in sustainability features is the 'payback period'. This simple calculation involves dividing the upfront cost by the expected annual savings, to show how many years of savings would be needed to 'recover' the initial cost. This is a very simple way to estimate the investment value, particularly for smaller investments such as appliances. However, it can lead to rejection of beneficial actions if the payback period is long. In these cases, lifecycle costing may be more useful.

Lifecycle costing

Lifecycle costing (or LCC) is a method for considering total costs over the life of a building, including construction, operation and maintenance, and end of life:

Lifecycle cost= initial cost + discounted cost (for operation, maintenance and end of life)

Calculators

The Energy Saving Trust provides home energy calculators to help you find out where you are using the most energy and where your greatest opportunities to make savings are, which will add to the long-term affordability of your home. It allows you to compare your home's energy and water use with that of an existing household and includes a diagnostic tool to indicate where savings might be made.
www.energysavingtrust.org.uk/energy-at-home/energy-tools-and-calcutators/

Net cashflow

This method factors in the costs and savings of borrowing to fund sustainability features, a useful method if you are borrowing for sustainability improvements as part of your mortgage:

Net cashflow = annual savings – annual interest repayment on initial cost

For example, when borrowing £10,000 at 5% interest for sustainability improvements that save £1,000 each year, the net cashflow is £500. This is calculated by deducting the annual interest repayment on the improvements (£500) from the annual savings. Over time, as the loan is repaid and the interest cost reduces, the net cashflow improves.

Rate of return on investment

This method calculates the rate of return on the investment. It can be a simple calculation as follows:

Rate of return = annual savings / initial cost

More sophisticated approaches can factor in the lifespan of the equipment. Using the same example as above, the simplified rate of return is 10%. This compares favourably to investing money in the bank and is less risky than investing in the share market.

Impact on market value

Sustainability features are likely to improve the market value of your home. Concerns about energy prices and climate change are increasing the demand for sustainability features and the market value of sustainable homes. Rating schemes and incentive programmes are also having an impact. Estate agents are beginning to recognise sustainable features and use them to market homes; sustainable features that make a home comfortable, healthy and cost effective to live in.

Broader economic considerations

In assessing affordability, remember that there are broader economic considerations to your calculations.

Keeping sustainability considerations in mind will help you to achieve a home that is comfortable and affordable to run. If you are building or renovating, now is the most cost-effective opportunity to integrate sustainability features and reap the affordability benefits.

Choosing not to include sustainability features may cost you money later on, if you decide to make changes. Many features can be easily implemented (or prepared for) in a new home or major renovation, that will be difficult and expensive to retrofit.

Sustainable housing can have other affordability benefits. With its focus on healthy interiors and thermal comfort, sustainable housing can reduce the likelihood of health problems and the associated expenses. Choosing a walkable neighbourhood that is well serviced by public transport also delivers health benefits, as well as reduced dependency on fuel.

Also consider how you might 'future proof' your home to be resilient to future changes and uncertainties. This might include changes in your household (for example, your changing needs as you get older) or the impacts of climate change.

Ensuring that your home minimises its energy and water demand, generates its own renewable energy and makes use of alternative water sources (for example, rainwater) is a good strategy for dealing with possible increases in energy and water costs.

Rebates and other incentives

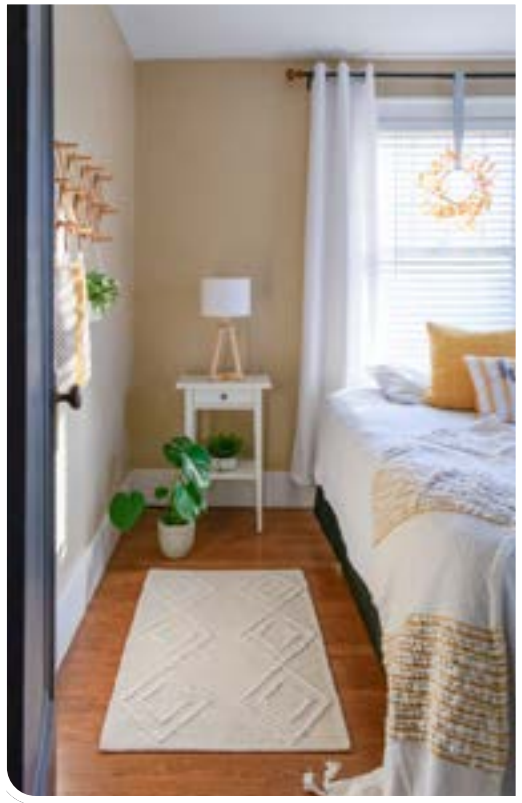
When you are calculating your costs and budget, remember that there are various incentives, including tax rebates, available to help you improve your energy and water efficiency and install sustainable products and technologies in your home.

You can search government websites for incentives to suit you. See Further Information section on page 80.

Save on construction costs

If you are looking to build a new home, build only the spaces you need now while preparing for future needs could help you save on costs. Think about:

- Number of bedrooms: If a bedroom costs around £2,500 per square metre, eliminating a 12m2 bedroom could save enough to pay for a solar PV system and higher thermal performance, which all reduce energy bills and help pay off your mortgage.
- Number of bathrooms: How much budget can you redirect with fewer bathrooms instead of a £10,000 en suite?
- Use smart design to reduce the quantities and costs of materials and labour.
- Use contractors who are experienced in working with sustainable products. This is likely to reduce labour costs and avoid potentially costly mistakes.
- Look for government subsidies and incentives.
- Reduce labour costs by doing the simple tasks that do not require a professional.
- Use low-cost finance.
- Look for banks that offer lower interest rates or other benefits for homes and renovations that achieve sustainable outcomes.
- Extend a mortgage instead of opting for a short-term higher interest loan.



Preliminary research

Careful research and assessment improve the likelihood that your home will be comfortable, cost effective to run and maintain, and hold its value into the future.

Once you know your budget, you'll need to choose a locality that suits both your lifestyle and budget. Remember that a more expensive home with good sustainability features will save money each year, with lower energy and water costs than a poorly designed but cheaper home.

Start your research by identifying your sustainability goals and developing a good understanding of how to choose a home that will work with, rather than against, the climate.

Make achieving thermal comfort with the lowest ongoing costs central to your decision making at every stage. Draw up a list of 'must haves' and 'must avoids', based on the climate. Also, make sure you are familiar with the options for renovation, including those that might be achieved easily, or those that might be difficult or more expensive. Doing your homework on the likely cost and impact of modifications, upgrades and extensions will help you to identify houses that can be more easily improved.

Understanding buying or building a home

Choosing or creating your next home can be a complex process. Where do you start, and what do you need to do before you buy, renovate, or build a home?

Throughout the process, it is a good idea to:

- Do your homework – search the internet; look through magazines, particularly those that focus on sustainability; visit display villages; explore free energy-efficient home designs; talk to friends who have recently been through the process; attend open houses; and window shop in estate agents' windows.
- Seek expert advice early and often – sound research and impartial advice are essential for clear decision making.
- Early in the process, choose an expert you trust and discuss your progress often, especially when you come across competing ideas, technologies and advice.
- Be flexible - you will probably have some ideas at the start, but try not to get locked into particular features early in the process. Evaluate all available options.
- Allow your brief to the designer to evolve – you will likely need to revisit decisions made in earlier stages to take into account ideas and information you discover later in the process – update your brief frequently and note why decisions were made or changed.

Step 1: Think about the best home for your needs

Many people have already decided on the type of home that best suits them before they begin. However, here are some issues you may still wish to consider:

- Upgrading or renovating an existing home can be a great way to achieve sustainable design outcomes. By retaining much of the existing building fabric, the need for new construction materials is reduced, saving on precious resources.
- Many people choose to design and build a new home because they feel it has the best potential to create a comfortable, sustainable home customised to their needs. If you want to build a new home, choose a company that demonstrates best-practice construction methods and reuse and recycling of materials.
- Buying off plan can be a cost-effective option and you can usually visit a display house to get a feel for the spaces and qualities of the home, and it is often possible to make modifications to the plan and specification to improve energy efficiency and sustainability outcomes.
- Flats and apartments can be an affordable and sustainable option, but the scope for alterations and renovations may be limited. That said, many flat owners are undertaking innovative upgrades to reduce their environmental footprint.

Step 2: Think about where you want to live

If you are buying or building a new home, one of the most important decisions is choosing the best location. A home that is close to everything you need, including public transport, saves on fuel costs and helps reduce your carbon footprint.

Step 3: Consider the long term

Your home is a long-term investment, so it makes sense to consider how it will suit you, both now and into the future and how you can minimise the long-term environmental impact of your home.

To ensure your home remains affordable and sustainable, ask:

- How big does your home need to be? Would a smaller home mean you could

afford a better location and a more comfortable, energy-efficient home?

- Does the design use passive design principles (design that works with the local climate to maintain a comfortable temperature in the home) to minimise energy use?
- How do climate change risks affect your home insurance?

To ensure your home remains comfortable and safe, ask:

- Is there a chance that the design will overheat during increasingly warm summers?
- Has the design included measures to minimise water use or recycle water for gardens and other uses?
- Could sea level rise affect your property? Does the local council have any development controls to deal with the risk of increased flooding or sea level rise?
- Will your home be in a flood-prone area?

To ensure your home continues to suit your needs, ask:

- Could your home be easily modified to suit changes in lifestyle when required (for example, having children, downsizing as you get older)?

Step 4: Set your goals

Now is the time to be clear about what you want from your new home. Setting targets can help to inform your brief, and help you to identify suitable properties or establish design targets to achieve the best outcomes.

Step 5: Examine your current home and lifestyle

Your existing home and lifestyle are usually the best source of information for your wish list. Analyse your current home to get a clear picture of what you like and dislike, how each member of your household lives in each space, and how this might be improved in your new home.

Step 6: Develop a baseline budget

Affordability is a primary consideration that influences all subsequent decisions about your home (see earlier section on Affordability).

First, understand your total budget. If you are unsure of your budget, talk to your bank or use an online calculator (offered free by most banks) to establish the limit of your borrowings. Always allow for contingencies and hidden costs like stamp duty, bank fees, consultant, and council fees.

Some banks offer discounted mortgage rates for homes with good energy ratings and may be prepared to lend more for sustainable features. Once you have determined your total budget, allocate some of that budget to sustainable features from the outset. Under-budgeting for sustainable features is a common reason for their ultimate omission.

Up-front costs for sustainable features should be balanced against the savings they will deliver over the lifecycle of the home or appliance. Choosing sustainable features will mean you will spend less on heating and cooling your home, and on running appliances.

Also remember that the cost of renovating, altering or retrofitting to improve performance is generally higher than incorporating it in a new build.

Step 7: Start your wish list or 'brief'

Your wish list, or brief to the building designer, should be an evolving document that records your 'must-haves' and 'must-avoids', and your general preferences.

People usually find it impossible to find or afford a home that satisfies all the items in their wish list. Prioritise important features on your wish list that are difficult or expensive to add later. Keep your sustainability goals in mind – consider choosing important thermal comfort, energy and water-efficiency features for less important ones such as rarely used rooms or cosmetic touches. Seek impartial, professional advice on sustainability and lifecycle implications every time you want to make a trade-off.

As well as lists of features and descriptions of building designs, your brief can also include photos you find online or in magazines. Photos – both of likes and dislikes – are a good way to communicate your ideas to your designer.

Step 8: Get timely professional advice

It is never too early to seek professional advice. Professional advice at an early stage can help to shape your ideas and avoid costly mistakes.

Find an advisor who understands your area and the type of home you want. If you want particular sustainability features or building methods make sure you find an advisor who is experienced in these areas.

Step 9: Check planning

Make sure you are aware of any planning restrictions at your chosen location. Your designer or consultant should be able to help, or you can check with your local council. These regulations cover objectives such as protecting the amenity of neighbours, and preserving neighbourhood character (Further information on planning permission is available on page 26).

Step 10: Find out about the process of designing and building

Before you plan your project, it helps to have an overview of the design process and what is involved, and this will be discussed in more detail in the following section: Sustainable design.

Sustainable design

Before starting on your design, you should have completed your preliminary research and know your budget. You can then follow this step-by-step guide to develop and finalise your design. This design process can also help you to plan renovations, conversions or an extension. Further information on finding and engaging experts, including architects and designers, is available on page 20.

Step 1: Site analysis

Visit the site with your designer to do a 'SWOT' analysis (strengths, weaknesses, opportunities, and threats). This allows you to start thinking about how your design will respond to the climate and specific attributes of the site.

Your designer's advice is likely to be limited if they are not paid for it. To ensure a comprehensive site analysis and a detailed fee proposal, negotiate a set fee for this initial consultation or make it part of the design contract.

On the site, consider:

- Climate.
- Orientation.
- Solar access.
- Prevailing seasonal winds.
- Views.
- Overshadowing by landforms, trees and existing buildings (site survey).
- Slope (site survey).
- Soil type (geotechnical report).
- Stormwater drainage.
- Access and transport.
- Services (electricity, gas, phone, internet, water, sewer).
- Potential climate change impacts (possible increased risk of flooding, tidal surge).

On completion of the initial consultation and site visit, ask your designer to identify possible design solutions that capitalise on the site's strengths and opportunities, and overcome its weaknesses (for example, poor solar access) and threats (for example, slipping soils, or flooding). Discuss orientation and other passive design strategies with your designer, and ask for clarification if you are unsure.

Step 2: Developing a brief, fee proposal and contract

The brief you began in the preliminary research stage should be a 'living document' that is frequently updated throughout the design process as a record of your agreed decisions. It should also form the basis of the designer's fee proposal. Attach both to your contract with the designer.

If your design contract was not signed earlier, it is usually signed at this step. If you are not happy or sure about the designer's site analysis and fee proposal, consider seeking an alternative opinion from another designer.

Designers generally work within a range of costs per square metre. Size is a major determinant of cost, but other variables include preliminaries (for example, council, geotechnical and engineer's fees), site difficulty (for example, slope, access, wind exposure), the construction system used, number and size of wet areas (bathrooms, laundry and kitchen), services (cost of water, sewer and energy supply) and access (for example, drive construction, materials transport distances, travel times for trades).

Ask your designer to review your preliminary budget in light of your brief to identify potential problems and suggest strategies to deal with them. Your designer should also provide indicative costs for each sustainable design feature in your brief and recommend additional ones that may be relevant for your site or climate.

Think about these costs from a lifecycle perspective. In many cases, ongoing savings on energy and water bills will soon outweigh any additional upfront costs for these features (see earlier chapter on affordability for more information on costs). Ringfence these costings in your budget from the outset to ensure the features you want are delivered.

Although designers will provide information on likely cost ranges, they generally do not accept responsibility for the final cost of your project because of the enormous range of variables beyond their control. Even the estimate provided by the builder, although it is based on more detailed information, can be subject to change due to unforeseen circumstances such as design variations that may be required during construction.

Step 3: Concept designs

Designers often prepare several concept designs to communicate their ideas and allow you to assess them against your brief. These designs can range from a simple bubble diagram sketch on the back of an envelope, through to hand-drawn concepts of form and spatial arrangements. When you look at the first concepts, make sure that you analyse them from several viewpoints, not just first impressions:

- Passive design principles – does the design suit the climate, and will it perform effectively?
- Space and layout – is it neither too large nor too small, is the space used efficiently, do the living spaces work well, is there enough storage?
- Look and feel – does it appeal to you, is it the character you want?

Concept designs should consider construction systems but not lock them in unless they are a fundamental component of your brief. The choice of high or low-mass materials and the amount of mass required in floor, walls or roof to achieve thermal comfort varies depending on the climate and other design decisions.

Top Tip

Input from a building sustainability consultant or accredited energy assessor can be very useful at this stage to ensure that every opportunity to achieve high-level thermal performance is locked in while the design is still very flexible. This will improve comfort and ensure lower heating and cooling bills for the life of your home.

Step 4: Design development

Through discussion with your designer, choose the concept design that best suits your needs. The designer will then develop the concept into a preliminary layout. More than one concept can be developed in this way, but each additional concept developed may increase design fees.

It is common for designers to discuss the proposal with council planners and building control at this stage to identify any issues requiring resolution. It is also a wise idea to have preliminary discussions with one or two likely builders to check whether the design could be built within your budget.

Floor plan and building shell

At this stage, the design usually includes preliminary room arrangements, window opening sizes and orientation, indication of indoor–outdoor flow, furniture layouts, and preliminary choice of construction systems. Spend time visualising your household living in the design. Revisit your analysis of your current home. Have problems been overcome? Have new ones been created?

Storage requirements

Remember that a larger home can cost more to build and operate (depending on the complexity of design). A larger home may also use more of your plot. Reducing the size and reallocating that budget to sustainable features is an important focus during this stage of design. Trimming just a few square metres from each room can pay for double glazing or a photovoltaic array.

Top Tip

Your designer can use computer-aided design (CAD) programs to help you visualise the design on your computer or tablet. They enable you to view and move through a 3D model of the design. Some more detailed programmes will enable you to see sunlight penetration and shading.

Optimising thermal comfort

Computer-based home energy rating tools can be used to predict environmental performance and model the thermal performance benefits of window numbers, size, placement, and orientation, as well as various mass levels in different construction systems.

You can use such tools to guide design by engaging a qualified energy assessor who can model the thermal performance of your design and recommend improvements. This will help you to optimise your design for comfort and reduce the need for heating and cooling. It will also inform your choice of construction system. The modelling results for the final design can be used later to show how the building is meeting building regulations energy efficiency requirements.

If you are designing to the Passive House standard, then the Passive House software must be used.

Finishes and landscaping

External and internal finishes are considered at this step. Take this opportunity to identify sustainably sourced materials with low lifecycle environmental impact. You can also start to prepare your landscape design.

Landscaping makes many critical contributions including shading the building or windows, diverting breezes, creating leisure spaces, increasing visual appeal, ensuring privacy and saving water.

Step 5: Final design

At this stage, you finalise and sign off on all aspects of the design. Changes made after this stage has been signed off are likely to add to design costs.

You will need to finish choosing interior finishes and appliances and finalise landscape design. Other issues to resolve with your designer might include final choices of external finishes, shading solutions, lighting, hot water, heating and cooling, rainwater, and solar (photovoltaic) electricity.

Final design is often when likely budget overruns become apparent and cost reductions are then made. At this point there may be pressure to eliminate sustainable design features. Remember that incorporating sustainability features now will save you money in the long term.

Top Tip

Make sure that you include the sustainability features related to the building fabric upfront – they are usually inexpensive (or free) if incorporated in the initial build, but more expensive to change later.

Also, remember that features you do not need right away can be built or added later. Spaces or rooms that you eventually want but do not require now can be incorporated in the total design and added cost effectively when future finances allow. Similarly, if you cannot afford sustainable technologies such as solar PV panels upfront, they can be added later as long as the design includes roofs orientated to suit them and sufficient provision has been made in the electrical circuits.

Step 6: Planning and building regulations approval

When both parties are satisfied with the design, the final plans are submitted to the local council for approval. Both planning permission and building regulations approval are required before you start building a new home.

Planning approval focuses on assessing the application against the relevant planning permissions. This seeks an undertaking that your development will have no adverse impact on the local environment and often has a detailed checklist of items to be addressed.

Building regulations approval on the other hand requires a greater level of detail on the design and focuses on compliance with the building regulations (see page 24) for more details on building regulations and planning permission).

Planning permission and building regulations approval are separate processes. However, it is often a good idea to apply for planning approval first. This means that any design changes required by authorities can be accommodated before you get into the detail of the design, saving time and money.

Step 7: Design detailing

In this stage, design and construction details are finalised and documented. The documents typically include:

- Working drawings (details of how the design is to be built).
- The specified materials, standards, finishes, and products to be used.
- Engineering design and certification.

These (or more detailed versions) are given to builders when they are invited to quote for the work and form the basis of your contract with your builder. Appointing a builder is discussed in more detail in the next chapter.

Specifying for sustainable outcomes

Final schedules of materials and quality of finishes are documented in the specification by reference to building regulations, industry practice and standards, and desired outcomes that are not noted on the plans.

Specifications are critical to achieving sustainable outcomes because it is here that sustainable inclusions, practices, and finishes are spelled out and linked to the contract.

Specification writing for environmental sustainability is a key skill, and some designers fail to adequately address important items, practices, and standards. Make sure that the sustainable products and practices you want are specified, clearly and unambiguously, in quote documents, and draw these clauses to the attention of builders.

Make sure that you pay attention to the products being specified. Product databases such as BRE's Green Guide can independently certify products and services as environmentally sustainable. Visit www.tools.bregroup.com/greenguide for more details.

Finding experts

Every home improvement project is unique, and the number of steps involved varies depending on the complexity of the project and whether you're undertaking a substantial project such as a loft conversion or simply making a few small home improvements.

The first step in developing a home improvement strategy is to seek professional advice. If your proposals are relatively simple, a builder who specialises in this type of work may be able to provide adequate advice and prepare simple concept plans and cost estimates. More extensive projects however, with structural alterations and additions, will need an architect or building designer who specialises in this type of work. You may also need a project manager to manage the build process.

Choosing the right designer is an important step. A good designer who produces a space-efficient and climate-responsive home can save you at least as much as the cost of their fees, by helping you reduce upfront construction costs, through efficient use of space and materials, and ongoing energy costs.

Designing a home usually involves working with an architect or designer to plan a new home, including:

- Developing a floor plan that shows room locations and layouts.
- Incorporating sustainable design principles (for example, good orientation,) and features (for example, advanced glazing, solar photovoltaic (PV) systems).
- Deciding on construction systems, materials and finishes.
- Choosing inclusions such as appliances.
- Designing landscaping.

Designers offer a range of services from concept design through to detailed design and project management. They can also co-ordinate a team of specialist consultants (for example, geotechnical engineer, structural engineer, accredited energy assessor, sustainability consultant, interior designer, and landscape designer).

Designers fit into one of two main categories: architect or building designer. Both are accredited and regulated and either can design your home. An architect may be able to deliver more individually crafted and challenging designs than a building designer, but may also be more expensive. However, the skill and cost level really depends on the individual architect or designer.

Architects are registered and regulated in the UK under the Architects Registration Board (ARB). A person must hold a recognised degree in architecture or demonstrate equivalent qualifications, undertake a period of experiential training, pass a practice examination, and are covered by the necessary liability insurance (this is required for ARB registration).

The range of services offered by building designers varies significantly. Many hold specialist design degrees; others are qualified professionals who have established their own practices. These days, the role of a building designer extends into the design of functional, energy efficient and often spectacularly creative homes.

You should engage an architect or building designer based on their experience, qualifications, and demonstrated capacity to deliver the type of home described in your brief. Many architects and building designers specialise in sustainable practice. Seek out a designer with skills in this field to achieve high-quality, cost-effective outcomes.

Seek references from previous clients and, where possible, visit homes that the designer has completed. Also obtain references for any nominated consultants to ensure they have the capacity to deliver consistent, professional results in your area.

You may want to delegate all of the design decisions for your home to the designer and consultants, or you may want to be fully involved throughout the process. In either case, discuss your level of involvement with designers before appointing one. Levels of client involvement in the design process are a common source of disagreement between the parties, so choose a designer who is prepared to work the way you want to.

Although it depends on the scope of your project, most will require building regulations approval to go ahead. Your designer should have a sound knowledge of the applicable building regulations and ideally have a good working relationship with the local authority.

Choosing a builder

Once you have finalised the design details of your project and are happy with your knowledge of the process going forward, you will have to make one of your most important decisions – who will carry out the building works. Finding a reputable builder who is committed to sustainable outcomes is going to be key to the overall success of your project.

If you're prepared to undertake some background research, tracking down a professional builder should not be too difficult, although you may have to wait a while before they can start – a good builder will always be busy and often have jobs lined up months in advance.

Recommendations from a family member or friends is probably the best way to find a good builder – if they've done a good job before, then there's no reason to think they won't do again.

Online trade directories can be a useful resource for finding local builders, but the wide choice can be confusing, so it's worth

checking builders' websites for further information, previous work, testimonials etc.

For larger and more complex projects, it is a good idea to engage a builder to manage construction and coordinate tradespeople. You may also need other services – this will depend on the scope of your project and what stage of the process you are at. For example, do you need the builder to provide design services, regulatory approvals, engineering certification, building regulations certification, and survey or geotechnical reports, or do you have a designer handling these?

Check the builder's history. Before signing a contract, make sure you are comfortable that you can work with the builder and that they have sufficient skill and experience to build what you want, and they are committed to sustainable outcomes.

Getting a price

Before planning your improvements, do your homework on the likely cost of modifications, upgrades, and any additions. Obtain preliminary cost estimates for each stage of renovation or addition in your plan to allow you to schedule each stage to suit your budget and needs.

To provide a quote for renovations and additions, your builder needs to allow for many unforeseeable contingencies. Even with extensive experience, building companies usually allow for the worst-case scenario.

Builders' preliminary cost estimates rarely come down, but they often rise. Always set some budget aside for opportunities or contingencies. It can be useful to nominate lump sums for specific areas of work, contingency allowances based on detailed materials invoices, and agreed hourly rates for unquantifiable work. Simpler projects with a trusted builder are often better managed on a cost-plus basis, with detailed weekly or fortnightly invoices.

Whichever option you choose, make sure you agree on a budget cap for each stage of the project, to be fully invoiced at each stage to avoid a massive bill at the end. Negotiate any variations or overruns as you go – do not defer them.

Protect sustainable features in the budget to make sure these are not consumed by cost overruns towards the end of the project, when they are often installed (for example, environmentally preferred finishes, solar hot water system, efficient heating and cooling, photovoltaic panels).

Signing a contract

Your building contract is a legal agreement between you and your building contractor. You must have a building contract in place, regardless of the scope of your renovation, because it is a crucial document in settling any dispute.

Make sure your contract covers:

- Definite timeframes for construction.
- All expected environmental performance outcomes.
- Site access, materials and waste storage requirements.
- Working hours, dust, noise and access to facilities.
- Site separation and safety issues.
- If and when the home needs to be vacated.
- Damage to existing property (who pays).
- Insurance and warranty.

Check that all your sustainability goals are reflected in the detailed plans and specifications that are submitted to the council for building regulations approval. These are the documents that will be tendered by builders and annexed to your building contract.

Project management

Decide who will supervise the project and ensure that they understand all specified environmental performance features. For alterations and additions, this is usually you or your designer. For larger projects, you may wish to appoint a project manager.

Use checklists to ensure sustainable design outcomes and the use of specified standards, materials and practices on site. Builders often need to make quick decisions about alternative materials due to delivery times or unavailability. You or your project manager should be in a position to make rapid, well-informed decisions.

Planning permission

Some conversions and extensions will require planning permission before you proceed. Most local authorities have planning policies that allow minor internal and external changes that do not alter structure or services to be made without requiring planning approval, but you should always check first.

Do-it-yourself (DIY)

Renovating your own home can be a rewarding experience and can work well for simple improvements. Indeed, popular TV programmes make home renovation look easy. However, for larger or more complex projects, inexperience may lead to unforeseen environmental and financial costs.

Critical design details such as thermal performance, and energy and water efficiency are often overlooked to achieve a quick result. Critical steps in construction might also be skipped, including damp proofing and adequate surface preparation before fixing finishes. This can reduce the lifespan of renovations and waste valuable resources.

Top Tip

If you choose the DIY path, take the time to design changes, and choose materials carefully. Also consider where you might need some expert advice or skills. You can get a professional to advise on your design, and it is always a good idea to use professional tradespeople as required. You must use a competent tradesperson for any plumbing, gas or electrical work. Visit www.competentperson.co.uk for more details.

Building regulations

As a homeowner, before you construct or change a building in certain ways you must check if you need building regulations approval. The building regulations are technical standards set by Government and help ensure that new buildings, conversions, renovations and extensions are safe, healthy and high-performing. They cover areas including health and safety inside a building, energy performance and accessibility; they also ensure that buildings are built to a reasonable standard.

Compliance with the building regulations is the responsibility of the homeowner or the person carrying out the work and the building control system helps to ensure that the required level of performance has been met.

The role of a building control body is to act as an independent third-party check to help achieve compliance. As an alternative to third-party checking by building control, some types of work may be self-certified as being compliant by installers who are registered as a member of a competent person self-certification scheme www.competentperson.co.uk – and have been assessed as competent to do so (see section below for more information).

Building regulations greatly influence how our buildings are constructed and used. As such, they help to deliver significant benefits to society.

Guidance in the Approved Documents that accompany the building regulations sets out some of the ways that requirements can be met. However, it does not always have to be followed if the required level of performance can be shown to be achieved in a different way.

Many of the sustainability measures listed in this guide will require approval under the building regulations. You or your building contractor should contact your local authority building control team for approval for your planned improvement before work commences.

Which type of building regulations application will I need?

There are generally two types of building regulations application: full plans and building notice.

Full plans

This is the most thorough option where detailed plans for the proposed scheme are sent to the local authority's building control department, along with an application form and the required fee. The required fee is dependent on the work involved, such as the number of site inspections that will be needed, and with extensions, the total floor area.

Building control will then check the plans for compliance with the building regulations and at the end an approval is issued. You will usually be provided with an inspection plan before you start work. This outlines the stages of work that require inspection, which will vary depending on the size and complexity of your project, age of your home, the construction type, ground conditions and your builder's experience.

Once a satisfactory final inspection has been carried out and if relevant, any competent person certificates have been issued and registered, your completion certificate is issued within eight weeks.

Building notice

This type of application is a much quicker process and designed for smaller projects. You can start work two days after your notice has been submitted to your building control department but you do not get formal approval as with a full plans application.

Once work has commenced, a building control surveyor will visit the site to meet the builder to discuss the plans, agree how the work should be carried out and when site inspections will take place. They will also discuss if further information is needed, such as technical drawings or structural calculations. Procedures will need to be followed throughout the build and notifications given to the local authority both during and on completion of the project.

When the project is satisfactorily completed, a completion certificate is issued that shows that it complies with the building regulations.

Regularisation approval

You can also apply to regularise work – but only via a local authority building control body – for work that has already been carried out but without consent. This type of approval only applies to work carried out after 11 November 1985 and alterations may be needed before the local authority building control body can agree the work complies with the building regulations and the regularisation certificate is issued.

Competent person schemes

Competent person schemes were introduced by the Government to allow individuals and enterprises to self-certify their work complies with the building regulations without having to submit a building notice and incur a charge.

A competent person, such as an installer (of windows or boilers for example) who is registered with a scheme can self-certify that their work complies with buildings regulations and they can deal with any building control issues should they arise.

If needed, they will tell your local authority about work on your behalf. They will also give you a certificate within eight weeks of completion which can be used as evidence of compliance - it will also show up in solicitors' searches if you come to sell your home.

Competent person schemes have insurance-backed warranties and complaints procedures if there is a problem with the work.

A list of all the types of work covered by competent person schemes and contact details can be found here:

www.competentperson.co.uk

It's always best to check with a building control body if you can't decide the best route to building regulations approval.

Planning and other permissions

Planning permission, which is separate from building regulations approval, will normally only apply for larger projects that include major external works or where neighbouring properties might be affected, for example, raising the height of a roof.

Planning officers at your local authority will consider the location of the project, the siting, height and size of the building, and the percentage of the plot that you want to build on. Planning applications are often approved with conditions and you should get all relevant matters signed off by your local council before you start to build.

Obtaining planning permission will take at least eight weeks, plus however long it takes to get the plans ready for submission. So, if you think you are going to need planning permission you should allow enough time to ensure it doesn't hold up your project.

The Government has produced a useful guide to the UK planning system. Visit www.gov.uk/government/publications/plain-english-guide-to-the-planning-system.

You can find more information and apply for planning permission online using the Planning Portal. Visit www.planningportal.co.uk for more details.

Permitted development and extensions

The Government has introduced a number of 'permitted development rights' in an attempt to boost housing supply and enable appropriate development to take place more quickly. This includes significantly greater freedom for homeowners to improve and extend their properties without the need to apply for full planning permission (but they will still be subject to appropriate engagement with neighbours).

Further guidance to help you understand how permitted development rules might apply to your circumstances has been produced by the Government.

Visit https://www.gov.uk/government/publications/permitted-development-rights-for-householders-technical-guidance#history for more details.

Further information on permitted development rights can also be obtained from the Planning Portal. The Planning Portal also hosts a number of useful interactive guides which householders can use to understand the types of development they can carry out without having to apply for planning permission.

Visit https://interactive.planningportal.co.uk for more details.

Other important legislation

Party Wall Act

Some kinds of building work carried out to a property may not be controlled by building regulations. The Party Wall Act 1996 provides a framework for preventing and resolving disputes in relation to party walls, boundary walls and excavations near neighbouring buildings.

A building owner proposing to start work covered by the Act must give adjoining owners notice of their intentions in the way set down in the Act. Adjoining owners can agree or disagree with what is proposed.

Where they disagree, the Act provides a mechanism for resolving any disputes.

The Act is separate from obtaining planning permission or building regulations approval.

What is a party wall?

The main types of party walls are:

- A wall that stands on the land of two (or more) owners and forms part of a building - this wall can be part of one building only or separate buildings belonging to different owners.
- A wall that stands on the land of two owners but does not form part of a building, such as a garden wall but not including timber fences.
- A wall that is on one owner's land but is used by two (or more) owners to separate their buildings.

The Act also uses the expression 'party structure'. This could be a wall or floor partition or other structure separating buildings or parts of buildings in different ownership, such as in flats.

The Act covers:

- New building on or at the boundary of two properties.
- Work to an existing party wall or party structure.
- Excavation near to and below the foundation level of neighbouring buildings.

This may include:

- Building a new wall on or at the boundary of two properties.
- Cutting into a party wall.
- Making a party wall taller, shorter or deeper.
- Removing chimney breasts from a party wall.
- Knocking down and rebuilding a party wall.
- Digging below the foundation level of a neighbouring property.

Further guidance on the Party Wall Act is available at https://www.gov.uk/government/publications/preventing-and-resolving-disputes-in-relation-to-party-walls/the-party-wall-etc-act-1996-explanatory-booklet

Building a new home

The homes we build today are our legacy for the future and will typically last at least 50 years and possibly much longer. It makes sense to choose your location, site, and house design carefully with resilience to climate change in mind.

If you are buying a plot on which to design and build a new house for most people the first consideration is choosing a location (that is, a general area to live in).

To make sure your location will suit you over the long term, there are many aspects to think about, including:

- Availability of services – Where will you go to work or school, shop or go to the doctor? Are shops, schools and health services within walking or cycling distance or easily accessible by public transport?
- Lifestyle – Does the location suit your lifestyle? Can it accommodate changes over time associated with your employment, financial position, health, recreational focus, family, retirement and old age?
- Look and feel of the area – Does the area have visual appeal? Would your style of home fit well in the neighbourhood? Is it friendly and vibrant? Are there enough open areas or greenspaces?

- Climate – What can you expect in terms of the temperature range, annual rainfall, winds, and frequency of storms and heatwaves? Is the area prone to flood or drought? Speak to neighbours who have lived in the area for a long time to find out useful local information on microclimate and the history of floods and droughts.
- Likely effects of climate change – What impact will warmer temperatures have? How might the local rainfall pattern change? What are the projections for flooding, sea-level rise or storm surges in your location? If your area is drought-prone, are water restrictions more likely in the future? Are there risks related to climate change that will affect your insurance?
- Neighbours – Is it a mostly residential area, or are there industrial areas or retail parks close by? Do you like the activities that go on around these areas?
- Transport – Is it close to public transport? Are there traffic problems? Are there bicycle lanes close by?
- Accessibility – Would you be happy to live in a rural or remote area? Will it be possible to build on the site, or will it be too expensive to bring in materials? What is the access to, and cost of, services such as electricity, gas, phone, internet, water supply, and refuse disposal? Are there alternatives to long-distance driving, such as train?
- Air quality – Are there any local sources of pollution or smells?
- Noise – Are there any local sources of noise? Are they constant or only intermittent or at specific times?
- Planning controls – What are the local rules and regulations (for example, Areas of Outstanding Natural Beauty or Conservation Areas), and how will they affect the building of your home?

Choosing a site

Once you have chosen the general location for your home, you can look at specific sites and decide whether they are right for you.

Size and shape

Note the size and shape of the plot: Is it large enough for your needs? Remember that all the features you want as part of your lifestyle do not necessarily need to be provided in your home. For example, access to nature and green space can be provided by a nearby park rather than a large garden.

Is it a standard rectangle, or something else? Different shapes might add to the interest of the plot, but they may require adjustment to the design of your home.

Does the plot contain any building restrictions such as covenants or easements? Remember that maintaining access to easements is usually a requirement on the title of the property, therefore building on or over an easement is usually not permitted. Some easements can be quite large and restrict the placement of your home on the site.

Climate

Find out what building designs work with the climate and see whether your site can easily accommodate them. Note the orientation of the plot. Ensure that the opportunities for solar access or cooling breezes are appropriate to the climate.

If buying a plot on a large development, consider the solar orientation of the plot relative to other plots. Make sure you can enjoy views and maximise access to winter sun and summer breezes (or shade and cooling breezes) without compromising privacy.

Observe how the site terrain and vegetation affect air movement and solar access.

Surroundings

Consider how future developments and buildings nearby might affect your home:

- If adjacent plots are empty, are the plots wide enough to prevent overshadowing and overlooking?
- Is there a potential for loss of privacy and increased noise from neighbouring areas?

Topography

Consider the natural topography of the site, and how that might affect your house design:

- Check the slope of the site and consider whether special measures will be needed to deal with a steep slope.
- Design or choose your house to respond to the natural topography of the site.
- Minimise the use of excavation and fill to save energy, preserve natural drainage patterns and prevent soil erosion.

  Excessive excavation can damage the ecological integrity of the site and disturb groundwater zones.

Stormwater, particularly overland flows, can create severe problems. Before buying, check that the site is not affected by stormwater entering from neighbours' gardens or downpipes.

Geology

The underlying geology of the site will influence construction costs and energy used in excavation. Investigate the geology and topography of the plot

What sort of rocks or soils are present? A geotechnical report will be required as part of the design process.

Identify any natural site drainage patterns and determine how they can be maintained. Steeper sites usually generate more stormwater runoff.

Vegetation

Your site may have vegetation or trees you need to remove, or you may be able to incorporate existing vegetation in your design plans:

- Identify vegetation that can be incorporated into open space, used for wind protection or used as part of the site drainage system. Make it a priority to retain native vegetation where possible.
- Understand which trees might be protected and cannot be removed, and how this might affect the siting of your home. Also remember that trees take a long time to grow, so it is a good idea to retain them rather than starting again, if possible.

The British Naturalists' Association can help to identify native vegetation. Visit https://bna-naturalists.org for more details.

Resilience to the impacts of climate change

During the lifespan of your home, the climate is projected to change. Projections vary across the UK but, in general, include temperature rises and more frequent heatwaves, more frequent and more extreme droughts and floods, rising sea levels, and more frequent high-intensity storms.

Think about how climate change could affect your site over time and consider strategies to help mitigate the risks. Ensure your house design is appropriate, taking into account projections for climate change in your area (generally, this means warmer and more extreme weather conditions).

Build well above historic flood levels

Use construction materials that are resistant to storms, drought, and impact (for example, hail).

Use storm-resistant construction systems in areas of storm risk.

Maximise capacity to capture and store water during periods of heavy rainfall with use of rainwater tanks, stormwater management, and landscape design.

When choosing garden plants, try to choose native ones that can survive longer periods of drought.

Dealing with challenging sites

A challenging site can set constraints on the design of your home. A number of strategies and techniques are available to address the design challenges of constrained sites and achieve sustainable outcomes. Getting advice from an experienced designer or builder can help you to achieve a comfortable, energy-efficient home, even on a difficult site.

It may be preferable not to build on a challenging site because of environmental impacts and additional costs. On the other hand, it is often possible to achieve good passive design and innovative solutions on challenging sites and they can be exciting places for creating a sustainable home.

Space

Efficient use of your plot will allow you to get the best out of your home, reduce operational energy costs, and create benefits for your neighbours and the community. The size and shape of the plot need to match your building design. A 'tight site' will have little flexibility. The shape of the plot and the building schedule determines design responses and the practicality of different construction techniques. Specific design solutions may be needed to overcome issues of difficult orientation, air circulation and access.

Small plots

Small sites are generally more constraining than large sites. The height and location of walls above ground level will affect building volume and spatial configuration. They may also affect the size and orientation of windows where overlooking neighbours may be a problem. Planning requirements may exacerbate the limitations of certain sites and prevent construction in those areas.

Reduce the ratio of the building's ground floor area to site area (building footprint) and use effective planning that eliminates waste space and optimises the footprint to increase the area available for landscaping. Increasing the number of storeys releases more site area, and allows optimisation of orientation, air circulation and access. Balance the building footprint with other impacts such as building height.

Poor orientation

The various strategies for dealing with poor orientation or solar aspect, particularly for existing homes, include rooflights or effective adjustable shading, and using clerestory windows or advanced glazing systems. A building simulation or rating tool can help you to investigate options and their effectiveness.

Dense urban environments can provide the most constrained and challenging sites of all. It may be almost impossible to guarantee southerly solar access. In such locations, good designs can still achieve effective passive solar performance. It is possible, for instance, to use solar gain from non-southerly aspects to bring light and warmth into a house provided shading and ventilation is designed to complement the configuration.

Overshadowing by trees, natural features, or built structures can also affect the performance of onsite renewable energy systems. Remember to account for changes in the path of the sun over the year.

Slope

A site that is considered steep generally has a gradient more than 30°. The slope affects the type of home that can be built. Steep sites require careful consideration of the contours for an appropriate design response. The slope may also be irregular with some parts steeper than others, and the fall may lie diagonally across the site.

Strategies often used on steep sites include:

- Balance cut and fill.
- Avoid retaining walls higher than 1m.
- Build along contours.
- Build into the slope to create an earth-sheltered home.

The slope also affects the types of materials that can be used economically, solar access, wind exposure, and physical access to the building for vehicles, pedestrians and people with a disability. On sloping sites, steep roads or large volumes of cut and fill may be the only solutions. Wheelchair access normally requires a ramp with a maximum incline of 1 in 12. The building regulations for building ramps with wheelchair access can be complicated and differ for new builds, existing buildings and when making a material change of use. Professional guidance should be sought from an architect or designer at the design stage.

Ground conditions

Ground conditions influence the type of foundations and disturbances to the site. Different soil conditions such as rock, sand, clay, or wetlands, place different constraints on design requirements.

Because of their inherent instability, the most challenging and difficult ground conditions are clay and wetlands. Rock presents the most stable ground condition but can be expensive and potentially damaging to the environment, to excavate.

Stormwater runoff

Steeply sloping sites increase stormwater runoff above and below the surface, from surrounding land and the site itself. Both site slope and hydrological ground conditions can constrain the building process and form.

Strategies for environmentally responsive design include:

- Directing stormwater runoff to appropriate destinations — and using it effectively where possible.
- Collecting and using runoff for landscaping.
- Minimising interference with subsurface hydrology.

Early identification of existing artificial and environmental features is crucial. Artificial structures on or below ground level are best identified early in the site selection and analysis stage. Artificial structures can affect waste, pollution, solar access, wind exposure, and services, whether subsurface or overhead. The costs of mitigating existing conditions can create an unintended design challenge, so early identification is critical for effective site planning and later construction work.

Protecting the site

Your home can change the nature of a site. Minimise the impact of your home on the natural environment by considering its effect on local flora and fauna; water, soil and air quality; and natural and cultural features. This need not add cost but simply requires forethought and careful choice of site.

Well-sited housing should:

- Retain habitat so that local flora and fauna flourish.
- Protect waterways from pollution including stormwater runoff.
- Maintain or improve soil and air quality.
- Protect any valuable natural features such as vistas and ecosystems.

- Preserve existing culturally significant streetscapes and buildings.

Conserving habitat

If your chosen site already has good environmental values, retain existing native plants and fauna habitat where possible. Surrounding vegetation can help to keep your home cooler and mitigate urban heat island effects. Extensive vegetation removal can result in soil erosion and a reduction in soil quality.

Maintaining and enhancing existing habitats is a central issue on sites with high ecological value. Make an inventory of existing species and examine the impacts of site planning on species distribution and the viability of habitats. Establishing areas for habitat conservation becomes a central strategy; reduce noise and light pollution impacts of the home on these areas.

On sites with high ecological values, consider:

- Establishing a habitat conservation area.
- Monitoring impacts of construction.
- Monitoring and adjusting activities that may disturb the habitat.

Flora and fauna impact studies are required by many local councils for larger developments. It is an environmentally smart choice to conduct one at a reduced scale for smaller projects, especially in areas with high natural heritage values or threatened species and ecosystems.

Conserving vegetation on your site can help to keep your home cooler and mitigate urban heat island effects.

Restoring and increasing ecological value

Urban development often removes existing flora and fauna, and inner-city sites rarely contain even remnant vegetation. Measures to restore or enhance ecological value are then needed. If the soil from the site's clearance has been stored, it can be reintroduced across the site. On rural sites, wildlife pathways can be created to allow animal movement across plots and plant food sources can be introduced for both humans and native animals.

If little ecological value remains or the pre-existing ecology has been destroyed, increasing the ecological value of the site as part of the landscaping plan is a good strategy, particularly on inner-urban sites. Strategies that increase biodiversity range from restoration of native species to the establishment of permaculture gardens.

Visit https://www.plantlife.org.uk for more details.

Key issues

When choosing a general location for a new home, think about your lifestyle and long-term needs. Consider the regional/seasonal variations in the climate, availability of services, transport, neighbourhood character, noise, and planning restrictions.

Once you know the general area where you want to live, you need to find a site. Assess each potential site carefully. Consider size, shape, orientation, shading, slope, and geology. To ensure your site is a good fit, think about the kind of house designs that will suit the climate and your needs.

Sites that are challenging because of their small size, odd shape, or steep slope, can require more creative building design to achieve a comfortable, attractive, energy-efficient home. Consider getting expert design and building advice.

There are various strategies for dealing with challenging sites, such as designing a small building footprint for small sites, reorienting living rooms for odd-shaped sites, and building above or into steep slopes.

Sites with high environmental values should be protected. Survey the site before building and designing the building footprint to retain as much habitat as possible.

Sites with low environmental values can be improved. Restoring the soil and adding native gardens can increase the biodiversity of even inner-city sites.

As homes are typically designed with a 50-year life expectancy (the best ones last for hundreds), it makes sense to factor in resilience to climate change. Think about how climate change could affect your site over time and consider strategies to help mitigate the risks.

Buying an existing home

If you are buying an existing home, knowing what to look for can help to ensure your home will be comfortable, cost effective to run and sustainable.

Buying an existing home simply means that you buy a home that has already been built. The home might be a house on a plot of land, a townhouse, or a flat/apartment. Buying an existing home has some advantages. You can see exactly what you are getting, and you can visit the home several times and see how it performs during different times of the day.

If you buy a home that has been built for a few years, any potential problems should have had a chance to show up. Bear in mind that homes built before 1965 will not have been required to meet energy performance targets of the building regulations. The building regulations set the minimum necessary requirements for safety and health, amenity and accessibility, and sustainability in the design, construction, performance, and liveability of new buildings (see page 24 for more information about building regulations).

Buying an existing home also means that various aspects of the design and fittings may not be just as you would like. You will need to decide whether the home can be cost-effectively renovated to suit your lifestyle and to be more comfortable and sustainable.

Market and financial research

Know your budget and choose a locality that suits both your lifestyle and budget. Remember that a more expensive home with good sustainability features will save money each year, with lower energy and water costs than a poorly designed but cheaper home.

Also be aware that some banks offer lower interest rates or other benefits for homes and renovations that achieve sustainable outcomes.

Preliminary research

Careful research and assessment improve the likelihood that your new home will be comfortable, cost effective to run and maintain, and hold its value into the future.

Start your research by identifying your sustainability goals and developing a good understanding of how to choose a home that will work with, rather than against, the climate. (see article opposite on the UK climate and its regional/seasonal variations).

Make achieving thermal comfort with the lowest ongoing costs central to your decision making at every stage. Draw up a list of 'must haves' and 'must avoids', based on the climate. Also, make sure you are familiar with the options for renovation, including those that might be achieved easily, or those that might be difficult or more expensive. Doing your homework on the likely cost and impact of modifications, upgrades and additions will help you to identify houses that can be more easily improved.

Inspecting homes

Inspecting a home allows you to see the space, layout, and structure. However, expensive hidden traps and inexpensive opportunities are often missed by inexperienced buyers. Sometimes an apparent bargain can be difficult or very costly to retrofit for sustainable performance. Conversely, a seemingly expensive home might be simply and cost-effectively upgraded.

A thorough pre-purchase evaluation is a critical step in choosing an existing home to buy and potentially renovate. Consider engaging an experienced, professional consultant (designer or builder) to identify the home's potential, expose hidden problems, and balance the cost of rectification or renovation against purchase price. This advice can more than pay for itself.

The UK climate

The UK has a temperate climate. In general, this means that Britain gets cool, wet winters and warm, wet summers. It rarely features the extremes of heat or cold, drought or wind that are common in other climates. The weather conditions are also very changeable.

Places in the east and south of the UK tend to be drier, warmer, sunnier and less windy than those further west and north. Also, these favourable weather conditions usually occur more often in the spring and summer than in autumn and winter. But that is by no means the whole story, and these climate descriptions illustrate the all-important regional and seasonal variations.

Further information on the regional climates of the UK is available here:

https://www.metoffice.gov.uk/research/climate/maps-and-data/regional-climates/index

In the UK, you need to achieve a balance between reducing cooling needs in summer and reducing heating needs in winter. Look for southerly orientation, good areas of south-facing glazing, minimal or shaded east-and west-facing glazing, good thermal mass and insulation.

Structure, damp and fire

Structural cracking due to reactive (clay) soils or subsidence can reduce the lifespan of the home if left unattended. It also causes heat loss and draughts and can be expensive to repair in masonry construction. Check for cracks, or signs of where they have been repaired, and have them checked by a builder or engineer before making an offer. The more extreme cycles of drought and heavy rain associated with climate change are likely to accelerate the cracking process in areas with reactive soils.

Rising damp is unsightly and can cause poor indoor air quality and health problems. It also reduces the lifespan of a home. Look for any damp walls or signs of mould or mildew. How easy it is to rectify depends on the site and the extent of the problem – in some cases it is relatively simple, but it can be very expensive. Engage a consultant to check and provide advice on how to fix any rising damp.

Shortlisting homes

After inspecting a broad range of properties, develop a shortlist of properties and compare it to your wish list or brief. Decide which properties best meet your brief or can be adapted cost effectively and narrow your list to one or two properties.

Choose a designer or builder with expertise in sustainable design and have them attend your next inspection to identify problems, answer questions and suggest solutions. Ask your expert to help you list and firm up your estimate of the cost of upgrading each property to meet your performance wish list – particularly its thermal comfort.

Top Tip

Be creative in your choices and consider location over size. You can always add to your home, but you cannot relocate it.

Closing the deal

Factor all these costs and considerations into your negotiations. Make offers based on the cost of achieving thermal comfort in addition to your other needs and sustainability goals. Make these costs known to the agent and vendor and be prepared to walk away if limitations are not adequately addressed in the purchase price. By doing this, you are educating the market and helping to change the way sustainable design features are valued in property transactions.

Key points

- If you are buying an existing home, knowing what to look for can help to ensure your home will be comfortable, cost effective to run and sustainable.
- Different features will be important in different areas.
- It is rare that you find a home that has everything you want. Do some research to find out what changes can be made easily through renovations, and what will be difficult or expensive to do.
- When you inspect homes, thermal comfort should be a key consideration. Also assess the risk of structural problems, damp and flooding.
- Expert advice can be invaluable. Get a design or building consultant to look at your shortlist of homes to see which will perform best and estimate the cost of renovations.

Renovations, conversions and extensions

Renovations, conversions and extensions can provide the means to improve the energy and water efficiency of your home, at the same time as improving liveability and comfort.

Renovations, conversions and extensions should be treated as if you are planning a whole building. Carefully assess how an addition will change the energy efficiency of your home and include insulation, thermal mass and appropriate glazing.

Research and decision making

Before you decide on any renovations, think about how your home functions now and how it could work more effectively, both in terms of your lifestyle and your thermal comfort. In particular, this is a good time to see how well your current design suits the climate, and what you could change to make your home more energy efficient.

Conduct a 'SWOT' analysis (strengths, weaknesses, opportunities, threats) of your

current home to identify the most cost-effective improvements. List all:

Strengths – current structures, spaces, uses and aspects that work well and should be retained.

Weaknesses – such as rooms that do not suit their purpose (for example, in poor condition, in the wrong place, too big or small, too hot or cold).

Opportunities – for example, to increase solar access and reduce heat loss in winter, to reduce solar access and increase breeze capture in summer, swap room function, improve existing spaces (for example, by adding storage, or combining or dividing rooms).

Threats – items that require maintenance or repair or are structurally unsound.

Expert services

Depending on the extent of your renovations, you may wish to get other expert advice. If your renovation proposals are relatively simple, a builder who specialises in this type of work may be able to provide adequate advice and prepare simple concept plans and cost estimates. More extensive renovations might require a designer who specialises in sustainable alterations and additions.

If you are planning an extension to your home, consider engaging an energy assessor to model the whole home as well as the extension. Building simulation using building thermal performance assessment software can identify opportunities to be pursued or weaknesses to be overcome through careful design. Once your building's data is entered into the software, modelling of options can be an inexpensive way to fine-tune your design as it progresses.

Building regulations require that minimum thermal performance standards be met as a condition of approval for extensions, so the assessment process will help to ensure you meet those requirements.

To find an accredited assessor for your home, visit https://www.gov.uk/get-new-energy-certificate

Approvals and permissions

Most renovation work and all conversions and extensions will require building regulations approval from your local authority before you proceed. You may also need planning permission. Most local authorities have planning policies that allow minor internal and external changes that do not alter structure or services to be made without requiring planning approval, but it is always best to check first.

See section on building regulations and planning permission on page 24 for more details.

If you rent your home, you will need to check with your landlord or agent before making any changes. Some building owners may be prepared to contribute to sustainable upgrades in the knowledge that they can increase market appeal and property values.

Do-it-yourself (DIY)

Renovating your own home can be a rewarding experience and can work well for simple improvements. Indeed, popular TV programmes make home renovation look easy. However, for larger or more complex projects, inexperience may lead to unforeseen environmental and financial costs.

Critical design details such as thermal performance, and energy and water efficiency are often overlooked to achieve a quick result. Critical steps in construction might also be skipped, including damp proofing and adequate surface preparation before fixing finishes. This can reduce the lifespan of renovations and waste valuable resources.

Top Tip

If you choose the DIY path, take the time to design changes, and choose materials carefully. Also consider where you might need some expert advice or skills. You can get a professional to advise on your design, and it is always a good idea to use professional tradespeople as required. You must use a competent tradesperson for any plumbing, gas or electrical work.

Renovations

With careful planning, thoughtful design and a considered choice of builder, renovations can improve the liveability and sustainability of your home. Whether your project is a simple DIY improvement or a major renovation, incorporating sustainability goals can deliver added benefits such as thermal comfort, lower energy and water bills, and improved market appeal. Even when making minor improvements such as patching up and repainting, there are small things you can do at the same time, such as draught sealing, that can deliver real benefits.

Insulation

Insulation is essential for good thermal performance – it helps to keep your home warm in winter and cool in summer. To improve your home's thermal performance, add insulation to accessible roof, wall and floor sections. Insulation costs can be medium to high, but it is a very quick and effective way of improving the comfort of your home and lowering your energy costs.

If existing ceiling insulation has been moved or damaged, fill the gaps or replace it. Older insulation often settles or slumps and loses its insulating properties, so the best option may be to replace it all.

If the underfloor spaces in your home are large enough, you can install underfloor insulation in sheets or rolls. For colder areas, consider additional bulk insulation.

Top Tip

If roofing is being replaced, this is a good time to check and install new roof insulation if needed.

Windows and glazing

Glazing can be a major source of unwanted heat gain in summer and heat loss in winter. The size, location and design of windows, skylights and other glazing elements will have a significant effect on the thermal performance and energy efficiency of your home.

In renovations, windows are a good area to target because they are relatively simple to change. Glazing improvements can be simple and cheap, or more extensive.

Simple options include:

- Using silicone or other sealants to improve the seals around windows and doors.
- Applying thermal films to windows to reduce solar heat gain and help retain winter warmth; these stick to existing glazing and are relatively easy to install yourself.
- Installing secondary glazing panels to the inside of windows in colder climates; this can bring some of the benefits of double glazing and is sometimes referred to as 'retrofit double glazing'.
- Shading problem glazing with external shades.
- Installing tight-fitting insulative blinds (for example, cellular blinds) or heavy curtains with pelmets to prevent heat loss.
- Planting deciduous trees or shrubs to shade the building and glazed areas in summer (pruning or removing trees that block solar access to south-facing glass in cooler seasons).

More extensive options include:

- Replacing windows and other glazing with high-performance units (for example, double glazing; uPVC or timber frames).
- Increasing the size of south-facing windows.
- Relocating or reducing the size of east- and west-facing windows.
- Tightly fitted cellular blinds prevent heat loss.

Ventilation and air movement

Designing your home to allow controllable natural ventilation is an important strategy for keeping your home comfortable, saving energy and contributing to a healthy indoor environment.

You can improve cross-ventilation by:

- Replacing existing windows and doors with styles that open more fully (for example, casements, louvres and bifold).
- Creating new openings in non-loadbearing walls and above doors.
- Moving doors to improve breeze paths.
- Designing landscaping planting, outbuildings or fences to direct breezes through the home.
- Removing trees and plants that block breeze access, unless they are needed as a windbreak.
- Allow cross ventilation by prevailing breezes on summer afternoons.

Draught sealing

Small gaps around doors and windows can let cold air through in winter and warm air through in summer. Check your home for air leaks. Can you see light around doors or windows or feel air moving through gaps? Are curtains moving even if the window is closed? Do doors and windows rattle on windy days? Sealing your home against air leakage is one of the simplest upgrades you can make to save energy and improve thermal comfort.

Very simple ways to stop draughts are:

- Sealing around windows and doors and any other gaps with silicone or other sealant.
- Installing a door or window seal or weather strip.

More extensive changes are:

- Fitting dampers to chimney flues or insulate if unused.
- Installing non-return baffles for exhaust fans.
- Replacing warped or poorly fitting doors.
- Installing doors in hallways and stairwells to control winter draughts and create zones that can be separately heated or cooled.

Thermal mass

Thermal mass is the ability of a material to absorb and store heat. Having the appropriate amount of thermal mass in your home can improve energy efficiency and thermal comfort.

Thermal mass is typically considered and included at the design and building stages. But there are some changes that can be made through renovations.

Existing brick homes often have adequate thermal mass. To improve passive heating in these homes, insulate external cavity walls, ensure that thermal mass is balanced by increased solar access, and design openings and convective flow paths to ensure that additional solar gains are distributed effectively within the home.

To improve thermal mass in any home, consider removing carpet or other insulative coverings from floor slabs and replacing with tiles or polished concrete finishes.

Install thermal mass in rooms that have little or none and are exposed to passive heating or cooling. This can include new internal masonry walls, sealed water containers or phase-change materials.

Technology and appliances

Renovations provide a great opportunity to target the replacement of old technologies in your home and upgrade to more efficient lighting, appliances, and heating, cooling, and hot water systems.

Look for the energy rating label on appliances and technology.

There are four key areas to consider for technology upgrades:

Heating and cooling – heating and cooling can use up to 40% of your household energy, so it makes sense to do whatever you can to reduce your heating and cooling costs. Upgrade your heating and cooling system with one that:

- Has the highest energy rating you can afford.
- Only heats or cools rooms that are in use.
- Can be expanded to include future additions.

Hot water – heating water for showers, baths and washing clothes can use up to 25% of our household energy. Consider installing an energy-efficient heat pump or solar hot water service.

Appliances and technology – new appliances such as fridges, dishwashers, and washing machines are far more efficient than older models, and can quickly pay for themselves in energy savings. The same goes for home entertainment and office equipment. Choose the highest energy rating when replacing appliances and technologies.

Lighting – replace any remaining low-efficiency incandescent or halogen lights with LED lights which use around 80% less energy.

Water

A renovation provides many opportunities to reduce water use – from small upgrades to plumbing fixtures and appliances, to larger projects that might include rainwater harvesting and landscaping.

To reduce water use:

- Install flow restrictors on taps that deliver too much water (for example, hand basins, sinks).
- Install the highest energy saving rated toilets, showers, taps and appliances available.
- Reduce lawn areas and convert parts of your garden to mulched, low-water planting beds to save work and improve privacy and air quality.
- Plant local native plants, which will reduce your water consumption because they are adapted to the climate's rainfall, and also increase biodiversity by attracting insects and birds.

To supplement your water source:

- Install rainwater tanks (you may require approval over a certain size, so check with your local planning department first).
- Consider reusing grey water for your garden; you will need to check which systems are approved by your council, and it's a good idea to have a soil expert explain the implications for your soil type and plants.

Space and amenity

Improving the space and amenity of your existing home will reduce the need for new construction with further environmental impact.

Storage

To increase your storage space:

- Experiment with more space-efficient furniture layouts to make room for additional functions and storage.
- Install additional, purpose-built storage.

Kitchens

If you are considering renovating your kitchen:

- Consider traffic flow and safety.
- Choose energy and water-efficient appliances ensure the fridge is well ventilated and not next to the oven or other heat source.

- Choose low or no VOC (volatile organic compounds) materials.
- Use eco-product selection databases such as BRE's GreenBookLIve.
- Consider reusing the existing joinery carcass and only installing new cupboard fronts.
- Choose durable, non-dating finishes.
- Include facilities for composting and recycling.

Bathrooms and laundry areas

If you are considering renovating your bathroom or laundry:

- Choose toilets, showers and taps with the highest energy rating.
- Consider a 2 or 3-way bathroom design to eliminate the need for additional bathrooms.
- Choose an energy and water-efficient washing machine with a high energy rating.

Floor coverings

If you are upgrading your floors, ensure timber flooring comes from sustainably managed sources with Forest Stewardship Council accreditation. Bamboo flooring can also be a good option. Ensure all hard flooring has high levels of acoustic insulation and specify low-VOC finishes.

For soft flooring, consider the most environmentally friendly options. Carpet made from natural, renewable fibres include sisal, seagrass, coir, organic cotton, jute, organic wool and bamboo. The materials used to create these carpets are biodegradable and don't require a lot of fertilizer and pesticides to produce.

Paints

Choose paints with very low or zero VOC emissions, which are readily available at no extra cost. In some places, recycled paint is available, where left-over paint from other jobs is mixed to meet customer needs. Colours can be limited, but white and undercoat are often available.

Noise

Noise can be reduced by:

- Designing room layouts to buffer quiet rooms, such as bedrooms, from noisy spaces.
- Adding high-performance acoustic materials to walls or ceilings.
- Using laminated glass or double glazing.

Outdoor areas

To increase your living spaces, consider building or improving outdoor living spaces close to kitchen and indoor living areas, with options for summer shade, and winter sun.

Conversions and extensions

Conversions and extensions can give you more space and help your home to better suit your lifestyle. Converting a loft or adding an extension can also improve the thermal performance and energy efficiency of your home. It is a good idea to see how the extension will affect the overall performance of your home, and to include energy-saving design options. These will be cheaper to include now, than to retrofit later. The key issue to consider are:

- **Insulation** – all new construction should be insulated as appropriate. During construction, you can also retrofit insulation to the existing building. Replace any insulation that is old or not in good condition.
- Windows and glazing – explore your options for window size, type, placement, glass and frame. Maximise south-facing windows and minimise east and west-facing windows. Use the right ratio of glass to thermal mass for the climate.
- Thermal mass – include thermal mass appropriate to the climate, availability of passive heating and cooling, auxiliary heating and cooling systems, and likely occupation patterns.

After construction, continue to manage moisture sources, and ensure gardens stop clear of walls. Further information regarding conversions and extensions and other home improvement projects is available in the Projects section overleaf.

Common projects

In this section we look at a range of common home improvement projects and what you can/should be doing to help tackle climate change. Each project has specific measures you should be looking at doing as well as other measures you might consider doing at the same time to help cut emissions and save on fuel bills. All the measures highlighted are outlined in more detail in the following section: Sustainability measures

Adding an extension to your home:

Building an extension is probably the biggest change you are likely to make to your home. Taking climate change into account will help to keep running costs low, provide a comfortable environment, and protect your extension against possible climate change impacts in the future. It could also be the most cost-effective time to improve the performance of the rest of your home as builders, plumbers and electricians will be on-site, as well as scaffolding and specialist equipment.

You should also look at:

- Replacing your heating system or boiler – as this might be a good time to consider doing this as well.
- Refitting your kitchen or bathroom – if you are going to include a bathroom and/or kitchen in the extension.
- Replacing your existing windows – so that they match the glazing and window frames in your extension, and give the same higher performance.

Ways to cut carbon emissions and save on fuel bills

- Orientate the extension to get the most from the natural warmth of the sun by having bigger, taller windows on any southerly facing sides and fewer, smaller windows on the northerly facing sides.
- Ask for high levels of insulation in walls, floors and roofs. Go beyond the minimum required by the current building regulations. It may also be a cost-effective time to upgrade the insulation levels in the rest of your home.
- With good insulation you will minimise the need for heating. You do need to consider whether your current heating system has the capacity to be extended.

Improving your home

Ways to make your home comfortable and safe:

- Consider how you will keep rooms cool in very hot weather. It is important to be able to shade and ventilate south-facing rooms.
- If you are in a flood risk area, consider how you might design your extension to minimise damage from flood waters or severe storms.

Checklist

Roof insulation

Wall insulation – cavity walls

Cooling and ventilation

Heating

Lighting

Double and triple glazing

Floor insulation

Planting

Household and building waste

Building a conservatory

Conservatories can provide extra space and a pleasant warm area to sit inside. They will always be a few degrees warmer than the

temperature outside. However, they can also be very energy inefficient, overheating in summer and losing heat in winter. Ensure that there are well insulated walls and/or double-glazed windows and doors between the conservatory and the rest of the house. Careful use of a conservatory, e.g. shutting doors to the rest of the house when the weather is cool or very hot, is also important.

You should also look at:

- Upgrading your existing windows – at the same time to improve their efficiency.

Ways to cut carbon emissions and save on fuel bills:

- Consider the orientation of your conservatory; south facing conservatories will tend to overheat and may need extra shading and ventilation; east and west facing ones will gain the most heat in the mornings/ evening; north facing ones will gain least heat.
- Insulate the walls, windows and doors to a high standard, as you would with your house in order to have comfortable temperatures for the maximum amount of time in the day and year.
- Accept that a conservatory will be comfortable to use mainly through the spring, summer and autumn but not in cold weather.
- Avoid installing a permanent or temporary heating system in your conservatory as this can waste large amounts of fuel, significantly increasing your heating bill.

Ways to make your home comfortable and safe

Ensure your conservatory has low and high level opening vents and blinds so that you can keep it cool in the summer

Consider using a 'conservatory' space to provide passive solar gain for your house, helping to heat it in winter and cool it in summer. This requires heat regulated ventilation into the rest of the house and to the outside.

Checklist

Wall insulation – cavity walls

Cooling and ventilation

Double and triple glazing

Floor insulation

Planting

Household and building waste

Converting your loft

Constructing extra rooms in your loft is an effective way of increasing the size of your home without necessarily increasing your energy demand or CO_2 emissions. A loft conversion may involve erecting scaffolding, which makes it a good opportunity for considering other measures up on the roof.

You should also look at:

- Replacing your heating system or boiler.
- Upgrading your existing windows – so that they match the glazing and window frames of your loft conversion, and give the same higher performance.

Ways to cut carbon emissions and save on fuel bills

- Improve the levels of roof insulation.
- Use the most up-to-date glazing in windows and skylights.
- Consider installing solar energy systems such as solar water heating or photovoltaic panels for generating electricity.

Ways to make your home comfortable and safe

- Consider how you will keep loft rooms cool in very hot weather.

- Consider if there is a need to increase the capacity of gutters to deal with heavy rainfall.
- If your loft conversion includes a flat or low pitched roof, consider having a 'green' or planted roof.
- If you live in an exposed position, seek advice about the most resilient form and materials for your new roof.

Checklist

Roof insulation

Double and triple glazing

Heating

Lighting

Electricity from sun and wind

Cooling and ventilation

Drainage, surfacing and green roofs

Household and building waste

Replacing your heating system or boiler

There are usually four elements to your heating system: the boiler (or equivalent equipment) which provides the heat, a hot water storage cylinder, the system that takes the heat around your home (e.g. pipes and radiators), and controls that ensure your home is kept at a comfortable temperature when you are using it. A conventional gas or oil central heating boiler usually needs to be replaced after about 15 years but other parts of the system should normally last much longer. A range of new low-carbon technologies for heating your home and providing hot water are now available.

Ways to cut carbon emissions and save on fuel bills

If you live in an area with a gas supply, you should choose a gas condensing boiler. Micro CHP (Combined Heat & Power) is another low-carbon option, fuelled by gas, that is now available.

If you live in an area without a gas supply, or want to reduce your reliance on fossil fuels, consider one of the new low-carbon technologies for heating your home and water such as air source heat pumps, ground source heat pumps or a wood fuelled boiler.

Whatever your type of boiler, good temperature and heating controls are essential. Consider solar water heating for providing part of your hot water requirements. Make sure you have done the low cost, simple measures such as insulating your hot water pipes and hot water cylinder (if you have one).

Ways to make your home comfortable and safe

If you live in a flood risk area, consider locating your boiler, associated electrics, pumps and controls above any potential flood level.

Checklist

Pipe and cylinder insulation

Conventional fuel heating systems

Ground source heat pumps and Micro CHP

Solar water heating

Heating with wood

Temperature and heating controls

Flood and storm protection

Household and building waste

Building a garage or shed

Whilst a garage or shed should make little impact on your CO_2 emissions it may enable you to collect rainwater. A garage or shed built as a 'lean-to' on your home could also shelter the shared wall and hence reduce heat loss from your house.

Ways to cut carbon emissions and save on fuel bills

- Install efficient lighting and switches that automatically turn the lights off when not in use.
- If your home does not provide a suitable southerly-facing roof, a shed or garage roof can sometimes be used to mount solar water heating or photovoltaic panels.
- If you intend to heat the garage or shed, insulate it as well.

Ways to make your home comfortable and safe

- Collect the rainwater that falls on the roof by using a water butt.

- Ensure any driveways or paths leading up to the garage or shed utilise permeable materials to allow the rainwater to drain through to the ground.
- If you live in a flood risk area, consider putting any wiring, electric points and fittings above any potential flood level.

Checklist

Lighting

Solar water heating

Electricity from sun and wind

Drainage, surfacing, and green roofs

Water saving

Flood and storm protection

Household and building waste

Building a driveway or patio

If you own a car and need off-road parking, use permeable materials that allow rainwater to pass through them and to drain slowly into the ground rather than quickly running off into drains and increasing the risk of flooding. Using different materials and avoiding concrete or tarmac on your patio can also help to keep gardens cool in summer.

Ways to cut carbon emissions and save on fuel bills

- Do not use patio heaters, which can produce up to 4 tonnes of CO_2 per year, the same as a large car.
- Install energy efficient lights, such as solar-powered lights with movement sensors where it is necessary to light driveways and patios.

Ways to make your home comfortable and safe

- Consider using green planting on driveways. Not only can they be more attractive, they also remove pollution from the air and absorb rainwater. Plastic lattice products stabilise grassed areas and prevent green driveways becoming compacted and muddy.
- Consider the use of other permeable surfacing, such as gravel and pebbles.
- Use FSC (Forestry Stewardship Scheme) certified timber for decking on patios and for garden furniture – wood that has

been certified by the Forest Stewardship Council is managed in a way that protects the environment and the lives of forest-dependent people.

Checklist

Lighting

Electricity from sun and wind

Planting

Drainage, surfacing and green roofs

Household and building waste

Refitting your kitchen or bathroom

These are the two rooms in your home where large quantities of energy and water are consumed. Refitting them provides the opportunity for significantly reducing your carbon emissions and conserving water resources, both of which could reduce your energy and water bills. Your kitchen contains some of the most expensive and energy-hungry appliances in your home and is the place where the most waste is generated. Kitchens and bathrooms are wet environments where you might be experiencing condensation and mould problems. A combination of improving insulation, heating and ventilation can effectively deal with such problems.

Ways to cut carbon emissions and save on fuel bills

- Upgrade the insulation levels in the walls and the floor (if the kitchen or bathroom is on the ground floor) and the roof if it is single storey.
- It is advisable to have some form of mechanical ventilation in kitchens and bathrooms which are automatically triggered by high levels of humidity.
- Choose energy efficient cookers, refrigerators, freezers, dishwashers and washing machines – look for energy labels to guide your choice.
- Include space for sorting and storing your waste and for recycling/composting bins when designing your kitchen layout.

Ways to make your home comfortable and safe

- Choose water efficient taps, showerheads, appliances and dual-flush toilets.
- Install a shower in your bathroom as a more energy and water efficient alternative to a bath but avoid energy-hungry power showers.
- Consider installing non-return valves on mains drains and other measures to stop flood water entering your home.
- For ground floor kitchens and bathrooms, if you live in a flood risk area, choose stainless steel or plastic cabinets in preference to chipboard or wood.
- Consider ceramic or vinyl flooring materials and raise white appliances and all electrical services above potential flood levels.

Checklist

Roof insulation

Wall insulation – solid walls

Floor insulation

Draught-stripping

Lighting

Appliances

Flooding and storm protection

Cooling and ventilation

Water saving

Household and building waste

Replacing your roof

This project is a key opportunity for upgrading the insulation levels in the roof. This is particularly important for flat roofs or 'rooms in the roof' where there is no access to the roof space. Remember that while you have scaffolding up for this project you might consider installing other measures such as solar energy.

Ways to cut carbon emissions and save on fuel bills

- Upgrade the insulation levels in solar PV panels or tiles on the roof and consider going beyond the levels specified by the current building regulations.
- Consider installing solar energy such as solar water heating or solar PV panels or tiles to generate electricity.
- Consider installing skylights or sunpipes to give more natural daylight in the rooms below the roof.

Ways to make your home comfortable and safe

- If you are replacing a flat roof or one with a shallow pitch, consider the possibility of creating a 'green' or planted roof.
- Make use of the rainwater falling on the roof by collecting it in a water butt or rainwater recycling system. You can use this water to water the garden.
- If you live in an exposed position, seek advice about the most wind resistant shape and material for your new roof.
- Consider if there is a need to increase the capacity of gutters to deal with heavy rainfall.

Checklist

Roof insulation

Double and triple glazing

Solar water heating

Electricity from sun and wind

Planting

Drainage, surfacing and green roofs

Flooding and storm protection

Household and building waste

Upgrading your windows

Windows allow the sun's light and warmth into your home. Skylights are particularly effective at bringing daylight inside which will save on electric lighting. Remember there will be times when you will need to reduce the sunlight entering your home to keep cool. Heat passes easily through single glazed windows so it is important to upgrade this type of window. All new glazing should be at least double or triple glazed. Timber window frames are the most environmentally friendly choice. However, if your existing frames are still in sound condition it may be more cost-effective to apply secondary glazing and draught-stripping than to completely replace the frames. This can also be a good option on listed buildings and in conservation areas where you may not be allowed to change the style of the frames.

Ways to cut carbon emissions and save on fuel bills

Consider if it is possible to apply secondary glazing and options for replacement with draught-stripping to your existing windows' frames. If not, consider the various options for replacement with new high-performance double or triple glazing

Ways to make your home comfortable and safe

- Choose windows frames with trickle vents that allow you to ventilate your home at night during hot weather without compromising the security of your home.
- Particularly on south-facing frames, consider how to reduce strong sunlight entering your house in hot weather by the use of shutters, blinds or awnings.
- If you live in a flood risk area, do not choose wooden window frames for ground floor rooms.

Checklist

Draught-stripping

Cooling and ventilation

Double and triple glazing

Household and building waste

Re-rendering your walls

Rendered finishes on walls come in a variety of forms, such as 'pebbledash' or a smooth sand/cement render which is often finished

with coloured masonry paint. These need to be replaced when they become cracked in order to stop water getting in. Rendered walls are common on homes that have solid walls with no cavity. There is considerable heat loss through uninsulated solid walls. It is possible to substantially reduce this heat loss by adding external insulation in special finishes. For houses with solid walls, this should be a top priority measure which will substantially reduce your fuel bills and CO_2 emissions.

Ways to cut carbon emissions and save on fuel bills

- If you live in a home with solid walls, using external wall insulation as an alternative to render.
- If you are thinking of replacing your windows, do this before re-rendering, as the external insulation or conventional render will butt up against the window frames.

Ways to make your home comfortable and safe

- Remember that improving insulation will keep your home warm in winter but will also keep it cool in summer.
- Choosing a pale coloured finish will also help to keep your home cool in hot weather.
- If you live in a flood risk area, you may want to consider the range of measures to stop flood water entering your home prior to re-rendering.

Checklist

Wall insulation – solid walls

Cooling and ventilation

Double and triple glazing

Flooding and storm protection

Household and building waste

Sustainability measures

Below is a list of the key sustainability measures highlighted in the previous section. These measures should be considered when carrying out building or renovation works to your home and are grouped under four main themes: improving thermal insulation; heating and hot water; electricity and appliances; and adapting your lifestyle.

Improving thermal insulation: Roof insulation

Roof insulation can reduce heating costs by up to 20%, (or more if there is no existing insulation), with a significant CO_2 saving through better energy efficiency. Particularly if your walls are not insulated, loft insulation is generally the most cost-effective insulation to install.

Using insulation quilts or loose fill material the best depth for loft insulation is between 250-300mm (with no real benefit of using more than this). Insulation quilts are laid both between and over the joists and so also reduce the amount of heat conducted through the timber joists. Insulation quilts can be made of mineral wool but more environmentally friendly options include sheep's wool, hemp,

jute or recycled denim jeans! Loose fill material made from recycled newspaper is available but needs professional installation.

Call in a specialist roofing contractor to insulate a flat roof with insulation laid either between the roof deck and waterproof covering (using polyurethane, polystyrene or high-density mineral wool), or on top of the waterproof covering (using extruded polystyrene and polyurethane). Cork board is a more sustainable and renewable alternative to foamed plastics.

Consider replacing a flat roof where the waterproof covering is beginning to fail (their lifespan is usually 15-20 years depending on materials used) with a pitched roof with more insulation.

Insulate the rafters of the roof either from the inside or from the outside (this is called sarking insulation). Ceiling joists can be hung from the rafters to give the required depth for insulation.

Safety Tip: Roofing work should be carried out by a roofing professional. Loose fill materials should only be installed by a specialist contractor.

For further information, visit the National Insulation Association website here: https://www.nia-uk.org

Most roofing work is notifiable to building control and unless your roofer is a member of a competent person scheme you will need to make an application before work starts.

Top Tip

Ensure that any water tanks and piping in attics are also insulated to avoid freezing and burst pipes

Improving thermal insulation: Wall insulation – cavity walls

A poorly insulated home can lose up to 25% of its heat from the walls. You can tell whether your house has cavity walls because bricks or stones will generally be placed lengthways in the wall. Most cavity walls can be filled with insulation, significantly reducing this loss of heat, and as a result saving you substantial amounts on heating bills, as well as reducing the amount of CO_2 emitted from heating your house. Installing cavity wall insulation could mean that a smaller boiler or heating system could be installed next time it is replaced. Check for and remedy any damp problems before work begins. It is recommended that cavities of less than 50mm should not normally be filled and you should consider options listed under 'Wall Insulation – solid walls' (see below). Install cavity wall insulation using a proven system and installer. The National Insulation Association holds a register of cavity wall systems and installers, go to https://www.nia-uk.org for more details.

Safety Tip: Cavity wall insulation should be installed by a specialist contractor who can provide a Cavity Insulation Guarantee Agency (CIGA) guarantee, or a manufacturer's guarantee for injected polyurethane. See https://ciga.co.uk/ for more details.

Improving thermal insulation: Wall insulation – solid walls

A poorly insulated home can lose up to 25% of its heat through the walls. Solid walls lose even more heat than cavity walls, often more than double that of an un-insulated cavity wall. Most pre-1930s houses have solid walls, with bricks or stones generally laid head-on and lengthways. Solid walls can be insulated on the inside or outside of the wall. It should be a top priority for cutting both fuel bills and CO_2 emissions.

Install internal solid wall insulation, using insulated studwork, rigid insulation board, combined dry-lining methods or flexible thermal linings. These methods are cheaper than external insulation and there is no disruption to the outside of the house. Internal insulation is particularly useful for houses only heated in the mornings and evenings as the wall surfaces warm up quickly. However, installation is more disruptive and room size will be reduced. Skirting boards, door frames and electrical fittings all need to be re-positioned following installation.

Install external solid wall insulation, where the walls are sound or can be made so. Insulation can either be a wet-render system or a dry-cladding system which may give a better appearance. Disruption is minimised because work is carried out outside the house, and room sizes are not compromised. However, costs can be high unless work is undertaken alongside remedial work, and the external disruption is significant.

Safety Tip: External insulation must be installed by a professional. The Insulated Render and Cladding Association (INCA) holds a register of proven systems and installers, go to: https://www.inca-ltd.org.uk for more information.

Improving thermal insulation: Floor insulation

Poorly insulated floors lose heat, especially around the perimeters, at the joint between the skirting boards and floor and between floorboards. This increases heating bills, makes floors uncomfortable and draughty and increases the CO_2 emissions from heating your home.

Insulate timber floors using mineral or sheep's wool quilts (100mm or more), rigid insulation boards or blown insulation. This work is most cost effective if undertaken when floorboards are already being lifted for other work.

Insulate solid floors from above using polystyrene, polyurethane, phenolic foam, or cork with chipboard or another finish placed on top. A downside of this method could be that it will raise the floor level.

Underlay under carpets or laminate flooring, though less effective than the options given above, will reduce heat loss through your floor and should be considered if the other options are impractical.

Safety Tip: Be careful not to seal or block under floor air bricks as joists and floorboards will rot without air circulation.

Improving thermal insulation: Draught-stripping

This is one of the simplest and cheapest ways to reduce your CO_2 emissions and your fuel bills. Most homes and particularly older Victorian properties can have gaps caused by poorly fitting windows and doors but don't forget that draughts also get in through gaps in the floorboards, between floors and skirting boards, through your loft hatch, and through your letter box. Modern double glazing in new frames has integral draught-stripping making any additional work unnecessary.

Draught-stripping existing doors and windows. Kits are available at most DIY stores and can be attached with pins or are self-adhesive.

Fill the gaps between wooden floorboards and skirting boards with a tube sealant or install a layer of hardboard under carpets or lino. Fit a letter box draught excluder on the inside of your letter box.

Safety Tip: Do not cover up air bricks or vents in rooms with wood stoves, gas fires or open fires as adequate ventilation is essential for good combustion and for preventing the formation of poisonous carbon monoxide gas.

Improving thermal insulation: Glazing

Installing double or triple glazing will cut the heat lost through your windows and new frames will have integral draught-proofing. It is an expensive measure and you may wish to consider the cheaper (but less effective) option of secondary glazing. The most environmentally friendly option for new frames is high quality wood. Frames can also be made of aluminium or uPVC.

The British Fenestration Rating Council (BFRC) Window Energy Rating gives a rating of A-G for different types of window – look for these

labels and choose windows with a rating of B or above. Triple glazing and gas filled double glazing are the options that provide the greatest level of insulation. You should bear in mind that triple glazing is heavy and so frames need to be stronger and rebates deeper. Low-E coating can be included on triple or double glazing and is a special layer added to the inner pane to help reflect radiant heat back into the room. Glazing that includes this coating will perform even better and reduce heat losses even more.

Secondary glazing and draught-stripping is the cheap alternative to new double glazing and is particularly useful for sound insulation. You can obtain kits from DIY stores, which usually comprise of sheets of clear plastic and some means of fastening this to the inside of existing window frames. Some fastenings allow easy removal for cleaning. There are more expensive systems that use glass in metal frames. A very cheap form of secondary glazing is a film plastic which is applied with a hair drier, but this has a limited life.

Safety Tip: Ensure that vents in windows providing ventilation to wood stoves, gas fires or open fires are retained as they are essential for good combustion and preventing the formation of poisonous carbon monoxide gas.

Improving thermal insulation: Pipe and tank insulation

The simple step of insulating your hot water pipes and your hot water cylinder can be one of the most cost-effective measures you can take to reduce your fuel bill and CO_2 emissions. It will also reduce overheating in your home in the summer. New hot-water cylinders come already covered in foam insulation but many older ones only have a thin layer of insulation or no insulation at all.

Insulated cylinder jacket

Any cylinder with less than 80mm of insulation would benefit from an additional jacket. These are available at most DIY stores for a few pounds. Ensure that the jacket is fitted snugly round the cylinder with no gaps.

Insulate pipes

The most important pipes to insulate are those carrying hot water from your hot water cylinder to your taps and between your boiler and the hot water cylinder. You can buy foam pipe insulation from DIY stores.

Heating and hot water: Conventional fuel heating systems

The majority of homes in the UK are heated with natural gas which if used to fuel a condensing boiler or condensing combination boiler will provide heat and hot water with relatively low carbon emissions. If you want to reduce your reliance on fossil fuels or if you live where there is no gas supply and are currently using oil, bottled gas or LPG, energy efficient condensing boilers are available but you might want to also consider alternative technologies. If you are currently using solid fuel (coal, coke and other smokeless fuels) or electric heating you would be strongly advised to consider alternatives which offer lower carbon emissions.

Condensing boilers have now become the standard boiler, cutting heating bills and resulting CO_2 by up to a third when replacing an old non-condensing boiler. They will deliver space heating through radiators or underfloor heating and hot water which is stored in a hot water cylinder.

A condensing combination boiler is also a very efficient type of boiler providing space heating through radiators or under-floor heating. The main difference is that water is heated instantly and delivered directly to your taps without any hot water cylinder. The 'combi' boiler is particularly suitable for smaller houses and flats where space is limited.

Safety Tip: Gas boilers must be installed by a Gas Safe accredited contractor.

Heating and hot water: Ground source heat pumps and Micro CHP

These new technologies are now widely available for space and water heating as alternatives to conventional electric, gas, oil and solid fuelled central heating systems. Both technologies function with low carbon emissions.

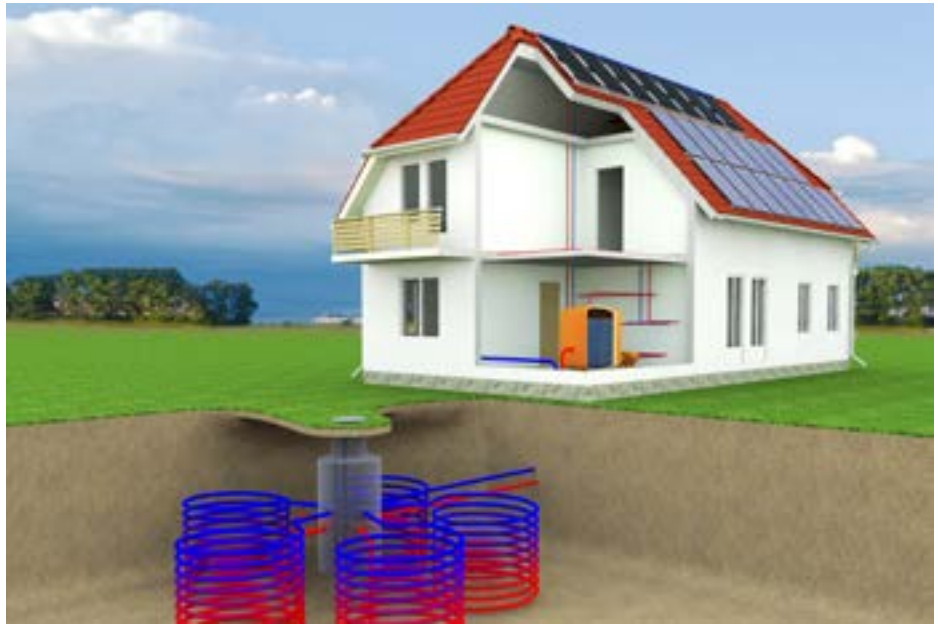
Ground source heat pumps use the useful amounts of heat which are available 2-3 metres deep in the ground. An electrically powered pump is used to transfer this into heat for use in the home. Systems typically produce three units of heat for every unit of electricity used to power the pump. The heat is extracted from the ground by means of a network of pipes under the surface of the ground or a deep bore hole. This is a technology best suited to homes with no gas supply, typically with a large garden and/or in a rural location.

Micro CHP (Combined Heat and Power) is usually powered by gas and about the size of a small domestic refrigerator, these units provide space heating and hot water just like an ordinary central heating boiler. But in addition, they generate electricity so reduce your electricity bills. Micro CHP is most useful in small, well insulated homes with modest heat requirements. Newer technologies include fuel cell CHP which uses hydrogen energy.

Safety Tip: Gas boilers must be installed by a Gas Safe accredited contractor.

Heating and hot water: Solar water heating

Solar water heating uses the sun to heat water for the home. It is a renewable technology that is usually used to supplement your current central heating system. A solar water collector will pre-heat the water, with a conventional boiler bringing it up to the required temperature if necessary. Some central heating boilers, such as combi-boilers, are unsuitable for use alongside solar water heating. Using



solar energy to heat your water may involve having an extra hot water cylinder or replacing your existing one – this requires space. Sometimes it just requires a second coil in your existing cylinder. You need a southerly facing roof to mount the collector. Solar collectors will function even in cloudy conditions but the brighter the sun the more heat is collected. There are two main forms of collector to choose from:

Evacuated tube collectors are the high-tech option. They will heat up more quickly than a flat plate collector, making better use of short bursts of bright light or sunshine. They are a series of glass vacuum tubes that contain metal strips which collect the heat. They are more efficient than flat plate collectors and can provide up to 60% of your annual hot water requirements. They are also more fragile.

Flat plate collectors are simpler technology and might be likened to having a black painted radiator in an insulated glazed box. The water in the radiator (collector) is heated by the sun and the heat is transferred to your hot water system. Modern flat plate collectors make use of specialist glazing materials and high performance, heat absorbing coatings on the collectors.

Safety Tip: You should not undertake a DIY installation without the use of scaffolding.

Heating and hot water: Heating with wood

Wood is a good choice in rural areas where there is no gas supply. Wood needs to come from a sustainable source, where trees are planted to replace those that are cut down, to be considered as a carbon neutral fuel. There is a choice between burning logwood chips
or pellets.

Burning logwood requires you to manually feed the stove or range. There are now a number of stoves and boilers available that burn chips or pellets and have automated feeds, making them much more like a conventional oil or gas central heating boiler. You do need to be near a wood pellet supplier to use this option. Using wood does require a dry, covered fuel store of sufficient size to accommodate this bulky fuel. Options for heating from wood include:

Wood chip or pellet boilers have automatic feed and control, allowing efficient operation for extended periods. They provide central heating and hot water. They represent the most energy efficient means of using wood fuel.

Log boilers have automatic control and operation but need refills every 12 hours. They provide central heating and hot water. They are slightly less efficient than a pellet boiler.

Log stoves require manual feeding and in their most basic form heat just one room. There are models that have back boilers enabling the stove to heat water and perhaps a few radiators.

Ranges usually require manual feeding with logwood. They have a hob and oven for cooking and often a back boiler to heat water and radiators.

Open log fires, though attractive, are a very inefficient way to burn wood, with most of the heat going up the chimney. They are not recommended as a way of cutting carbon emissions.

Safety Tip: Some wood fuel appliances have very hot exposed surfaces which may mean they are unsuitable for installation in homes with young children.

Heating and hot water: Temperature and heating controls

It is essential that there are good temperature and heating controls on your central heating system if you want to cut your fuel bills and CO_2 emissions. Having temperature and heating controls will enable you to heat your home only when necessary and to keep it at a comfortable temperature and not become overheated. The following controls and thermostats are appropriate for use with a standard central heating system comprising of a boiler with radiators.

Digital programmers allow you to set the periods when heating and hot water is required. Modern programmers allow you to set timings over a whole week with different settings for each day.

Zone control programmers perform the same function as standard programmers but allow you to have separate settings for different zones in your home. This is particularly useful in large houses where different parts of the house are in use at different times.

Room thermostats turns your boiler and heating pump off when the room in which it is sited has reached the required temperature. You would normally have the thermostat in the living room or hallway. If you have a zone control programmer you might have more than one thermostat. Remember that turning the thermostat down by 1°C can reduce your heating bill by up to 10%.

Thermostatic radiator valves (TRVs) can be fitted to radiators in rooms where there is no room thermostat. They will reduce the flow of hot water to the radiator when it has reached the required temperature. TRVs are useful in bedrooms where you might want a different temperature to living rooms.

Safety Tip: Programmers and thermostats should be installed by competent heating engineer.

Electricity and appliances: Electricity from sun and wind

Electricity can be generated using free, renewable energy in the form of sunlight and wind but should only be considered after you have done all you can to improve the energy efficiency of your home. Small-scale wind turbines are suitable in rural, windy locations particularly where there is no mains electricity supply.

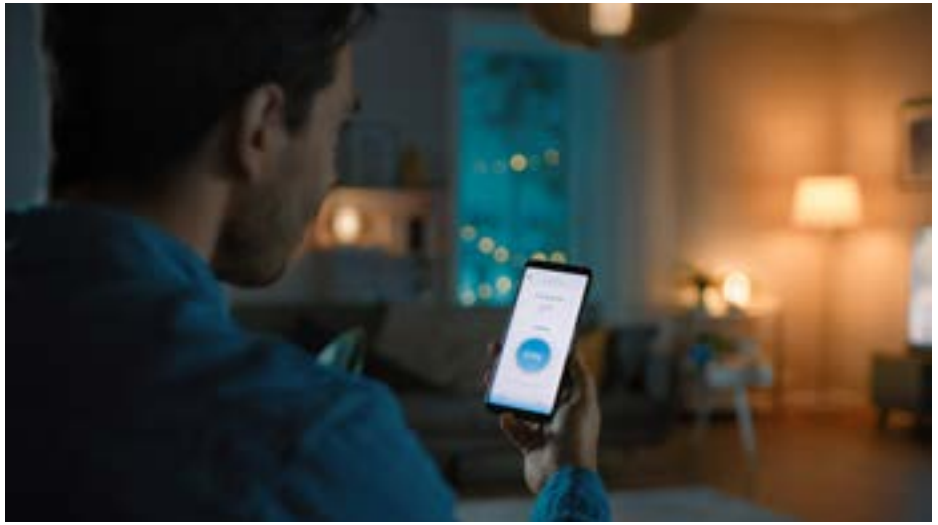
For most of us living in built-up areas a far better choice for generating our own electricity is to use photovoltaic (PV) technology. With either wind or solar technology, it is very likely that the times when you need electricity will not always match the times when you are generating electricity, so electricity from the grid could still be needed to top-up up your supply. There will also be times when you produce a surplus of electricity and it should be possible to sell this back to the grid.

Roof mounted PV panel array. Using the most efficient type of PV cells (monocrystalline) you would need an array of about 8 square metres on a southerly facing roof to produce a third of the total electricity requirements of a small house. You will also need an inverter to convert the low voltage direct current from the PV cells to mains voltage alternating current for use in your home.

Solar roof tiles are where PV cells have been moulded into the shape of a roof tile enabling you to create an array by linking a large number of solar tiles together. They would look more like an ordinary roof and are a good choice if you are renewing your roof. They also require an inverter and control equipment.

A Small 2.5kW wind turbine on a windy site, unobstructed by trees and other buildings would produce electricity equivalent to an average household's consumption. As with PV, an inverter and control equipment is required.

Safety Tip: You should not undertake a DIY installation of wind or PV on your roof without the use of scaffolding. Wind turbines can be attached to a house but may cause vibration and potential damage in high winds. It is often preferable to mount them on a mast.



Electricity and appliances: Lighting

Though the savings that can be achieved by each energy efficient bulb are small, if you replace any old bulbs the savings will stack up and if everyone does the same the national savings are very large. It is one of the easiest and cheapest ways to cut your CO_2 emissions. Make the most of natural daylight by putting desks and worktops where there is good access to daylight. But when you do need artificial light the main choices are:

- LEDs (Light Emitting Diodes) use 90% less energy than traditional bulbs
- CFLs (Compact Fluorescent Lamps) use 60-80% less energy than traditional bulbs

All traditional incandescent bulbs have now been banned to accommodate the shift towards more efficient technologies. Less efficient halogen bulbs were phased out in 2018 and replaced by energy-efficient light bulbs. If you replaced every bulb in your home with LED bulbs of the same brightness, you could save around £35 per year on your electricity bill.

LEDs are a more expensive lighting option to install but this is balanced by the fact that you don't have to replace any bulbs. LEDs are particularly good for directional lighting providing instant even white light.

Strip fluorescent lighting is particularly good for illuminating working areas such as kitchens, a home office or a garage. The reflective fittings for the fluorescent tubes are integral to their efficiency.

Safety Tip: Some forms of lighting (e.g. strip fluorescent lighting) require direct wiring into your household supply and such works should only be undertaken by a qualified electrician.

Electricity and appliances: Appliances

Appliances now account for a significant part of the electricity consumption in our homes. It is becoming much easier to identify energy efficient appliances in the showroom as most now carry an energy label giving each appliance a rating from G to A for the most energy efficient and specific information relevant to the type of appliance. You should choose an
A-rated appliance wherever possible in order to cut your fuel bills and CO_2 emissions.

Fridges and freezers – as well as buying the most energy efficient model you can afford

also consider the size you need. Don't buy a model larger than you really need as this will use more electricity than a smaller model. In planning your kitchen make sure you site your fridge/freezer away from heat sources like radiators and cookers.

Dishwashers and washing machines – as well as buying the most energy efficient model you can afford also consider water consumption. Choose dishwashers and washing machines that have low water consumption – if you are on a water meter this will save on your water bills and conserve our water resources.

Kettles are one of the most heavily used appliances in the home. Look for one with the high energy rating label. Choose one that has a gauge on the side allowing you to see how much water you are boiling. Remember to only heat up the amount of water you need.

Energy labels

The energy label has been a mainstay of appliances and products for more than 25 years. It's supported consumers and professional buyers in the searching and choosing of energy efficient products, and helped manufacturers and retailers develop more innovative and efficient products.

Due to increased demand for more environmentally friendly options, the energy that products use has reduced. This meant that the old labelling scheme - ranging from A+++ to G - had become less effective. This made it more difficult for consumers to identify the most efficient products.

The label has therefore been revised and optimised. The new label, which started to appear in high street and online shops from March 2021, features a new, simpler range: A to G.

Adapting your home: Cooling and ventilation

We are likely to experience an increasing frequency of very hot days during the summer when your home could become uncomfortably hot. Open windows during the evening or night to help keep your home cool and ventilated, but close them during the day to keep the heat out. Improving insulation
will keep you cooler in summer. Even in winter it is necessary to ventilate your home to remove damp air from kitchens and bathrooms. To maintain comfortable temperatures and air circulation you could: Install reflective blinds, awnings and shutters, on unshaded skylights and roof glazing to provide shade from the sun.

Replace decorations with heat and light-reflecting materials. Replace carpets with wooden floors or tiles and paint walls and external walls with light-coloured paint to reflect light. Blinds and curtains should have white or reflective outer surfaces.

Install vents and extractor fans. Vents are cheap to install and don't require maintenance. Low-wattage extractor fans should be fitted in kitchens and bathrooms with humidistat controls (which will turn on when the air becomes humid). More sophisticated heat-recovery ventilators will help to keep your bathrooms airy but retain the warmth.

Install passive stack ventilation (PSV) to provide greater control of temperatures and air flow throughout your house. Ducts bring fresh air in and remove moist air without noisy extractor fans. PSV is relatively simple to install but most suited to whole-house refurbishments or extensions.

Use plants and water to cool your home and garden. Trees and plants can provide shade in the garden and reduce glare through windows. Houseplants, particularly leafy varieties help to oxygenate rooms.

Safety Tip: Extractor fans should not be fitted in rooms with open-flued heating appliances but there should be air bricks or window vents.

Adapting your home: Drainage, surfaces and green roofs

More frequent and heavy rainfall will put pressure on your drains and increase the risk of flooding in your area. Help protect your own home and your wider community from flooding by maintaining and creating opportunities for water to drain into the ground, and ensuring good capacity of your drains.

You can take basic measures to slow down water drainage into the ground by using porous materials or open structures such as gravel on driveways and in the garden. Increase the coverage of trees and plants to help store water. Also ensure that surface water flows away from your house.

Install a green roof to help reduce rainwater run-off from your roof and slow the passage of water into the drainage system. A green or planted roof is covered by turf or low growing plants (see also Planting) providing an additional green space on flat or low pitch roofs.

Make your drains big enough to cope with increased rainfall and flooding events by ensuring gutters and drains are of sufficient size and are always kept clear of leaves and debris.

Prevent back up of water by installing anti-backflow valves on drain outlet pipes of washing machines and dishwashers, one-way gate valves or stop valves on drainage systems, and an anti-siphon toilet or inflatable bladders with integral pumps in toilets to divert back-up water.

Improve the soil's ability to drain away water with gravel and organic matter.

Safety Tip: Do not use your toilet, bath, sinks or washing machine if an anti-backflow valve closes, as your property will be disconnected from the sewer. Sealant should never be put down waste outlets to prevent backflow as this may block the drain. When fitting pipe closers and valves the manufacturers guidelines should always be followed.

Adapting your home: Water saving

Saving water helps tackle climate change by reducing the energy used in the treatment and transfer of water to our homes, whilst also reducing our water bills. There is an increased potential for times of water shortages as a result of climate change, making water saving measures all the more important. Use less water when washing yourself, your clothes, dishes and car and watering plants in the garden. Buy water efficient appliances.

You can also fit water efficient devices to reduce water used. More efficient shower heads and low or dual-flush toilets can use a third less water. Fitting low flow taps in your bathroom or kitchen is cheap and simple to do, and can save around £10-15 per year on your water bill.

Harvest rainwater from roofs to flush toilets, water gardens and feed washing machines. Purchase a water butt at low cost from some councils and water companies. More complex systems require installation of a storage tank and ultra violet (UV) systems to improve water quality.

Reuse grey water from your showers, baths and wash basins by collecting it in a tank and using it to flush toilets and water your garden. Systems can reduce your water use and bills but can be costly to install and maintain, and use chemicals to stop the growth of bacteria.

Safety Tip: Water-efficient shower heads should not be fitted to electric showers as this can lead to overheating of the water. Electrical appliances should be fitted by a qualified electrician and plumber. Care must be taken when installing grey water recycling systems to ensure no cross-contamination of mains water. Further guidance is available at the Water Regulations Advisory Scheme. Visit www.wras.co.uk for more details.

Water efficiency

There's an array of products and measures that can help make homes become more water efficient, but the Water Regs UK research suggests that many people are unaware that some of them even exist.

10 common water saving measures:

1. rought resistant plants (81%).
2. Taps with aerators that use less water (79%).
3. Cistern displacement device (74%).
4. Insulating pipework to prevent leaks (69%).
5. Using greywater or rainwater to flush your toilet (66%).
6. Shower flow limiter (65%).
7. Water efficient dishwasher (63%).
8. Water efficient washing machine (54%).
9. Water efficient shower head (51%).
10. Shower timer (49%).

Adapting your home: Flooding and storm protection

The average cost of damage to homes that have been flooded is £30,000, and around five million people in two million properties live in flood risk areas in England and Wales. Check if you are at risk from flooding by visiting https://www.gov.uk/check-flooding

Register with the Agency's flood warning scheme, and store valuables and paperwork upstairs. Protect your home in one or two stages: first take measures to minimise damage to your home and second, it may be worth thoroughly sealing your home to keep the water out.

Stage 1 Minimise damage

Minimise the use of or protect materials which would be damaged by flood water by using water-resistant paint for the lower portions of internal walls, using dry-bags to protect soft furnishings, fitting rising hinges so that doors can be removed, use steel or plastic kitchens rather than chipboard ones and replacing carpets with vinyl, ceramic tiles and rugs.

Relocate electrical systems and equipment above a possible flood level, including raising

electrical points with wiring from above, boilers, meters and white goods.

Check the condition of your roof regularly and call a qualified roofer for necessary repairs to damaged or missing tiles. Keep overhangs of eaves and gable ends short, check condition of rafters and use steel straps on rafters in exposed areas.

Stage 2 Keep the water out

Keeping water out of a home can be extremely difficult and a very thorough job needs to be done, otherwise your actions could make the situation worse rather than better. Consult a professional before taking these measures:

Seal entry points for water using drainage bungs for drains, sinks and toilets, weighing down manhole covers, installing air brick covers and sealing gaps around pipe and cable entries, and fitting non-return valves on mains drains. Installing demountable door guards and raising door thresholds will prevent water coming in.

Improving your home

Repair damaged mortar on external walls and consider other measures to seal the walls such as applying waterproof render to walls and installing waterproof membranes.

Safety Tip: Professional advice should always be sought when taking measures to keep water out of a house.

If you are installing flood protection measures as part of the restoration costs following a flood, your insurance company may expect you to pay the extra cost of the alterations. But the extra cost should be offset by lower future claims and lower premiums.

Adapting your home: Planting

Climate change will mean higher temperatures which will be worsened by a reduced rainfall potential in summer and drought conditions. Careful choice of plants can help to make our homes and environment more comfortable and safe by providing shading. Longer growing seasons, drought conditions in summer, and an increased risk of

flood episodes means that planting choices may change.

Choose plants, especially trees which will provide shade both inside and outside. Deciduous trees provide shade in the summer whilst allowing light through in the winter. Trees and hedges, chosen and sited well, can help protect your property from storms.

Install a water butt. Your roof collects about 85,000 litres of rain each year which could fill 450 water butts with free water for plant watering. Establish a watering system from your water butt to water early or late in the day.

Choose drought tolerant species of trees, shrubs and hedges which require less water. Enjoy growing fruits such as grapevines, apricots and figs.

Install a green roof to help keep your house cool in summer, warm in winter and to reduce rainfall run-off from your roof. Green roofs can use ordinary turf or a drought-resistant, shallow-rooted species such as sedum. A wide range of other non-sedum species can be used such as Sheep's Fescue, Festuca ovina, and Hens and Chicks Jovibarba species.

Safety Tip: Make ponds and water features safe by checking them regularly, supervising young children in the garden and using a mesh or a grille to create a secure cover.

Adapting your home: Household and building waste

The waste we produce contributes significantly to climate change, through the production of both methane and CO_2 which are greenhouse gases. This is the result of the breakdown of biodegradable material such as kitchen and garden waste, and wood which is often thrown away as a result of construction work. The breakdown of plastic products derived from fossil fuels releases carbon when they degrade, as well as transport, storage, treatment and disposal of waste which all also emit greenhouse gases.

Reduce your waste. Reducing these emissions should always start with reducing the amount of waste produced. This means thinking twice before making purchases, only buying the amount actually needed, and choosing goods which use less packaging. The next options are reuse and then recycling of waste.

Reuse construction materials during renovation wherever possible, or buy already used or recycled materials. Recycled plastics for garden construction projects are on the market and there is a very active trade in upcycled and reclaimed materials.

Carefully consider how you dispose of construction materials. There is a thriving market for reused materials and local scrap yards and reclamation companies may be interested in purchasing materials. You could give the materials away through schemes such as Freecycle, go to: www.freecycle.org.

If you do need to throw items away, always separate them at the local waste disposal site rather than simply throwing them in a skip. Find out about your local disposal site from your local authority.

Separate your garden and kitchen waste and use a compost bin or wormery in your garden as methane produced as a result of land filling biodegradable waste accounts for about 2% of the UK total greenhouse gas emissions.

Help separate your other household waste, to ease reuse and recycling, by installing recycling bins in the kitchen for paper, cans, bottles and plastics. Contact your local authority waste department to find out what else can be reused and recycled locally.

Safety Tip: When disposing of materials always do so at a waste disposal site run by your local authority. It is against the law to fly tip.

Further information

Energy Saving Trust

Provides impartial advice on energy saving and reducing carbon emissions as well as information on the financial support available. The Energy Saving Trust also provides home energy calculators to help you find out where you are using the most energy and where your greatest opportunities to make savings are, which will add to the long-term affordability of your home.

https://www.energysavingtrust.org.uk

Environment Agency

National government agency with responsibilities that include water resources and flood protection. Provides information on what to do in a water shortage and how to save water. Also provides information about risk from flooding and flood protection:

https://www.gov.uk/government/organisations/environment-agency

Royal Horticultural Society

Gardens are an increasingly important part of the natural environment – as gardeners we can all help tackle both the causes and effects of climate change, right on our doorsteps. The RHS has undertaken extensive research into the impacts of climate change on our gardens and has made available general advice to gardeners.

https://www.rhs.org.uk/gardening-for-the-environment

British Naturalists' Association

The British Naturalists' Association can help to identify native vegetation.
https://bna-naturalists.org

Energy efficiency in your home

A Government website for homeowners in England or Wales where you receive recommendations for home improvements that could make your property cheaper to heat and keep warm. For each recommendation you can see:

- An estimated cost of making the improvement.
- How much you could save on your bills.
- Next steps if you want to make the improvement.

https://www.gov.uk/improve-energy-efficiency

Local authorities

Most councils have programmes supporting energy efficiency improvements in local housing. Contact your local council for details.

Electricity and gas supply companies

All energy suppliers have a statutory obligation to reduce carbon emissions by investing in measures in customers' homes. You will need to contact your energy supplier to find out details of what support they are offering. It could include support for any of the measures detailed in this guide. You should find an energy efficiency advice telephone number on your electricity/gas bill.

Water companies

All water companies are encouraging their customers to conserve water and provide cheap offers on water butts and other water saving devices. To find out your water supplier visit the website below.

https://www.water.org.uk/advice-for-customers/find-your-supplier

Passivhaus Trust

An independent non-profit organisation that provides leadership in the UK for the adoption of the Passivhaus standard and methodology.

https://www.passivhaustrust.org.uk

Green Building Store

Products and support for energy efficient homes and buildings.

https://www.greenbuildingstore.co.uk

AECB Low energy buildings database

A repository of UK low-energy building information created to help inform the planning and development of low energy new build and refurbishment projects. Anyone can view for free to learn about real projects and how they turned out.

https://aecb.net/low-energy-buildings-database

Centre for Alternative Technology

Free, independent and impartial advice on a wide array of topics relating to sustainability and sustainable living: renewable energy, green building and renovation, water and sewage treatment, organic growing, and more.

https://cat.org.uk/info-resources/free-information-service

GreenSpec

GreenSpec promotes sustainable building products, materials and construction techniques. edited by practising architects and specifiers – it is aimed at design professionals and the self-build audience.

https://www.greenspec.co.uk

Low Carbon Trust

A not-for-profit organisation highlighting the connection between buildings and carbon emissions. It offers a range of professional services, from consultancy on renewable energy and low carbon technologies to CPD seminars.

https://www.lowcarbon.co.uk

Energy efficiency

Centre for Sustainable Energy (CSE) – National charity that shares knowledge and experience to help people change the way they think and act on energy.

https://www.cse.org.uk

Materials

Inno-THERM

Social enterprise specialising in recycled cotton/denim insulation

http://inno-therm.com/

Forest Stewardship Council (FSC)

Promotes responsible management of the world's forests.

https://fsc.org

Building Control
Council Offices
South Street
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