

# ECO LIVING

Whether you're looking to improve the energy efficiency of your existing home or build an eco house from scratch, our essential guide is packed with expert advice to get you started *Words Luke Tebbutt and Sarah Baldwin*

**B**uilding eco is a no-brainer, whether you're doing a new house or renovating an old one: it will make your home a healthier, happier, more comfortable place to be. Plus, it will not only help the planet, but your pocket, too – especially with the Government's new Feed-in Tariff, which pays you for the energy you generate at home, helping you recoup up-front costs much quicker.

This is for good reason. Homes account for 27 per cent of Britain's carbon emissions, and the scale of work needed to reduce this is monumental. By 2016 all new-builds must be zero carbon, plus there are 26million existing homes and many are in need of insulating and sealing. 'Climate change is an absolute runaway beast. The whole world's seeing an increase in extreme weather conditions,' says Simon McWhirter, director of the Great British Refurb campaign, which GDM launched a year ago with the Energy Saving Trust, WWF and the UK Green Building Council. It aims to make green makeovers easier for existing homes and has had some notable successes – but there is more work to be done.

Luckily, grand designers are ahead of the curve when it comes

to sustainable buildings and technologies (see our inspiring TV house from the new series on p58 for proof).

'TV's *Grand Designs* created a level of interest in architecture that just wasn't there before, and now sustainable technologies are a regular feature in the houses,' says McWhirter. 'Grand designers can be the ones trailblazing the new technologies that can really make a difference.' We guarantee that the following pages will help point the way.



## 'Our house is almost entirely self sufficient'

**NESTLED** in the heart of the New Forest National Park, this new eco home by Perring Architecture and Design (01590 670 780; padstudio.co.uk) is as stylish as it is sustainable. It's almost entirely self sufficient, and has got to be since access is via a mile and a half of dirt track. Rainwater is recycled and a fully refurbished well supplies drinking water. Photovoltaic panels generate electricity to run the ground source heat pump and

there are solar panels and wood-burning stoves. 'What is very satisfying is that we tap into all the resources that are on site, from taking water from our own well to the solar thermal panels heating the water,' explains the owner. 'We are actually using our own environment to run the house.'

'Getting planning for a site like this is the biggest challenge,' architect Wendy Perring says. Not only is it in a National Park, it is also designated a site of special scientific interest. There were countless restrictions, even down to a six-week-long reptile survey. The owners were not allowed to increase their footprint beyond that of the existing cottage, so they expanded downwards and a new basement afforded necessary extra storage. Going subterranean meant that concrete, thanks to its heat-retaining properties, was the best material for the build.

Building down meant considerable excavation, as did forming the natural swimming pond that sits in front of the house. Everything that was dug up was reused elsewhere on site. What would have cost £30,000 to take to landfill was instead built into an earth berm – a mound of earth packed against a massive shuttered concrete wall to the north, which insulates the house and blocks out the noise from the nearby road.

Every effort was taken to ensure the building has minimal impact on the surroundings; it's growing green roof blends into the site's 18 acres of ancient woodland and a special blend of local plant life has even been used for the roof's seed mix. And, of course, it's timber clad, keeping the flavour of a traditional woodland dwelling.

*left and below left*  
Excavated material from the pool area and new basement has been re-used to provide a visual screen to the north and to help reduce the noise from the nearby dual carriageway

*right* Set within an 18-acre plot, both the main building and annex have a low-rise green roof



## Expert advice from Kevin McCloud

**Eco building is pretty daunting to most novice builders; there's so much technology, choice, money involved and jargon. Here, Kevin strips it back to the basics and tells you what to look for and what's important with environmental design**

**What are the basic things we can do?** 'Insulate, and insulate again. Then draughtproof and insulate some more. There is no point installing solar panels or biomass boilers if the heat is just going to leak out.'

**Once we've insulated, what next?** 'Before you consider a new boiler or a green-rated fridge, get a Wattson energy meter (020 7729 7500; diykyoto.com) and monitor your energy use. You can probably cut 30 per cent immediately by being careful. This saves a huge amount of money at zero investment. Technologies are the last thing you should do.'

**What is one thing that we all need to know?** 'The Feed-in Tariff (FiT) pays you for electricity you generate by selling it back to the grid (see p53 for more information). If you've got £10,000 that you were thinking of putting into the bank or stocks and shares, spend it on photovoltaic (PV) panels. With FiTs you can get between 8-10 per cent return guaranteed for 25 years, and it pays itself back in 10 years.'

**How do we ensure we get a reliable installer?** 'Avoid anyone who is selling just one type or brand of product. Go for an independent specialist with a good local reputation who works across all the different technologies. They mustn't be new to the game. The Energy Saving Trust is a good place to start (0800 512 012; energysavingtrust.org.uk).'

**What emerging technologies should we watch out for?** 'The next generation of photovoltaic panels is very exciting. They are going to be silicon free, much less bulky, with a very low embodied energy. This means that you can fit more on your roof and they're more sustainable to produce. Keep an eye on the eco news pages in *GDM* for regular updates.'

# UPDATE YOUR EXISTING HOME

*If you're planning a renovation, there's never been a better time to invest in some eco updates – and they'll definitely save you money in the long run*

There are 26 million homes in Britain, many leaking energy out of their poorly insulated walls and draughty windows and doors. With this in mind, GDM teamed up with the Energy Saving Trust, WWF and the UK Green Building Council a year ago to launch the Great British Refurb campaign ([greatbritishrefurb.co.uk](http://greatbritishrefurb.co.uk)), which has been lobbying the Government to make it easier and cheaper to do eco makeovers. Last year the campaign demonstrated just how straightforward this can be by spending £2,173 upgrading the energy efficiency of a Victorian terraced home in Manchester, saving the owner £240 in bills each year. Earlier this year it went one step further with a competition to win a £23,000 eco makeover, upgrading the insulation of the winners' Bristol terrace and adding photovoltaic panels. With the electricity generated from these solar panels, the owners will no longer need to pay energy bills, and with money earned from the Feed-in Tariff (see box, right), they will be nearly £800 better off each year.

The Feed-in Tariff has been a central tenet of the campaign, and in 2012 the new Government is set to introduce another key aim – a pay-as-you-save scheme that will let people buy energy-efficient measures for their home now, and pay later (for more information, see [decc.gov.uk](http://decc.gov.uk)). But there is still more work to be done. The campaign wants VAT cut on the cost of eco refurb, and cash rewards such as council-tax rebates for those who

have already done one. It has also upped its ambition with an aim to help us transform our homes into superhomes (ones that have reduced carbon emissions by 60 per cent). Turn to p76 to see how one couple have reduced their carbon footprint by a staggering 80 per cent on a standard London terraced home. And for energy-saving measures that cost as little as a couple of hundred pounds, take a look at our grand guide on p161 for a whole host of ideas.



## DIARY DATE

Pick up eco refurbishment tips from other superhomes plus advice and guidance from superhome owners this September at open house events around the country. There are 14 different houses participating in English Heritage Open Days (9-12 September) and seven in London's Open House weekend (18-19 September). See [greatbritishrefurb.co.uk](http://greatbritishrefurb.co.uk) for more details and further information.

## 'Our old Sixties house leaked energy like a sieve'

**TRANSFORMING** a leaky and dilapidated Sixties beach house into an efficient and sustainable property is no easy task, but Black Architecture (020 7021 0068; [black-architecture.com](http://black-architecture.com)) turned the Deckhouse on Hampshire's Emsworth Marina into a stylish zero-carbon holiday home that bagged first prize for the best eco home at this year's Grand Designs Awards.

'I would definitely call it a re-make rather than a refurb,' says architect and owner Paul Hinkin. 'It leaked energy like a sieve.' The run-down property had less than three centimetres of insulation in the walls and roof. To pack in as much as possible, Paul opted for Celotex ([celotex.co.uk](http://celotex.co.uk)), a high-performance foam insulant, ruling out more eco-friendly options like paper and sheep's wool as too bulky for such a small property.

The exterior cladding needed a complete overhaul to make it airtight, so he used FSC (Forest Stewardship Council, [fsc.org](http://fsc.org)) accredited oriented strand board and a Dupont Tyvek breathable membrane ([construction.tyvek.co.uk](http://construction.tyvek.co.uk)); it acts like the building's very own Gortex



jacket. Replacing the draughty windows was one of the biggest expenses; Paul spent £7,375 in total. He used the highest-spec windows – argon-filled double-glazing units and nifty Venetian blinds called Screenline built into the cavity (0113 277 8722; [morleyglass.co.uk](http://morleyglass.co.uk)).

The real bells and whistles are up on the roof; Paul has installed 10 photovoltaic panels (PV) and a solar thermal water heating system, which supplies free hot water for more than half the year. In hindsight, Paul thinks he might have scrapped the solar thermal for more PV. 'It gets pretty hot in summer and if the heat was feeding into PV the house would be exporting the unused energy back to the grid at a premium thanks to the Feed-in Tariff,' he says.

*above New exterior cladding and windows ensure the entire building is airtight  
left In an ideal waterside location, the Deckhouse is now modern and highly sustainable*

## What is the Feed-in Tariff?

Introduced by the Government in April this year, the Feed-in Tariff pays you for energy you generate at home, plus extra for any excess energy that you are able to export back to the national grid. You are paid a flat rate (from 26.7p per kW hour for a wind turbine to 41.3p per kW hour for solar electric panels). Tariffs are guaranteed for a set term (25 years for solar PV; 20 years for wind turbines) and are indexed to inflation. Systems installed since 15 July 2009 are eligible, and registering is simple: your system and installer need to be certified by the Microgeneration Certificate Scheme ([microgenerationcertification.org](http://microgenerationcertification.org)). Your installer will register you with the central Feed-in Tariff database and give you an

eligibility certificate, which you present to your energy supplier to start receiving payments. According to the Energy Saving Trust, a typical domestic solar electricity system could save you around £110 per year because you are using free energy from the sun, rather than buying electricity from your energy supplier. Plus it could earn you £700 per year from the flat rate you are paid through the Feed-in Tariff for the electricity you generate and use at home (yes, really) plus another £25 per year through the Feed-in Tariff for any excess electricity you are able to sell back to the grid (you get paid 3p for every kilowatt hour). All up, this means you could be £830 better off each year. For more information, visit [energysavingtrust.org.uk](http://energysavingtrust.org.uk).

## Winning updates

**Will Homoky and Catherine Beswick (below) won a £23,000 eco upgrade for their Bristol home. They expect it to reduce carbon emissions by 85 per cent**

**What work did you have done?** 'Insulation in walls, floor and loft, double-glazing upgrade, water-saving taps, a chimney balloon to stop draughts, and solar photovoltaic panels that generate electricity.'

**What's made a big difference?** 'Insulation. Before, our boiler had to be on all the time; as soon as it was off, the house got cold. Now it may be on for 30 minutes and the house stays warm for hours.'

**How much will you earn from the Feed-in Tariff?** 'For every electricity unit our solar panels generate, we get 41.3p, which will add up to £667 a year. Combined with money saved on bills and earned from selling back to the grid, we'll be £796 better off each year. Over the 25 years that our Feed-in Tariff is guaranteed for, we expect to see savings and income amounting to more than £28,000.'

**What about the value of the house?** 'We bought the house in September 2009 for £195,000 and just after the refurb earlier this year it was valued at £225,000 to £235,000. House prices have gone up in the area, but I doubt they increased by that much. I think the green retrofit helped.'

**Was it easy to set up with the Feed-in Tariff?** 'My energy provider sent me an easy online application form. You send it back along with a product certificate, bank details and proof of address, then we provide a quarterly meter reading and that's it.'

**You installed VPhase – what is this?** 'A VPhase (around £250; 0845 003 8235; [vphase.co.uk](http://vphase.co.uk)) intercepts electricity coming off the grid and steps down the voltage by 20V. Everything functions the same; we save about 10 per cent on energy bills.'



Timothy Soar

# BUILDING AN ECO HOME

*Starting from scratch means you can consider green issues from the outset and tailor your design to harness natural energy and reduce consumption*

## What is passive design?

It involves choosing materials and orienting your house so that it soaks up heat and light from the sun. The best way to do this is to put your largest windows facing south, so they catch the sun as it travels from east to west during the day. This should be combined with materials that have a high thermal mass.

## What is thermal mass?

The ability of a material to soak up heat and release it later. Some materials do this quickly – they have a low thermal mass; others, such as concrete and rammed earth, do it slowly, trickling out heat when the temperature drops, so you get a nice even temperature inside.

## What about shade?

In winter, the sun is at a lower angle than in summer – overhangs and other forms of shading are a vital part of passive design, so you can shield your home from the summer sun when it's highest and strongest.

## And ventilation?

Hot air rises, so stack ventilation, which involves building in an easy escape route for hot air – such as a roof light above a stairwell – is a typical feature of a passively designed house. Alternatively, a mechanical ventilation and heat recovery system allows you to maintain fresh air without the need to open windows, and also keeps the temperature even all year by extracting heat from stale air going out of the house and mixing it with the fresh air coming in.



## So is a passively designed house a PassivHaus?

Not always. PassivHaus is a rigorous German standard of energy efficiency, based on passive design principles. A typical PassivHaus requires no active heating or cooling system because it maintains a comfortable temperature year round by being super insulated, extremely airtight, maximising solar gain with south-facing windows, and using a mechanical ventilation and heat recovery system. See an example from the new TV series of *Grand Designs* on p58 or visit [passivhaus.org.uk](http://passivhaus.org.uk) for more information.

*right With a high thermal mass, the black basalt flooring at the rear of the house remains cool, even in the height of summer*



## 'You have to go way beyond building regulations'

**THE DARING** design of this project by Mole Architects (01353 667 068; [molearchitects.co.uk](http://molearchitects.co.uk)) in suburban Cambridge isn't for show. The geometric structure, made from cross-laminated timber panels and part clad in a shimmering glass screen, uses passive design principles. A far cry from the street's Victorian homes, it was the green credentials that persuaded planners.

To make maximum use of the sun's energy, architect Meredith Bowles covered the south facade with windows, keeping them to a minimum on the northerly roadside. 'When insulating, you have to go way beyond building regulations with a passive house build,' says Bowles. He insulated with 220mm of recycled glass wool, and, although the draughtproofing doesn't quite reach German PassivHaus standards, it is far better than most



*left Made from cross-laminated timber panels and part clad in a shimmering glass screen, the modern geometric structure contrasts with the classic Victorian terraced houses in the same street*



*left Extra-large windows and doors make maximum use of the sun's energy at the south-facing rear of the property*

British builds. 'Always test airtightness early enough to do something about it,' he adds. When a house is so sealed up, one problem can arise – overheating. Bowles designed temporary shade-making sails over the windows and laid black basalt flooring that remains beautifully cool, even in summer – its high thermal mass ensures it takes a long time to heat up.

While all this might sound pricey, many of these improvements can be done on a shoestring. Insulation and windows are an unavoidable expense, but elsewhere you can get away with spending very little. Bowles says simple tiles from B&Q (0845 609 6688; [diy.com](http://diy.com)) would work just as well as basalt, and you can make the solar shades out of pieces of cloth. Passive design principles might sound advanced, but don't be intimidated if you're on a tight budget.

# RENEWABLE TECHNOLOGIES

*If you're thinking about generating your own energy at home, follow our guide to see which technology is the best choice for you*

## Solar thermal panels

These sit on your roof and collect heat from the sun to heat water. **Best suited for** A south-facing roof with 5sqm of space. Or you could put one panel facing east and another facing west, but installation will be more expensive.

**Costs and savings** A typical system is £4,800, and will save around £50 to £80 each year.

## Solar electricity

Photovoltaic (PV) panels convert sunlight into electricity, even on cloudy days, and can be attached to your roof or walls. Choose from conventional panels or more expensive solar tiles, which sit flush with your existing roof tiles rather than on a metal frame.

**Best suited for** A south-facing wall or roof, which is strong enough to take the weight of the PV panels.

**Costs and savings** An average system is £12,500. A system that generates 2kW at peak performance

could provide 40 per cent of a household's yearly electricity needs, and with money saved on bills and earned from the Feed-in Tariff, you could be around £830 better off each year.

## Ground source heat pump

These extract heat beneath the ground through pipes, which are either laid flat or drilled vertically, to provide heating and hot water.

**Best suited for** You need a particularly large garden in most cases, and the ground needs to be suitable for digging a trench or borehole, and accessible to digging machinery.

**Costs and savings** A typical system is around £14,200. The Energy Saving Trust will publish a report on the performance of heat pumps this month, based on field trials. Check [est.org.uk/generate-your-own-energy](http://est.org.uk/generate-your-own-energy) for results.



## Air source heat pump

A boiler-size box sits outside your home and extracts heat from the air, even when the temperature is as low as -15°C, to provide heating and hot water. A typical heat pump can provide all your heating, and around half your hot water.

**Best suited for** Homes with enough room outside to fit the box with plenty of air space around it. A sunny location is ideal. Works best when producing heat at a lower temperature than a traditional boiler, so it's essential your home is insulated and draughtproofed for it to be effective.

**Costs and savings** A typical system is around £8,300.

## Wind turbine

Rotating blades drive a turbine that generates electricity. Many experts suggest a larger freestanding version (2.5-6kW capacity) over a smaller roof-mounted turbine (see our refurb guide on p161).

**Best suited for** An exposed location unimpeded by nearby trees, hills or buildings. To be effective, you need an average wind speed of no less than five metres per second. The Energy Saving Trust has a tool that estimates wind speeds in your area ([est.org.uk/generate-your-own-energy](http://est.org.uk/generate-your-own-energy)), or buy an anemometer to get a precise reading for your home.

**Costs and savings** Between £14,900 and £22,600 for a freestanding turbine. Recent monitoring has shown that a well-sited 2.5kW turbine could earn around £1,300 a year with money from the Feed-in Tariff.

## Wood-burning boiler

Also called a biomass boiler, this uses wood pellets, logs or chips to provide central heating and hot water.

**Best suited for** A large, dry area close to the boiler to store the wood, and somewhere – ideally close by – where it can be delivered.

**Costs and savings** A typical wood-burning boiler is around £11,500, plus about £1,000 for wood

each year for an average home. It could end up more expensive than a gas system, but if you replace electricity or coal you could save between £170 and £400 each year.

## Mechanical ventilation and heat recovery

A MVHR system ensures a well-ventilated interior and an even year-round temperature by extracting heat from stale air going out of your home and mixing it with fresh air coming in.

**Best suited for** Very airtight homes. Easier for new-builds than retrofits, as requires ducting to be installed throughout your home.

**Costs and savings** A system for a three-bedroom semi is from £1,800 depending on size and duct work. Energy is required to run system, but as it maintains an even inside temperature (providing the building is very airtight), you can save on heating and cooling (the retrofit featured on p76 cut energy use by 80 per cent, half of which was due to installing the MVHR system).

*All figures supplied by the Energy Saving Trust*

*left Sky Developments' zero-carbon house in Holywood, Northern Ireland, was the first carbon-neutral property in the region and features Solarcentury's innovative photovoltaic slate roof tiles*  
*below The flat, wide-open fenland of Ely in Cambridgeshire is the ideal site for a wind turbine for homeowners Graeme and Heather Lockhart (see p64)*



**'Our biggest challenge was the heating system'**

**'I BOUGHT** the ugly house on the good street,' says designer Oliver Heath (01273 326 031; [oliverheath.com](http://oliverheath.com)). 'The great thing about ugly houses is nobody wants them, so they're cheap. Mine was built in the Sixties and probably cost £50,000 less than a Victorian one the same size. But it's a solid, well-built house (above) that was ripe for a complete eco refurb.'

'After it was gutted, we packed in insulation. With a grant, this cost only £200 for cavity wall insulation, plus £200 for the loft. Anyone can apply for a grant through the Energy Saving Trust or energy suppliers (see box, left). We then replaced all the old uPVC windows with slim-framed Velfac units (01223 897 100; [velfac.co.uk](http://velfac.co.uk)), sealed up the draughts and fitted a wood-burning stove to block an open chimney.'

'Our biggest challenge was the heating. We've fitted five systems, including a condensing boiler, solar water heating panels and a heat recovery system. The problem is getting all of them to work at the right time. I used Vaillant (0906 802 0251; [vaillant.co.uk](http://vaillant.co.uk)) for most of the products and recommend using a single manufacturer for everything. It makes installation so much easier and more efficient.'

'It's been a huge amount of work, designing and project managing it all, but I've discovered some fantastic materials. Thermilate (0845 313 8681; [thermilate.com](http://thermilate.com)) is an insulating render, which basically works like an overcoat on the whole house. Fingers crossed the changes will cut our gas bill massively and our carbon emissions from 10 to around 2.5 tonnes.'



## Grants and assistance

The six big UK energy companies (British Gas, EDF, E.On, nPower, Scottish & Southern Energy, Scottish Power) are required to help reduce carbon emissions from homes under the Government's Carbon Emissions Reductions Target (CERT). Often, they offer subsidised insulation, either directly, through local authorities or through installers. Anyone can benefit from these offers and the scheme has been extended to December 2012, with energy companies having to meet higher targets, and 65 per cent of all reductions now required to come from insulation. Visit the Energy Saving Trust's grants and offers database (0800 512 012; [est.org.uk/grants](http://est.org.uk/grants)).

## Home energy survey

If you're serious about cutting your carbon footprint, it's wise to get a home energy survey. 'We record everything that leaks energy and uses energy, and ask the owner how it's used,' says Russell Smith, managing director of Parity Projects (020 8643 6630; [parityprojects.com](http://parityprojects.com)). Its average survey cost is £300, which includes listing the best options for your home and budget, with estimates of costs and savings. 'The idea is you do the work piece by piece, and leave it for the next owner if you move,' says Smith. There is no accreditation system for surveyors, but a good one will take into account every element that leaks or uses energy and quiz you on your lifestyle.

## Directory

### Building Research Establishment

(0845 223 2966; [bre.co.uk](http://bre.co.uk))  
Book a tour of the BRE Innovation Park – a collection of buildings using sustainable materials and technologies.

### Consumer Focus

([consumerfocus.org.uk/energy-help-and-advice](http://consumerfocus.org.uk/energy-help-and-advice)) Energy tips from the consumer champion, including how to compare energy suppliers and access grants and funding.

### Energy Saving Trust

(0800 512 012; [energysavingtrust.org.uk](http://energysavingtrust.org.uk))  
A one-stop shop for tips on energy efficiency, the Feed-in Tariff, grants and offers.

### Great British Refurb campaign

([greatbritishrefurb.co.uk](http://greatbritishrefurb.co.uk))  
Join Kevin McCloud's venture to make it easy and affordable for you to install super-low-energy measures.

### Old Home SuperHome

([sustainable-energyacademy.org.uk](http://sustainable-energyacademy.org.uk))  
A network of exemplar, old dwellings that have undergone an energy-efficiency retrofit, which regularly open their doors to the public.

### Solar Century

(0800 334 5996; [solarcentury.co.uk](http://solarcentury.co.uk))  
Leading solar-energy company that produces its own PV panels and tiles, project manages installations and has a large network of accredited installers.

### Think Insulation

(0870 061 2216; [thinkinsulation.co.uk](http://thinkinsulation.co.uk))  
A great place to start for any eco project. You can also arrange free no-obligation surveys and quotes for subsidised cavity-wall and loft insulation via power/energy utility companies.

### YouGen

([yougen.co.uk](http://yougen.co.uk))  
Independent advice on renewable energy, plus a search function to locate installers and people who have had renewable technology installed.