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# HOUSEHOLDER ENERGY EFFICIENCY MANUAL



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HOUSE TYPE

## Modern Eco House

CASE  
STUDY  
**6**

# How can you make your home more comfortable and efficient?

*This document provides specific guidance to those of us who would like to live in a **modern eco home**.*

By choosing to build a new home like this you are saving energy, cutting fuel bills, making your home more warm and comfortable and reducing your environmental impact.

This shows the measures how a house like this performs and how you can make a new home even better.

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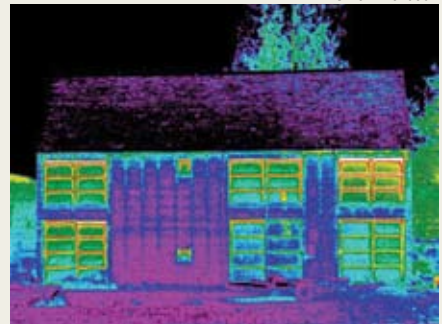
**page 3** Sample of the super insulated wall construction

© Tom Morton



**page 4** Clay plaster wall finish can be left natural or painted

© Tom Barbour



**page 5** A thermal image shows minimal heat loss from the house

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# Why does this house perform so well?

*This house is light and bright, warm and has low fuel bills. The secret to a great eco home is to build the fabric of the house really well so your energy use is as low as possible. If you like you can then add renewable energy technologies to generate your own power and further reduce your environmental impact.*

## 1. SUPER INSULATION

All of the solid elements of the house are super insulated. This means they are insulated to the optimum level. This can be as much as 30cm thick or even greater. This includes the roof, floor and walls.

## 2. GREAT WINDOWS

High performance double or triple glazing can perform as much as twice as well as a standard window. The advantages of this are:

- You lose less energy through the window to outside
- The surface of the window is never as cold so you don't feel cold sitting next to it
- You can have more glazing without losing too much energy to outside. This lets in more sunlight so you need less artificial lighting and you make use of the warmth of the sun to help warm the house instead of using your boiler and heating system.



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**A typical house of this size and type, would use about £700 of fuel - electricity and wood - and emit about 4.6 tonnes of CO<sub>2</sub> per year. This is about a quarter of the energy used by the older houses in the area of the same size.**

### 3. BUILD TIGHT, VENTILATE RIGHT

Building a new house carefully means you can minimise heat loss through unintentional leaks and draughts in the building itself. You need to make sure you have good ventilation where you need it – kitchens, bathrooms and utility rooms. You can also include heat recovery on the ventilation fans. This means that stale damp air is ventilated to outside, but the heat is kept inside so you don't need to heat the fresh air so much, again saving energy.

### 4. CHOOSING THE RIGHT MATERIALS

Choosing great materials is also really important. There is a big range of these and you can choose what is best for your own project. Using materials such as insulation made from recycled newspaper or sheep's wool is great. Also using sustainable materials to build the structure of the house helps. For example using sustainably sourced timber is helpful. When decorating, using eco friendly paints is another good idea. Standard paints can be toxic to the people living in the house, as well during manufacture. Eco friendly paints reduce this as much as possible.

This house is made from a timber frame, with recycled newspaper insulation. Wood fibre board insulation is also used in the walls. The outside walls are clad in lime render and sustainably sourced timber.

The inside of the walls is finished in clay plaster, which helps to reduce the humidity in the air in kitchens and bathrooms, creating a higher air quality. This is all finished off with clay paints which further help with this.

### 5. HEATING AND LIGHTING YOUR NEW ECO HOME

A house like this one has a low energy demand so providing a heating system is much easier. You have lots of choice and some modern eco homes don't need a standard heating system at all. This one doesn't need one most of the year as it is warm enough anyway, and the whole house is heated by a log stove and boiler.

For heating hot water log boilers work well and in this area there is plenty of timber. Some people prefer a more automatic system, and this can be built in to a house like this in other ways. For example you could consider:

- A ground source heat pump
- A wood pellet boiler
- Solar thermal panels



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Why does this house perform so well?

Powering the lights and appliances needs electricity. This house is connected to the grid and minimises use of electricity by using high efficiency appliances and low energy light bulbs. You can also install renewable technologies to generate electricity. These include:



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• **Photovoltaic panels**

These work best on south facing roofs which get lots of sun. With the feed in tariff scheme, these can generate up to £1000 per year in income for you.

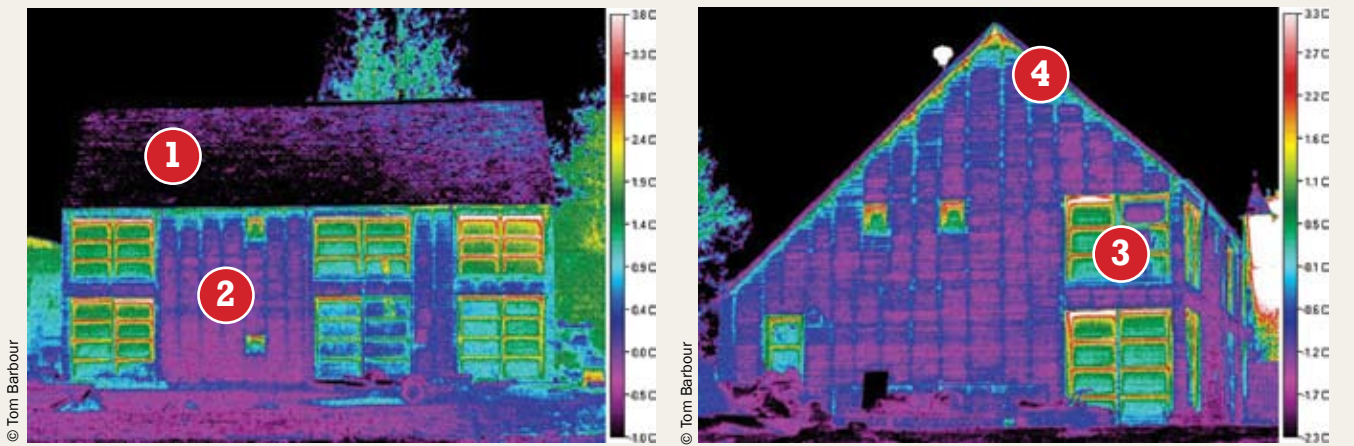
• **Micro wind turbines**

These work best away from trees and obstructions such as houses or steep hills to interrupt the wind. If you have a good site for these they can be successful. These can also generate income from the ‘feed in tariff scheme’ to the end of the paragraph.

Planning permission and Building Warrant is sometimes required to install these kind of renewable technologies. You should check with the local council.

WHERE HEAT IS LOST: MODERN ECO HOUSE

This image shows different temperatures of each part of the house, and where heat is leaking from the property.



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- 1 The high level of insulation in the roof means very little heat is lost here
- 2 The walls are also super-insulated meaning there is little heat loss. The vertical lines you can see on the pictures are the timber battens which hold up the timber cladding. This is not visible without the thermal camera
- 3 The windows are a darker colour than the frames. This is because with really high performance windows, the glazing can be a better insulator than the frame.
- 4 Thermal photographs are a great tool to check construction for air leaks and cold spots where insulation may have been missed. In this case there is very little air leakage, with a small amount visible only near the apex of the gable.







# How does it compare to other houses in the area?

*This type of house can be compared to the other house types in the area.*

This table compares energy costs and carbon emissions for the whole house, as well per m<sup>2</sup> of floor area. Comparing this on a per m<sup>2</sup> basis, means you can compare like for like without having to consider the overall house size.

This shows that upgrading an existing house can achieve very high levels of performance as well. Adding more renewable energy technologies to this house could also make it have net zero carbon emissions annually.

## ECO HOUSE COMPARISONS

Property	Upgrade status	Cost of energy per year (£)	Total CO <sub>2</sub> emissions per year	Cost of energy per year (£) per m <sup>2</sup> of floor area	CO <sub>2</sub> emissions per year (£) per m <sup>2</sup> of floor area
 <b>CASE STUDY 1 Victorian Villa</b>	Before upgrade	890	10.3 tonnes or 10,300kg	10.00	0.08 tonnes or 800kg/m <sup>2</sup>
	After full upgrade	330	Minus 0.11 tonnes or 110kg*	5.00	Net zero emissions annually
 <b>CASE STUDY 2 Traditional Stone Cottage</b>	Before upgrade	688	7.98 tonnes or 7980kg	6.40	0.07 tonnes or 700kg/m <sup>2</sup>
	After full upgrade	330	2.85 tonnes or 2850kg	2.20	0.03 tonnes or 30kg/m <sup>2</sup>
 <b>CASE STUDY 3 Stone Tenement Flat</b>	Before upgrade	720	7.2 tonnes or 7200kg	10.70	0.11 tonnes or 110kg/m <sup>2</sup>
	After full upgrade	330	1.8 tonnes or 1800kg	4.90	0.03 tonnes or 30kg/m <sup>2</sup>
 <b>CASE STUDY 4 Modern Timber Frame House</b>	Before upgrade	719	4.3 tonnes or 4300kg	9.30	0.05 tonnes or 50kg/m <sup>2</sup>
	After full upgrade	273	2.2 tonnes or 2200kg	3.50	0.03 tonnes or 30kg/m <sup>2</sup>
 <b>CASE STUDY 5 Dorran House</b>	Before upgrade	1030	6.1 tonnes or 6100kg	13.90	0.11 tonnes or 110kg/m <sup>2</sup>
	After full upgrade	330	Minus 0.35 tonnes or 350kg*	3.10	Net zero emissions annually
 <b>CASE STUDY 6 Modern Eco House</b>	As built	700	4.6 tonnes or 4600kg	4.50	0.02 tonnes or 20kg/m <sup>2</sup>

\*This means that you are generating more energy than you use and by selling this to the grid, you save more carbon than you generate.

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# What can you do next?



## Building a new house

Finding a plot of land.

Your local estate agents can help you with this. Also advertising locally if you are looking for a plot can be helpful.

## Designing your house

Finding an architect who suits your needs and aspirations is key. You can find a listing of architects at the following:

Royal Incorporation of Architects in Scotland (RIAS)  
[www.rias.org.uk](http://www.rias.org.uk)

Architects Registration Board  
[www.arb.org.uk](http://www.arb.org.uk)

If you would an eco or low energy home look for architects who have gained RIAS sustainability accreditation  
[http://www.rias.org.uk/content/default.asp?page=s6\\_19](http://www.rias.org.uk/content/default.asp?page=s6_19)

or are Certified Passive House Designers.  
<http://www.passivhausplaner.eu/phplaner/planersuche.php?clandc=1&clandv=Scotland>

## How do I keep up to date with the efficiency manuals?

The BGT blog has an up to date list of local suppliers. Please look here for information.  
BGT blog: <http://greentarbert.wordpress.com>

# How to use this information

Because heating patterns and bills vary so much, the best way to check the energy saving percentage against your own bills to get an idea of savings.

This is a simplified system and should be taken as a broad brush indication. However it is here to give you a clear indication of the difference between the options, allowing you to make informed decisions.

Also, some people can carry out many of the measures as DIY, whilst others will ask tradesmen to do the work.

When considering individual measures, one thing to be aware of is that if you carry out several upgrades, the savings cannot be added together directly. Of course, doing more upgrades will save more money and carbon, but the amount you save per additional measure is less. All costs are approximate and are based on the case study house.

## Further information

For updates to this manual please visit the Big Green Tarbert blog: <http://greentarbert.wordpress.com>

Energy Saving Trust: <http://www.energysavingtrust.org.uk>

The Eco-House Manual: how to carry out environmentally friendly improvements to your home.

Nigel Griffiths. ISBN 9781 84425 4057

Energy Heritage: A guide to improving energy efficiency in traditional and historic homes. Changeworks. 2008.

Can be downloaded for free at: <http://www.changeworks.org.uk/projects/energy-heritage/544/>

Renewable Heritage: A guide to microgeneration in traditional and historic homes. Changeworks. 2009.

Can be downloaded for free at: [http://www.changeworks.org.uk/uploads/Renewable\\_Heritage\\_Programme.pdf](http://www.changeworks.org.uk/uploads/Renewable_Heritage_Programme.pdf)

## Energy Modelling Assumptions

All projections are based on SAP 2005 modelling of changes. Overall the figures should be accurate as a broad indication, but any individual house will vary. You can compare your own bills and potential savings pro rata. There were high discrepancies found between modelled and actual fuel bill data – for example one of the properties was shown as having fuel bills of £690 annually and emitting 8 tonnes of CO<sub>2</sub>e when modelled in SAP, but fuel bill data indicated an annual energy spend of £2240 and CO<sub>2</sub>e emissions of 12.6 tonnes.

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BIG GREEN TARBERT 

