Yew Tree House, 5b Preston Park Ave, Brighton BN1 6HJ

OVERVIEW

- Age: 2010
- Type: Detached
- No of bedrooms: 3
- No of other rooms: 3
- No of floors: 2
- Floor area: 180 sqm
- Cost: £370,000
- Walls: Timber frame above ground level, concrete retaining wall below

FEATURES

+ Airtight construction
+ Green roof
+ High performance glazing
+ Low water goods
+ Low energy LED lighting
+ Mechanical ventilation with heat recovery (MVHR)
+ Passive solar design
+ Rainwater harvesting
+ Solar thermal panels
+ Solar PV panels
+ Wood burning stove
+ Zero carbon

Introduction and approach

Mick and Sue Paskins had this new house designed by award winning eco architects ZED Factory, based on the original concept design by local architect John Turner. It is an outstanding exemplar of urban low energy design. The house is orientated to maximise solar gain. It has high levels of insulation and heavyweight materials inside to store the sun's energy and is very airtight with a heat recovery ventilation system for the winter.

Hot water is mostly supplied through a solar thermal array. A condensing gas boiler can top up hot water during winter and a wood burning stove can top up heating. Rainwater is harvested for flushing toilets and watering vegetables and fruit. The house is clad in Sweet Chestnut, which needs no treatment to preserve it and is grown in Sussex. There is a green sedum roof to attract beneficial insects and other wildlife. A 3.6kWp Photovoltaic array has recently been added to the house.

Energy use is a small fraction of a conventional house and the income from the Solar PV Feed-in-tariff means that the energy budget is £1000 in credit each year.

This house won the Federation of Master Builders Energy Efficiency Award 2011 as an 'Inspiring eco home'.

Energy efficiency measures

The house is orientated to maximise solar gain and has extensive double glazing on the south / west elevations to allow solar gain. Triple glazing on east and north elevations reduce heat losses.

Walls, ground floor and roof are super insulated, whilst incorporating high levels of thermal mass. The house is partially earth sheltered as planning requirements restricted the building height to one story above ground level.

Energy systems

There are various energy systems in place:

Wood burning stove Located in the living room for top up heating. All wood is salvaged waste wood provided free by a local builder.

Mechanical ventilation system with heat recovery Much attention has been focused on achieving a highly airtight building which means a ventilation system is required to provide fresh air in winter. The system is an Itho HRU Eco4. Natural cross ventilation in summer provides cooling.

Solar thermal The system is a Navitron solar system. This was installed after completion by Mick, who took a course organized by the manufacturers. The gas boiler is generally turned off during spring and summer. During winter hot water is boosted by a condensing combi boiler to be topped up to the required temperature but only on when water is being used.

Condensing gas boiler Originally ZED calculated that the house would not need a boiler, due to its highly efficient design. However, the below ground rooms proved far cooler than expected and a boiler was needed, together with unobtrusive skirting radiators in the main downstairs room. An Alpha CD 25C was chosen because it was the only combi boiler which could take pre-heated warm water from solar thermal and just top it up to the required temperature. This suited two retired people whose lifestyle did not have fixed patterns, and a likelihood of some HW needs during the day. When originally built, the only central heating was in the bathrooms which have heated towel rails and underfloor heating. Heating has now been added to lower ground floor bedrooms to provide top up heating during cold weather.

LED lighting This low energy form of light allows the large living area to be lit using 156 watts. The lounge is lit by 56 watts.

PV A 3.6kWp system was recently retrofitted. Between July 2011 and July 2012, 1067kWh of electricity and 581kWh of gas were used totalling 1648kWh. Meanwhile 3326kWh of electricity was generated from the PV panels. The house is a net generator of energy; it generates double what is used. Grid energy use results in 0.67 tonnes CO_2/yr, but because electricity is generated by the PV, this is offset; the house is 'carbon negative' by a wide margin of 1.05 tonnes p/a.

Water

There are various measures in place to minimise water use from 300 litres a day used by the average UK couple down to 70!

Rainwater harvesting There is a 5,000 litre tank for flushing toilets and watering fruit and vegetables. Mick & Sue are aiming to grow as much food onsite as possible.

Low flush toilets These are 2.6l/4.0l dual flush from the Wickes Eco Range.

Aerated showers Taps are Bristan taps to reduce water usage.

Bath All taps are Bristan 'eco-click' taps, again to reduce water usage. Area around/under bath is insulated to avoid 'topping up' the hot bath water.

Grey water Grey water recycling will be possible in the future if necessary, facilitated by fitting separate pipework for black and grey water .

Composting toilet Provision has been made for the inclusion of this in the future, including outside collection access.

Materials

Materials used during construction were as natural and low impact as possible:

Sweet chestnut cladding This local wood grown in Sussex is used on the walls and needs no treatment to preserve it.

Glulam (laminated timber) frame This enables large spans as a low embodied energy alternative to steel.

Terracotta vaulted block floor This French system, achieving high levels of thermal mass with minimal amounts of concrete. This is the first application in the UK, to our knowledge.

Kitchen work surface Made by Glass Eco from completely recycled glass with the under support made from recycled plastic carrier bags.

Castor oil based floor finish (by SENSO) The downstairs rooms have a self coloured floor finish derived from castor oil, which was applied in liquid form and trowelled perfectly smooth.

Concrete Ground Granulated Blast furnace Slag (GGBS), a waste from steel manufacturing, concrete was used. In the concrete blocks, 45% of the cement content of the blocks is replaced by GGBS and in the in-situ concrete, 28% of the cement content is replaced.

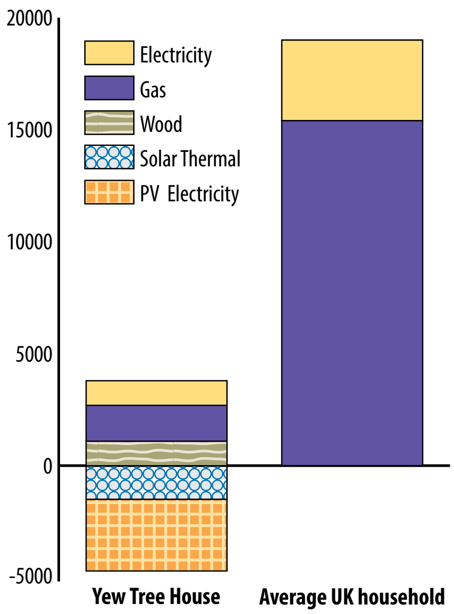
Insulation Recycled glass wool insulation used in walls and roof. Recycled glass block insulation (Foamglas) used at base of structural walls to minimise cold bridging.

Green roof Sedum north facing roof encourages biodiversity

Food cultivation on site The beautiful surrounding garden allows for the cultivation of a wide variety of food crops.

Energy and CO_2 performance

Energy performance kWh



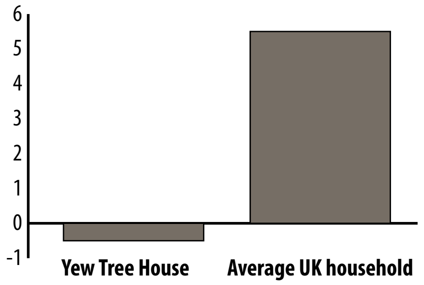
Energy use (generation) kWh

	Yew Tree House	Average UK household[1]
Gas	1600	15400
Wood	1100	0
Electricity	1100	3600
PV Electricity[2]	-3200	0
Solar Thermal	-1500	0
Totals	**-900**	**19000**

[1] 15400 kWh average gas use (DECC Energy Trends March 2013), 3600 kWh average electricity use (EST 'Powering the Future' 2012)

[2] Total generation figure, of which 500 kWh is assumed used by household

CO2 performance Tonnes CO2



CO_2 emissions (tonnes)[3]

Yew Tree House	Average UK household[4]
-0.5	5.5

109% below average

[3] CO_2 fuel emissions factors from SAP 2009

[4] Average fuel emissions 0.233kg CO_2/kWh (from EHS 2009 fuel split)

Lessons

Modelling of performance is often over optimistic and it pays to make provision for later changes. To claim that a house will not need a boiler needs to be examined carefully – it proved to be wrong in this case.

Initial modelling for solar renewables was flawed in that it did not properly take account of shading from a large tree in a neighbouring garden. Fortunately, this was subsequently trimmed back heavily, to enable both solar PV and solar thermal.

The high thermal mass of solid floors and some of the walls means that the building can be slow to heat up after a break, but it balances this by having very stable and comfortable temperatures in winter.

Initial projections of build cost proved greatly underestimated, which caused concern and led to cutbacks.

Professional contacts

ZedFactory www.zedfactory.com

R&R Building Services
www.fmb.org.uk/member-builders/R-and-R-Building-Services-Limited-BN1-5AF

Materials supply

Foamglas www.foamglas.co.uk

Aerated shower head
www.nigelsecostore.com

Eco Open Houses is an annual collaborative project between Low Carbon Trust, Brighton Permaculture Trust and Brighton & Hove City Council. This year the event is run as part of the Ecobee Project and has been selected within the scope of the INTERREG IV A France (Channel): England cross-border European cooperation programme and is financed by the ERDF. For more information on the Ecobee Project see: www.ecobeeproject.eu

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