

## Zero Carbon House & Office, IP29 4ET

### Ralph Carpenter –

He says:

Top o the Hill is a timber framed building dating from the early 1600s with additions from 1984 and 1998. It is located at the top of the steepest hill in Suffolk (hence the name) about 500m to the east of the village of Hartest.

Its appeal in 1984 was as a house which could be redesigned for 20<sup>th</sup> century living and also had a large enough garden to allow the family's food to be produced on site.

When the house was initially renovated a number of the greener materials we now use were not available, but the general ethos was to build something which was, even then, as green as possible, better insulated than was strictly required under building regulations, and generally more energy efficient.

Only in the mid 1990s did it become possible to start considering really green construction methods, and this ethos flows through the latest extension, with a number of add ons in the original house. Babergh DC offered a free desk top rating, and scored the house at F despite the fact that it is now pretty much zero carbon!



The 1998 extension, and some refurbishments within the 1984 house, turned it from pale green to deep green. This extension was built with a palette of highly sustainable materials, resulting in an embodied energy footprint better than ZERO carbon.

In other words, more carbon is locked up in the building fabric than was emitted in their manufacture and transport to site.

### Key features

- Rainwater storage and use for wcs and washing machine with some irrigation (supplemented by well water) saving the 25KW used for each m3 of water delivered through the tap.
- Solar thermal panels – one commercial model (Self installed at a cost of about £2500) and one home made following the guidance sheet issued by CAT (at a cost of about £300) and delivered hot water is broadly the same!
- Hot water cylinders in series so that solar hot water goes into pre-heat cylinder, then into smaller cylinder for use (and temperature boosting).
- Solar PV panels installed in Nov 2011 and generating about 3500 KW hrs per year with pay back on old tariff of about 8 years
- Log boiler (Froling) and 2000 litres hot water storage feeding central heating and hot water systems burning about 6 tonnes of logs per year (equivalent to 24,000 KW hrs). We were early adopters and fall outside the RHI sadly.
- Wood burning stove used in very cold weather and at beginning and end of season (up to end October) in place of log boiler, and burning about 1 tonne logs (equivalent to about 4000 kw hrs)
- Food growing on site reduces food miles and many meals are entirely home grown with massive carbon savings.

### Overview

**Age, Type:** 1915-2000, Domestic

**Cost of measures:** £29,000

#### Energy usage:

Total energy use for house equates to around 30,000 kW hrs per year.

At 250m<sup>2</sup> of heated space this equates to a total energy use of 120 kW hrs /m<sup>2</sup> per year.

In addition to this, all energy is now ZERO CARBON so the house can be classed as meeting the standards required by 2016 (now abandoned in the cuts).



The building fabric is cement free. Only natural limes are used for the load bearing elements, i.e. foundations (shallow) made using limcrete, brick plinths, hemp and lime walls 250mm thick, 8mm lime render and 1mm internal lime plaster, limewash decoration external and organic paints internally.

Timber frame was largely recycled timber with some new wood from sustainable sources. Internal partitions and ceilings are finished with Fermacell board (with large proportion of recycled cellulose binders and natural gypsum). Windows are softwood and stained.

Glazing has 16mm cavities but not low E as this was not really considered for normal use at the time. Roof tiles are soft fired natural clay (lower embodied energy than hard burnt variety), and ridges are bedded on with pure lime mortar making them re-usable.

The project was self build, one building worker was employed with a part time mate and owners did some work themselves. The overall cost/m<sup>2</sup> of the extension was £490 (completed in 1999). This compares with equivalent projects delivered through commercial builders at rates of £700 – £800/m<sup>2</sup>

The main advantage of this type of construction is its vapour permeability and therefore the absence of moisture within the building fabric. The effect of this is to massively reduce heating loads, to provide hugely improved perceptions of comfort at lower temperatures, and to eliminate moulds, toxic gases and damaging house dust mites.

General health and well being are greatly enhanced in natural buildings. Maintenance cycles are longer (limewash can be left for 15 years without recoating), painted surfaces with natural paints do not yellow as quickly as synthetic paints so redecoration cycles are much longer.

If you have any specific questions about this case study, these can be directed to the building owner via the website:

[www.greensuffolk.org/sgbn](http://www.greensuffolk.org/sgbn)

### **Design Process**

Architect owners made this all simple! There were no planning restrictions despite being in a conservation area because natural building methods are generally favoured by planners because of their ability to look right in a rural setting. The motivation behind the project was to demonstrate that hemp construction is a viable alternative to brick and block. Building Inspectors generally understand the benefits of soft construction methods after years of failing 'hard' buildings.

### **Green Lifestyle**

Users can make a huge difference to the performance of a building. With careful controls fuel use is kept down, solar systems work best with 2 cylinders to avoid duplication of water heating, wood burners are great for early and late in the heating season when demand is low.

Food grown on site is critical – it reduces travel to shops, cuts out waste, provides lots to compost, and is healthier all round. We work from home so travel is minimised – something the planning system should encourage a lot more by allowing space dedicated to non residential use. Bikes are used for short journeys weather permitting. The cars only get used occasionally.

### **Evaluation**

The 1999 extension is very different in feel from the original house. It is noticeably warmer, more even temperatures, quicker to heat up in really cold weather, much more draught proof, and with no mould.

Some things have worked less well – e.g. the lime floor in the garage which is not sufficiently robust, the ground floor where we store fuel is more vulnerable to mice which like the wood and can then remove the wall surface (plenty of mouse traps at the right time of year!). The rainwater recycling system would have worked better if the filters had been lower down the downpipes (there are barely 1m and the vortex effect is not great enough to get good water collection rates) but our well supplies large amounts of water for most of the year to compensate.

### **Awards & Grants**

We obtained a capital grant of £1800 for log boiler & FIT for Solar PV at old rate.

Numerous articles have appeared in national newspapers looking at the hemp and lime construction methods (Telegraph, Times, East Anglian) and Architects Journal Students regularly visit to experience the variety of hemp construction methods available.

### **Professional Contacts**

- Modece Architects  
<http://www.modece.com/>  
Telephone: 01284 830085
- Morrish & Partners, (Structural Engineers)  
<http://www.morrish.co.uk/>  
Telephone: 01284 761444
- Singleton Birch, from natural hydraulic limes (through Bulmer Brick and Tile)  
<http://www.singletonbirch.co.uk/>  
Telephone: 01652 686000
- William Blyth, pantiles (Barton on Humber)  
<http://www.williamblyth.co.uk/>  
Telephone: 01652 632175
- Ingilby Paints, (Glensford) for limewashes etc  
<http://www.ingilby.co.uk/>  
Telephone: 01787 280864