

Deep Green Retrofit: 17th Century Suffolk Timber Framed House



Property Overview

Property age: Originally built 1600; extensions built 1984 & 1999
Project timescale: July 2021 - July 2022
Type: Detached
Walls & roof: Timber frame throughout
Floor area: 150 m²
Cost of Renovations to 1600 house: £100k
Occupants: 2 adults

Meet your hosts, Ralph & Jenny:

I'm an architect and my wife is a teacher - we're both now retired. In 1984, we bought our 1600 timber-framed house, in the beautiful Suffolk countryside. It had been clad in brick by Victorians so it was mis-identified and never listed by Suffolk County Council. I'm a member of the [RIBA Sustainable Futures Group](#) and also worked to create the [LETI Climate Emergency Retrofit Guide](#), so a deep green retrofit of our home was the obvious approach.

Restoration work: 1984 onwards

After careful planning, I assembled a team and then set to work on restoring the house, first stripping off the brick and then replacing the posts damaged by woodworm as a result of the Victorian brick cladding. It was then insulated between the timber-frames, mainly with rockwool. A modern extension was also built for cooking, washing and WCs because of the difficulty of bringing these services into the 1600 house.

I am a huge advocate of using hemp in UK buildings. In 1999, we built the adjoining hemp extension using a 100mm-thick timber frame made up mostly of reused timber, with 200mm of hempcrete cast around it and rendered in lime. Workshop and utility space on the ground floor only have 150mm thick walls. As a building material, hemp has excellent properties: capable of temperature and humidity regulation, it helps to create a healthy and comfortable living environment.

The recent renovations to the 1600 house were needed because the work we originally did in 1984 was beginning to show signs of serious defects, particularly in the roofing and the air tightness. The aim was to make the house more comfortable and energy efficient, while carefully selecting materials with low embodied carbon. We don't have children living at home any more, so the retrofit was carried out to reduce the need for heating, which will be tested this coming winter. For us, it's important to have a home that is healthy and beautiful, with stable temperatures, yet feels fresh and remains connected to the outside.

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17C Timber Frame, Suffolk – 2022

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Removing brick facing, 1984



Adding 150mm wall insulation, 2022



1600 house West end, 2022



Design, Financing & Construction

As an architect with considerable experience of this type of work, I did as much as I could myself. First, I prepared the full drawings. Then I approached local small builders to do bite-sized chunks of the work. However, when they were unable to complete parts of the external wall and roof insulation during Covid restrictions, I stepped in to complete the work myself. Being based here meant I could ensure the work was completed. However, given the choice, I'd have much preferred to pay for good, reliable builders and not just local one man bands. There's also a tax advantage to using a contractor - zero rated VAT is then applicable.

The Victorian suspended timber floors were replaced with a limecrete slab and loose hemp shiv insulation was used to fill the space between the joists. Thermal imaging had shown that the masonry plinths at the base of the walls leaked the most heat, so the plinths were insulated on the outside with 120mm of [Foamglas](#). The walls are now externally clad with an additional 70mm layer of sheep's wool between the new studs and 80mm [Pavatex wood-fibre tongue and groove insulation boards](#) which together provide an air-tight, breathable envelope ($U=0.16$). Special lime render with a grey decorative finish was applied directly onto the Pavatex to weatherproof the outside. Much of the 1984 rockwool insulation in both the walls and the roof had been damaged by mice, so these were mostly replaced with sheep's wool. The Pavatex envelope created problems for the dormer window details, which we subsequently solved by using lead. Nearly all the windows are now triple-glazed. The roof has 200mm of rockwool and an 80mm layer of Pavatex ($U=0.18$). Wherever possible, we have re-used existing materials such as tiles and timber cladding and used a render finish. The 1600 house now looks and feels superb!

We also installed a 4kW solar PV system and a homemade solar thermal panel designed by [CAT](#) on the roof. A 30kW wood-fired boiler (plus a bit from solar) heats all the buildings via two 1,000 litre thermal stores. The firewood has been seasoned to give us 2 full years of fuel, but with the new insulation, it is lasting much longer! When it is finally used up, we may switch to a heat pump.

Performance

We love all the home-energy improvements we've made, resulting in a massive boost to our mental well being. We now enjoy far higher levels of comfort and lower running costs, and I even cut all my own firewood. We've also recently purchased electric bikes for use on shorter trips.

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Key Specifications

Energy Consumption	Energy kWh/m ² /pa			Carbon kgCO ₂ e/pa	
	Wood	Electricity	Total	/m ²	/person
Before Renovation	1.78	28	29.78	5.4	406
Mid-Renovation	1.25	28	29.25	5.4	406

Insulation & Glazing

- Walls: replaced with sheep's wool + 150mm extra insulation
- Roof: replaced with sheep's wool + 80mm wood fibre board
- Plinths: 120mm [Foamglas](#) with lime render finish
- New triple glazed windows & doors throughout
- Re-used pantiles
- New zinc roof over 1984 extension

Heating & Energy

- Existing log boiler retained to assess winter heating needs & suitability of GSHP
- Wood burning stove within existing fireplace
- 4 kW solar PV system
- Home made solar water heater for 1 cylinder
- LED lighting & low energy appliances

Water, Garden & Natural Systems

- 22 yr old rainwater harvesting system: supplies 34m³pa for 3xWCs, washing machine & partial garden use
- 1 acre garden with fruit & vegetables, chickens & local venison



1600 interior from 1984

Our top tips:

- Insulate before all else!
- Then insulate to achieve min. U values of 0.18 for walls & roofs (& floors if possible).
- Finally, consider a heat pump.
- Controlled ventilation (e.g. MVHR) may be needed, so have that up your sleeve if required.

