

Carbon-Neutral Studio Flat

An experimental PassivHaus build

Meet your hosts, Trish & Ian

Ian says:

I am a retired architect and I have built energy efficient buildings since 1980. I have won a number of design awards, including awards for energy efficiency from the RIBA and Civic Trust. I am passionate about design and energy conservation.

I built a low carbon holiday home in South Scotland in 2004, which is super-insulated, and substantially heated by driftwood.

Where we live in Grantchester, the house is mainly Georgian, built in 1800. When we bought it in 1985, it was derelict. It required underpinning, re-roofing and complete refurbishment. We made it fairly energy efficient then. We have plans to make it a great deal better now.

We hope that by building this eco -barn and the previous Scottish home, we have learned some of the building and design skills necessary to make energy efficient buildings - which may be useful to helping improve housing in general. We have made a lot of mistakes, mainly in not realizing how much attention to detail is required in energy efficient building.

The project is self-financed, and it is hoped that rent from the flat will provide an income for further energy efficiency projects. It would have been much cheaper and quicker to have done the minimum work to make an immediately rentable flat, but much less fun! And much less useful! The project is not only a financial investment, but hopefully an investment in the future.

Renovation to create a studio flat

Our goal was to create a carbon neutral building to PassivHaus standards that would also make a comfortable home. Having spent time researching the alternatives to standard construction methods, I built many of the fittings myself using reclaimed and re-purposed materials wherever possible.

The air sourced heat pump, related heating and domestic hot water systems and MVHR are complete and await commissioning. Currently, electrical work, external insulation and cladding are in progress. The mezzanine joinery and the kitchen are also in progress, but completion will depend on lockdown restrictions. In all, there is probably about 3 months work outstanding. We hope to have a PassivHaus pressure test on the flat in due course and feel it will pass.

In addition to the eco renovation of the studio flat, we also undertook some minor experimental insulation improvements to our home, but we consider the flat as a dry run for future work.

www.openecohomes.org

Carbon-neutral Studio Flat, Cambridge – 2020

Open Eco Homes is a [Cambridge Carbon Footprint](#) project. Charity number 1127376



What would we have done differently?

Certainly, I should have controlled the roofing work more tightly.

Future plans

We already have an office heated by a ground sourced heat pump and solar PV. We plan to improve this and substantially improve the main house with high levels of insulation, a heat pump and hopefully around 10kW of solar PV.

Performance

We are very excited that we should have data on the building's performance in autumn 2020. From experience, mechanical ventilation and heat recovery does provide a very pleasant environment, so we're very much looking forward to seeing this in action.

Key Contacts, Products & Costs:

Architect: Ian Steen, the owner

Heating Engineer: Heat Different, Norwich

Domestic hot water: Heat Different, Norwich £11k

Roofing insulation & roof windows £20k

Air sourced heat pump: by Viessman

MVRH: BlueMartin £2.5k - installation and operating instructions are all in German.

Best sources of information

- 1972 [Club of Rome Report](#) during the 1973 oil crisis
- Institute of Heating and Ventilating Engineers Guide (early edition) has valuable performance data, now replaced by [CIBSE](#)
- Writers:
 - David Anink
 - Rachel Carson, [The Sea Around Us](#); [Silent Spring](#)
 - Janet Cottrell & Adam Dadeby
 - Bill Dunster
 - Roger Hallam & Gail Bradbrook
 - Mark Lynas
 - Dave MacKay
 - Chris Morgan & Sofie Pelsmakers
 - James Trayner
 - Robert & Brenda Vale

The best advice

"we need numbers not adjectives"

"you can understand a subject only by creating it"

For me, it is about learning lessons for the future - what I could have done better - and I hope this will be informed by the monitoring data, available in Autumn, 2020 - I am very excited!

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Key Specifications:

Property age: 1995

Type: First floor flat in self built barn

Walls: Insulated & over-insulated on timber frame

Floor area: 50m²

Cost of Renovation: £50k

Project Started: 2019

Expected Completion: Summer 2020

Occupants: 2 adults

Insulation & Glazing

- Well insulated fabric – average U-value 0.15 W/m²Co
- Continuous vapour barriers, sealed around openings
- New triple glazed windows; existing double glazed windows

Heating & Energy

- 3kW Solar PV - hopefully, making the flat carbon neutral
- Predicted heating load ($\Delta t = 21\text{oC}$) 1kW but we know buildings are less efficient than predicted
- Weissman air sourced heat-pump serving radiators & domestic hot water
- Over-sized Radiators to compensate for lower heat-pump temperatures
- BlueMartin mechanical ventilation with heat recovery (MVHR)

Other features

- Reclaimed & repurposed materials e.g. roof tiles, cladding & kitchen
- Self built fittings
- LED & fluorescent lighting
- Rainwater & ground water harvesting
- Acoustic separation between ground & first floors
- Monitoring of energy and comfort data

Our top tips:

- (1) Consider each strategy separately & evaluate the cost benefits**
- (2) Consider that if the work you do is to benefit others in general, then recording the research & collecting & publishing the data could be useful**
- (3) Be aware that to produce an energy efficient building, it is the detail that matters, certainly to achieve air-tightness in a refurbishment!**

