

More Space, Less Energy: Extending & Upgrading a 1940s Semi

Impressive DIY Eco-retrofit with Passivhaus extension

Meet your hosts, Rose & Bart

Bart says:

When buying the house in 2011, we knew it would require a lot of work to bring it up-to-date. Once we realised how much energy was required to provide hot water and keep the house warm in winter, I got more and more interested in the energy consumption of homes and how ours could be improved.

When we decided to go ahead with having an extension built, I wanted to have this built to Passivhaus standards since the extension should not increase energy consumption, but act as a starting point for a whole-house thermal improvement project instead. The architects, Eco Design Consultants, did the Passivhaus calculations, designed the extension and provided an options report which sets out the steps required to achieve different levels of energy efficiency: AECB Silver, EuroPhit and PassivHaus EnerPhit.

From the resulting build specification, I quickly became aware that our budget would not stretch to accommodate the many eco-specialist tradespeople needed to achieve the desired build standard, so I decided to do many of the more specific jobs myself. This required doing a lot of homework, and requesting some extra leave from work.

The extension is now finished, and even though I expected it to be good, the level of comfort still astounds me, in particular the contrast with the existing part of the home before renovation. This has spurred us on to improve other bits of the existing house, taking it room by room, on a DIY basis, as time and finances allow.

The build process

The extension and initial thermal improvement was financed through savings and taking out an extra mortgage, so obviously we were on a very restricted budget. I believe the eco-retrofit has been very cost effective so far: the “eco” aspect of the extension has added about 15% to the cost compared to a “standard” extension.

Since the house is small, fuel bills were manageable even before extending, and the main driver for the building works was to make the house bigger and more comfortable, without increasing fuel consumption. It is difficult to put a price tag on comfort and indoor health, so although they were considered, payback periods were never our main consideration. They are a very unfair measure anyway, in my opinion.

The builder was contracted to deliver the raw build of the extension, after which I would further manage the build, hiring tradespeople directly and contributing through DIY. As the build is slightly out of the ordinary, I have been very involved from an early stage onwards, doing a lot of reading and homework, and making sure the specifications and details were right to avoid getting locked into below target performance or standards. As we continued to live in the house, the project had to be scheduled to fit within the space available.



www.openecohomes.org

More Space, Less Energy, Cambridgeshire – 2020

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



Performance

The changes have been enormous! The extended living space has transformed the house, and comfort levels have improved beyond recognition. Draughts are largely gone, and the house is at an even temperature throughout the year, staying warm in winter and cool in summer. Indoor air quality has also significantly improved, with the MVHR system eliminating both the stuffiness of some rooms, and the damp and humidity issues that had developed halfway through the renovation.

The CO2 footprint of our house has reduced by about 60%, or 1.5 tonnes per year, with potential for more. The house is now much more comfortable, while energy use for heating has gone down by 70%. However, the sheer pleasure of living in a well insulated, well ventilated home has to be experienced to be understood – the numbers simply do not tell the whole story. We are absolutely delighted with the improvements and want to tell everybody about it all the time!

Making different choices

In a retrofit, there are always compromises. Had we known about the final performance, we would probably have chosen a much lower rated heat pump instead of a new boiler.

Future Plans

We plan to replace the entrance door and front windows with triple glazing units, and complete the EWI wrap to include the front as well. After that, it comes down to behavioural changes, which might be hard to achieve!

Key Contacts, Products & Advice - all recommended:

Architect: [Eco Design Consultants](#)

Builders: [SMB Builders](#)

Electrics: [DS Electrical Service](#)

External Wood Cladding: [Millworks, Bottisham](#)

Insulation: [Insulation Shop](#)

Kitchen: [Magnet](#)

Kitchen Surfaces (recycled plastic): [Smile Plastics](#)

MVHR: [Green Building Store](#)

Plasterer: Mikey 07860 679 646

Plumber: [Clarity heating](#)

Plumbing: [MJ Potts](#), [D&J Plumbing](#)

Roof lights: [Roofing Superstore](#)

Structural Engineer: [Watson Hallam](#)

Surveyor: [ALS Surveys](#)

Full list of Trades & Costs [here](#)

Information & Advice: [Green Building Bible](#),
[Green Building Forum](#), [Open Ecohomes](#), [Passivhaus Institute](#),
Tom Bragg's videos on [Trumpington Warm Homes](#)

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Key Specifications:

Property age: 1945

Type: Semi-detached

Wall type: 50mm cavity brick wall

Floor area: 78.9 m²

Project dates: July 2017 - July 2021

Cost of project: £80k; Expected total cost: 85k

Occupants: 2 adults, 1 child

Key features:

- Single storey extension with super insulation, very high airtightness & triple glazing throughout
- Mechanical ventilation with heat recovery (MVHR): Paul Focus 200
- Low CO2 embedded materials: timber ridge beam, low mass roof tiles, aerated block with exterior wood cladding instead of brick

Insulation:

- Kitchen & living room floors replaced with super insulated screed floors with underfloor heating (UFH)
- 200mm polystyrene external wall insulation (EWI) on rear & side, front pending
- 150mm EWI to 300mm below DPC

Heating & energy:

- 2.88 kWp solar PV array with diverter feeding heat bank to supply domestic hot water
- A+ rated appliances on timers to optimise solar PV
- Weather compensation controls on modern boiler driving UFH directly, with zone valve for upstairs radiators. Separate circuit for heat store.

| | Energy kWh/m ² /year | | Carbon KgCO ₂ /year | |
|--------|---------------------------------|------|--------------------------------|---------|
| | Electricity | Gas | /m ² | /person |
| Before | 35.5 | 83.7 | 24.4 | 643 |
| After | 21.5 | 22.8 | 9.7 | 255 |

Water & environment:

- Wildlife-friendly garden; avoiding hard surfaces

Our top tips:

1. Think long and hard about what you want your house to be at the end of the renovation road.
2. Compile a comprehensive whole-house plan with lots of detail. Read lots to see what can be achieved, and in what order upgrades should be carried out. If you are ambitious, have an architect run a Passivhaus planning package (PHPP) calculation on your existing house so it becomes clear what should be done, and where the biggest gains are to be had.
3. Be patient, and stubborn. An eco renovation done well on a limited budget will take lots of time.

