

# 1935 EnerPHit Extension & Retrofit



## Property Overview

**Property age:** 1935

**Project timescale:** June 2020 - October 2022

**Type:** Detached

**Wall type:** Early cavity wall (50mm)

**Floor area:** 169m<sup>2</sup> (post renovations)

**Cost of eco features:** £58k+

**Occupants:** 2 adults, 2 children

## Meet your hosts, Rachel & Philip:

We are a family of 4 who are conscious of our impact on the environment and try to minimise this where possible: we're interested in practical and technical solutions, as well as learning to live with the impacts of global warming. We cycle everywhere, only using the car for long journeys. We are also keen to help the wildlife in our area by planting a wildflower meadow and adding animal houses.

## Design, Financing & Construction

When we bought our home in 2018, we knew that it would need substantial work to make it a comfortable 3 bedroom family home. After talking to colleagues and visiting other eco homes in Cambridge, we decided to do the best that we could with the renovations that were needed to our house: this was the only opportunity to do the job 'properly' and so, we committed to trying to design and build to meet the [EnerPHit standard](#).

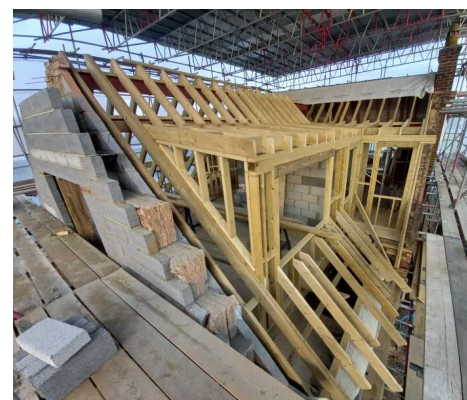
Every attempt to find a way to do the renovations in stages was met with a 'chicken and egg' issue, so in the end, we decided to do all the work in one go, which is more efficient and less disruptive. We soon realised that we needed to treat the house as a whole system to get the full benefits of making it energy efficient e.g. having a warm roof didn't make sense if large amounts of energy was being lost through the windows! We also picked suppliers and manufacturers that fitted with our ethics and, where possible, used recycled materials. It was important to us that the job was done well and would last, as it's not eco-friendly to be re-doing the work just 5 years later.

We then consulted [EcoDesign Consultants](#), asking them to come up with plans for the house including an extension, and working out what options would give us the best return in terms of energy efficiency. They modelled the house using the [PassivHaus Planning Package](#) (PHPP), which enabled us to make selections of different insulation types and thickness and see the effect that these choices would have on energy usage and the likelihood of overheating. After writing a very detailed tender document, we found a local builder to carry out the work. Work then started in 2020, during the pandemic. Once the house was taken back to bare walls and no roof, everything was refitted from scratch.

[www.openecohomes.org](http://www.openecohomes.org)

1935 EnerPHit Extension & Retrofit, Oakington – 2022

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



*Super insulating the building fabric*

## Our top tips:

- *Insulate & reduce unwanted air & heat leakage before contemplating more 'flashy' interventions such as solar PV or heat pumps.*
- *Think about the weakest points, deal with these as far as possible & make sure what you're doing is consistent - there's no point fitting triple glazing if most of your heat escapes through the roof!*
- *If you don't know where to start, borrow a thermal imaging camera from Cambridge Carbon Footprint and use it to photograph your house in winter. It'll let you see clearly where your expensive energy is being lost to the outside.*



The key features of our retrofit include:

- Replacing the single storey extension with a 2 storey extension to PassivHaus standard
- Replacing the roof: now a warm roof with [Kingspan K107](#) phenolic board (100mm) & [Knauf Dritherm 32 glass fibre](#) (100mm)
- Insulating underneath the concrete floor slab with [Kingspan K103](#) phenolic board (200mm)
- Adding 150mm of EWI (Enhanced EPS with XPS below DPC) to the original house
- Adding cavity wall insulation to the new extension with Knauf Dritherm 32 glass fibre (200mm) & thermally broken wall ties
- Making the house air-tight with a mixture of [SIGA](#) membranes and [Blowerproof](#) airtight paint (yet to be tested - we are aiming for less than one air change per hour)
- Adding a MVHR unit, [Zehnder ComfoAir Q350](#), which brings in fresh air & warms it with waste heat, while removing stale air
- Adding an air source heat pump, [Panasonic 7kW Aquarea Monobloc J Series](#), to supply the underfloor heating downstairs and oversized radiators upstairs
- Installing a 5.2kWp solar PV array (16 [Trina 330W panels](#))
- The complete removal of the gas connection
- Installing airtight, PassivHaus-rated triple glazing throughout

## Performance

Temperature extremes outside make very little difference to the inside environment: the temperature of the house is very stable and you do not get noticeable variations in temperature walking between rooms, which almost always range between 19°C and 25°C, with humidity at a near constant 50%. Previously, rooms would drop to 12°C on cold nights and exceed 35°C on the hottest days, with humidity regularly over 70%.

The ventilation system makes a huge difference to comfort. On spring mornings you can smell the damp grass outside as if you were camping, which is lovely. This was very unnerving at first - we spent a lot of time looking for open windows! Because the humidity is consistently around 50%, we can dry a load of washing overnight in the house at any time of year, in any weather, just by using a ceiling clothes airer. Previously, we had to use a dehumidifier in an overheated room to do this.

The insulation and airtightness means we find it hard to tell what the weather is like outside just by looking out of the window, as it's always calm and still in the house and a constant temperature. Occasionally, we've started cycling to work dressed inappropriately for the weather!

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## Key Specifications

Energy Consumption	Energy kWh/m <sup>2</sup> /pa			Carbon kgCO <sub>2</sub> e/pa	
	Gas	Electricity	Total	/m <sup>2</sup>	/person
Before Renovation (140m <sup>2</sup> )	145.5	19.1	164.6	29.9	1046
After Renovation (169m <sup>2</sup> )	None	16.6*	16.6	3.2	135

\*Prior to full EWI installation

## Insulation & Glazing

- Super insulated roof (200mm), underfloor (200mm), EWI (150mm) & cavity walls (200mm)

- PassivHaus-rated triple glazing

## Heating & Energy

- MVHR
- ASHP supplies UFH & radiators
- 5.2kWp solar PV
- LED lighting & low energy appliances

## Water, Garden & Natural Systems

- Wildflower meadow & animal houses

## Key Contacts, Products & Advice:

**Architect:** [Eco Design Consultants](#)

**Surveyor:** Tom Boreham, [Think SPI](#)\*\*

**Structural Engineer:** [Stuart Thomas Associates](#)

**Electrician:** [J Kilborn and Son](#)\*\*

**Heating:** [Eco Installer](#)

**UFH & radiators** (£6k)

**Heat pump:** [Panasonic 7kW Aquarea Monobloc J Series](#);

[Panasonic 200L A-rated hot water cylinder](#) (1kWh/day standing loss); [Nu-heat zone heating control](#) & plant

room (£11.3k - £5k Green Homes Grant)

**Solar PV:** [Cambridge Solar](#)\*\*

16x [Trina 330W PV panels](#) &

3.6 kWp [SolarEdge inverter](#) (£7.1k)

**MVHR:** [Zehnder ComfoAir Q350](#); [Lindab Safe](#) spiral ducting & fittings (£6k)

**Triple glazed windows & doors,** [Green Building Store](#)\*\* (£28k)

\*\* *Exceptional service - highly recommended*

The thermal mass of the house is so great that in winter we only need to run the heating once a day and the timing is unimportant, allowing us to maximise the use of our solar energy. In summer, even the hottest day only increases the average temperature by around half a degree per day. Provided it's cool at night, we can avoid overheating by opening the windows at night.

We are delighted that our energy use has gone down by nearly 90% and that includes a winter when the insulation was not yet completed. We estimate we're saving around 3.5 tonnes of CO<sub>2</sub> per annum as a result.

