

Property Overview

Year built: 1930

Location: Gilbert Road, Cambridge

Property type: Detached

Timeline: August 2023 - July 2024

Meet your hosts: Paul & Joan

I am a retired environmental and sustainable development consultant and my wife is an educational consultant. Our house is large for just the two of us, but our children (for whom this was their family home) and grandchildren visit frequently.

The Renovations

Sustainable development was formerly my business and remains a strong motivation for us. We wanted to reduce our carbon footprint at home and I was motivated by the technical challenge to see how low we could reduce the CO² emissions from a property of this construction. Along with our architects, Freeland Rees Roberts, we developed a strategy, engaged other professional advice and tendered for a main contractor. Strictly speaking, only the lifting of the roofline required planning permission but the whole project was described in the application. This appeared to be a formality as the change was insignificant and didn't take long. Suppliers were sought in consultation with the architect and the main contractor who oversaw the works.

We had the house re-roofed, raising it by about 30cm to permit additional insulation (costing £45,000). The existing roof structure was left in place and a new roof structure was added on top consisting of: an inner membrane, new timbers fastened to the old ones, rigid foam insulation inserted between and overlying the timbers, then an outer roofing membrane, battens and tiles.

We added external wall insulation, which was airtight, to the solid brick walls (costing £45,000). This involved pushing all the existing windows outwards to align with the new insulation. There is now a mechanical ventilation and heat recovery (MVHR) system throughout. An Air Source Heat Pump (ASHP), costing £25,000, supplies pre-existing underfloor heating and radiators. This required a new water tank and quite a bit of new plumbing because the water pipes from the heat pump enter at the front of the house and travel to the second floor.

We installed ten 400W solar PV panels, two 5kWh batteries and two EV chargers (costing £27,000). Demolishing a prefabricated concrete garage allowed access for the wall insulation. It was replaced with a bike port, incorporating three of the solar PV panels.



Rear of house with external wall insulation

At a Glance

Challenges

- Seeing how low we could reduce our CO² emissions
- Lifting the roofline to permit additional insulation
- New water tank & plumbing

Benefits

- 80% reduction in energy consumption
- Even & stable temperatures throughout
- Draughts have been eliminated!



Solar shading with brise soleil

Finance

We had sufficient capital to carry out the work and wished to reduce potential future running costs. However, cost was a lesser consideration compared to the environmental benefits. The project was almost entirely self-financed, although we did receive the £7,500 Boiler Upgrade Scheme grant for the heat pump. We realised that the work would not pay back in our lifetime(!) but consider the work as an investment in the future. We have been monitoring energy consumption and costs before and after the renovations, and had the house revalued to assess the added capital value. An estate agent estimated a new sale value that would have recovered about £200k -£250k.

Performance

The changes, especially the MVHR, have massively reduced energy consumption and increased levels of thermal comfort throughout the house. Demolishing the two chimney stacks, which were in poor condition, removed these sources of draughts and created space for air ducting in the former chimney breasts. This also removed the need for vents in each room and reduced the ducting required. The temperature levels in the house are now much more stable and even throughout. Draughts have effectively been eliminated.

Energy Consumption

Energy Consumption	Energy kWh/m ² /pa			Carbon kg CO ₂ e/pa	
	Gas	Electricity	Total	/m ²	/person
Before Renovation	112	22	134	24.7	2049
After Renovation	None	25*	25	5	431

*From grid + PV; excludes EV charging

Conclusions

Now that we have a full year of energy data since the works finished, we are pleased to see a 80% reduction in energy use. The house has performed well during the cold winter months. We have been pleasantly surprised by the quietness of both the heat pump and the ventilation system: the former is unnoticeable, and the latter is unobtrusive. Only two locations required intrusive boxing to contain sound baffles: the bathroom and a small study.

We are very pleased with our home energy improvements and are not planning any further work.



Solar PV array

Key Features

- External wall insulation: 160mm BAUMIT 'Star System' EPS sealed for air-tightness
- Roof insulation: 150mm KINGSPAN Thermaroom TR27 rigid foam & Pro Clima Dasatop airtight vapour control membrane
- Ubbink MVHR system
- Vaillant Arotherm Plus 12kW ASHP using R290 (propane)
- 10 Panasonic 400W solar PV panels
- 2 Myenergi EV chargers

TOP TIPS

- Insulate & eliminate draughts before you look at heat pumps.
- Ventilation: the better you control draughts, the more you will need ventilation (& heat recovery) to control humidity.
- Get professional advice independent of suppliers & contractors.

Professional Contacts

Architect: Alex Hobohm, Freeland Rees Roberts

Main contractor: NG Uttridge

Heat pump: O'Dell Heating & Plumbing

Solar panel, battery & EV charger: ILB Solar/ILB Electrical

MVHR: Apex Ventilation

Structural engineer: Andrew Firebrace Partnership (chimney stack demolition;

assessed floor strength for new 250L hot water tank)

VAT consultant: PEM (fees easily recovered by the reduction in VAT payable)