

Bold, Beautiful & Energy Efficient



Property Overview

Year built: 1930s

Location: Highfield Avenue, Cambridge

Property type: Detached

Cost of energy improvements: £100k (incl VAT)

Timeline: November 2024 - May 2025

Meet your host: Anna

I am an architect with a practice that specialises in retrofit and passivhaus architecture, and felt I needed to practice what I preached - as far as I could afford to! We bought our house in 2022 and see the renovations as an investment for the future. The payback period is long as there are not enough financial incentives and electricity is too expensive compared to gas.

The Renovations

The ground floor was very draughty with a conservatory which was part of the heated envelope: in the summer, it would be too hot and in the winter, too cold. It was impossible to upgrade as the roof was made of thin polycarbonate and the walls wouldn't take any additional weight. This was a big driver to the works. We were also keen to reduce our carbon footprint, improve biodiversity, create a more comfortable internal environment, and upgrade the kitchen.

The previous owners had internally insulated the walls in the 1970s using 40mm of PIR insulation. However, the insulation was not continuous in several areas – such as the window reveals and along the stairs, where it could not be fitted – resulting in cold draughts and, in some cases, mould. While this approach was remarkably innovative for its time, the overall thermal performance of the walls no longer meets current retrofit standards. In addition, I was concerned about the risk of interstitial condensation caused by the use of non-breathable internal insulation.

Our strategy, therefore, was to insulate externally using 100mm of BAUMIT EPS insulation, carefully sealed for airtightness. Although our first choice had been a low-embodied-carbon, more breathable material such as wood fibre, this would have cost around three times as much and was unfortunately beyond our budget. The combination of internal and external insulation means that the external walls have a U-value of 0.15 W/m²K (other than where the insulation is missing internally and are 0.3 W/m²K) which is pretty good. We also insulated the suspended floors with wood fibre insulation and airtightness membranes. The existing double-glazed windows remain; as whilst their uPVC frames are aesthetically the project's weakest point they were not yet at the end of life. The architect in me wanted to replace them as part of the works, but the environmentalist won that argument and the money was spent on insulation! All new windows in the conservatory are timber-framed and triple-glazed to Passivhaus standards, and we added external blinds to help reduce overheating.



Bold, bright exterior & ASHP

At a Glance

Challenges

- Draughty conservatory - too hot in the summer, too cold in the winter
- Keeping costs affordable

Benefits

- A family-friendly space, better connected to the garden
- Overheating has dropped dramatically
- Highly insulated energy-efficient walls



External blinds

To reduce embodied carbon, the rebuilt conservatory was constructed on the existing foundations, eliminating the need for new concrete. The walls and roof were built with a timber frame, insulated with wood fibre both between the studs and externally to minimise thermal bridging. Wood fibre was selected for its low embodied carbon, breathability, thermal mass—which helps to reduce overheating—and its excellent acoustic performance. This approach achieved outstanding U-values of 0.11 W/m²K.

The floor was insulated with phenolic insulation. While this material is not ideal due to its high embodied carbon, it was chosen to allow the reuse of the existing concrete slab and to accommodate the existing ground levels. Heating and hot water are provided by an air source heat pump (ASHP) paired with innovative fan convector radiators, ensuring an efficient and sustainable system.

Three single-room mechanical ventilation with heat recovery (MVHR) units were installed in the kitchen, bathroom, and living room to maintain good indoor air quality, avoid using trickle vents in the new triple-glazed windows, and manage moisture. These required a 200mm core-drilled opening and careful positioning with structural input. They offer a good interim solution until a whole-house system can be fitted with a future roof refurbishment.

The new electrical switchboard will cope with the additional electricity loads from the ASHP and electric car charging, and wiring is ready for photovoltaics. Lighting and appliances are low energy. Outside, we have taken up hard paving, planted a fern garden and installed rainwater butts. We have added a pond for wildlife and planted bird-friendly hedges. There's also a raised bed for growing vegetables.

Energy Consumption

We only have a few months' data so far. However, we will be analysing energy consumption carefully and have installed a dedicated monitor to the ASHP so we can get some detailed figures. We do expect our energy bills to go down, though it will not be as markedly as you might expect due to rising energy costs and the price of electricity compared to gas.

Conclusions

We are now fully electric and have drastically reduced our carbon footprint. The rebuilt conservatory is a lovely space to be in with a much better connection to the garden.

Future Plans

Planned upgrades include re-insulating and retiling the roof (to reduce overheating and improve thermal mass, ideally with wood fibre), designing in shading/cross-ventilation, and eventually replacing windows with timber units with integrated shading. Possibly whole-house MVHR.

OEH is run by [Cambridge Carbon Footprint](#), charity no: 1127376.



Rebuilt conservatory interior

Key Features

- External wall insulation: 100mm BAUMIT EPS sealed for airtightness
- Additional existing internal insulation
- Suspended timber floors insulated with woodfibre insulation
- Timber-framed triple-glazed new windows
- External "[Maanta](#)" blinds to reduce overheating
- New electrical switchboard
- Vaillant Arotherm Plus 5kW Air Source Heat Pump
- Innovative [fan convector radiators](#)
- [Single room MVHR units](#)
- Wiring ready for PVs

TOP TIPS

- Start with a whole house plan
- Make what you have better *before* looking to extend
- Factor in a contingency

Professional Contacts

Architect: [Within Planetary Boundaries Studio](#)

Builder: [Green Hat Company](#).

Heat pump installer: [Conga](#)

Photographer: [Anna Pamphilon](#)