

Solar PV House, Weymouth

Our Victorian mid-terraced house was built in the 1890s and had been slightly modernised before becoming a cannabis factory which when the previous owner died became semi-derelict quite quickly. The rear extension roof had large holes in it, the main roof was leaking, a lot of poor quality alterations (mainly bodged electrics and insulation to help grow the weed had been carried out and were not respecting the fabric of such an old house. There was also evidence that it had been severely rat infested for a long time.

We decided that the renovations needed to make the house as sustainable as possible and in the research and planning we got the bug to try to take it as far as we could toward net zero carbon. At the start we looked at passive house and EnerPHit standards but with a lack of specialist builders, likely cost and a feeling that we wanted to respect the fabric of the house and let it breathe again we decided to go as far as we could in a more conventional way. This involved us deliberately avoiding filling the wall cavities and installing internal insulation to the room walls front and back.

The desire to create more space without increasing the footprint of the original house meant we tried to build up and not out. So, despite local planners objecting, we managed to get permission after hiring a planning consultant (Charlie Hopkins from Axminster) and taking our case to the planning committee with the personal support of Lord Deben, chair of the Committee on Climate Change, who gave us a direct message from him to the members of the committee imploring them to give us permission because what he felt we were wanting to do was what was needed in millions of similar properties across the UK which were the biggest impediment to the UK reaching its Paris Agreement emissions targets.

So, a three bedroom mid-terrace became a four bedroom house with a full width loft conversion containing another living room which we soundproofed and call "the den". It also doubles as a great guest room with views over Weymouth town towards the Isle of Portland.

The concept was designed by a close friend who is a very well known architect, Sean Griffiths, once of FAT (Fashion Architecture Taste) who did a lot of innovative and unusual work for many years (their last commission being The Essex House with Grayson Perry). Sean shaped the internal spaces and a local draughtsman, Patrick Cray, drew up plans from them. The rear cladding and roof was carried out by Ross Anderson of Architectural Metal Roofing in Devon. The PV was installed by us and connected by Nick Neza of XL Electrical Excellence in Dorset. The stove was installed and commissioned by Ed White of Whites PHS in Dorset.

The ground floor walls were removed to create a more open plan living space and the kitchen was moved from the back to the front of the house.

The changes we made were:

- Insulation to internal walls, new flat roofs, living room slab and the raised ground floor.
- Insulated wooden loft and rear bedroom structure clad in standing seam steel and rubber EPDM (Building Regs. 2016)
- Removed the gas supply.
- Installed double glazing including south facing glass 'curtain' for passive solar heating in winter and passive stack cooling in summer with electric skylight at top of stairwell.
- Installed a 350L thermal store heated by a 6.4KW building integrated PV system with east, south, west arrays. The PV is thin film CIGS stuck to standing seam steel walls and EPDM flat roof covering.
- Far infrared underfloor downstairs and ceiling mounted panels in upper floor rooms.
- Tesla Powerwall 2 battery.
- Small 5KW wood stove connected to the thermal store which burns primarily coffee logs and sawdust briquettes from a local joinery factory. Burning coffee logs gives off fewer emissions than wood, burns hotter and stops coffee grounds going to landfill where they give off methane which is twenty-five times more harmful than CO₂.
- All LED lighting, AAA domestic devices and electric induction hob.
- Side return extension green roof.
- Rainwater irrigation of garden borders for growing.
- 98% recycled shed from leftover wood offcuts with rainwater capture to large butt.
- 6 large palms were already in place and were retained with the addition of a new wildflower meadow lawn and wildflower and sedum green roof over the living area.

The demolition of the internal spaces and walls involved careful recycling and re-use of materials where possible (e.g. bricks).

We have kept detailed statistics from the start and were rather pleased to be able to get our electricity price down to 3.6p per kWh during the first lockdown using the Octopus Agile (real time pricing) tariff, although Ofgem's price cap removal has made the price rocket now. However, the stats tell us that, despite not going down the passive/EnerPHit route we still managed to get to net zero carbon (net because we do still produce some emissions from the stove but on balance our PV and a fully renewable electricity tariff offset them).

Energy Comparison

Victorian terraces 421.5 kWh/m²/year approx.

Passive retrofit in Kensal Rise London 15 kWh/m²/year

Superhomes (Energy Saving Trust) 104 kWh/m²/year

UK average according to Superhomes 177 kWh/m²/year

SolarPVHouse (predicted) 53 kWh/m²/year (recorded over period) 73-86 kWh/m²/year (likely adjusted actual) 65 kWh/m²/year

Carbon Comparison

Superhomes 60% reduction to qualify

SolarPVHouse Co2 Emissions Reduction Over 75% (maybe just under 100% as all electric renewable and as mentioned the stove burns 50% coffee logs which reduce methane emissions from landfill)

SolarPVHouse Co2 Emissions Rate 7.51 Kg/Co2/m2/year

SolarPVHouse Changes

Energy Efficiency 'F' EPC to 'B' (predicted) high 'C'/low 'B' (actual)

(mitigating factors retained old front door/no green roof for first year/digital teenagers, 'comfort taking' with stove and all cooking is electric which SAP and EPC don't take into consideration)

Environmental Impact 'F' to 'A'

We believe that adding extra space to Victorian terraced houses in the way we have along with similar fabric and system changes could play a big part in solving the UK's biggest issues with old houses (i.e. getting them off gas and to at least a 'C' EPC which is the UK governments target). This assertion has been recognised by the UK Parliament Environmental Audit Committee who recently published a paper we wrote as a response to a call for evidence. We are currently in the process of using the house data to create a flexible digital blueprint for others to use to hopefully streamline, improve and de-risk similar retrofit projects.

The striking look of the rear of the house (thin film PV on steel) made us dub it the Solar PV House when we created a website to document the project. We also have a fun timelapse video of the construction of the rear of the house.

Website: <https://solarpvhouse.com>

Facebook Page: <https://www.facebook.com/solarpvhouse>

Published Papers: <https://committees.parliament.uk/writtenevidence/36190/html/>

Fun Timelapse Video (which could be shared where you need it): <https://www.youtube.com/watch?v=GjvfRIW2mj8>