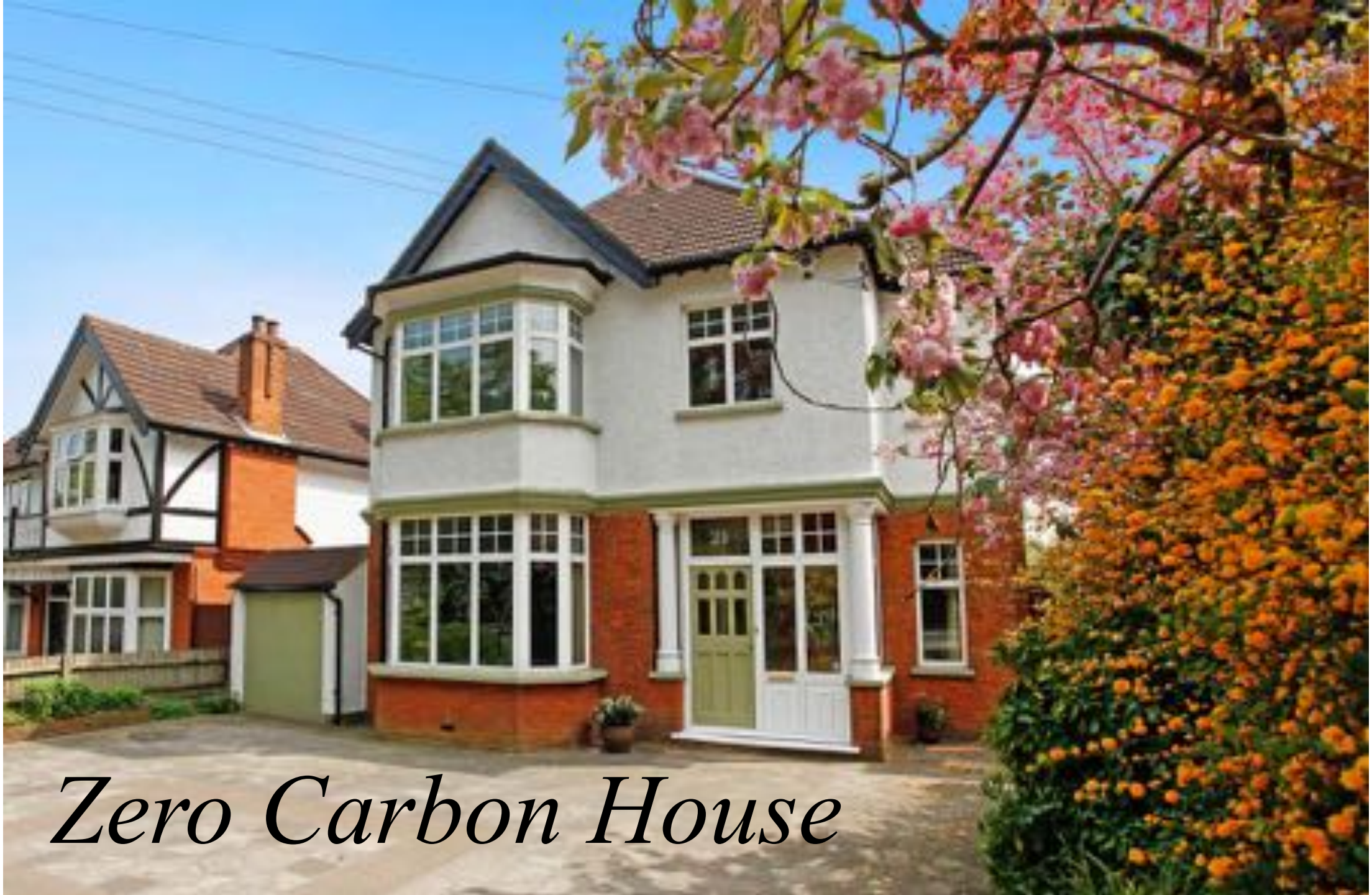
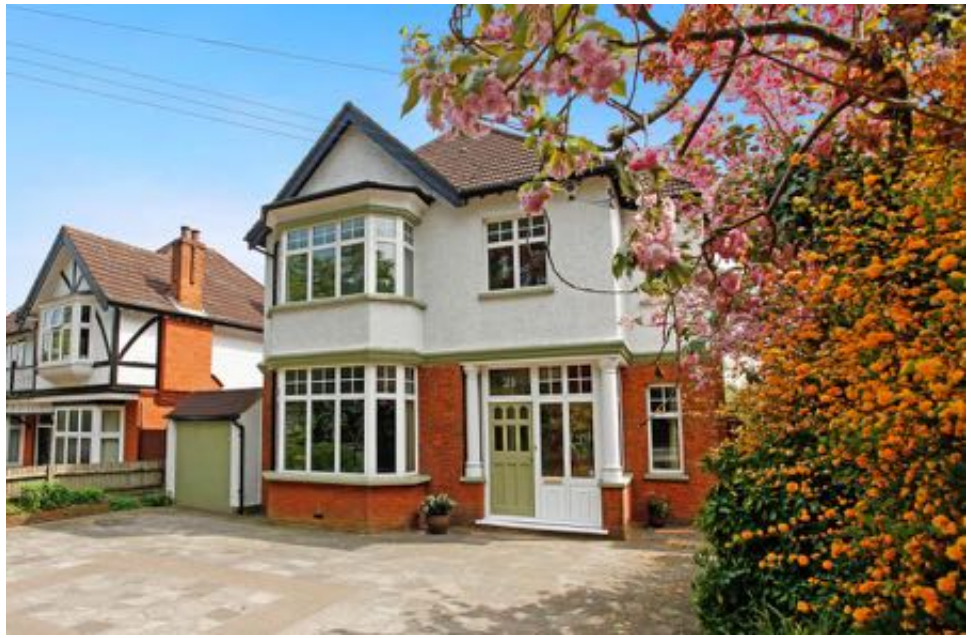

Zero Carbon House

Zero Carbon House Orpington

Making a typical suburban Edwardian house Zero Carbon, using reasonable measures, and without busting a gut.

Energy saving measures we've adopted…

- *Improved insulation*
- *Double glazed all windows*
- *Replaced gas boiler with an air-source heat pump*



Around a quarter of UK's energy use goes to heating homes – mostly with boilers burning natural gas: a fossil fuel.

Going Zero Carbon is in theory simple: switch from gas heating to electric. But electricity coats around 4 times as much as gas, per kilowatt hour.

So how do we reduce the cost of heating using electricity?

We can't knock down all our existing houses and build new totally-and-utterly zero energy high-tech houses.

We have to deal with our existing housing stock: 25 million homes of all ages shapes and sizes, using affordable measures.

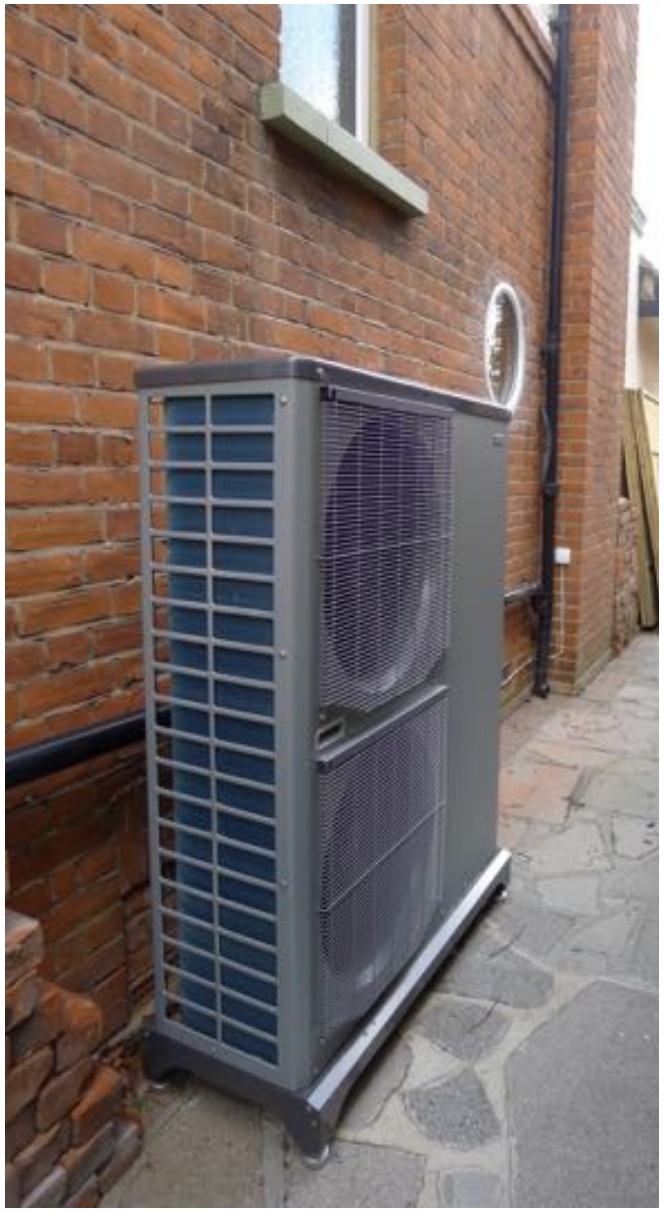
Adapting a leaky old Edwardian house in Orpington to Zero Carbon, using readily available and affordable measures..

- *Replace gas boiler with electric heat pump (air-source..*

  ..not ground-source, so no need to dig up the garden)
- *Increase insulation as much as possible (where reasonable)*
- *Double glaze all windows*
- *All-electric cooker (with fast-acting induction hob)*
- ***Disconnect the gas meter!***

Heat pumps move heat from outside to inside – the same principle as a fridge. Typically they use 1kW of electricity to move between 3kW and 4kW into the house. This works even if it's below freezing outside, and you want a cosy 20 degrees C indoors.

Ours is an air-source heat pump. You simply park it next to the house, and plumb it in.



Gas boilers tend to simply switch the radiators on and off two or three times per day.

Heat pumps have more sophisticated programmers, which monitor external air temperature, and adjust the heat going to the radiators accordingly.

As they produce more gentle heat, all the time, insulation is more important.

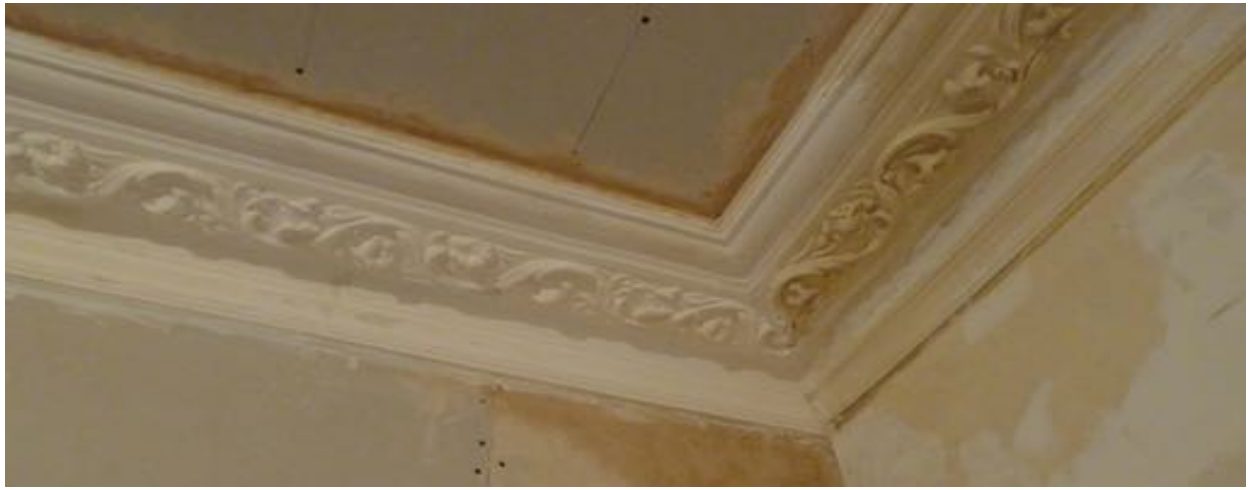
Heat pumps work perfectly well with radiators, provided they're reasonably sized. We didn't need to increase ours, or change to under-floor heating, which is difficult and expensive in old houses.

When we moved in in 2018, the house had…

- *Solid walls of 9” (225mm) brickwork, with no insulation*
- *Roof with negligible insulation: 2” (50mm) of mineral fibre quilt*
- *Timber ground floor, above a well-ventilated (therefore cold!) air space, with no insulation*
- *Windows partly replaced with double glazing*

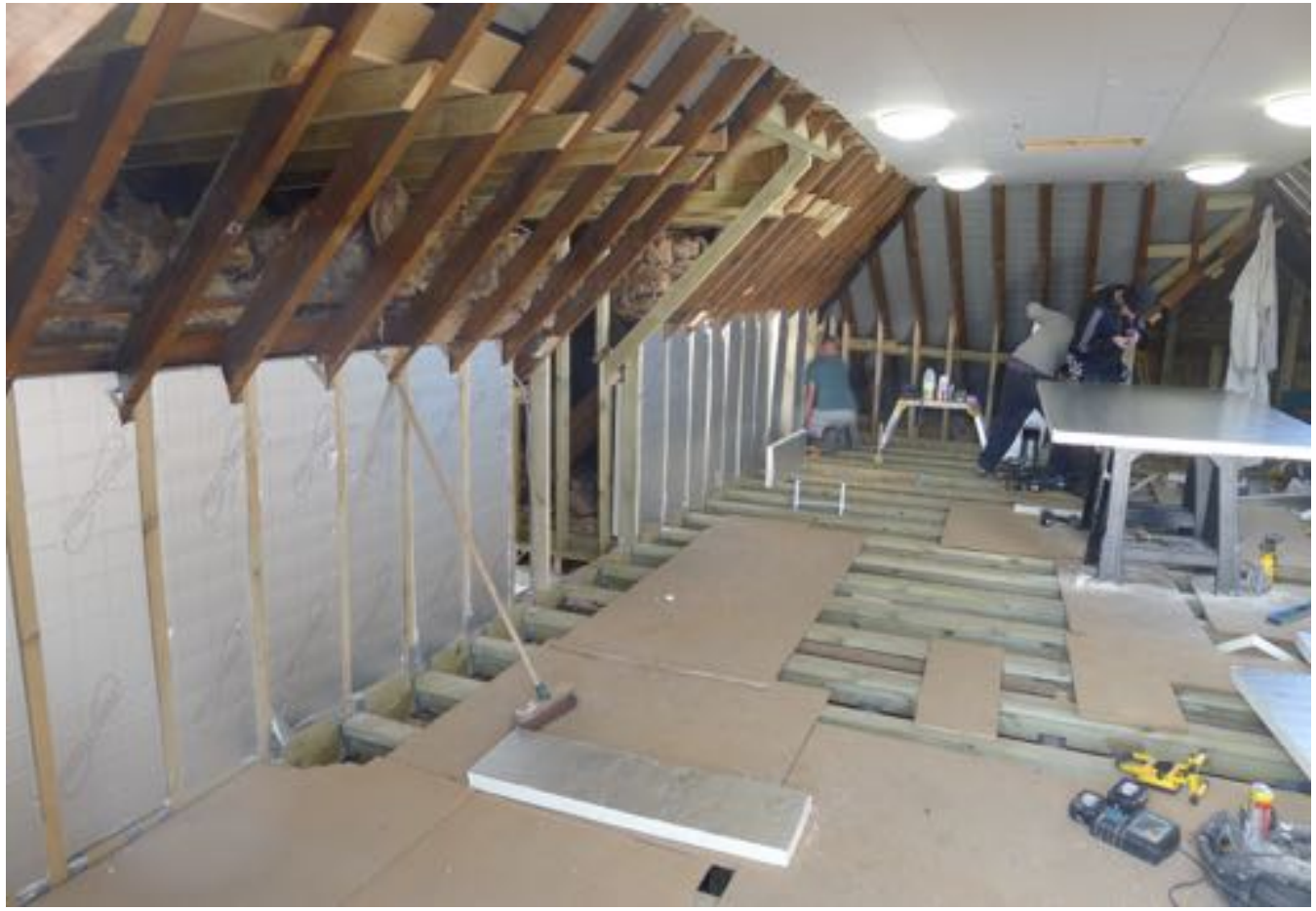
Insulating solid brick walls is possible but expensive and disruptive. You change either the external appearance, or destroy the internal features such as cornices, skirtings, etc.

We haven't needed to.

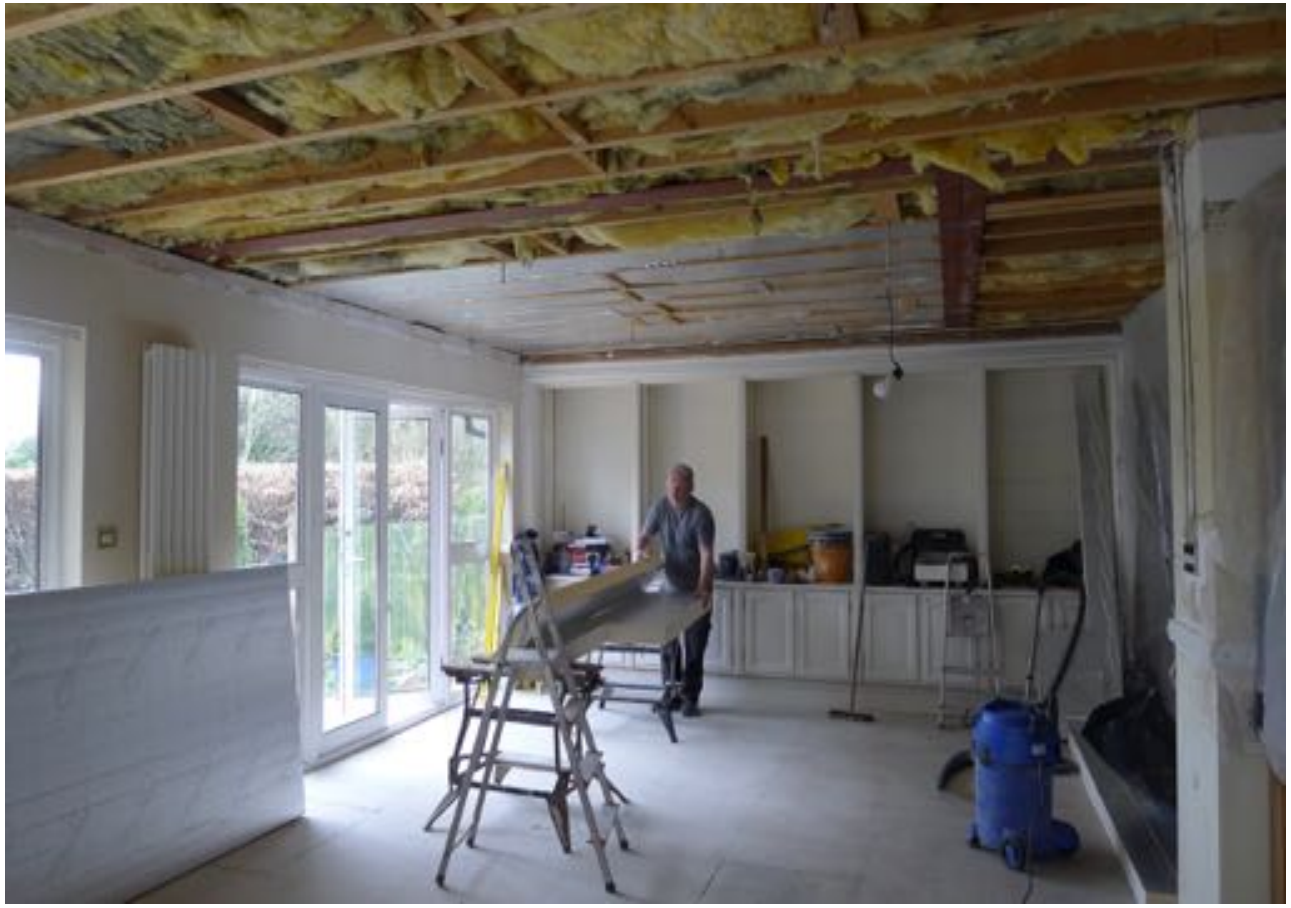


But we have…

Insulated the loft space with 12” (300mm) of fibreglass quilt, and with 6” (150mm) of foam insulation board where less space was available, such as between the rafters.

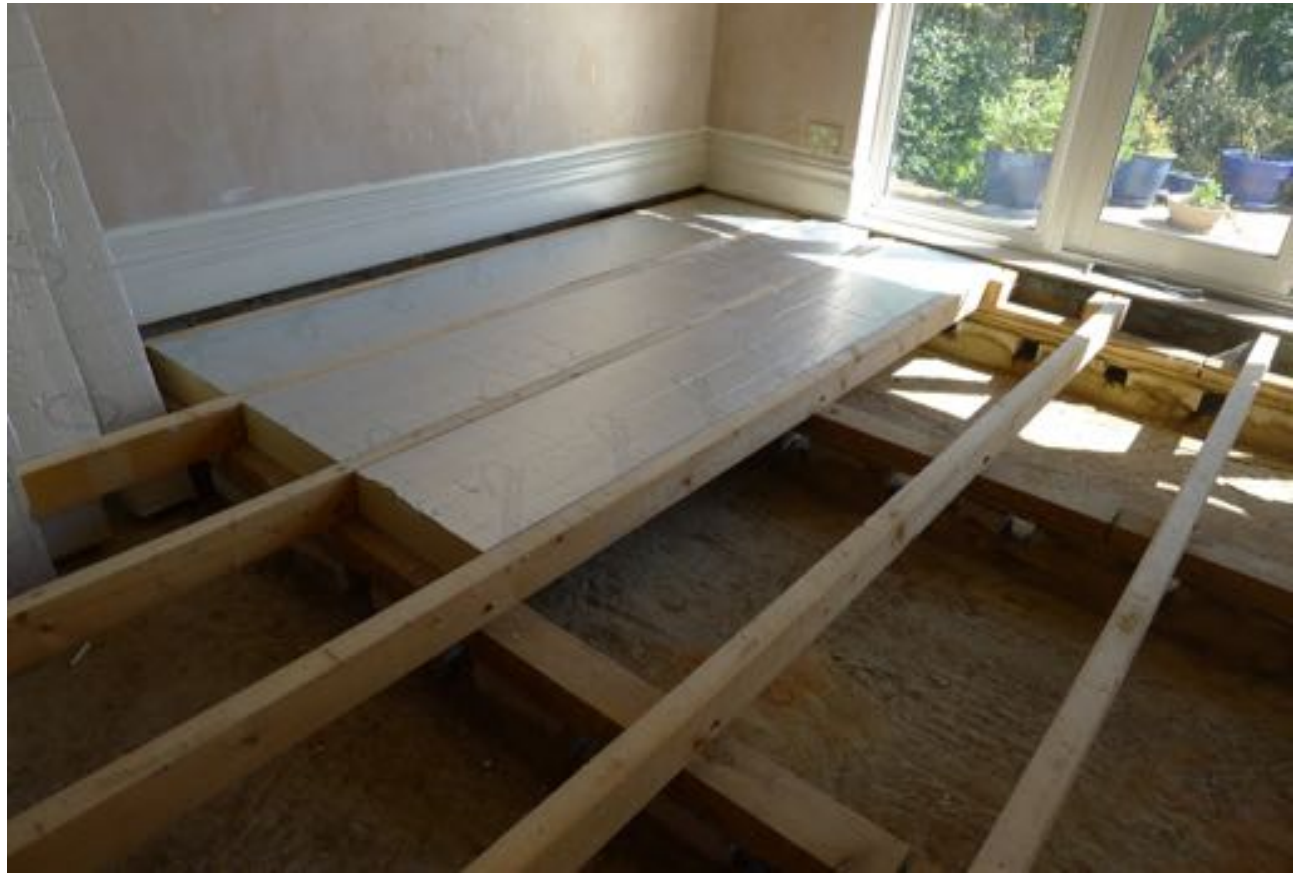


We super insulated the flat roof of the large rear extension (built in 1994) adding 4” (100mm) of foam board to the existing 6” (150mm) of glass fibre quilt.



We insulated the ground floor, by lifting the floor boards and putting down 4” (100mm) thick foam boards.

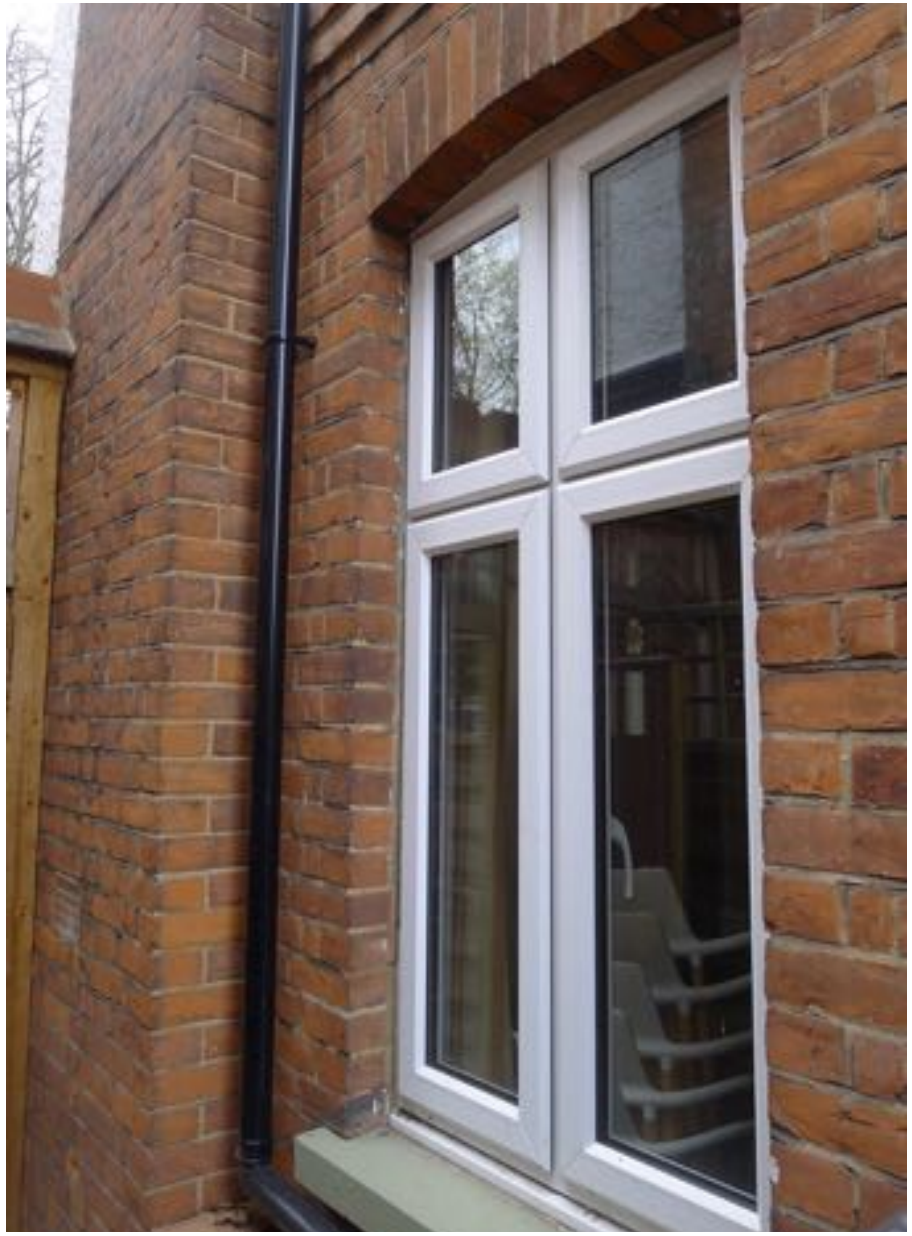
These span over the under-floor void, while retaining the ventilation underneath by airbricks.



We replaced all remaining single-glazed wooden windows with new plastic windows, with high performance double-glazing.

Replacement uPVC windows, with argon-filled spacing and low-emissivity glass, are easily available and affordable.

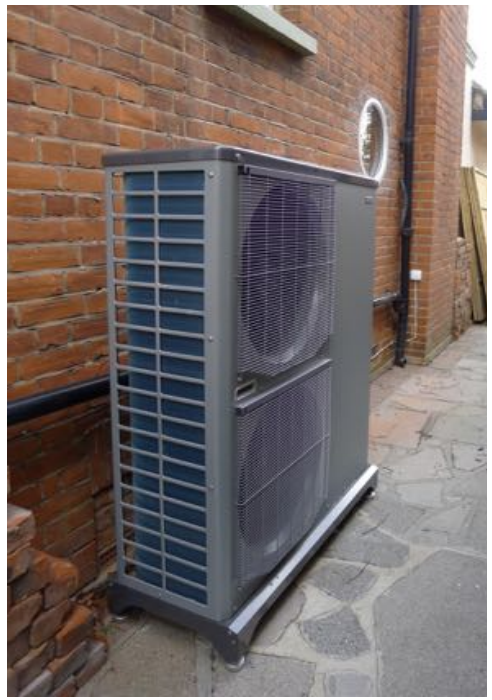
They also stop draughts completely!



Energy performance

Our Air-source heat pump is rated at 16kW. This is the maximum amount of heat it can bring into the house, not the amount of electricity it uses, which is much less.

The house now needs around 10kW to keep it at 20 deg C, when it's freezing outside. (Around 7kW of this energy is lost through the solid walls.) For comparison the gas boiler we replaced was rated at 30kW.



How much has all this cost?

Our 16kW Air-source heat pump is one of the largest sizes available. Heat pumps are expensive, but prices should come down a lot with economies of scale.

Installing the heat pump cost around £10,000. We got a Green Homes Grant of £5,000.

This GHG scheme was a bit of a shambles, and stopped in April 2021. But grants of up to £5,000 are due to be re-introduced in Spring of 2022.

Running costs reduced!

Heat pump installed in March 2021. Running costs over first 12 months are looking good.

Despite changing from gas to electricity, costing more per unit, the heat pump and increased insulation have ***reduced*** *our energy costs to a little over £100 per month.*

This is for central heating, hot water, ***and*** *also charging a small electric car at night.*

Energy Tariffs

Tariffs vary enormously! We use Octopus Go electricity tariff, a low night-time rate, intended to charge electric cars. But it's also used by the heat pump to heat the hot water very cheaply during the night.

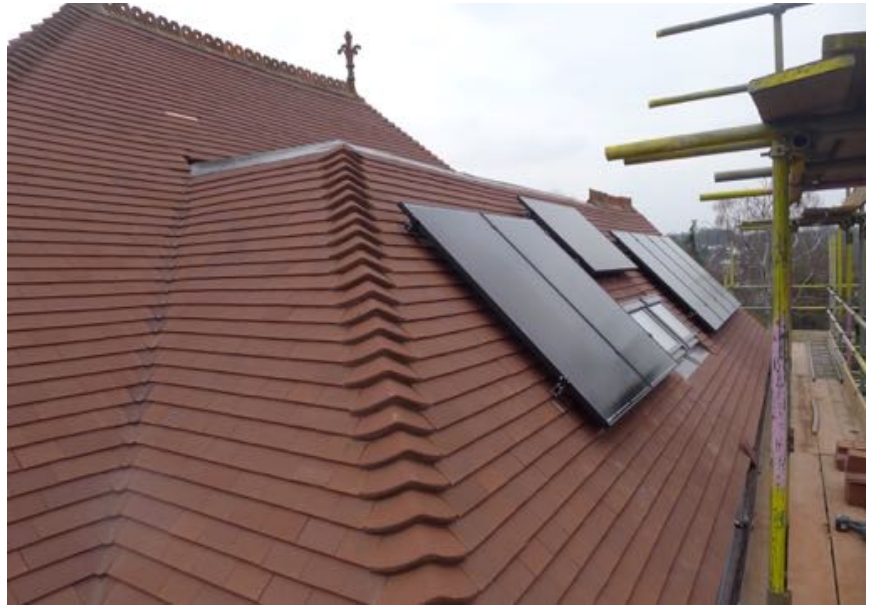
By removing the gas meter, we no longer pay any gas service charges.

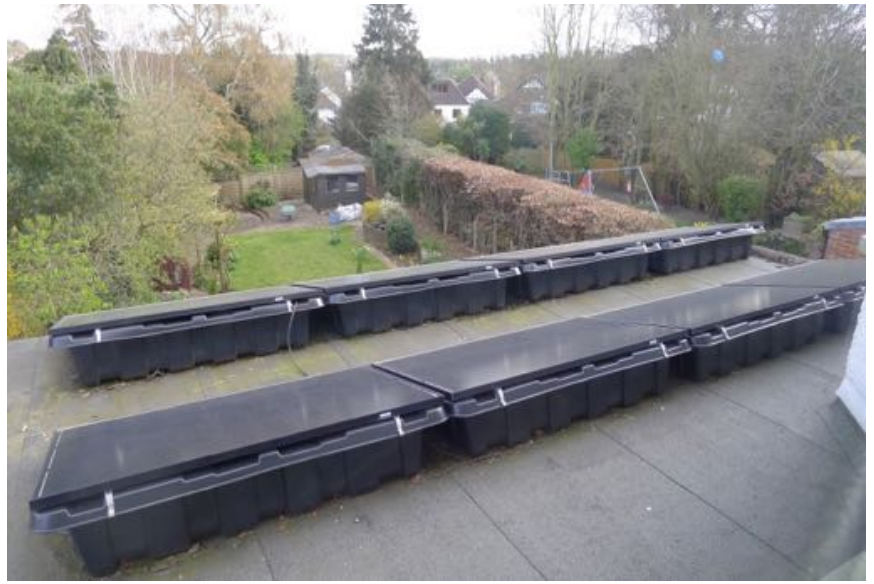
(But NB: ALL energy costs are due to increase in 2022)

Other energy saving measures..

In 2019 we installed 15 solar PV panels. Seven on the main roof and eight on the flat roof of the rear extension.

On cold but sunny days, the output from the panels goes towards heating the house, very efficiently!





And finally…

In August 2019 we bought this small electric car.
Second-hand, so affordable, but rather limited mileage.

At night we charge it at a low tariff, but on sunny days we can charge it with the solar panels… for free!