6 Southdown Avenue, Brighton BN1 6EG

http://home2.btconnect.com/eco-refurbishment

Overview:

Age/period of house:	1887 / Victorian
Type:	End-of-terrace
Years in residence:	2.5
No of bedrooms:	4
No of other rooms:	5
No of floors:	3
Wall type:	Solid
Loft conversion:	Yes

Key words

+ internal insulation
+ condensing boiler
+ solar thermal
+ high performance glazing
+ radiant heating
+ energy controls
+ solar thermal
+ wood stove
+ low energy cooking

Introduction and approach

Sigrid and Peter's initial plan to have a passive solar house built was hampered by the lack of affordable building plots in the city of Brighton and Hove. Driving by car to an eco-house outside the city did not seem coherent so they ended up buying a lovely Victorian house near Preston Park, where they can walk to the city centre and cycle to the University. However, the house was far from their green aspirations and expectations of living conditions. This is how the idea of the eco-refurbishment of a Victorian house was born.

Although they work in the environment field, Sigrid and Peter had no design or technical expertise in sustainable building before embarking on this project. It took five months of planning and eight months of hard work by various tradesmen transform the house into a bright, warm and environmentally friendly home. Sigrid says, "It's much more widespread in Austria. More people do it there, on the one hand there's much more government subsidies for putting energy efficient gadgets... and building regulations are stricter than in this country."

"It's also become a bit of a cultural thing that if you're refurbishing you do it in an environmentally friendly way because that's what you do and your neighbours do, otherwise they'll talk about you."

Features

Energy efficiency measures

The first step was to improve the building fabric to reduce heat loss and subsequently the amount of energy needed to heat the house. Preston Park is a conservation area and this reduced some of the potential eco-renovation techniques (external wall insulation was not an option). All the external walls were insulated to two levels, either 50mm or 25mm of insulation added to the inside of them depending on whether they had wall radiant heating installed, this created wall U values of 1.2 and 1.6 respectively.

Wall radiant heating works with lower water temperatures, but larger surfaces than conventional central heating system with radiators. This uses 30% less

energy because of lower water temperature of 35–40°C rather then 65–70°C. Also, radiant heat contributes to feeling warm at lower temperatures than convection heating of radiator systems and is also good for combining with solar water heating. It also means there is no need for radiators.

There is under-floor heating in the kitchen as there was not enough wall space (kitchen units, windows, doors) (supplier: Roth). After the mesh and plaster have been applied, the heating pipes become invisible.

New timber frame double glazed windows were installed throughout for 22 windows and two doors (U-value = 1.1, or 1.3 including frame); plus 5 new roof-lights (normal UK standard).

The insulation details for the house: 5cm of insulation were added to all exterior walls (U-value of wall =1.2); 2.5cm where wall radiant heating installed (U of wall =1.6). Magnesite bound woodwool slabs from Heraklith BM (supplier: Skanda UK Ltd). The loft also had additional insulation added.

A+ rated appliances; low energy induction hob.

Condensing boiler

Energy controls – Thermostats in every room.

Energy-saving appliances throughout.

CO2 emissions are down from 14t to 3.8t per year, which is a reduction of 72% (it would have been 80%, if we had not increased the living space by 38%). These figures were calculated by Aidan Dunsdon from ECSC. We could not know the real difference compared to before because we refurbished the house immediately after the purchase, i.e. we never used it in its old state (there were night storage heaters).

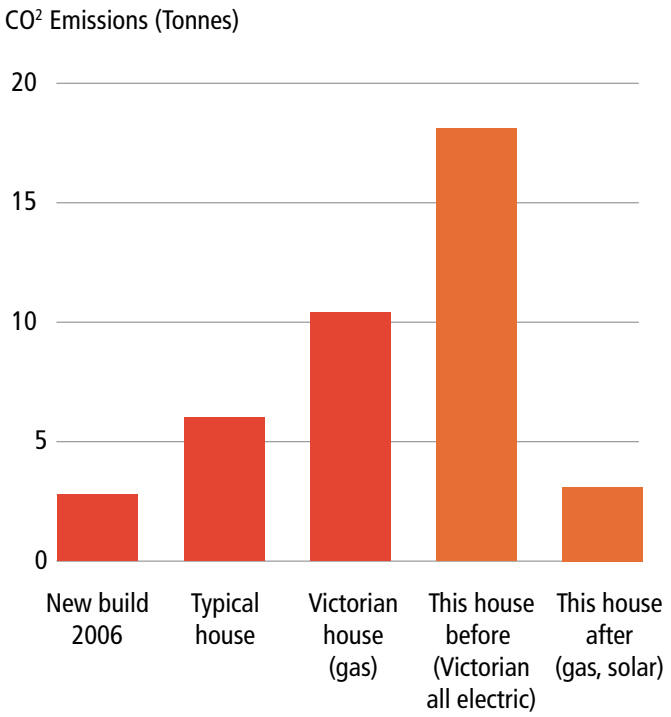
Economic outcomes:

Reduced energy bill by at least two thirds. Payback period for solar heating system is roughly 9 years (at current energy prices).

This project demonstrates that the 40%-House scenario – where CO2 emissions are reduced by 40% – (Boardman et al, 2006) is achievable and more. Even Victorian houses can become 30%-Houses – with existing and marketed technology – and provide excellent living conditions. We think that it is important to highlight this potential and to empower people to make their contribution to sustainable devleopment.

Due to the conservation area status, outside insulation was not possible in our project, which is why we adopted inside insulation. This was combined with a wall-radiant heating system that perfectly worked with the wood wool insulation and the solar heating system, backed up with gas. For the heating system, our first choice had been wood pellets combined with solar, but the lack of storage space and with only one supplier in Sussex, it seemed too problematic. The second choice had been a ground source heat pump but our garden is not big enough for the loops (even vertical alignment) and a

Carbon emissions before and after refurbishment compared to typical house emissions



Graph based on one created by Energy Centre for Sustainable Communities using www.carbonplanner.co.uk

borehole to tap into the ground water is too expensive (£8k min+heat pump); the third choice would have been an air source heat pump, but this deemed too risky because of possible noise in garden; we are situated in a densely populated city area. While compromises were necessary, we are very happy with the result. We transformed this house from a typical Victorian house (a 98 year old lady had lived here, thus not much was done on the house for a while) to a modern building with a much lower carbon footprint, but still kept the basic character of the house, and we feel we live now in a very healthy environment by using eco-material and paint, except the insulation under the ground floor where we used polystorol (this was judged to be necessary).

Renewable energy

- Solar thermal for hot water plus heating support.
- Wood stove with 6kW heat output in lounge.
- Four solar panels with 15 tubes each (supplier: Schott), 500 litre cylinder (150 lt hot water, 400 lt puffer for heating; 8 cm insulation on each side, 12 cm on top; supplier: Sonnenkraft). Backup for the heating: system gas condensing boiler (supplier: Bosch).

Water

Meter, of course. Water is conserved by use of dual flush cisterns, Raindance water saving shower heads, and use of drought resistant plants in gardens. Use of rainwater

for grey water was not possible because rainwater drains are on neighbour's ground.

Materials

- Insulation material for walls: magnesite bound wood wool.
- Floor boards wherever possible. The original wooden floors were retained as much as possible, but lifted and underlaid with 10cm polystyrol insulation in lounge and hallway. The wood in the kitchen was unrecoverable, hence insulation, concrete, underfloor heating, and tiles were used. Between floors 10cm Knauf insulation were added (all ~ U=0.2).
- Natural paint for inside (Biofa) and natural oil for colouring floor boards. Biofa eco-paint was used throughout for internal walls, and Biofa hard oil and parquet oil for wooden floors (supplier: Villa Natura). The hard oil nurishes the wood and is more elastic than traditional paint. And of course it's less environmentally harmful, which was particularly important to us given that our new baby was to arrive soon.
- A+ rated appliances and low energy induction hob; durability was also a concern for us (supplier: Miele).
- Energy saving light bulbs.

Lifestyle

Food, transport, work, recycling and composting

Future improvements planned

- Getting rid of gas as backup system.
- Integrating PV into south wall (no south facing roof space left).

Difficulties and things that might have been done differently

Gathering all the information and materials from many different suppliers, the most difficult thing was to find good installers. Often we trained them up after having been advised by the Austrian or German suppliers (e.g. insulation, wall radiant heating). Fortunately, these jobs are not that difficult. But close monitoring of work was certainly necessary.

We found it difficult to find tradesmen with expertise in eco-refurbishment (with the glowing exceptions of SunTrader and EarthWise). It took us many phone calls with producers to gather relevant information and we relied on help from lots of willing individuals across Europe who volunteered their knowledge. Reducing the effort for anybody who plans a similar project motivated us to put this webpage together.

Planning applications – 4!

Professional contacts

Suntrader Solar Energy Systems – http://www.suntrader.co.uk/

Earthwise Construction – http://www.earthwiseconstruction.org/

Materials

Wall radiant heating – Roth