2 Holly Cottages

Opening Times

Sunday 16th October [1]

Sunday 23rd October [2]

Details

Address: 2 Holly Cottages, St Helena Lane, Plumpton Green
Owners: Nick and Janet Rouse
Type: Terraced cottage
Built: 1865
Beds: 2
Walls: GF solid brick, FF timber frame tile hung
Residents: 2 adults

Eco Features

Ground sourced heat pump
High performance secondary double glazing
Insulated front door
Solar PV (5.9kWp)
Solar thermal
Solid wall insulation(internal)
Underfloor insulation
Underfloor heating
Electric Smart car (charged on PV)

Summary

Holly cottages represents the kind of problems faced in conservation areas. Nick was obliged to keep the very leaky lattice glazed windows, but greatly reduced heat losses by fitting high performance double glazed secondary panels. The front door, although thin and leaky, also had to be kept for conservation reasons. A replica of the inside of the door out of reclaimed Victorian pine was fixed to the original with insulation between. The solid walls were insulated internally by Nick himself, using foam backed plasterboard.

As the house is off gas grid, it was originally heated by high emission coal, but now has a ground sourced heat pump, which runs an underfloor heating system. Again, this installation was carried out by Nick, whose background is in engineering.

To offset the fairly high electricity demands of this system, there are two solar PV arrays totalling 5.9 kW, fitted in 2004 and 2010. Around 50% of hot water also comes from solar thermal panels.

The House

2 Holly Cottages is a semi-detached cottage built in 1865 for workers in the local brick works. In trying to make it more environmentally friendly, we faced many of the problems faced those in by older buildings in and around Lewes. It is built in the style known as Sussex tiling. The ground floor has 9 inch solid brick walls and the upper storey is timber-framed, tile-hung on the outside and lath and plaster inside. The original floors were solid. The windows in the front of the house were a particular problem. They have very thin Victorian glass diamond panes puttied into a zinc lattice frame. They are important for preserving the character of the house, but lose over twice as much heat as modern single glazed windows.

There is no mains gas available at this site and no room to put a gas storage cylinder. When we bought the cottage, heating and hot water were supplied by an old and inefficient anthracite boiler.

An extension in the same style was built in 1990 to provide a garage, an extra bedroom and a bathroom. This was built to reasonable, although not great, insulation values.

Photovoltaic System

A 2.7kW photovoltaic system was installed by Solar Century in May 2004. It consists of 15 panels, each rated at 180W, connected to a 2.5kW inverter to feed mains voltage electricity to the house and, when in excess of household needs, back into the grid. The panels were made by Sanyo using their HIT technology. These have a single crystal silicon base layer with a polycrystalline top layer. These panels provided almost the highest obtainable efficiency when installed. The same style of panel is now obtainable at 205W which is again very close to the best obtainable efficiency. Their output drops much less with temperature than other panels and they are very reliable; they come with a twenty year guarantee.

We have recorded the daily output of the system and it has generated 11,500kWh over the five years. This works out at 850kWh per year per rated kilowatt. This is close to the ideal that could be expected for a southeast facing system in this part of the country. There has been no observable drop off in output over the five years. The system cost £20,000 to install, including re-covering the area of leaking slates over which the system was fitted. Half of this cost was covered by a government grant. A second arrary of 3.15 kWp was fitted by Southern Solar in October 2010, to bring total output up to 5.9 kWp.

Solar Thermal System

Our solar thermal system consists of two sets of 22 vacuum tube absorbers made by Apricus using heat pipes to transfer the heat to the water system. Each set has 1.5 square metres of collecting area. One set of tubes is on the southeast part of the roof and the other is on the southwest part. They have separate pumps and are separately controlled. This system gives some output continuously over 14 hours in midsummer. The system is unusual in that there is no separate coil in the hot water tank for the water in the tubes, the water in the tank for domestic use also flows around the top of the tubes. This system has the advantage of allowing the use of the existing tank, but requires the use of bronze-bodied pumps to circulate the water.

The system was installed by us with the parts and instructions being supplied by Powertech Solar for £2500 for the double system and extra costs coming to about £500. In installing it ourselves, we had to forgo any grant but at the time this was only £360 and self installation saved much more than that. The efficiency of a solar thermal system depends on the brightness of the sunlight and the temperature difference between the air and water. This system is specified as 66% efficient at full sunlight and 25°C temperature difference but the average over the year is expected to be about 50%. This should give about 1600kWh of heat over a year. The rest of the water heating requirement is supplied by the ground sourced heat pump.

Ground Sourced Heat Pump

The ground sourced heat pump is made by Wiessmann and is rated at 8kW output. It was supplied together with the ground tubes, buffer tank and pump by Geosciences for £6800 pounds. This price included commissioning the system once we had installed it ourselves. The rest of the plumbing and electrical wiring components came to about £2000 and the contractors to dig and refill the trenches for the ground tubes charged £2500. The ground tubes consist of two 50 metre runs of overlapping one metre diameter loops which were buried two metres down surrounded in sand in trenches that wind back and forth over the entire back garden. We installed the heat pump, buffer tank, pumps, associated plumbing and wiring in the garage.

The output of the heat pump is connected to the indirect coil of the hot water tank and the underfloor heating. The coefficient of performance of a heat pump, the ratio of the heat out to the electrical energy in, is critically dependent on the difference in temperature between the water in the ground loops and the temperature of the water used to heat the house. This system will give 5.5kW of heat out for 1kW of electrical energy in, with a temperature difference of 25°C, but only 2.5kW of heat out for 1kW of electrical energy in with a temperature difference of 45°C. To keep the temperature difference as low as possible, it is necessary to keep the ground tubes as warm as possible, despite the action of the heat pump in trying to cool the ground, and to heat the house with water as cool as possible. To keep the ground tubes warm they need to be deep enough not to see the annual swing in temperature at ground level; to have the pipes sufficiently spaced; and to have enough water circulation in the earth to bring heat in from the surrounding ground. To heat the house with low temperature water requires that the heating surface area is as large as possible to compensate for the low water temperature. The best way of maximising the heating area is to use underfloor heating. With underfloor heating we have managed to keep the house warm with a water temperature of 40°C and the water in the ground loops has not dropped below 8°C throughout the winter. According to the specification be getting 4.5kW of heat for every 1kW of electrical input. Further improvements in insulation should raise this figure.

Underfloor Heating

We have installed underfloor heating throughout the house. Downstairs this has been done by raising the floor by about 70mm. Battens were laid on the concrete floor and polyurethane foam was placed between the battens allowing enough depth to fit loops of pipe on top of the foam. A weak dry mix of sand and cement was spread over the pipes up to the level of the top of the battens to spread the heat from the pipes. Bamboo flooring was then nailed to the battens. Bamboo is strong enough in 15mm thickness not to need any under flooring. It has a fairly high thermal conductivity compared to timber and it is fairly ecologically friendly as it is a grass which is coppiced every 3 to 4 years. As well as providing heating, this system provides underfloor insulation. Upstairs, the foam insulation is suspended between the joists on small battens nailed to the sides of the joists. The pipes, sand and cement and bamboo flooring are used as before. Installing this heating upstairs required removing and relocating all the plumbing and wiring that had been routed under the floor boards. Each room is separately controlled via room temperature sensors and valves for each room on a manifold system.

Insulation

To insulate the brick walls, external cladding of rockwool behind plywood sheet was used where there was protection such as in the garage. Elsewhere internal lining with 50mm phenolic foam backed plasterboard was used. In the front of the house, this had the advantage that, in extending the window linings and window ledges to cover the edges of the foam-backed plasterboard, it provided enough depth for double glazing panels to be installed behind the zinc lattice windows. Very high specification panels were used, with softcoat E-glass and krypton gas filling.

Upstairs at the rear, the tiling was removed, insulation was placed behind between the timbers of the frame and the tiles were replaced. It is planned to also do this at the front of the house.

Decoration

Recent decoration has been done with water-based environmentally friendly paints and the curtains in the front of the house are organic hemp/cotton material hand printed with vegetable dyes by textile artist Sarah Roberts.

Low energy lighting is used throughout with large globe lights being used to enable the use of open lampshades that obstruct much of the light.

If you would like to discuss what is involved in doing these jobs by yourself please come and visit us.

Electric Car

In September 2014, Nick took delivery of an electric Smart car, which takes advantage of the solar PV electricity generated on site.

Professionals

Eco design: Nick Rouse.
Ground sourced heat pump: Wiessmann GSHP fitted by Nick Rouse.
Solar PV panels: 2.7 kW Sanyo HIT installed by Solar Century: www.solarcentury.com/uk/ [3] and 3.15 kWp by Southern Solar: http://www.southernsolar.co.uk/ [4]
Solar thermal: Powertech equipment fitted by Nick Rouse.
Solid wall insulation: laminated plasterboard insulation installed by Nick Rouse.

[5] [6] [7]

Links:
[1] http://lewesecoopenhouses.org.uk/booking#2HollyCottages16th
[2] http://lewesecoopenhouses.org.uk/booking#2HollyCottages23rd
[3] http://www.solarcentury.com/uk/
[4] http://www.southernsolar.co.uk/

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