The Oil Drum: Local
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Green Cottage: eco-renovation of a 100-year-old Victorian end-terrace

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This is a guest post from Andy Hunt (solar_bud on The Oil Drum). It's an inspiring account of what can be done today with a modest property to live efficiently and maintain a degree of energy security.

Vital Statistics

Our house was built around 1900. It is an end-terrace house with 2 bedrooms, located in an inner-city area in Bury, Lancashire, UK. Our household comprises me and my partner, with no children, and we live in the property all year round. No planning restrictions are in effect in our area.

Wood burning stove with back boiler.

Annual Energy Use

We use around 3200 units of electricity annually from the grid, although this is expected to fall once we install the second stage of our solar PV system. This includes all cooking, as we don't have a gas supply, and is about average for our part of the country.

Our heating system is 100% wood and solar fuelled, so we don't tend to count heating in our energy consumption. We go through quite a few logs over the course of a winter though!

We use a 'green' electricity tariff, initally Npower "Juice" but now Good Energy as it's 100% renewable unlike Juice.

About Us and Why We Did It

I work as Sustainability Manager for a local Council, and have a long-standing interest in energy issues, climate change and fossil fuel depletion. I have always wanted to live in an eco-house, and my home renovation project of our very ordinary Victorian terraced house has made that dream a reality.

My partner comes from a family whose motto is "mend and make do", and she has grown up with solid fuel heating all her life. She is very practically minded, the daughter of an electrician, so her ideas and practical suggestions have been a very valuable part of our 'green' experiment.

Heating

The existing gas central heating system was converted to run on wood fuel and solar power.

I hired a plumber who disconnected the existing radiator system from the (cheap and low-quality) gas combination boiler which was running it when I bought the house, and connected it up to a new wood burning stove which was installed in the fireplace in the living room. The stove has a back boiler which runs two pipe loops – one connects the stove to a dual-coil hot water storage cylinder in the bedroom directly above, and the other connects the stove to the radiators in the house.

The hot water storage cylinder is heated by convection from the back boiler, and on the return pipe from the cylinder to the stove is a pipe thermostat. When the temperature of the return pipe (and hence the water in the cylinder) reaches 60°C, the thermostat starts a circulation pump in the radiator circuit, which pumps hot water around the house. This ensures that the hot water cylinder is heated as a priority, and is kept hot at all times.

When choosing a wood stove, it is essential to choose the right type for the application and situation. An ordinary room heater stove will provide warmth and cooking facilities in an emergency such as a power cut. A larger stove with a back boiler like ours can also run a central heating and hot water system, but is more expensive to install.

If you live in a smoke control area, you must legally install a stove which is exempt from the Clean Air Act by DEFRA for burning wood in a smoke control area. Most stove manufacturers make such models, but at the time of writing the only wood stove with a back boiler which is CAA-exempt is the Dunsleyheat Yorkshire stove.

In the summer, the cylinder is heated by a solar hot water system, which is plumbed into the lower coil in the hot water storage cylinder – the wood stove is plumbed into the top coil. Our solar hot water system is by Zen Eaga Solar – it is a flat plate system, and works well. Most solar hot water system installers will provide a dual-coil cylinder as part of the installation. The cost of the cylinder is actually a substantial part of the cost of the whole system.

Power Generation

The house uses solar photovoltaic panels and a battery back-up system for power security and low carbon emissions.

In the house there are two ring-mains - one which serves the heavy duty appliances in the kitchen such as the hob, cooker and washing machine, and a second one which serves the rest of the house.

When considering solar PV for electricity generation, I didn't like the idea that I would still lose power during a power cut if the system was grid-connected. So I went for a hybrid system, which doesn't feed excess power into the grid but stores it in batteries, will work during a power cut for several days, and can also take mains electricity when it is available.

We currently have 330Wp of solar PV (to be expanded to around 700-900Wp soon), connected to a 720Ah battery bank and an inverter-battery charger, which serves my second (low power) ring main. The inverter/charger is a Powermaster 1.5kW pure sine wave inverter which can take a 240V mains input, or can run off the batteries and solar PV in the absence of mains electricity. It was originally designed for use aboard boats, and so we just use the grid as our 'shore power' equivalent. Interesting to think of our home as a ship afloat at sea when we are running off-grid! Our PV panels are currently two Schüco 165Wp polycrystalline panels – the next stage will see an additional 165Wp Schuco panel plus a 200W Kyocera polycrystalline panel, bringing our installed capacity to 695Wp. The 30A solar controller on the inverter/charger can take up to 1kWp of solar, so even then there will still be room for another 200-300Wp of PV, as long as we can find the roof space for it!

In the summer the system will run for around a week at a time before the batteries need to be recharged from the mains. Further PV addition should improve this so that it runs pretty much constantly over the summer months. In the winter when the PV isn't generating as much, the batteries can be charged from the mains and in UPS mode the inverter will switch over to the batteries during a power cut, which will last us for 3 days or so, giving us desk lamps, TV (using a laptop and TV card), central heating pump, solar pump and general electrical gadgetry which makes life much more bearable during a power cut.

The only things we can't use during a power cut are the heavy-duty kitchen appliances. The fridge can be plugged into the off-grid ring main during a power cut with an extension reel.

Batteries and inverter.

Water and Sewage

We have only made fairly basic water efficiency improvements at Green Cottage - the installation of two water butt in the garden holding around 450 litres, a dual-flush toilet and spray nozzles on the bathroom taps all help to reduce water consumption.

We do have a dishwasher and a washing machine but they are both 'A' rated for energy and water efficiency. Studies have shown that dishwashers make more efficient use of water and electricity than washing up by hand, and we have a manual ‘wonder washer’ for clothes which we can use during power cuts. Our dishwasher is a very new model, and the instructions give details on how to connect it up to make use of solar-heated hot water. However, we tend to use our solar hot water for baths and showers only, so the dishwasher is actually connected to the cold water supply in our case. Not ideal, but with British summers the way they are, we need all the solar power we can get just for washing ourselves!

Insulation

We have had the standard 250mm of loft insulation installed under a Scottish Power discount insulation scheme a few years ago - most utilities offer these schemes under the Government's Energy Efficiency Commitment. You can find out which are the cheapest schemes in your area by telephoning your local Energy Efficiency Advice Centre on 0800 512 012.

Unfortunately our house does not have a wall cavity and so we can't install cavity wall insulation. We have no intention of getting external insulation done - far too expensive! The nice thick Accrington brick walls of our home give a good thermal mass though.

Summer Cooling

The high thermal mass of our old house helps to keep it cool in the summer.
We are lucky in that our living room is on the North-facing side of the house, but houses the wood stove which heats the house in the winter.

This arrangement means that in the winter, the living room is the warmest room in the house,

and in the summer it is deliciously cool, even in the hottest weather. The high thermal mass of the house means that the North side stays very cool, like a larder, even whilst the back of the house is baking in the midday sun.

Lighting

All the lights in the house are Compact Fluorescent Lamps, otherwise known as energy-saving bulbs.

We tend only to use low-power desk lamps rather than the 'big light' in each room. As the desk lamps run from the solar PV/battery system, this means that we get free electricity to run the house's lighting, and also that we have lighting even during a power cut.

Appliances

All appliances are energy efficient appliances, under the European rating system.

The kitchen appliances are 'A' rated, with the exception of the fridge, which although old is still working. Rather than scrap it and buy a new one, we invested in a 'Savaplug', which regulates the motors on old fridges and reduces their energy consumption.

We watch television on a laptop computer with a LCD monitor, and a TV card, which uses very little electricity. The same computer doubles up as our stereo CD player and DVD player, which means we have very little entertainment technology clutter.

Even with 100% electric cooking, our electricity bill is very low, typically around £5-6 weekly.

One measure we have recently taken to cut our electricity consumption is a flat-bottomed kettle to go on our wood stove – electric kettles use huge amounts of electricity, and our £3 aluminium stove-top kettle from Ikea will hopefully make a significant difference to our electricity bill!

The Garden

Although just a small terraced house back garden, ours is crammed with food plants, biodiversity and storage areas.

Our back garden is South-facing, and has been planted up according to Permaculture design principles.

A huge variety of perennial fruits and berry plants are crammed into a small area, with an additional raised bed for growing annual vegetables.

Perennials include: strawberries, blackcurrants, redcurrants, whitecurrants, blueberries, a grape vine, apple tree, pear tree, raspberries, cranberries, blackberries and hazelnuts.

We have tried a variety of different things in the raised beds – the most successful to date have been carrots, pak choi, tomatoes (although we have had problems ripening them as they grow against an East-facing wall), French beans, onions, potatoes and a pumpkin which we have just harvested. We also had a butternut squash plant in the miniature greenhouse which did very well, although the pot it was in turned out to be too small for it in the end.

A storage space for logs, a bunker for kindling, a small lean-to greenhouse and a table and benches for enjoying the sun are all crammed into this typical small terraced house back yard. Space has even been found for a network of four small wildlife ponds and wildlife areas amongst the food growing, and the garden has a significant population of frogs, which is good because slugs and snails are a big problem. We use copper 'slug rings' to try to keep small plants safe, but it's a constant battle, and I may well try other approaches in the future such as beer traps.

Conclusion

It has taken a good few years to get from standard gas-heated end-terrace to low-carbon eco-cottage, a lot of hard work, improvisation and a reasonable chunk of hard-earned cash, but we love the end result. The old gas combi used to really struggle to heat the house, but the wood stove system warms the brickwork through, and we are really cosy. It's also great not having to use any kind of heating in the summer, as the solar hot water system provides us with a cylinder full of free hot water, and even the solar pump runs on free electricity.

I'd like to thank Powerswitch for the inspiration, help and encouragement provided on their forums.

There's nothing quite like relaxing in a hot bath knowing it has been heated free of charge by the sun, and free veggies from our back garden taste so much better than from the supermarket. A couple more PV panels and we will be finished. And then, we might start looking for a small patch of woodland for our next project...

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