Eco home

An ordinary Stapleford home has state-of-the-art energy saving. YASMIN EMERSON went to look…

"There is no boiler as such", says Bill Powell, as he explains how his ordinary-looking four-bedroom house in Stapleford is heated. The house had been run down – "When we inherited this house, it needed fully rewiring," – and needed lots of work to bring it up to a modern standard. Bill spent six months reading, and decided that the way forward was an exhaust air heat pump, connected to underfloor heating and four fan-assisted radiators.

It sounds like magic. Air-source heat pumps extract warmth from the outside air and compress it, and then this heat can be used to heat up water for a heating system. You may have seen ground-source heat pumps being installed on dramatic television programmes; air-source pumps are similar, although without the drama of digging up a garden. Bill's system, however, required neither drama nor digging. His *exhaust* air source heating system extracts air not from outside, but from a warm part of the house: the kitchen. This air is pumped upstairs to the airing cupboard (see picture), through a compressor, and is used to heat a 300-litre tank of water. The system keeps this water warm for use in the underfloor heating downstairs, and in two upstairs bedrooms, as well as providing the hot water for washing. You've got at least one compressor in your house already: your fridge works in a similar way, but the other way around – think how warm they get at the back.

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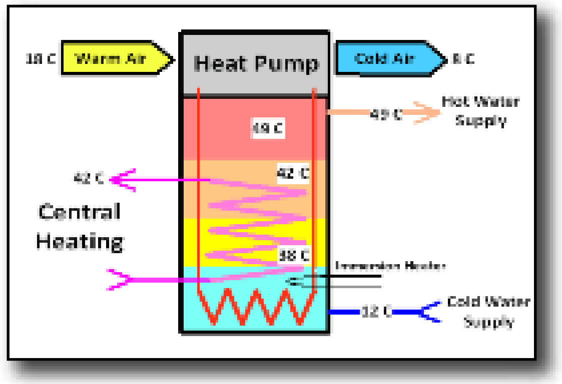
Most of the time, Bill says, his exhaust air source heat pump is quite sufficient, and much like anyone with relatively recent central heating, he uses a radio-controlled thermostat to set various temperatures, in various rooms, throughout the day. "We have it set to 18°C at breakfast time, and 21°C in the evening in the living room when we're watching television; the bedrooms are set to 16 or 17°C. It meets that quite adequately."

Of course, there are times when Bill's exhaust air source heat is not enough to meet the needs of the house. It provides around 3kW of heat. On extreme occasions, he has an immersion heater, and also two gas fires (one of which is a flueless model, and requires an airbrick that he's put behind the dishwasher). But, because the exhaust air source heat pump effectively circulates that warmth throughout the house, the whole house benefits from a single gas fire.

So why not use the system with a more ordinary technology, such as conventional radiators, rather than expensive underfloor heating? The crucial thing, Bill says, is that "If you heat from below, that's said to save 25% *[of the fuel used to create the heat]*, because the average temperature can be one to two degrees less." If you've got a modern thermostat on which you can set the temperature, think how long it takes to change the temperature inside the house by a degree or two, and you'll see why being able to heat it to a degree or two less is important. The Energy Saving Trust says: "Every degree that you turn your thermostat down could save you around £65 a year on your heating bill." Combine that with other factors; if our feet feel warm, the rest of you feels warm; and hot air rises. So heating from below means that Bill has a heating system which can run efficiently with water at a temperature of 37 to 40°C – conventional radiators need water at 70°C to heat a room to 20°C.

Bill found that, for reasons of space and money, he couldn't have underfloor heating throughout the whole house (supplied by *www.wundafloor.co.uk*). More research, and he came across Ecovector radiators (*www.smiths-env.com*). Costing around £300 apiece, these are fan-assisted radiators which blow warm air down, rather than allowing warm air to rise up – much like heaters inside a car. So they use a small amount of electricity, but because of the benefits of heating from below, they don't need such hot water. Bill used them in the hallway and in three bedrooms.



The amount of time and energy Bill has investigated in researching and designing his system is clear. His background, as an electrical engineer, clearly helped – but it's his enthusiasm for restricting energy consumption as much as possible in as practical a manner as he can that's driven his project. "When we inherited our house", he says, "I saw the opportunity for an eco project, and to make the house ready for the next fifty years – to make it 'future proof'." Had he done building projects before, and had builders to draw on? Not particularly, he says: his builder was not especially knowledgable about 'eco' projects – but he was keen to learn and to use the materials Bill had researched. And the plumber Bill asked to install underfloor heating and work on the exhaust air source heat pump? "Recently qualified," says Bill.

My own house, by virtue of its steel-frame construction, has virtually no insulation (except in the roof) and so insulation is one thing I'm very interested in learning more about. Did Bill go to special efforts to insulate his house, to keep the precious heat in? "It was incidental in many ways," he explains. The cavity walls were already insulated; the new walls in the modest extension and roof were insulated to current building regulations. The house has a suspended timber ground floor, so the floorboards were removed and 50mm Celotex insulation laid on battens before the underfloor heating pipes were installed. The underfloor heating pipes are laid in a 25mm dry sand and cement 'pug' mix. The windows needed replacing anyway, so modern double glazing was fitted.

Now, I'm not a clever technical person; my science knowledge stopped at GCSE. I don't fully understand this system, so my apologies if I've explained it incorrectly. But what I can see is the practical side: Bill's system combines separate bits that work together to make a highly efficient whole. With the heat pump and heating from below at the core, you could adapt other elements to suit your own home. For example, a wood-burning stove might replace a gas fire, and the heat pump would ensure that that heat was circulated throughout the house. Or solar water panels on the roof might heat the water in addition to the exhaust air heat pump. Or fan-assisted radiators might replace conventional radiators, and be heated by a conventional boiler – which, at a later date, could be replaced by an exhaust air heat pump like Bill's. He's recently added photo-voltaic panels to the roof, which provide some electricity for the system.

What most struck me, though, was his enthusiasm for doing the research and keeping track of the numbers. It makes me think that it would be possible to find improvements to suit my own home. His approach seems to be one of working out the desired end point, and working back from there to calculate individual requirements – which is an approach anyone could learn from.

Book a tour of Bill's house on Saturday 15th June as part of Cambridge Carbon Footprint's Open Eco Homes – details in the DIARY; the tour takes about an hour. Book for Bill's and many other interesting homes at http://openecohomes.org or contact Cambridge Carbon Footprint: www.cambridgecarbonfootprint.org or 01223 301842

OVERVIEW

Age and type: **1957, semi-detached**
Wall type: **Brick cavity**
Floor area: **135 sq m**
Project timescale: **1 year**
Cost of heating system: **£10,000**

ENERGY USAGE – TWO ADULTS

49 kWh per sq m pa electricity (2011)
22 kWh per sq m pa gas (2011)

KEY FEATURES

- insulation: cavity walls, loft, extension, underfloor
- windows and doors: double-glazed, triple-vents
- exhaust air source heat pump system: simple, low cost, easy to install
- heat recovery system: Bill's own design
- flueless gas fire, ecovector radiators
- underfloor heating system: low cost, easy to install
- underfloor heating pipes: laid in 'pug', supported on insulation between joists
- photovoltaic (PV) cells
- heating controls: careful timing
- high performance appliances
- induction cooker
- water conservation: water butts, low water toilets