Our Journey towards a low carbon home pt. 2: ditching the gas

Having completed the majority of our bungalow retro fit and increased the EPC from D to a top end B we set out on the final part of our journey to reduce the carbon footprint of our home; taking out the mains gas heating and installing an air source heat pump (ASHP).

Planning to apply for a Green Homes Voucher grant and topping it up with The Renewable Heat Incentive Scheme which will over several year cover most of the cost, three quotes were requested from installers with MSC certification and Trust Mark approval.

Some research on the subject led us to understand that homes with a poor EPC were unlikely to be suitable for ASHP heating as their heat loss would be too great. We also knew micro bore pipes could sometimes cause issues with lower water flow rates. We did not tell the invited installers what our EPC was.

We were concerned to find considerable differences in specification. All three recommend a 9kW heat pump. One said it would definitely not be necessary to upgrade radiators at all, (this one also provided us later with a ten year old EPC showing the pre retro fitting rating) One said try for a winter and upgrade to some double radiators if it proved the house was not warm enough, (this installer also wanted to replace all micro bore pipework anyway.) The third said from the outset that we would need to double living room and bedroom radiators (the recent dining room extension had better insulation and they felt should be adequately heated).They also said the micro bore piping was a technical design challenge they could confidently overcome. Excluding the additional cost of some new radiators the three quotes were roughly the same. The third installer, noting we had 12 p.v. panels also suggested we divert surplus electricity from the p.v. before export to the immersion heater, rather than always using the heat pump to heat hot water. We went with this idea and find even in winter on a sunny day the P.V. can supply a lot of the electricity required for hot water via the immersion heater, even able to raise the temperature to 60 degrees C to combat legionella.

There were also differences re where the outside unit would be placed. The first installer suggested placing it out of sight against the back of the house on a draughty north facing wall with a long pipe and cabling run to the hot water tank. The others suggested at the south facing front of the house, closest to the hot tank; the tank would be new as the old gas system was a combi boiler with no hot water tank. I raised the question of noise disturbance and both of these installers said noise would not be an issue as the unit was many metres from neighbours.

We opted for the third installer and subsequently during a spell of sub-zero temperatures they were proved to be correct over the need to upgrade the majority of the radiators.

The work took a total of seven days, (five for the plumbing and two for the electrical work.) Installation was on time and communication with the company was good. The system took a few days to settle down, purging some trapped air on one occasion (we had been shown how to do this) and an unexpected fault code closing the system down which was quickly resolved over the phone.

ASHP's take a bit of getting used to, especially with micro bore pipework causing lower flow rates to the radiators; they take longer to get rooms up to temperature, so time clock settings needed to be adjusted. To get the maximum heat out of living room radiators we have found it helps to turn down the RTV's a little in lesser used rooms though the system can cope even with daytime temperatures of minus 5 C. Doing this reduces the heat demand on the ASHP and during sub-zero temperatures reduces the electrical consumption which incidentally seem to be around 3.5Kw when the unit is working hard.

There is some noise from the cupboard where the two pumps, the two heat exchangers and hot tank are. This is in the centre of the bungalow but we don't find it intrusive. *(the picture was taken before all pipes were insulated and Eddi controller installed.*) The outside unit produces 64 decibels at one meter distance and 54 decibels to passing pedestrians who are twelve metres away, (little more than quiet conversation.) Even with a front bedroom window open we are not disturbed by noise from the ASHP unit when running at night time and are never aware of it from inside during the day. To reduce the visible impact of the outside unit the garden will be slightly rearranged with some new plantings suitably distanced so as not to impede air circulation.

Electrical consumption will certainly be higher, especially in the winter. On sunny days the surplus generation from the p.v., now controlled by an Eddi Controller **goes first** to the house, **next** to the immersion heater, **thirdly** to the electric car charger if required and finally to export. This sequencing may prove enough to keep the hot water topped up most of the time in the superbly insulated hot tank (set at 48 degrees C.)

Having a smart meter allows us to change our green supplier to one with a variable rate tariff, to take advantage of low prices during parts of the day. We also plan to change the fixed room thermostat / time clock to a smart wireless one which will work via the internet in conjunction with the variable rate tariffs to help reduce electricity bills.

Would we recommend an Air Source Heat Pump? Most certainly BUT only in a well-insulated property and with a competent installer who conducts a thorough heat requirement and technical survey first.

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Six months on: Last part of the journey.

The Eddi P.V. controller has proved very successful, diverting output from the P.V. array to the immersion heater. Even on cloudy days hot water temperatures are more than adequate and the heat pump hardly ever needs to switch on. The order the P.V. output is used has been changed to **house, car charging when required, immersion heater and then export.** The fixed smart thermostat, (designed for the old gas boiler) proved to be an unsatisfactory companion to the air source heat pump and a **Homely** system installed. It learns how long the house takes to heat up and cool down. It then looks at weather forecasts and electricity prices to make sure the house is heated at the

cheapest times to meet desired temperatures. It will overheat the house a couple of hours before expensive tariff periods by up to 2 degrees, the temperatures gradually dropping to those normally set. The heat sensor is wireless and kept in the living room. Should the internet or iPad, through which Homely is controlled, fail, the system remembers settings and times of the past 24 hours until services are restored. A full winter is required for a complete assessment. Monthly energy records are being kept so running costs and emissions can be compared with the gas boiler in due course. We changed our energy supply to Octopus renewable Energy Agile tariff once the Homely system was installed. Tariff rates vary every half hour and are known 24 hours in advance. Dishwasher, washing machine and electric car time clocks are now used much more to take advantage of lower price periods. During sunny days our P.V. output is generally sufficient for all our electricity needs other than the electric oven, (the gas hob has for the time been retained.) We are however exporting less. By knowing in advance what the variable tariff costs are (shown via a smart phone App) we are, when we can, more likely to avoid peak consumption times and therefore highest prices. With a variable rate supply, it is very noticeable that during cloudy and windless periods, tariff costs are high. This is offset by winter prices (when there is more wind) which can even be negative during periods of excess generation. Then we are actually paid to use electricity!

Have we finished the journey? As far as home energy efficiency and reducing emissions is concerned, possibly. As far as electricity consumption costs and responding to greater demands at peak times on the national grid are concerned, possibly not. Home battery storage or car to grid battery connections will possibly be the last piece in the jigsaw.

Reducing personal emissions, well that's another journey which is ongoing ….

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