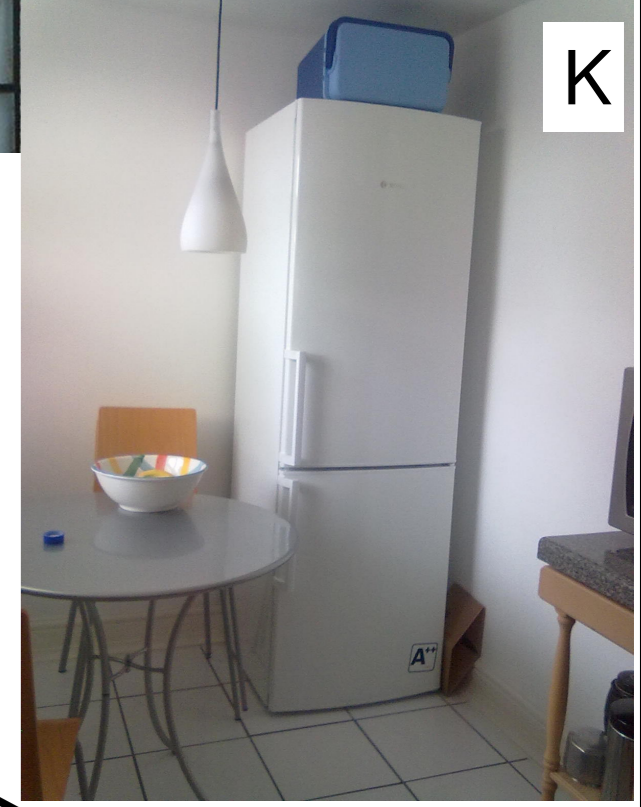
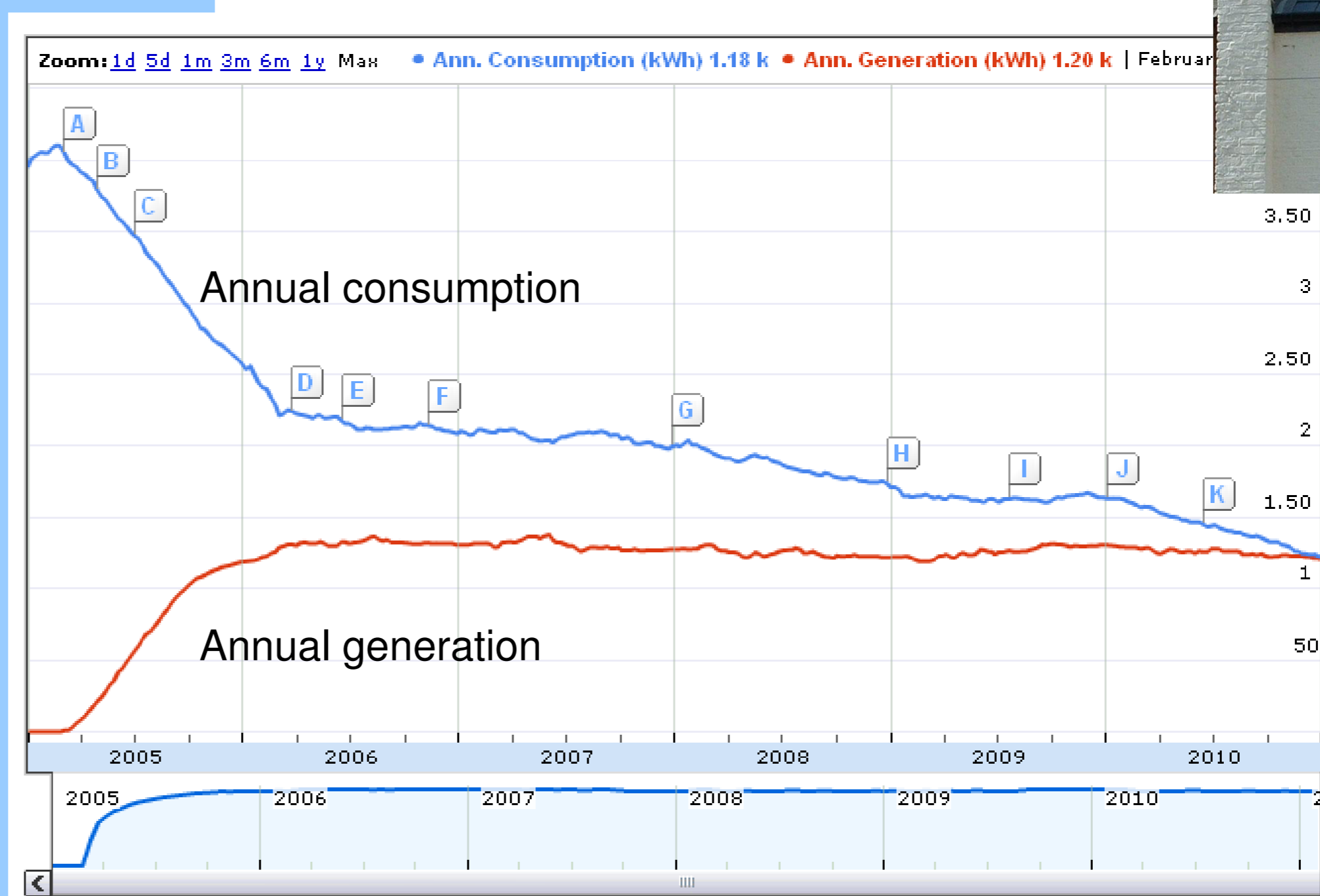


2 Amyand Cottages

Timeline of Improvements

Electricity Improvements

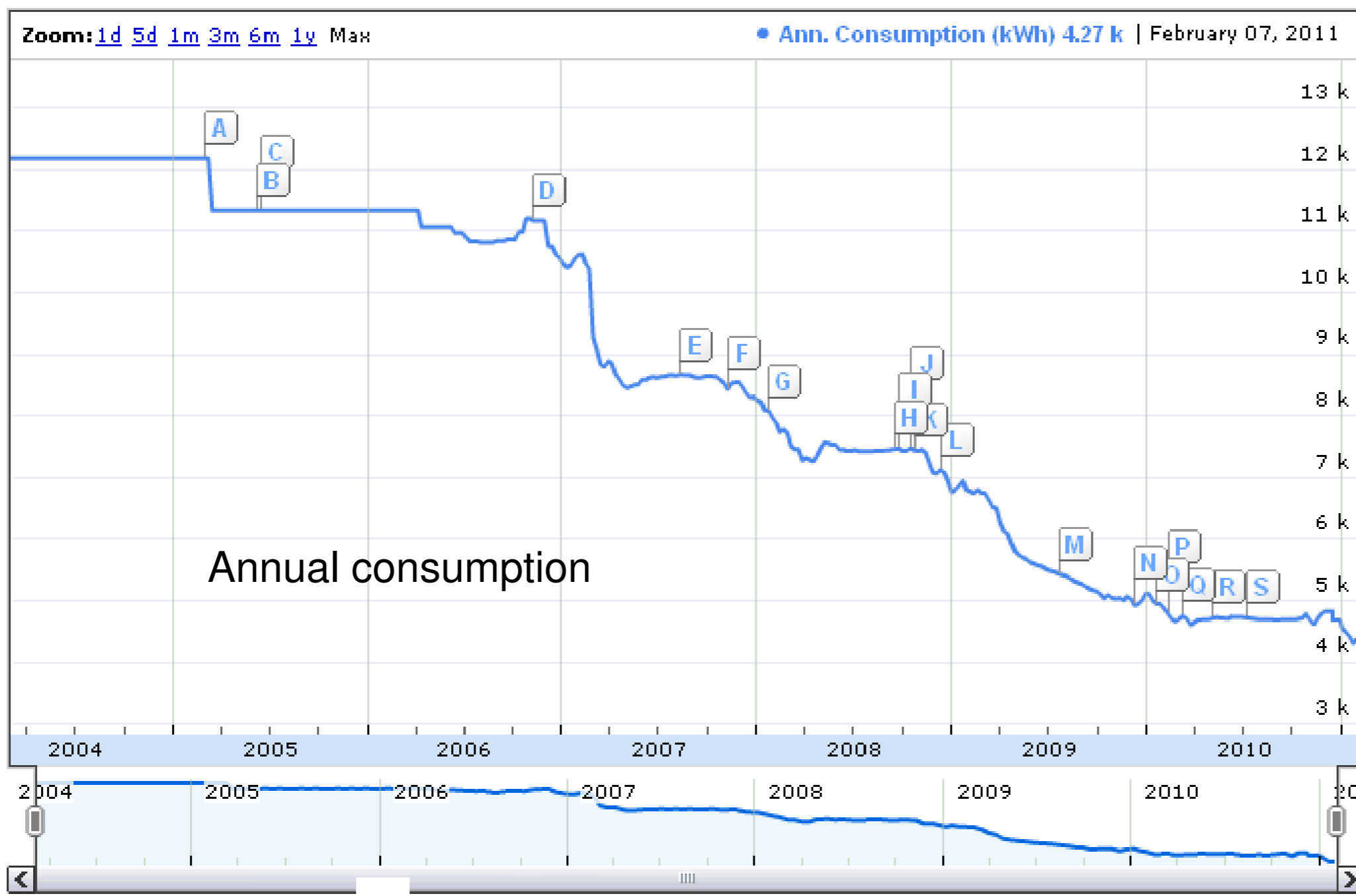
- | | |
|----------------------------|--------|
| A. PV installed | Mar-05 |
| B. Towel rail off | Apr-05 |
| C. Standby reduced | Jul-05 |
| D. CFL bulbs in kitchen | Mar-06 |
| E. Washing at 30C | Jun-06 |
| F. Hybrid cooker bought | Nov-06 |
| G. Freezer Savaplug fitted | Dec-07 |
| H. Eco kettle bought | Dec-08 |
| I. 1st Heat Recovery fan | Jul-09 |
| J. 2nd Heat Recovery fan | Jan-10 |
| K. New fridge/freezer | Jun-10 |



Hooray, we have become a power station



disappeared from the graph about one year after implementation.



Heating improvements

- | | |
|--------------------------------|--------|
| A. Main roof insulated | Mar-05 |
| B. TRV on radiators | Jun-05 |
| C. Cavity wall insulation | Jun-05 |
| D. New room thermostat | Nov-06 |
| E. Better flat roof insulation | Aug-07 |
| F. 1st thermal blind | Nov-07 |
| G. North wall improvements | Jan-08 |
| H. Radiator foils fitted | Sep-08 |
| I. New lined curtains | Sep-08 |
| J. New boiler | Oct-08 |
| K. Solar water heating | Oct-08 |
| L. 2nd thermal blind | Dec-08 |
| M. 1st heat recovery fan | Jul-09 |
| N. 3rd & 4th thermal blinds | Dec-09 |
| O. 2nd HR fan fitted | Jan-10 |
| P. Underfloor insulation | Feb-10 |
| Q. Rads moved to inner walls | Mar-10 |
| R. Spacetherm installed | May-10 |
| T. 5th thermal blind | Jul-10 |

Solar Electricity

- In March 2005 we had 9 m² of photo-voltaic cells installed on our south-east facing pitched roof. These generate around 1,270 kilowatt hours of electricity each year.

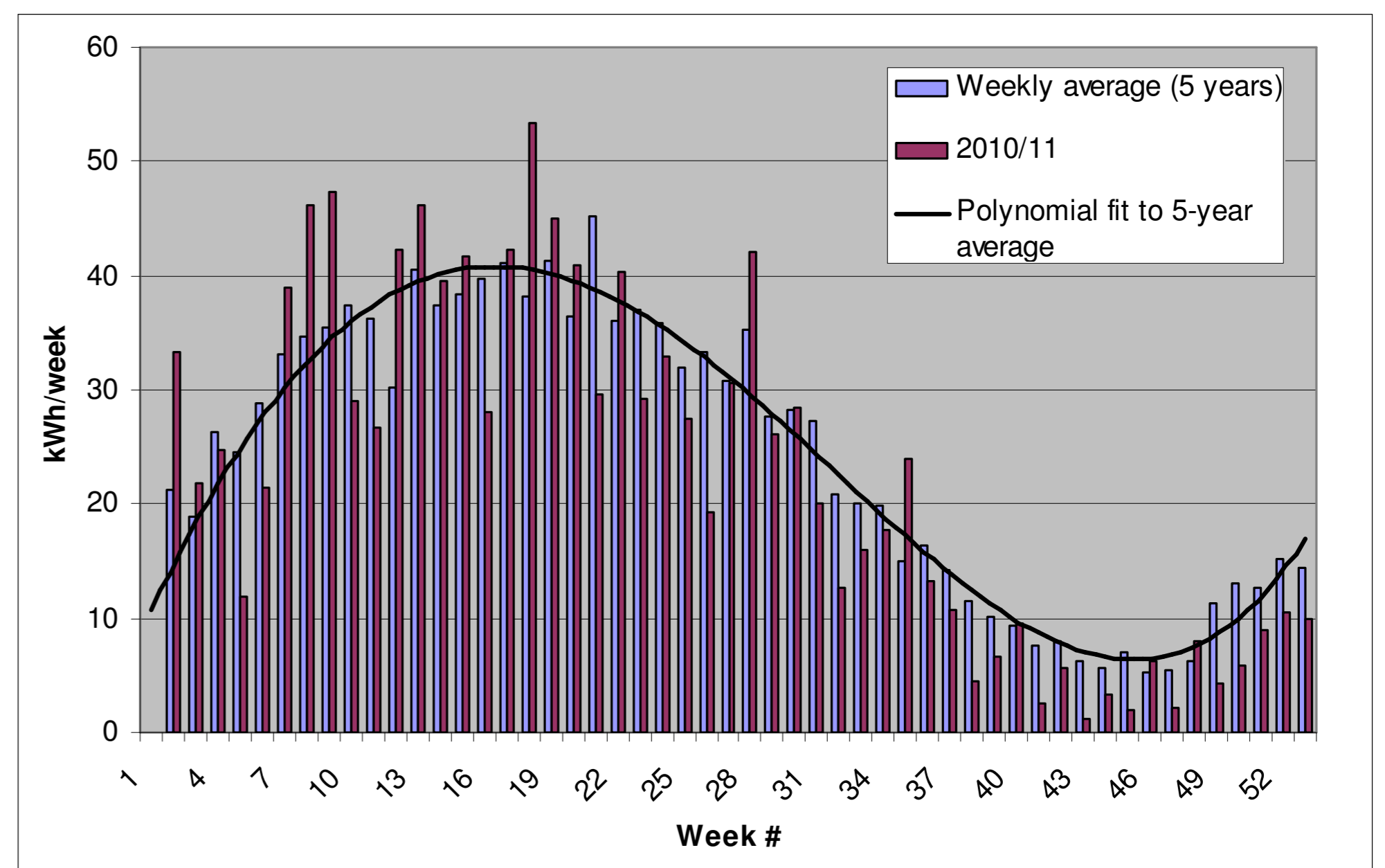
- On the advice of Solar Century, we chose hybrid silicon type cells, called Sunstation, manufactured by Sanyo. The entire system was installed in half a day (in a snow storm) by Chelsfield Solar. Both of these companies were extremely helpful and reliable.

- An inverter, an isolator and a generation meter are the only other parts of the complete system.



After 6 years of trouble free operation there has been no detectable degradation of the panels' performance.

They have not needed cleaning (although we did get the window cleaners to give them a scrub once but it made no difference).



The electricity output peaks in the early summer (May to July) and is very low in mid-winter. No electricity is generated at night. But the output averaged over a few weeks is rather predictable.



Solar Water Heating

- The PV proved so successful that in Oct. 2008 we had a solar water heating system installed on the flat roof of the extension.

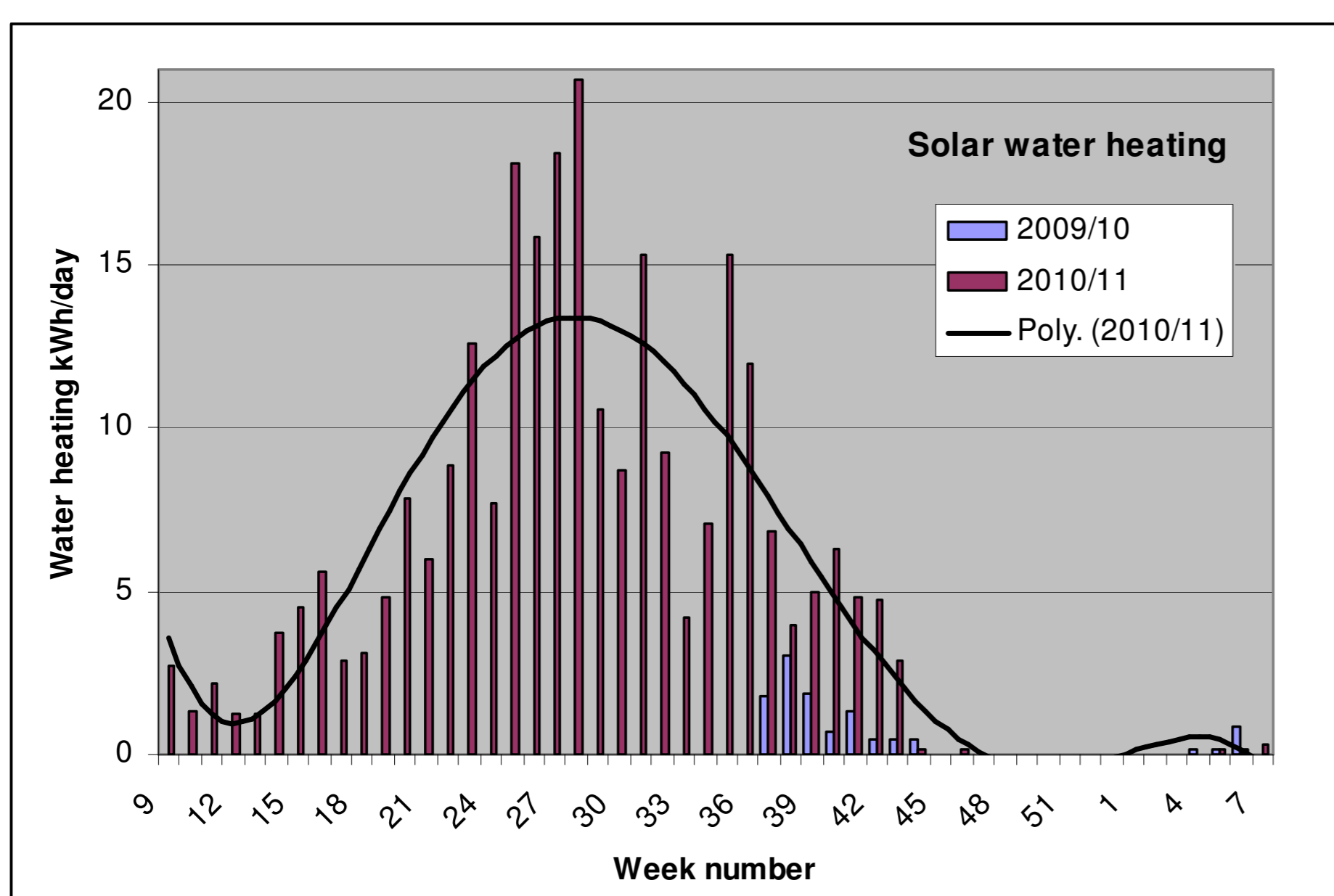
- It is a 20 vacuum tube unit – Viessmann Vitosol 200-T with tiltable absorber surfaces inside and a total effective absorber area of around 2 m².

- The panels feed a 200 litre insulated hot water tank which is also connected to the gas boiler (a new 12kW condensing Worcester Bosch).

- The system generates a little more than 1000 kilowatt hours per year, enough for more than 60% of our needs.

- To save space the tank is outside the house in a wooden enclosure, with much expanded polystyrene lagging.

The solar hot water output peaks in mid summer (June to August) and is effectively zero in mid-winter. Domestic hot water demand is more or less constant throughout the year.



The hot water tank (200 litres) is probably bigger than is needed for a 2 person house. The tubes would also perform better if they were mounted higher up and so would be less shaded.

Structural Thermal Insulation

Original house (1880) - solid brick walls.

Flat roof extension (1960) - brick cavity walls.

Added Insulation:

All windows double glazed (wooden sash windows -15 years old – 12mm gap, kitchen upvc windows 20mm gap)

Suspended wood floor - 90mm Celotex foil-backed insulation between joists plus a plastic membrane between insulation and floorboards and additional insulation under wooden flooring.

Kitchen extension cavity walls filled.

Main roof - Tri-Iso Super 9 insulation (equivalent to 200mm mineral wool).

Flat roof - 3 layers Ht felt + vapour barrier and 100mm insulation slab over existing deck.

Internal wall insulation (20mm Spacetherm Aerogel + 10mm plaster board) over 75% of external walls at first floor level.



Insulation Quick Wins

- Floor to ceiling thick lined curtains over windows and walls (living room and bedroom) and front door.
- Thermal louvred blinds on all sash windows.
- Removable chimney balloon.
- Removable radiator-foil linings on front and back doors.
- Draught-excluder strip on windows & doors.
- Expanded polystyrene light weight loft hatch.
- Fabric sausage at floor level in bay window.



Quick Wins

- Eco kettle – only boils amount needed.
- Turning appliances off at mains when not using.
- When replacing desktop PC substituted laptop.
- Eliminated tumble drying by using an internal well-ventilated drying space.
- Checking suspect appliances (e.g. electric towel heater) and turning off if not needed.

Energy Efficient Appliances

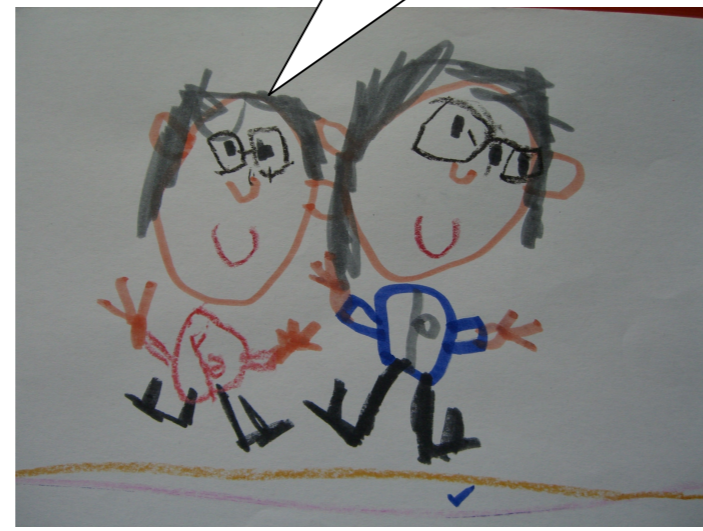
Larger Commitments:

- Replacing a 11 year-old boiler with a modern condensing type (and reducing power rating to 12kW) reduced gas use by more than 20%.
- Replacing separate old fridge and freezer with A++ rated combined unit saves 300kWh per year.
- All incandescent bulbs replaced by either compact fluorescent tubes or LED lamps.
- Extractor fans in bathroom and kitchen replaced with heat-recovery models, to provide trickle and boost ventilation, without wasting heat.
- Replace broken microwave cooker with hybrid cooker, combining microwave with grill and small conventional oven.

Behaviour Changes

'Buildings don't use energy: people do'

Kathryn Janda



Heating

- Thermostat turned down to 18 -19°C, depending on activity.
- Central heating comes on for short morning period and longer evening period, turning off one hour before usual bed-time.
- Turn on heating for a one hour boost when the temperature seems too cool for comfort. Repeat when necessary.
- Wear more warm layers in winter.
- In winter when no solar water heating turn on boiler for a short period before shower etc.
- Short showers rather than baths, to limit the amount of (hot) water used.

Kitchen

- Using oven efficiently by cooking several dishes at a time.



- Experimenting with heat-store cooking.
- Using washing machine on low temperature setting (30°C).



- Eliminated tumble drying by using an internal well-ventilated drying space.

Water

- Replaced bath with shower with low-flow shower head.
- Dual-low flush toilet in refurbished bathroom.
- Use shower timer to reduce wastage.



Monitoring

- One of the most important actions (in our view) is to monitor energy use and changes.
- We record meter readings once a week and also measure temperatures inside and out.
- This gives us a good view of what changes made improvements to energy efficiency (and discourages backsliding....)

Future Plans

- Add more Spacetherm insulation to ground floor when refurbishment needed.
- Insulate solid concrete floor in kitchen and use warmer tiled flooring.
- Rainwater use for garden & toilet flush.

A Future Carbon Neutral House?

- The existing PV panels produce more electricity (~ 50kWh) in a year than we use.
- So we are carbon negative on electricity.
- In a normal year (i.e. one with an average winter) we use less than 4000kWh of gas energy (~ 0.7 tonnes CO_{2e})
- An air source heat pump could produce *all the annual heat energy we need from just 1000kWh of renewable electricity*, to make us carbon neutral.
- ***We are looking for roof and wall spaces to install more PV panels.***