

CONNECTING LOW CARBON GROUPS ACROSS THE COUNTY

Low Carbon Warwickshire Network Newsletter

March 2021 Issue 4 - Technical Appendix

The Low Carbon Warwickshire Network aims to connect low carbon groups across the county, sharing ideas and stimulating and supporting new activity. Although primarily rural in focus, we exclude no one.



<https://www.harburyenergy.co.uk/warwickshire-low-carbon-network>

Technical Appendix – Monitoring Home Energy Consumption and Using Heating Degree Days

By Keith Sinfield

Tracking Energy Consumption Changes

Keith Sinfield's experience of using Heating Degree Days

Energy saving measures and tracking corresponding changes in consumption. Since first becoming a homeowner in the early 1970s, I have taken a keen interest in my utility bills and corresponding consumption figures – I trust I'm not alone in this! Later, however, this developed into an interest in implementing energy saving measures to reduce consumption save money and 'save the planet'! One winter to the next, however, temperatures can vary significantly, making it difficult to decide whether a consequent change in energy consumption is down to the weather or because of the extra insulation you might have added.

Heating degree-days (HDD). What is needed is a way of normalising energy consumption figures to remove the influence of temperature variations. This can be achieved by using, what are known as, 'heating degree-days' (HDD) - these provide a measure of the severity and duration of cold weather and allow energy use to be expressed as a function of that measure, and are defined thus: -

$$HDD = \sum ((\text{base temperature} - \text{average outside temperature}) \times \text{number of days})$$

Figure 1, below, provides a graphical explanation of this. The base temperature is regarded as the temperature above which a heating system would not be required to operate. Outside temperatures above the base temperature are counted as zero – hence the plain, none cross-hatched, area in Figure 1 is discounted.

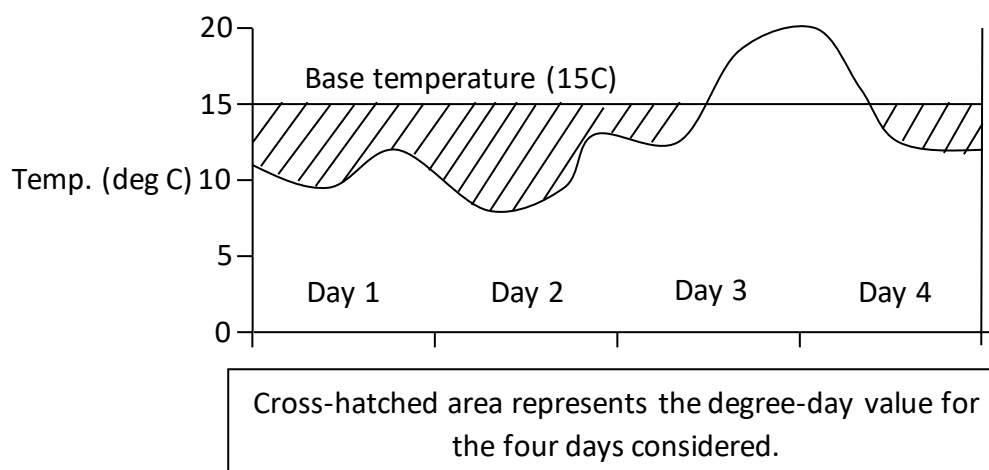


Figure 1 - Heating degree-day calculation.

Obtaining HDD data. This is freely available, on-line, for the various weather stations dotted around the UK and it is simply a matter of selecting the station nearest to your position. I am lucky enough to have a weather station located in our parish of Church Lawford, so it couldn't be better. As an example, Figure 2 shows an extract of HDD data recorded at the Church Lawford weather station for the year 2010. Note that the data is calculated for a base temperature of 15.5C; this base temperature is in general use for most buildings, a base temperature of 18.5C would be used for hospitals. For my purposes I needed HDD for complete years, this was obtained simply by summing the data for the quarterly periods in each year.

Using HDD data. Next, I collected gas consumption data for the years in question. Originally, when compiling my consumption figures, I needed to convert the gas metered cu. ft. to kWh, however, the Smart meter monitors now show consumption in kWh directly. Finally, we can now normalise the gas consumption figures by dividing them by the HDD data, to obtain kWh/HDD, thus relating energy consumed to prevailing weather conditions, the result is plotted in Figure 3.

Description: Celsius-based heating degree days for a base temperature of 15.5C			
Source: www.degree-days.net (using temperature data from www.wunderground.com)			
Accuracy: Estimates were made to account for missing data: the "% Estimated" column shows how much each figure was affected (0% is best, 100% is worst)			
Station: Church Lawford, ENG, GB (1.33W,52.36N)			
Station ID: 3544			
QUARTERLY HDD			
Month starting	HDD	% Estimated	
01/06/2010	60	4	
01/07/2010	19	3	
01/08/2010	49	3	
01/09/2010	79	3	147
01/10/2010	173	3	
01/11/2010	321	4	
01/12/2010	496	4	990
01/01/2011	369	3	
01/02/2011	255	3	
01/03/2011	283	4	907

Figure 2 – Weather station heating degree-day data.

In Figure 3, the various energy saving measures we have taken are indicated, showing the effect they have had. In some cases the effect on consumption is not immediately apparent, for instance, when the work was done in the summer the effect would not be noticed until the winter of the following year. I believe that other fluctuations might have been caused by changes in behaviour.

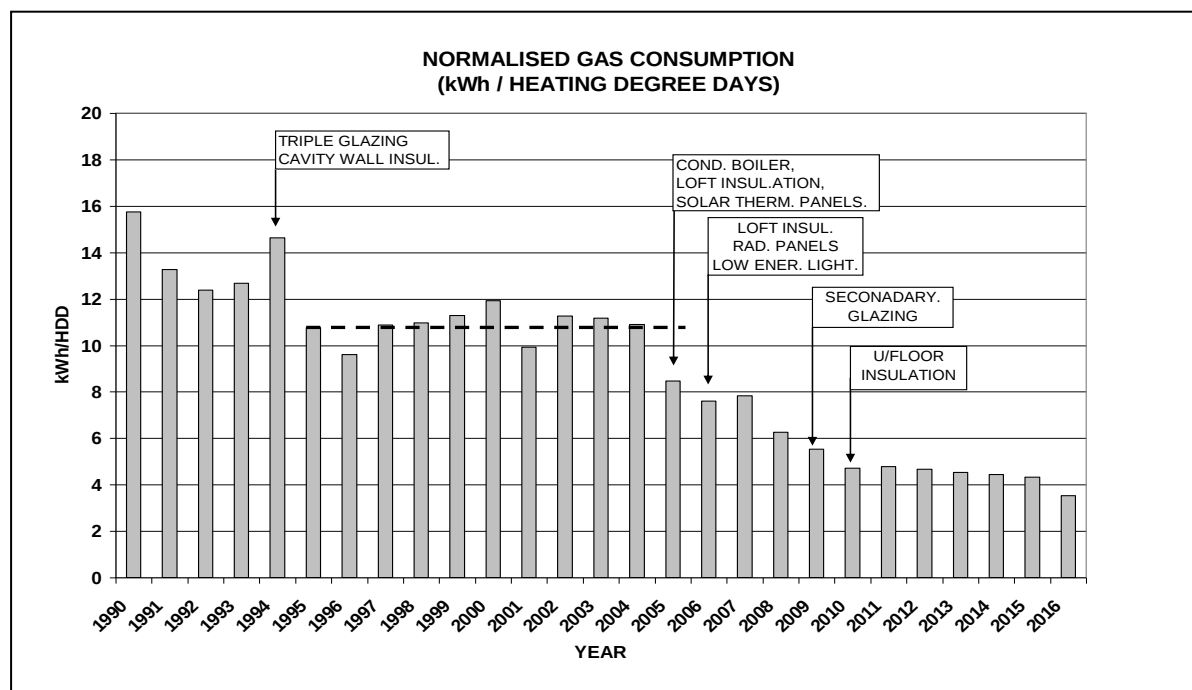


Figure 3 – Normalised gas consumption.

The example I have given is by no means the only way in which HDD data can be used. For those wishing to delve more deeply, I refer you to the Carbon Trust publication: 'Degree days for energy management – a practical introduction'.

[degree days for energy management carbon trust.pdf \(sustainabilityexchange.ac.uk\)](http://sustainabilityexchange.ac.uk/degree-days-for-energy-management-carbon-trust.pdf)

Would you be interested in continuing a conversation or have any questions about any aspect of monitoring home energy consumption and using Heating Degree Days to track progress?

If so email lowcarbonworks@gmail.com and we'll put you in touch with Keith.