

3 Energy Management

The following chapter concentrates on the management of energy consumption and the tools that can be used to assist in this task. The latest concept of ‘degree days’ will be discussed and how to make use of this information will be considered, illustrating the text with real examples. Important short- and long-term measures will be discussed along with a suggested action plan including the importance of training. Finally measurement, without which no control can be achieved, will be addressed and again real examples will be used to show how to get the best results from the different techniques such as half-hour data and automated monitoring and control.

3.1 Degree days

3.1.1 Introduction

Essentially this subject focuses upon quantifying, monitoring and controlling the amount of energy used for heating any controlled set of buildings, offices, or factory complex. The cost of this energy is readily obtained but how do we determine if the heating system is under control, or whether we are using more energy than is necessary for the task. Additionally, when we make changes how do we monitor any improvements that we may make? What happens if the weather becomes warmer and less energy is used as a natural course of events? Any changes that have been made will then be lost because of the change in demand for heating within the building.

Using degree days enables a comparison to be made between any changes that have been implemented, eliminates weather factors thus helping to observe trends in energy usage and assists with the budgeting of expenditure on heating energy.

3.1.2 Definition of Degree Days

Different types of degree days can be obtained and used for a variety of applications. There are ‘heating’ degree days, ‘cooling’ degree days, and ‘growing’ degree days, and

the names give a good indication of their potential usage. Whilst all are of interest and can assist in the objective of reducing energy consumption, it simplifies matters to limit this section to a definition of heating degree days.

Degree days (heating) are a means of quantifying the expected demand for heating of, for example a building, dependent upon the prevailing weather conditions. Thus, a high figure for degree days would imply a high demand for heating energy, and a low figure would mean less demand. Obviously the nature of the building, its insulation efficiency, occupancy, and heating efficiency will all influence the energy demand. However, degree days are based upon different levels of, what are known as base temperatures. The base temperature being the temperature at which the building does not require any additional heating beyond what is supplied by its occupants and their computers and so on. Obviously all buildings are different but it has been found that certain base temperatures can be used to cover most buildings. This is discussed more fully in the next section.

Degree days are in fact the summation of the temperature difference below the base temperature multiplied by the time at that temperature. Thus, if the temperature remained constant at 14.5 °C for a whole day then the degree days, on a base temperature of 15.5 °C, would be one degree multiplied by one day, effectively one degree day. In reality the actual ambient temperature will vary considerable during the course of a day but this can be accommodated by taking temperature readings every hour, multiplying the difference below base temperature by one twenty-fourth and then adding the 24 results to give the degree day for that day. These degree days can then be added over the course of a month and a figure arrived at for degree days for that month. The monthly degree days are in fact the most commonly quoted and used figure.

An excellent and more detailed definition of degree days can be found by going to the website *Degreedays.net* and then the 'knol' by Martin Bromley. [1]

3.1.3 Obtaining Degree Day data

Historical degree day data can be obtained from a variety of sources, but before discussing the sources it is important to understand some of the variants that can occur in the type of data that is available.

3.1.3.1 Base Temperature

One of the most common base temperatures used is 15.5 °C (60 °F) which applies fairly