

Collector Efficiency

A comparison of efficiency curves for collectors employing absorbers with selective or non-selective surfaces is shown in Figure 9.

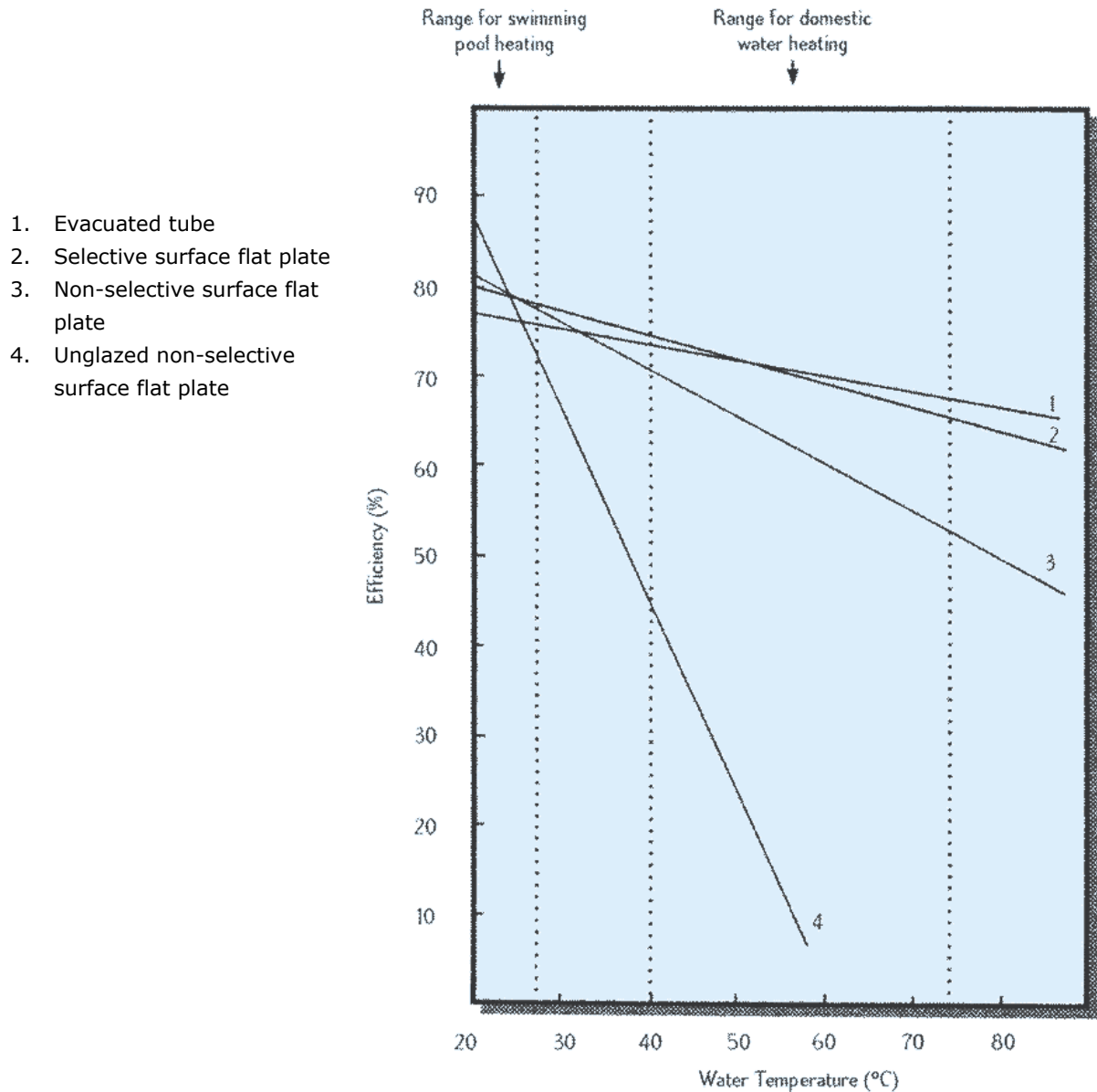


Fig. 9 - Efficiency Comparison Curves

The different types of collector vary in their efficiency of collection of solar energy.

At low water temperatures the efficiency of all the collector types is similar. As the water temperature rises all collectors show a reduction in efficiency of collection. This is a result of an increase in radiation losses.

As would be expected the unglazed swimming pool collector loses efficiency most rapidly. Nevertheless over the temperature range it is designed to operate in, it is extremely efficient.

Of the glazed collectors, designed to operate at domestic hot water temperatures, the simple single-glazed flat plate collector with a non-selective black painted absorber surface loses efficiency most rapidly as the temperature in the system rises. The evacuated tube collectors are the least sensitive to system temperature increases. Over the normal domestic hot water solar system operating temperatures, however, there is little difference between selective surface flat plate collectors and evacuated tube collectors.

Too much emphasis should not be placed on laboratory generated solar collector efficiency tests as, by their nature, they are very unrepresentative of real operating conditions.

As has been noted in Guidance Notes, monitoring of real systems has shown that all types of domestic hot water solar collectors will work at all times of the year and will, if sized correctly, give similar results in terms of hot water delivered.

The lower efficiency of some collectors in a domestic solar hot water system therefore is not necessarily of prime importance. As all the collector types are capable of raising water temperatures to well above those required for domestic use, a suitable area for all collector types can be chosen to meet the customers requirements and expectations.

If the lowest efficiency collectors are chosen this may entail installing an additional 30% of collector area compared with using the most efficient collector. However since the total collector panel area of a domestic system is small, this increase can usually be readily accommodated.

Efficiency increases in collector performance are generally accompanied by an increase in unit area prime cost. This can be reflected in an increase in overall installed system cost. The type of collector chosen therefore can be influenced as much by system installed cost or even appearance as by efficiency.

Collector Energy Output

It is important to be aware of the amount of energy that can be generated by a solar collector. Solar panels under clear sky conditions particularly in late spring, summer and early autumn are quite capable of boiling water. In stagnation, that is when no heat transfer fluid is flowing through the collectors, or they are empty, selective surface solar collectors can attain temperatures of 160 - 180°C.

A crude estimate of the output of solar collectors can be obtained from the efficiency curves shown in Fig 9.

At system water temperatures of say 60°C the efficiency of selectively surfaced solar collectors is approximately 70%. If we say that radiation levels on a very clear cloudless summer day when the Sun is high in the sky may be 1000 watts / m² at ground level in the UK, then each square metre of solar collector will be generating 0.7 kilowatts. A typical 4m² flat plate solar hot water system, therefore, is capable of generating 2.8 kilowatts under these conditions. More realistically because of pollution in the atmosphere ground level radiation is likely to be no more than 850 watts, when system output would be 2.38 kilowatts.