Applications in Other Countries

FRANCE - The Centre National de Recherche Scientifique (CNRS) (39,40,41)
The French solar housing research programme started in 1956 when the 'Trombe wall' principle was first patented. It is interesting to note the similarity between this system and that described by Professor Morse a hundred years ago (42). The basic principle is that thermally massive south facing walls, usually made of concrete, are painted black, or some other relatively heat absorbing colour such as red, dark green, or dark blue, and covered with glass on the outside, leaving an air gap between the wall and the glass. The wall is both a heat collector and a heat store. As solar radiation passes through the glass it is absorbed by the surface coating which heats the wall. As the long-wave re-radiation from the wall is trapped behind the glass, the air between the wall and the glass becomes heated. Ducts at the top and bottom of the wall allow the heated air to be fed into the room at ceiling level, while the colder air from the floor is drawn in at the bottom, as shown in Fig. 4.14. For summer cooling, the valves at the top of the wall are arranged to vent the heated air to atmosphere and the valve at the rear of the building, at ceiling level, is opened to allow cooler air to flow through. The walls are typically 300 mm to 400 mm thick. It would be possible to have other heat storage systems within the walls, such as water tanks or change-of-state chemical storage. The prototypes at Odeillo were aesthetically unattractive because they were poorly insulated and had very small south facing windows. In the latest designs the ratio of collector area to volume of the house is 0.1 m^2 per m^3 and it is now quite difficult to distinguish between the solar collectors and the windows. The latest house has been described as having the general appearance of a classical dwelling.

Fig. 4.14. Trombe Three-Unit Dwelling

The French estimate that between 60 and 70% of the heating load in Mediterranean climates, such as at Odeillo, and between 35 and 50% in less favourable climates, such as Chauvency le Chateau, Meuse, can be provided by this system. The main lessons which can already be drawn are as follows:-

(i) There are no problems of mechanical resistance to flow as with conventional roof-mounted water heaters.

(ii) There are no leakage problems.

(iii) There are no problems associated with freezing.

The latter consideration is probably most significant for the UK, but although in temperate Northern European countries a slightly greater percentage of the available solar energy lands on a vertical south facing surface in mid-winter, the scarcity of direct radiation or sunny winter days is a distinct disadvantage.

GERMANY - The Philips Minimum Energy House (43,44)
An analysis of the energy consumption in the Federal German Republic showed that about half was in the form of low temperature heat, defined as heat available at less than 100°C. The major part of this low grade heat was used in the private sector for heating buildings and providing hot water - a pattern broadly similar to that in many Northern European industrial countries. The Philips research programme concentrates on this area and has identified the measures which can be taken to reduce the consumption of conventional sources of energy into four groups as follows:-