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THE ENERGY PERFORMANCE ASSESSMENT PROJECT

Phil Dolley of ETSU reports on research aimed at reducing energy consumption through carefully considered building design.

About half of the primary energy used in the UK is consumed in servicing buildings. While this can be reduced through well-known measures such as better insulation, a parallel approach aims at enabling buildings to make full use of the sun's freely available heat and light. Manipulating the form and fabric of a building so it can better utilise solar gains for heating, lighting or ventilation has come to be known as passive solar design.

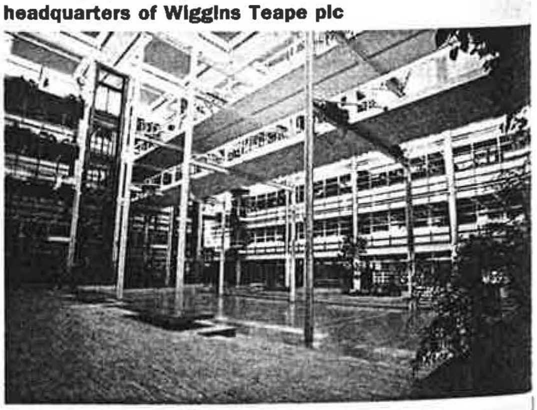
A number of benefits have been claimed for passive solar design. These range from energy saving through to enhanced natural environments. In 1985, the then Department of Energy established the Energy Performance Assessment (EPA) project to undertake field trials. These focused on the energy performance and occupant issues relating to buildings incorporating passive solar principles. The ultimate aim was to improve understanding and so accelerate uptake of low-energy and passive solar design. The project was completed in 1992; the core of the work was carried out by Databuild Ltd of Birmingham and the Welsh School of Architecture, University of Wales.

So that the results would be credible and acceptable to designers, developers and other members of the construction industry, time was taken to develop a robust methodology capable of being applied to a range of designs in a variety of geographical locations. This was structured around the principle that, for a design to be successful, it needed to save energy, to be economic to construct and, throughout the seasons, to provide an environment acceptable to building users. The methodology involved a series of interconnected components, variously devoted to monitoring the energy flows in the building, the physical environment, occupants' feelings and the way occupants used the available controls.

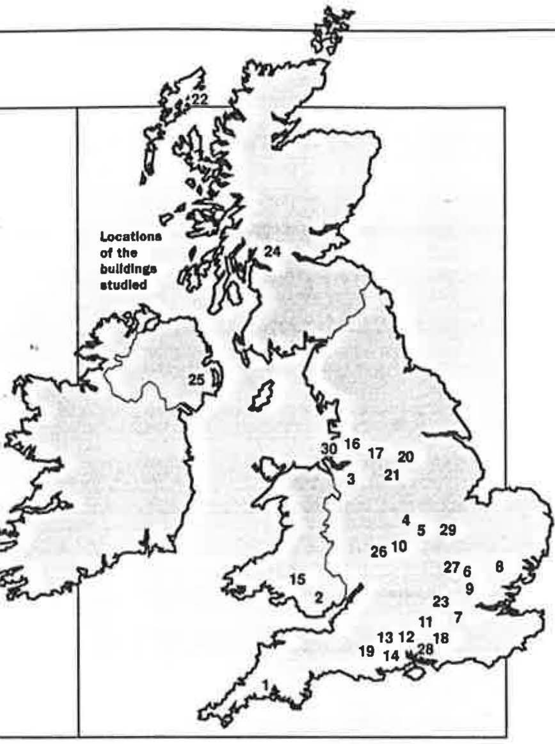
Each case study building was monitored for up to 18 months. Some 15 domestic and 17 non-domestic buildings, ranging from a community hospital in mid-Wales to Local Authority housing in Glasgow, were monitored. In addition, each building's costs were assessed to evaluate how they compared to other buildings in the relevant market sectors.

In comparison to traditional buildings in those sectors, most of the buildings

Gateway II, Basingstoke – headquarters of Wiggins Teape plc



Report No.	Building Name
1.	Looe Primary School
2.	Copper Beach House
3.	JEL
4.	SSWC
5.	Solar Cottage House
6.	Solaire House
7.	Spinney Gardens House, Crystal Palace
8.	Nabbotts Junior School
9.	St. Michael's Close, Harlow
10.	Oak Farm Road House, BVT
11.	Gateway II, Offices
12.	Netley Junior School
13.	John Darling Mall, Rehabilitation
14.	Warsash Engineering Workshops
15.	Ystradgynlais Community Hospital
16.	Cedar Grove, Willow Park, House
17.	Dawbank, Willow Park, House
18.	Brune Park Sports Hall
19.	Mountbatten Sports Hall
20.	Wakefield House
21.	Sheffield House
22.	MacDonald Road House, Stornoway
23.	Hasbro-Bradley, Multi-national H.Q.
24.	Edderton Place, Refurbished Flats
25.	Warmhome, House
26.	Christopher Taylor Court, Flats
27.	Cockerell Grove, House
28.	Netley, Police H.Q. & Training Centre
29.	Albert Hall, House
30.	Brittania House, Offices



studied had a better energy performance; most also compared favourably with buildings designed according to alternative low-energy principles. Typically, in the houses studied, 25% of the heating requirement was met from solar gains. For non-domestic buildings, it is less easy to make a general statement because of the range of building types studied. However, there were notable cases which stand out as examples of what can be achieved.

Gateway II in Basingstoke, a naturally ventilated office building with an atrium and a gross floor area of 11,000m², housed 490 people without recourse to air conditioning. With an annual energy consumption of 190kWh/m², its heating/cooling load compared very favourably with typical figures for the sector of 270kWh/m², and without the expense of air conditioning plant. The building also met with a favourable response from the occupants.

Despite being 'open to the sun', few of the buildings overheated and most were comfortable at all times of the year. Although the distribution of temperatures in the buildings was wider than is usually found in artificially conditioned environments, few complaints were received. Where overheating did occur, the problem was usually relatively easy to rectify.

Increasing or manipulating the flow of daylight within a building has two potential benefits – a reduction in the need for artificial lighting, and the enhancement of environmental comfort for the occupants. In many of the cases where the designers had tried to use daylight in this way, they had been successful. However, there were examples where insufficient understanding of how daylighting works had led to an uneven distribution of light and some instances where glare was a problem.

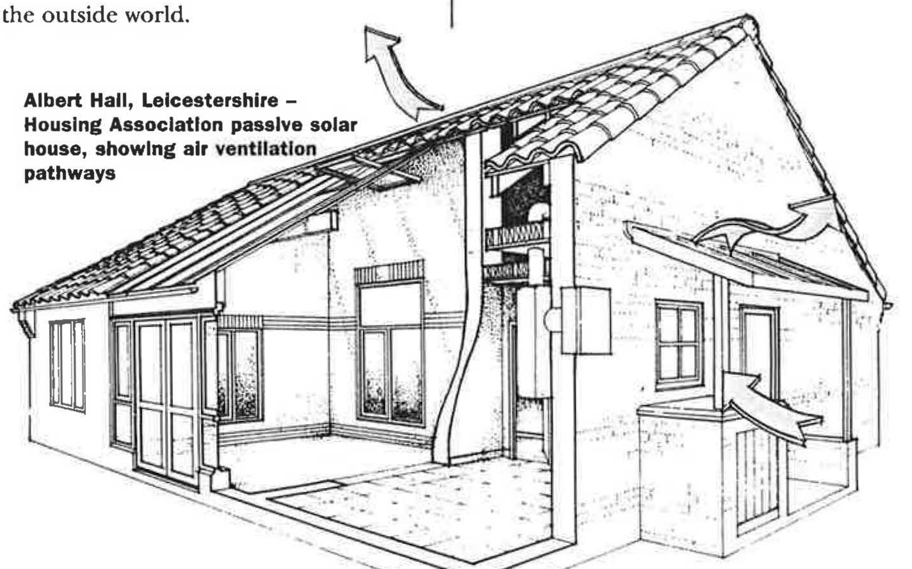
Few of the people who took part in the studies mentioned the energy benefits of passive solar design. Instead most cited benefits such as the pleasure of occupying the comfortable, light and airy environments, or pointed to the naturalness of the buildings and the sense of contact made possible with the outside world.

Results demonstrated that passive solar design can be implemented at a cost comparable to more traditional design. Combined with the often reported increase in amenity, the low-energy passive solar buildings offer an attractive alternative design philosophy.

The EPA project has yielded a number of important lessons:

- if used properly, passive solar principles are applicable throughout the UK
- daylighting is applicable to many non-domestic buildings, where lighting loads can be brought down to as low as 6W/m²
- natural ventilation has been shown to be effective in commercial buildings where formerly only air conditioning (which is expensive to install and operate) would have been considered
- the assessed buildings were exemplars of their time designed without input from the DTI's Passive Solar Programme; with the additional knowledge now available from the Programme, designers could be expected to produce even better buildings today
- the project succeeded in drawing together various research strands into a form of comprehensive building appraisal, with considerable value for the future evaluation and evolution of low-energy buildings in the UK.

For further information on the EPA project and the reported studies, contact the Renewable Energy Enquiries Bureau (see p.2 for address and telephone number).



Albert Hall, Leicestershire – Housing Association passive solar house, showing air ventilation pathways