

# LOW ENERGY INDUSTRIAL BUILDINGS

*Industrial buildings form a major component of the new buildings constructed each year in the UK. Reducing energy requirements in this building category can therefore make a real impact on the national fuel bill.* Paul Ruyssevelt of Halcrow Gilbert Associates reports on results from a group of design studies managed on behalf of the Department of Energy.

Encouraging results have been obtained from a group of design studies, commissioned by the Department of Energy, to explore the energy savings which might be achieved by applying low energy design principles to industrial buildings. The designs considered all relate to premises for businesses requiring light industrial assembly/workshop space together with some office accommodation.

In each study a real client produces a brief from which an architectural practice designs an attractive low energy building. The architects are

encouraged to achieve low energy targets by placing particular emphasis on daylight, natural ventilation and solar heating. The design automatically incorporates sensible energy efficiency measures such as insulation and efficient building services.

At various stages during the evolution of the design its energy and environmental performance is assessed with the aid of computer simulation and the capital cost estimated using traditional quantity surveying techniques. This iterative process provides the architects with feedback which helps them to develop and

optimise their designs. Each final design is written up into a case study report which forms the documentary basis for information dissemination.

## Clients and Architects

The light industrial building sector spans a broad range of building uses and budgets. At the bottom end of the market there is the low cost 'shed' providing serviceable accommodation without architectural excitement. At the other extreme is the bespoke factory for an image-conscious manufacturer where the budget allows the architect scope to produce a 'landmark building'.

Of the three designs presented here, the lower end of the market is represented by a building for English Estates, who successfully sell or let inexpensive buildings in areas of the country where others find development difficult. This design study, undertaken by the ECD Partnership tackled the difficult challenge of producing a low energy solution within a very tight budget.

The other two designs were for owner

*Savings can be achieved for little or no additional capital expenditure*

occupiers and represented the mid to high range of the market. One, designed for Graphex Industrial Art by Ryder Nicklin Partnership, was a factory for producing exhibition material. The second was a furniture assembly facility designed by Jestico & Whiles for SunarHauserman, suppliers of high quality office furniture. Although the higher cost budgets for these two buildings allowed greater flexibility the architects still faced the challenge of integrating suitable technological solutions with the aesthetic qualities required in the design of prestigious buildings.

## A Speculative Industrial Building

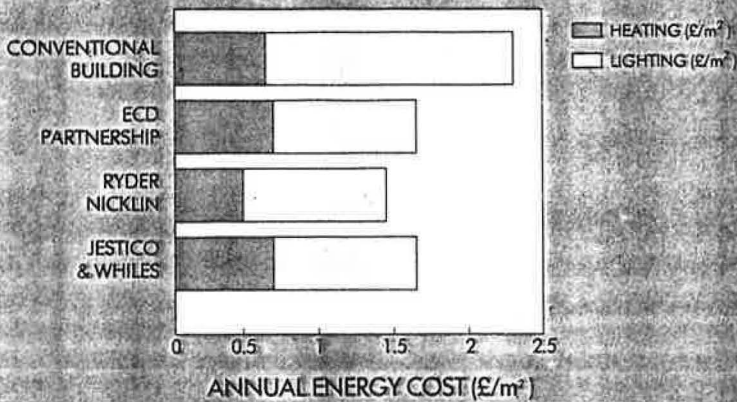
The ECD Partnership design for a speculative light industrial building for English Estates illustrates how an attractive low energy solution can be

**ESTIMATED CAPITAL COSTS**  
(£/m<sup>2</sup> gross internal floor area)

Client	English Estates	Graphex	SunarHauserman
Architect	ECD Partnership	Ryder Nicklin	Jestico & Whiles
Design	£338	£412	£450
Conventional Building	£332	£416	£485*

\*Client budget, conventional building not costed for comparison

### PREDICTED ANNUAL ENERGY COSTS



achieved with minimal additional cost. The estimated cost of the design based on late 1987 prices for an outer London location is £338/square metre, and is only 2 per cent more than a conventional building designed to a similar brief. By comparison with the conventional building the ECD design shows an overall saving in annual energy costs of 30 per cent. This significant reduction in annual energy costs has been achieved by exploiting daylight to displace artificial lighting - through careful sizing and location of double skin rooflights in the workshop area and thoughtful design of windows in the office areas. By locating the offices on the north side of the building the need for potentially expensive solar protection is avoided and the risk of summer over-heating is significantly reduced.

English Estates were very pleased with the outcome of the study but recognised that elements of the design would need to be developed in more detail in order to ensure viability. Recognising the wide range of potential tenants and owners for their buildings, they felt that this design approach could best be employed in developments where the type of building occupant was identified at the outset.

#### Factories for Owner Occupiers

A dominant feature of the Ryder Nicklin design for Graphex Industrial Art is the 'responsive roof'. This consists of rows of 'Toblerone' shaped rooflights. A reflective roller blind suspended under the south face of each rooflight responds to variations in sunshine and temperature. The design allows daylight into the building whilst avoiding excessive overheating. As in the ECD building, the offices are located on the north side.

Comparisons with a similar building owned by the same client revealed savings in the estimated capital cost of 2 per cent and in the total energy costs of 36 per cent.

In responding to the design, the client stated that 'the advantages of daylight together with a view of the outside world cannot be overestimated. The design seems to offer ample opportunities to create an excellent working environment'. Graphex were 'very impressed' with the annual energy cost savings which amounted to some £2,150.

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The SunarHauserman building has three distinct areas - offices, assembly shop and warehouse. Each area is designed to have an environmental responsiveness appropriate to its functional requirements. The offices, where the occupants perform sedentary tasks, take advantage of solar gain and

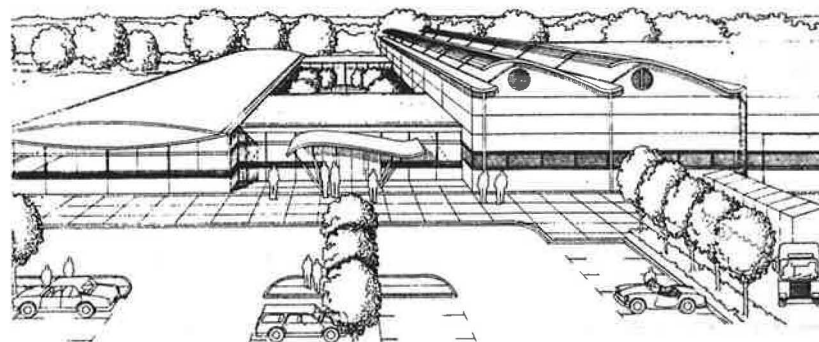
offer a view to the outside. Shading devices which add interest and articulation to the facade prevent summertime over-heating, while lightshelves in the south facing offices help distribute daylight evenly. The assembly shop, where the occupants perform more energetic work and require uniform overhead lighting, is daylight by south facing rooflights over which louvres are suspended to form a curved shading element. The warehouse is used to store light sensitive fabric, so here the glazing was limited to small windows for view only.

A courtyard divides the offices and assembly shop, allowing daylight to enter an otherwise deep plan office and offering a welcoming outdoor recreation area.

The single storey office accommodation results in a higher exposed surface area than the conventional two storey approach and gives rise to increased heating requirements. This increase is offset by the 60 per cent saving in lighting achieved by the automatically controlled lighting system. The capital cost of the building is relatively high at £450/square metre, but 'reflects an excellent investment .... and could be funded by normal financial institutions' - according to SunarHauserman's Managing Director.

#### Conclusions

These studies demonstrate that significant energy cost savings are attainable in modern industrial building designs. What's more - these savings can be achieved for little or no additional capital expenditure. When questioned, the clients and architects involved confirmed that the experience had been very informative and that in future they would give greater consideration to the energy and environmental aspects of their buildings.



Artist's impression of SunarHauserman building designed by Jestico & Whiles