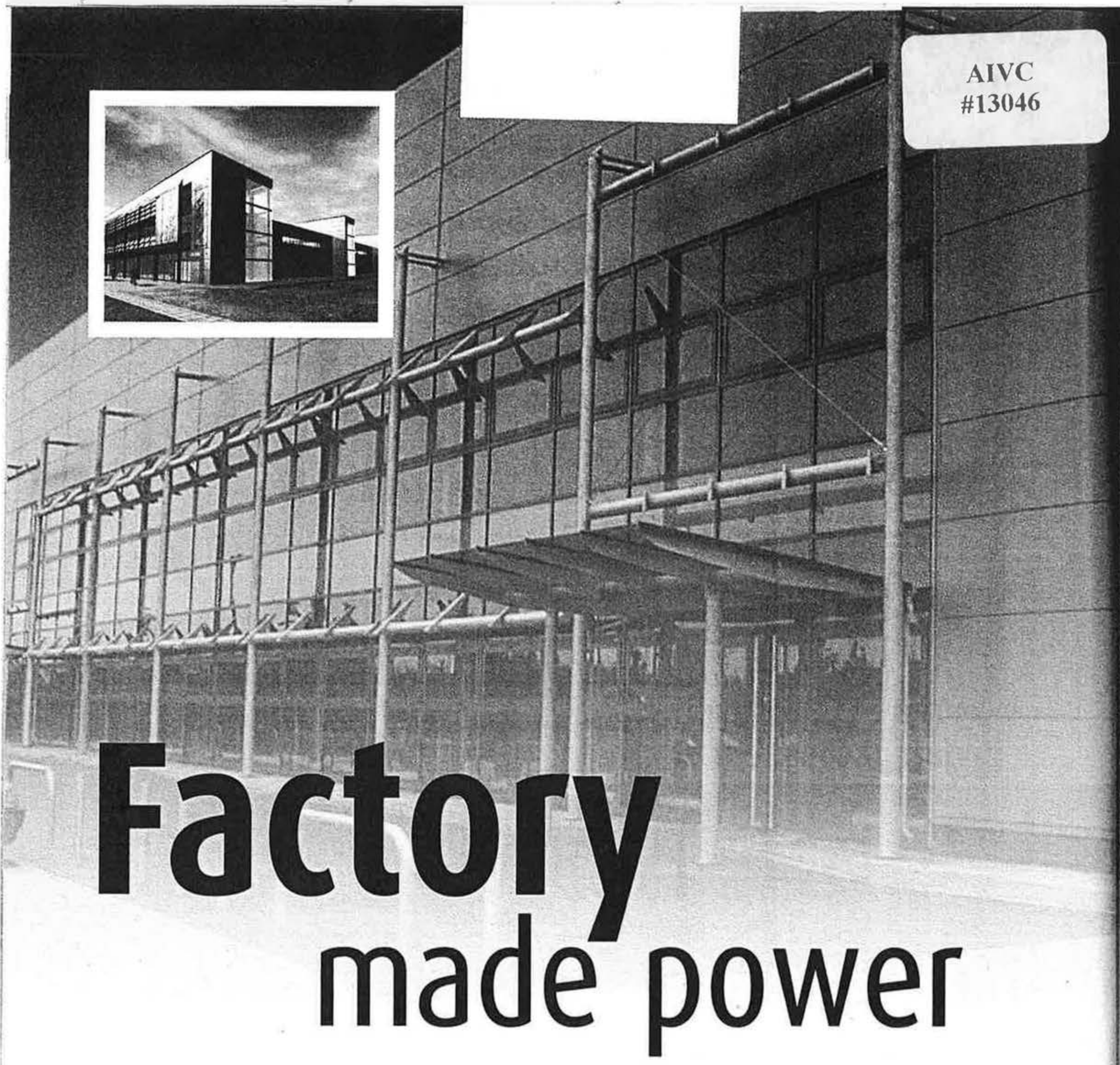


Factory made power

Heavy industry in the UK may be on a downward spiral, but light manufacturing is springing up in its place. Can the structures housing these industries have less impact on the environment?

BY ALISON LUKE

Baglan Bay in South Wales is a typical UK industrial area: a dense mix of petrochemical, steelworks and heavy manufacturing plants sprawling along the coast. The development of the area was also typical, until the local council and the Welsh Development Agency (WDA) stepped in.

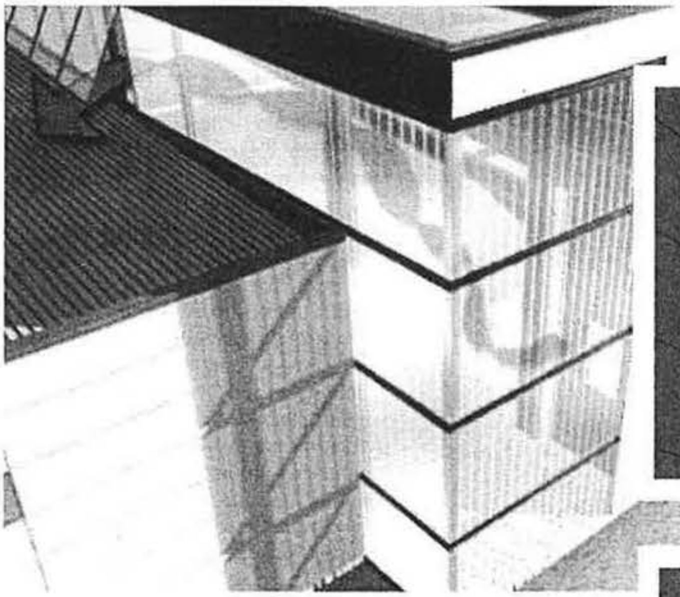
With the region suffering from a drop in heavy manufacturing, there has been an inevitable rise in light manufacturing industries. Companies are tempted by the ready availability of labour and speculative buildings erected in an attempt to stem rising unemployment. These units were built to the same blueprint, the principle aim being to attract jobs quickly, and little attention was paid to their energy consumption. Until now.

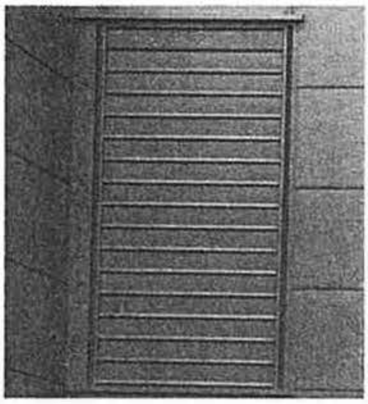
The closing of a BP refinery in Baglan Bay meant a large area of brownfield land was available for redevelopment. With no immediate tenants for the site, clean up and development was down to Neath Port Talbot County Borough Council and the WDA, who grasped the opportunity to change the design and operation of the factory units it used, and prepared a master plan for a 250 ha low energy industrial park.

The Borough Council successfully applied for funding from the Energy Challenge Fund (a Welsh Development Office scheme), receiving a grant of £2.5 million to design and construct the first unit. The brief stated this should be an 'eco-factory', the site's flagship unit and should achieve an 'excellent' BREEAM rating.

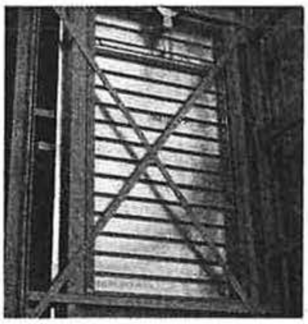
At the same time, BP donated £100 000 of photovoltaic panels for use on the unit: a BP Solar demonstration office faces the site and the company saw this as appropriate for further demonstration of use and "to give something back to the community".

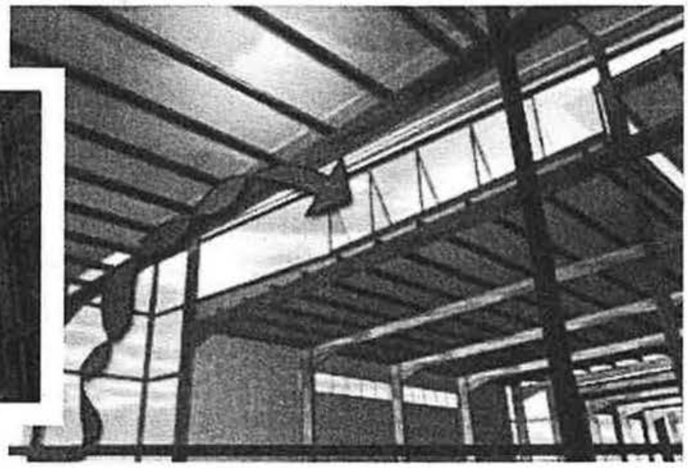
With the project being carried out in-house by the Council, it approached Cardiff University's Welsh School of Architecture for





LEFT: Externally, the ventilation louvres blend discretely into the sides of the 'pop-ups'.
BELOW: The natural ventilation strategy viewed from inside the production area showing the use of the high roof level windows for extraction of used air.





ABOVE: The factory's natural ventilation strategy at the design stage. Note the full glazing of the 'pop-ups', this was later reduced on cost grounds.
RIGHT: A ventilation louvre viewed from inside the production area.

help with the concept design and to act as BREEAM consultants. Phil Jones and Wayne Forster of the university's Design Research Unit (DRU) carried out the design process.

The design process

With the site mapped out and the production area set at 3400 m², Jones and Forster used the standard WDA factory unit first, as a starting point to determine the optimum orientation of the building for the site conditions and factory requirements.

After establishing a north-south orientation, the team turned its eyes to Europe for inspiration. The UK has lagged behind mainland Europe in building low energy, BREEAM-approved factories, so more examples were available abroad for scrutiny of possible adaptations to the standard design.

As the final tenant was unknown, the amount of space they would require was also an unknown quantity. To ensure flexibility of use the design team decided to allow for multiple tenants, creating an internal space that could be divided equally. This led to the idea of what the design team have termed 'pop-ups' (see inset photograph, above left). These enlarged spaces became principle to the services design, providing a means of daylighting, ventilation and services containment and access. They were also viewed as a means of dividing the main production area.

The possibility of the building being fully supported on the 'pop-ups' was toyed with in an attempt to lower the number of central columns required, and hence increase the working area. This was not possible due to the poor ground conditions on the site, the land being primarily a mix of sand and clay. As Jones says, "You have to go a long way down before you hit anything." This resulted in the final unit needing over 300 piles, which reach depths of over 25 m. There are a few columns in the centre of the internal space, but it is virtually fully open-plan.

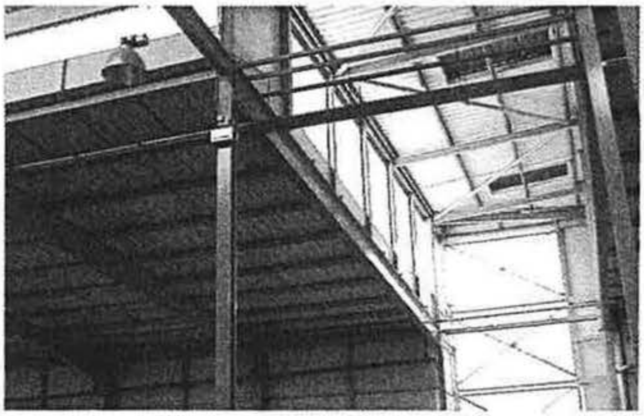
The 'pop-ups' are principle to the servicing, providing a means of daylighting, ventilation and services containment

The design was completed in a relatively short time. It provided an "interesting research through design project" for the Design Research Unit (DRU) which was able to apply its modelling technologies, such as an artificial sky and computer modelling, with scale models being used to confirm and modify proposed features. The final proposals were then scrutinised under the design process for aspects such as cost.

Some features were changed due to cost constraints – proposed side and back windows were lost at this stage and the structural form changed slightly to a more traditional style – however the integrity of the original design was maintained.

Another design idea lost during the pre-construction process include the use of timber, which was more due to politics than cost. The DRU proposed the use of sustainable Welsh hardwood for the main structure, with the possibility of timber cladding. The developers however did not accept this as viable for two reasons: first, it didn't have the high-tech visual impact they desired, but second (and perhaps more important) was proximity to the local steelworks. With the current climate in this industry it was thought insensitive to promote timber over steel.

The resulting steel frame and blue-grey steel cladding was also an area of contention, the



ABOVE: The 87 m x 38 m production area of the factory unit. Note the lack of support columns and the light available despite the lamps being uninstalled. LEFT: Roof level windows are used to increase daylight levels and as part of the ventilation strategy.

developers preferring a green cladding to complete the environmental image. The designers won this argument and the choice turned out to be a sound investment; the cladding is reported to change colour with the weather, giving the unit an ever-changing image. In the evenings external lighting combines to make the unit "glow fluorescent blue".

The final factory unit

The final building consists of the main open-plan production area stretching from a two-storey office area on the south face of the building – an insistence of the developer as this faces what will become the main entrance to the eco-park. An option exists to increase the offices to three storeys; the third floor currently being fitted out simply as a storeroom. Windows are not included on this floor but could be easily incorporated, giving a view across the factory roof.

Having offices on the south elevation brought other issues to the fore, namely solar gains. In order to counter this, the donated solar photovoltaics are being positioned on a galvanised steel frame across the glazed face of the offices rather than on the 'pop-ups' as originally planned, providing shading as well as electricity.

Two basic forms of pv are being installed: amorphous thin film and standard crystalline pv cells. The amorphous pvs will be in two flat panel square screens, one either end of the unit front, with the standard cells on 1·5 m long panels in-between. The square screens doubling as a 'badge' for the building and tenant.

The open-plan office area on the first floor is heated by floor-standing convectors along the single glazed face, counteracting draughts. The ground floor has toilets, a reception and space for a canteen. Low NOx gas boilers are installed for heating and hot water and low energy LG3 Category 2 intelligent luminaires are installed throughout the offices. These are controlled by integral occupancy and daylight sensors.

Mechanical ventilation is provided in the toilets, otherwise all ventilation throughout the production and office areas is natural. In the offices, a row of openable windows runs the length of the glazed wall to enable a fresh air supply. Cross-ventilation is made possible by opening roof-level ducted louvres along the opposite and rear wall of this space. These are user-operated by simple pulling of chains. A 'chimney area' sits above the louvres, acting as a passive stack, sucking the air through for venting at roof level. The 'chimney' sits behind a wall of the upper storage area, with facility left to enable vents to be installed at this level later.

In the production area, ventilation louvres are installed down the north and south sides of the 'pop-ups', with additional units in the roof: these were originally all intended to be vertical louvres but costs meant some were moved to the flat roof of the 'pop-ups'. Rain sensors have been included so the louvres will automatically close if rain begins, however they are uncovered and there is some concern over the airtightness of these units. A pressure test is planned, which should prove the reliability and airtightness of the structure.

A large proportion of the lighting in the production area is provided by daylight, being designed to a minimum daylight factor of 2%. The 'pop-ups' are heavily glazed with blue opaque glass and further windows are included around the central roof area (see photographs, left). Extensive modelling work was carried out on the daylight provision in the artificial sky at the DRU, and the results appear to have been well proven. Despite the day of visit being very overcast and no lamps yet installed, the production space was very light, with the light patterns produced on the floor showing an exact image of those predicted.

Grid connections have been made and the electricity supply taken to distribution board stage, the internal servicing to be completed by the tenant depending on requirements. Secure splitting of the work area is still possible, as access doors are provided on all 'pop-ups'.

Achieving environmental excellence

The 'excellent' BREEAM standard has been achieved, with points lost at only three places: building longevity, due to the absence of low level masonry; location to public transport (while it sits near to Neath railway station there isn't the frequency of trains BREEAM requires); and the inability to see clear external ground views from the production area.

It isn't just the final product that is proving environmentally friendly, the managing contractor Tilbury Douglas Construction has also earned praise for its building methods. The company has a waste management policy; reusing the majority of waste on-site, recycled aggregate, sand to cover foundations rather than polythene, and permanent formwork. This was reported to be part of the contractors standard practice rather than specific requirements of the job and was stated to be based on cost. The company won the contract by tender, but the policies it brought to the job were certainly within the ethos of the site.

No funding has yet been found for a follow up study after occupation and the unit is intended as an example of a different way of thinking and designing, rather than a new blueprint. As Jones states, "There are still lessons to be learnt" and improvements which can be made, especially if it is possible to get involved at an even earlier stage in the design process so features lost in this event, such as a lake, can be incorporated. However the fact that an as yet unnamed tenant has been found is surely proof that this new way of working is acceptable not only to the environmentally-conscious among us, but to industry also – surely a winning combination.

Dear Harold

I'm leaving you. I've tried but I just cannot cope with your obsession for chlorine dioxide any more.

I know that the disinfection and treatment of water systems is really important to you, and that chlorine dioxide is the key to maintaining water quality, but I feel as if it's the only thing in your life that you have ever been truly passionate about.

Chlorine dioxide, chlorine dioxide, chlorine dioxide. It's all you ever talk about. I just don't understand you any more. It's like there's no room in your life for anything else.

When did it all start going wrong? If only you could show a little more interest in other things.. like me, or the children, or even the dog, there might be some hope.

If you ever get the stuff out of your system you'll find us at my Mother's. (She was right about you all along)

love Dierdre

xx

P.S. Your dinner's in the dog!

Vernagene, the only company in the UK that specialises in Chlorine Dioxide. If you need impartial advice about water system disinfection, doesn't it make sense to talk to a company that really knows its stuff?

Vernagene

The Chlorine Dioxide Solution Company

A Division of Verna limited

ref: LBSJ07

To find out more call **01204 529494** or email **harold@vernagene.com** **www.vernagene.com**

► MORE INFORMATION 13