

Delivering buildings that perform

An awards scheme is a wonderful opportunity for a wider appreciation of the imagination and creative thinking and effort that goes into achieving a successful project. CIBSE's Building Performance Awards for 2011 did just that, and we have the details behind some of the successful entries.

Now into their fourth year, CIBSE's annual awards have taken on a change in emphasis in claiming commitment to creating a sustainable built environment. CIBSE president Rob Manning explains, 'For three years, CIBSE held the Low Carbon Performance Awards. We then decided it was time for a slight change of emphasis, and the Building Performance Awards were born. The aim was to make an awards scheme for the whole of the building-services industry.'

Winning an award is a proud moment for the recipient, but what does not have the chance to come across at the event itself is the detail of the entries. To share more of the abundance of ideas of good practice for these awards, we were able to look at the entry information. Here is a selection from the winners of just a few of the categories demonstrating highly effective performance in both new-build and refurbishment projects.

Given the importance of refurbishment in meeting the Government's long-term carbon-reduction targets, it was fitting that the work of the Metropolitan Housing Trust in refurbishing Victorian properties should win the 'Carbon champion of the year award'—and that was in addition to winning the category for 'Client of the year in the public sector'. It is worth reminding ourselves that the majority of the buildings that will exist in 2050 have already been built and that 15% of UK homes were built before 1920 but account for 23% of total notional CO₂ emissions.

Metropolitan Housing Trust has been involved in refurbishing about 60 properties a year for the London Borough of Haringey. Residents are moved into alternative accommodation for 14 weeks while a whole-house refurbishment is carried out. The typical outcome for a mid-terrace house is an annual energy consumption of 164 kWh/m², CO₂ emissions of 2.3 t a year and estimated fuel costs of £457 a year. An EPC of 80 is typically achieved.

The comprehensive programme of work



includes stripping walls back to the brickwork, ensuring high levels of insulation, double glazing windows, replacing the roof, replacing gas central heating with A-rated condensing combi boilers and low-energy light fittings. The result is well beyond the Government's Decent Homes Standard.

The programme is funded mainly by Metropolitan Housing Trust, with top-up grant funding if it is available. As experience has been gained, the cost of £55 000 per home has been reduced to £43 000 per home.

These refurbishments have resulted in a noticeable reduction in maintenance costs.

More adventurous work included looking at how to integrate micro-generation technologies into refurbishments. One project includes solar PV panels, which has halved the energy bill. The Feed in Tariff and other mechanisms to improve the cost effectiveness of micro-generation is encouraging MHT to explore the wide use of such technologies.

The judges comments, 'Refurbishment is a huge challenge, and their entry is a significant demonstration of what can be achieved by a relatively small organisation with the commitment and determination to make a real difference.'

Demonstrating just how effective a commercial refurbishment can be in reducing

carbon emissions and retaining much of the embodied energy of the original construction is Hampshire County Council's Elizabeth II Court in Winchester. The achievement of consulting engineer Ernest Griffiths won the category for 'Refurbishment project'.

Tried-and-tested techniques were used, as reflected in the judges' comments: 'This has a simple structure and has used technology where appropriate. It offers sensible solutions without gilding the lily.'

This poorly performing 1960s office building has been transformed into a modern and efficient working environment with modern office equipment, including a major data centre, whilst reducing its carbon consumption by 70%. The 12 600 m² building has been awarded a BREEAM 'Excellent' rating and is said to be well on the way to meeting the Government's 2050 target for carbon reduction.

CO₂ emissions have been reduced from 90 kg/m²/year to a targeted level of 39 kg/m²/year. The building team is confident that over time emissions can be reduced to 30 kg/m²/year, perhaps even lower. The project is being used by the Carbon Trust as a case study to evaluate the reductions in carbon emissions that can be achieved through refurbishment.

Re-using the concrete frame saved 50% of the embodied energy normally required to construct a building. A large proportion of the demolition materials were recycled through the contractor's supply chain, including pre-cast concrete cladding panels being crushed off site and used as aggregate in other projects.

Noise levels from traffic means that windows cannot be opened on street-facing elevations. This problem has been addressed by a natural-ventilation solution that draws air from internal courtyards across the floorplates to be expelled through ducts or 'chimneys' along the street facades. The ducts have wind troughs at the top that use the wind to create suction to draw air across the floorplates.

Mechanical ventilation is used to support the



Excellence in commissioning — the Midland Co-operative Society store at Oakham.

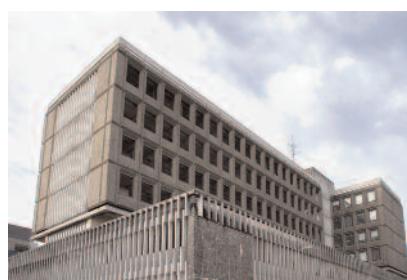
natural ventilation in areas where CFD modelling and wind-tunnel testing at Cardiff University indicated it would be needed. Back-up air when it is necessary to keep windows closed is provided by local air-handling units via swirl diffusers in the floor.

Some areas are mechanically cooled where natural ventilation is not sufficient by a heat-recovery VRF air conditioning system. Mechanical solutions are only used when the benefit of natural system has been maximised.

Significant energy savings in the refurbished building are achieved by solar shading, daylight linking of lighting, exposing the thermal mass of the concrete soffits and a completely new energy efficient building envelope. Despite a near-doubling in occupancy, water-saving devices in toilets and washrooms have kept consumption at previous levels.

Energy rejected from the data centre is used to temper all mechanically supplied air. The data centre itself is cooled using fresh-air whenever outside temperature and humidity permits, with support from chilling plant.

The building previously occupied about 600 people in cellular rooms. Occupancy has been



The carbon consumption of a poorly performing 1960s office building (lower right) was reduced by 70% by an imaginative refurbishment. Elizabeth II Court at Winchester has achieved a BREEAM 'Excellent' rating.

increased to 1100, enabling Hampshire County Council to reduce its central headquarters estate by about 30% and dispose of other offices in Winchester — with clear energy-saving benefits.

Finally, there is no renewable energy, as natural ventilation and using heat rejected from the data centre more than satisfied the requirements of Part L and planning policy at the time without the need to install expensive renewables. However, provision has been

for installing solar DHW in the future.

Two notable new-build projects in the Building Performance Awards were a multi-occupancy Canolfan Hyddgen PassivHaus office building and IT learning facility at Machynlleth in Wales and the Midland Co-operative Society food store in Oakham.

When the Midland Co-operative Society's store in Oakham was destroyed by arson, a new operational store was required as soon as possible. A temporary retail facility was provided on the site, and the new 1700 m² building was open for trading just 15 months after the original store was destroyed and a year after the design team was engaged.

A large number of environmental features were incorporated in the new store, which along with the interactive nature of these technologies and the required interaction between the various specialists meant that commissioning had to be carefully managed and controlled. The client appointed the services consultant to oversee the commissioning process — winning for EDP Consulting the 'Commissioning project of the year' award.

Among features of the new building were the following.

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- Airtight construction to reduce infiltration.
- Large areas of roof glazing to increase daylight factor.
- Daylight linking and presence detection on control lighting.
- Heat recovery from the refrigeration system to heat the building.
- Heat recovery from mechanical ventilation to preheat fresh air.
- Natural ventilation and passive cooling in store and café.
- Overnight cooling in the Summer using outside air.
- Desratification fans to reduce heat loss through the roof in Winter and reduce the effect of cold aisles in front of chilled display cabinets.
- Underfloor heating in the sales area.
- Sophisticated control system to maximise energy efficiency and comfort.
- Solar thermal system for DHW.
- Rainwater recovery.
- Sub-metering of all separate gas services, all separate heating circuits, major water usage and electrical circuits above 50 kW.

It is self-evident that those systems will not work harmoniously by accident. The calculated payback for all the energy-recovery systems is 12.3 years at current energy costs.

Guidance in CIBSE 'Commissioning code M, commissioning management' was generally followed. The full requirements of the commissioning process detailed in the tender specifications, which also included commissioning the natural-ventilation system — a topic not really covered by the standard commissioning codes.

There were many meetings between the consultants and the various contractors and the commissioning specialist during the construction period to explore the commissioning process and ensure that particular nuances involved with the project were identified early. Those meetings ensured that adequate provision was made in the commissioning process and programme and that everyone involved had a good understanding of the engineering services and how they were intended to operate.

The most critical aspect of the commissioning was the interaction of the various technologies, followed by the BEMS — the successful operation of the building depending heavily on the correct functioning of the controls.

Commissioning the BEMS involved checking that the controls strategies were correct, that plant was controlled as required and the building reacted as expected. EDP's experience on similar projects has shown that buildings using natural and passive technologies often react in a counter-intuitive manner.

That methodical approach to commissioning from the outset of the project to practical completion paid handsome dividends later. Seasonal commissioning proved remarkably

simple, and problems and issues anticipated at the time of the design did not materialise. The consultants observe that poor weather during the first Summer of operation may not have tested services to the full extent. The intention is to continue monitoring the building, a task that is simplified by remote access to control logs over the Internet.

Tweaks and refinements to the controls strategy have been made based on occupant reaction. The information was obtained by contractors and consultants regularly walking around the building asking in an apparently informal manner 'how the building is?'. One outcome was identifying a rogue offset



The first Passivhaus in the UK has total carbon emissions well below the Passivhaus Planning Package prediction.

inadvertently applied to a temperature sensor to be identified and corrected.

Detailed stories about commissioning are rare, and the judges commented, 'The commissioning process was well planned, well integrated and implemented to the service design.'

Canolfan Hyddgen won the 'New build project of the year' for JPW Associates. The Oakham Co-operative store gave prominence to the benefits of an effective commissioning plant by winning 'Commissioning project of the year', while featuring a host of low-carbon technologies.

JPW's philosophy is always to minimise energy consumption and associated CO₂ emissions. Appropriate renewable technology is then applied to achieve carbon neutrality if viable. The starting point, based on previous experience, is an air-tight thermal envelope with no thermal bridges. The envelope is constructed from materials with low embodied energy with carefully designed heat-recovery systems and low-carbon auxiliary heat sources.

Canolfan Hyddgen is said to be the first non-domestic certified PassivHaus office in the UK. It achieved a BREEAM 'Excellent' score of 84.43, the highest in Wales at the time.

The performance of the building is close to or exceeds values calculated by the PassivHaus Planning Package (PHPP). Space-heating requirements came in just below the PHPP result. Total operational energy was nearly 40% below the PHPP calculation. Actual total carbon emissions are just below half the PassivHaus Planning Package (PHPP) prediction.

So how were these results achieved?

The climate in mid Wales is fairly mild, but solar gains tend to be lower than other parts of the UK. The fabric incorporates high levels of insulation and glazing to benefit from daylight. Overheating in Summer is prevented by simulated external Summer shading to the ground floor, with brise soleil and overhanging roof eaves on the first floor.

To compensate for heat gains from IT equipment, lighting consumption was pushed below 10 W/m² with extensive daylighting controls. PIR sensors and daylighting balancing are used throughout the building, and ventilation is only provided when rooms are in use.

Internal mass provided by a central masonry core and floor slab plays a significant role in the Winter heating strategy and Summer night-time cooling with the ventilation system.

A 7 kW solar PV on the roof meets 20% of what is a low electricity consumption.

An air-tightness/breathable membrane incorporated into the timber frame and on-site management practices achieve a permeability well below half the PassivHaus Institute requirement.

Mechanical ventilation is provided by a dual approach of centralised and decentralised ventilation. One of three ventilation levels is automatically selected according to PIR and timer controls. Unoccupied rooms are run at level one with no artificial lighting. Rooms in use are run at level two to provide adequate fresh air, with lighting if required. Level 3 is automated according to temperature with manual boost control. The heat exchangers have 100% bypass for the Summer.

The peak load for space heating is just 4.8 kW and is supplied by a gas boiler with LST radiators and minimised pipe runs. With such a low heating requirement and the client Powys County Council enjoying a competitive gas tariff, a heat pump or wood-pellet boiler was considered unnecessary on the principle that low energy equals low carbon, even using a fossil fuel.

A simplified BMS is linked to PCC's County Hall to permit remote monitoring and enable local key holders and caretakers to manage the building under instruction from centralised energy managers — reducing CO₂ emissions associated with travelling across Wales's largest county.

The judges were impressed with the project itself and also by the extensive subsequent monitoring; 'Much hard work has been done to get the energy demand down — and the energy monitoring data has been provided to show that this has been achieved. There is also clear evidence of good user feedback.'

CIBSE president Rob Manning summarises the objectives of the Awards as being to raise industry standards by recognising the UK's most sustainable and innovative projects and projects. We will let you know when CIBSE announces its awards scheme for 2012.

