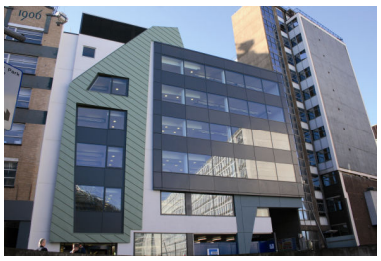
view from the field



How can building design reduce CO_2 emissions?

David Pelly, Resource Director, Prospect

Our View from The Field provides an insider's view into the challenges of creating sustainable buildings. David Pelly, Resource Director of UK-based trade union, Prospect, takes us through the process of creating a headquarters that delivers on energy efficiency objectives without forgetting the needs of the building's occupants. It provides some useful tips for others embarking on the process and for those in the building and construction industry.

Fact – About 50% of all CO_2 emission in the UK are the product of constructing and using buildings.

Prospect is a trade union with over 100,000 members most of whom are engineers, scientists or other professionals many of whom work in the fields of energy, climate change, environmental protection, conservation and health & safety. Prospect has taken a strong stance in support of policies addressing climate change and has taken a lead in the union movement on this issue working closely with government and employers. When Prospect chose to sell their old building next to Waterloo Station in London and build a new one next door, we found a real opportunity to put these principles into practice.

Sustainable building design

In selecting their design team, Prospect chose both architects and services engineers who had expertise in sustainability and energy efficiency. However, we still found, at least in 2004, that finding practical examples of highly sustainable office buildings in main urban centres was difficult. This was particularly the case since we were 'pushing the envelope' in terms of energy conservation and efficiency.

The final design for our new building centred on a very high performance envelope – that is the outside fabric of the building is designed to provide a very high level of thermal insulation. This means that in the winter any heat created internally in the building from lights, equipment or people is retained within the building along with any energy entering from the sun ('solar gain'). This is achieved by:

- Highly insulated external walls;
- Reduction in the extent of external glazing; and
- Eliminating air leakage.

In addition to this Prospect chose to go with a system of 'chilled beams' for ventilation and cooling. The chilled beams deliver most of the cooling in a more energy efficient way than an institutional standard, fan-coil unit system. Although chilled beams have a slightly higher capital costs they are low maintenance and have lower lifetime costs. There are also solar panels on the roof which supply the hot water system.

Perhaps the biggest challenge was eliminating air leakage. A performance target figure was set that was three times as tough as the building standard. This meant that in a practical sense the building is designed to be

almost 'airtight'. This proved a problem with the main contractor who was very reluctant to make a contractual commitment to meet this requirement although in the end it was achieved.

Energy efficiency through sustainable building

We believe that, despite all the difficulties with this innovative design, the benefits in terms of energy consumption and reduced carbon footprint will be significant. Although, it is difficult to quantify energy savings in new and unique buildings we estimate that the heating requirement, and therefore the related CO_2 emissions, should be about a third of what it was previously. This will also be reflected in reduced operating costs.

Staff needs in sustainable building

However, having a building that sets very high standards in energy terms must also provide a good working environment for staff. This provided additional challenges for us. Since the building was essentially 'sealed' in order to preserve energy, ventilation had to be provided mechanically and is controlled by a sophisticated, computer-controlled Building Management System. Although it maintains a comfortable temperature, staff cannot simply open and close windows or turn radiators on and off which can lead on occasions to some staff frustration. Moreover, the building must cope with significant variations in occupancy levels. As a union we often have as many members in the buildings in meetings as we have staff in our offices. This can test the capability of the heating and ventilation systems at times.

Having been in occupation for almost eight months Prospect, and the staff and members who use it, are very happy with our new building, although we are still learning to maximise its potential for energy saving. We believe it demonstrates how building design can contribute significantly to reducing CO_2 emissions.

Sustainable building – lessons learnt

At the same time we think there are a few lessons to be learnt from our experience:

- Organisations commissioning new buildings, especially owner/occupiers, must ensure that very high standards of sustainability and energy efficiency are built into the specifications for new buildings from the start. They will need to drive their design team and contractors to aim higher than simply meeting existing building standards. A building will have a life of 50 or 60 years or more by which time as a society we should have achieved cuts in CO_2 emissions of 60% or more.

- The investment community needs to catch up with the challenge of energy efficiency and sustainability. Financial advisers are too risk averse where building design is concerned and will tend to mark the capital value properties down which might not utilise more traditional heating and ventilation systems. This is despite the fact that most institutions, which may buy or lease those buildings, have clear policies designed to reduce their carbon impacts.

- Design teams need to be better at matching up the objectives of sustainability and the internal working environment. Careful attention to detail and the needs of users must be brought to bear whether

relying on natural ventilation or more sophisticated systems.

- The UK is on a very sharp learning curve in relation to sustainable buildings – both commercial and residential buildings. There needs to be better sharing of information both across the industry, government and users. In particular, there should be mechanisms for exchanging information about energy performance when buildings are in operation. This may involve building professionals (and owners) owning up to some failures as well as some successes.

- Whilst 'vision' does have a role, the government needs to focus on delivery and achievement against targets and less on rhetoric. Enforcing existing building standards could do much more to reduce CO2 emissions than commitments to building what will inevitably be relatively small numbers of 'zero carbon buildings' at some future date.

- Local government bodies should require that planning applications for new buildings involve more stringent requirements on energy efficiency. Setting requirements for 'renewable energy' is important but may ignore the greater potential for reducing CO_2 emissions that may be achieved though energy conservation.

- Organisations should not be frightened off by claims that sustainable buildings are much more expensive to build than traditional ones. If sustainability objectives are built in, the difference may be down to a few percent in total project costs and these can easily be recouped through reduced running costs

- There is a clear relationship between building quality and sustainability. The energy efficiency of a building will be completely undermined by a few very small holes in the envelope or other defects. That means the contractor must have a sense of 'ownership' of the energy objectives, incorporate these into sub-contracts and put effort into 'policing' the plethora of sub-contractors they use. Most critically, the actual building workers must be properly trained on the techniques and tasks that are critical to achieving energy objectives.

- Try to keep designs and systems as simple as possible. Buildings with facades comprising different systems and materials may look good but will be more complex to build and make it more difficult to maintain the integrity of air and thermal barriers.

- Last but not least, remember the human element. A building is not sustainable if it does not meet the needs of those working or living in it. Wherever possible, users should have an input into the design – both in terms of basebuild and fitout. Energy efficiency should not over-ride human needs but at the same time people can, and should, be educated to adapt their behaviour to improve energy efficiency. For example, allowing internal temperatures to vary a bit through the seasons will save energy, without impacting on health or productivity.

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