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Sustainability Innovation in United Kingdom Schools

Wayne Head,

Richard Buckingham

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Sustainability Innovation in United Kingdom Schools

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By Wayne Head and Richard Buckingham, BDP, United Kingdom

This article recommends approaches to take in designing sustainable educational environments. The authors present recent examples of UK school buildings that reduce carbon emissions and capitalise on renewable energy sources, and predict how schools will respond to energy needs in the future.

SUSTAINABLE DESIGNS FOR LEARNING ENVIRONMENTS

Architects and designers should look for opportunities to capture, re-use and recycle the energy, water, materials and waste resources available on site to minimise energy consumption and resources. The integration of buildings with their natural environment and the use of local bio-climate for environmental benefits is fundamental to the design.

Sustainability is measured by a "triple bottom line"; proposals need to be economically viable, socially equitable and environmentally sound. These three broad themes inter-relate throughout design, and optimising the synergies between them in an imaginative way is key to producing quality school buildings.

Sustainable thinking has played a key role in generating exemplary educational buildings and masterplans. Whether an innovative technology academy or a low energy school for students with learning difficulties, the overriding aim is to create socially progressive and resource efficient designs. The designs should provide inspirational learning environments shaped around people and deliver improved environmental performance in the present; they should also ensure the building has the ability to incorporate further renewable and low carbon solutions in the future, as the economic and environmental contexts change.

Sustainability should be a visible part of the educational environment. This can be achieved through the integration of living roofs, planting within the building, low-embodied energy and sustainable timber construction, and the use of renewable energy technologies.

CURRENT EXEMPLARY BUILDINGS

Leigh Technology Academy in Kent demonstrates an innovative sustainable design. The school specialises in information and communication technologies (ICT) with 1 500 pupils located in four new colleges under one roof. The building's CO_2 emissions were estimated to be 65% of the permissible limit set by the building regulations (Part L), based on the calculation methodology used by the UK Department for Education and Skills at the time of design. Leigh Technology Academy won three awards at the Building Services Awards 2008 including "Project of the Year" and "Best of the Best". Its sustainability credentials comprise the following:

- **Passive cooling –** Thermal mass is extensively used to eliminate the need to install mechanical cooling. In addition to the exposed ceilings (carefully co-ordinated with acoustic baffles and lighting to gain maximum radiant "coolth"), the floor void, risers and building structure are all used as heat sinks.
- **Earth tubes –** To further increase passive cooling, each of the four air handling units have 40m-long earth tubes drawing clean air (away from the busy road) under the school and up through concrete risers, thereby using ground source cooling to temper the air prior to introducing it into the teaching areas.

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Leigh Technology Academy

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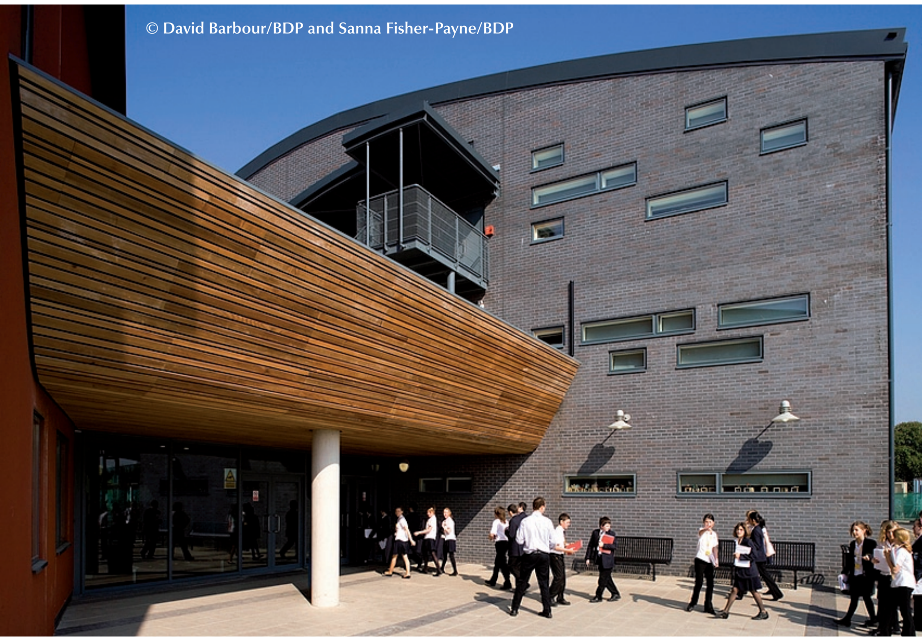

Leigh Technology Academy

- **Wintergardens –** These are key to passive stack ventilation in summer and reservoirs for heat reclamation in winter.
- **Orientation –** The building is designed to catch low angle sunlight in walkways where it can be captured and reused through central air handling units with heat exchangers, while avoiding summer sun angles and overheating. Classrooms predominantly face north to minimise the use of blinds and maximise the quality and quantity of daylight.
- **Sealed façade –** Due to surrounding external noise levels, the building needs to be acoustically sealed. However, rather than penalise the energy figures, the mechanical ventilation has been designed to maximise heat recovery and reduce heating energy.

A new school building in the London borough of Islington, to be completed in 2009, will generate 20% of its energy from on-site renewable energy installations. The 16 000 m² development will combine the Highbury Grove School and the Samuel Rhodes School, for users with mild learning difficulties. The new Highbury Grove School will provide, on the site of the existing school, a 21st century learning environment for 1 200 pupils thanks to the Building Schools for the Future (BSF) programme and a partnership between Islington Council and Transform Schools.


Highbury Grove School © David Barbour/BDP and Sanna Fisher-Payne/BDP

Highbury Grove School

The project sets the two schools on either side of the dining and social space and offers terrains for a variety of learners. The design wraps nine faculty bases around a new garden and external learning space. Internally, a day-lit covered street creates a sociable route linking the school with resource and support areas set along it.

The school building is revolutionary in its low energy design utilising high-end technologies to offset and reduce carbon emissions and to provide energy on site through micro-generation. Technologies include ground source heat pumps, earth tubes, a mini combined heat and power (CHP) system and a wind turbine, as well as natural daylight and green roofs. It utilises the sustainable development methodology of measure, minimise and mitigate. The building fabric meets the 20% recycled content target and makes best use of A-rated materials from the "Green Guide to Specification" (see *www.thegreenguide.org.uk/*) (all timber used is Forest Stewardship Council certified). The range of renewable and low carbon technologies has been installed to spread energy risk among the different energy providers and users within the school.

This is one of the first BSF school projects that will deliver 20% renewable energy from on-site sources in compliance with the planning requirements of Islington Council; and it will do so without resorting to biomass boilers. The development has gained an "Excellent" BREEAM[1] rating.

Most recently, at the Archbishop Sentamu Academy in Hull, the proposed design will achieve 55% CO_2 reductions from on-site renewable energy installations. This will be achieved, in part, through local environmental considerations informing the location and orientation of the building.

1. BREEAM (BRE Environmental Assessment Method) is a measurement for green buildings developed by the Building Research Establishment in the United Kingdom.

GOING FORWARD

In the future, public policy, resource restrictions and environmental considerations will further drive the resource efficiency of schools and the incorporation of renewable energy generation technologies. The move towards zero carbon new build schools will likely happen over the short term.

However, operating schools uses resources in other ways as well, such as transport, waste management, water use, food consumption and supply chains. A zero carbon school may emit no carbon from its building's energy use but have carbon implications elsewhere. Tackling these other resource consuming elements of school operation should form the next agenda for carbon reductions in schools.

These elements can be addressed through a combination of clever design and operational policies. The interface between design and operation should not be overlooked – design should enhance, rather than restrict, opportunities to deliver resource efficient operation.

In the United Kingdom, the government's commitment to achieving an 80% carbon reduction target on 1990 levels by 2050 affords an excellent opportunity to deliver carbon negative buildings. Schools can capitalise on their physical and operational attributes to generate energy for use in other contexts and move towards a carbon negative position. Energy generated by their renewable technologies can be made available to the electricity grid and surrounding buildings when the school does not require it. This could be achieved through linking the schools to surrounding buildings to balance energy loads.

Schools generally operate during the day when domestic properties require less energy; conversely, in the early mornings, evenings and weekends when domestic properties require more energy, schools require less. Therefore, any district heating systems and CHP systems at the school site could be linked with other uses in order to balance energy loads, increase economic viability and provide for carbon reductions.

Other renewables such as photovoltaics and wind power could export electricity to the grid in the evenings, weekends and school holidays when power is not required for the school.

Historically, the link between design performance and operational performance has not always been appropriately considered. Going forward, the necessity to deliver low and zero carbon lifestyles as well as low and zero carbon buildings will forge a more integrated relationship between design and operation.

For more information, contact:
Wayne Head
Architect Director
BDP
16 Brewhouse Yard, Clerkenwell
London EC1V 4LJ
United Kingdom
Tel.: 44 (0)20 7812 8340
E-mail: wayne.head@bdp.com
www.bdp.com

Richard Buckingham
Head of Sustainability
BDP
16 Brewhouse Yard, Clerkenwell
London EC1V 4LJ
United Kingdom
www.bdp.com

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