

Sustainability in building design

With the ever-increasing need to provide climate responsive and sustainable buildings and sites, David Rowley, an architect at Nightingale Associates, comments on how it is important to take a proactive and flexible approach to building design.

The approach to high quality sustainable design has many similarities irrespective of type, location and budget.

Important aspects include the commitment of all parties from the client to the design team, the contractor and ultimately to the user, the need to consider sustainability aspects from the outset to maximise on the opportunities and to be able to assess effective measures early, for example, the choice of the site. All, however, need to accept life-cycle costing approaches that consider running and maintenance costs as well as capital costs.

The aim should be to minimise the unnecessary complexity and make the building comfortable and easy to operate. The choices that are made may have different emphasis depending on the situation. They will need to maximise the use of daylight and natural ventilation will need to be addressed where beneficial and possible, as well as maintaining control of solar gain where it can lead to overheating.

They must also allow for the benefits of good views, future building and climate changes, and many other factors, such as transport implications, water saving and use, the use of more sustainable renewable materials and intelligent controls – such as for lighting – to help reduce use where not required.

This must also help maintain comfort, maximise renewable energy, landscape and ecology, and address the need to ensure heating and cooling and the level of insulation that is appropriate.

Sunyani Hospital, Ghana

Completed in 2003 this remote 240-bed US\$22m EU funded urban hospital was designed to provide long-term value for money. The design maximises the use of local materials and minimises running costs and future maintenance. The extensive gently-sloping site, with consistent cooling breezes, facilitated a 'green' natural ventilation design approach in which air conditioning was restricted to operating facilities only. This was achieved by the use of 'shallow plans' with an open corridor system, separated by large, planted courtyards. This allows cross ventilation via adjustable glass louvers.

The entire hospital is single-storey, except for the administration offices above the outpatients. The large roof overhangs and open corridors provide protection from the rain and sun. The hospital makes good use of the abundance of available land and the result is a human-scaled building. Engineering services have been designed as generic replaceable units to maximise choice. The building is technology modest.

The twin hospital streets servicing the various departments were designed with open ends for future expansion.

A review in 2008 to assess the effectiveness of the low energy, low maintenance costs, design approach on clinical outcomes: and patient, staff and visitor satisfaction reported on a thriving optimistic hospital that had grown to 400 beds and was seeing five times as many outpatients and maternity cases as was originally envisaged. There were high levels of patient satisfaction. The environmental and clinical success of the hospital has led to

an unusually high level of staff retention in rural Africa, leading to a fourfold increase in doctor and nurse numbers.

Gateway Sixth Form College, Leicester, UK

Completed in August 2009, this college is one of the most sustainable colleges in the UK. It has an emissions rate of 17.3Kg CO₂/m² per annum which is less than half of a conventional college building. The new college has reduced its emissions by roughly two thirds compared to their old college. This fits in well with Leicester's status as Britain's first Environmental City'

The building has a UK - Energy Performance Certificate score of 28 (B) compared with 46 for a similar new building.

The building is 11,500m² over three stories and designed for 1500 students, with room for expansion at the rear.

The project uses blocks for teaching, administration and ancillary accommodation accessed from a central three-storey glazed street, providing the primary circulation route and containing dining and social space, designed to encourage a living 'heart'

Energy conservation and creation was one of the top priorities for the building, and its fabric was designed to exceed current statutory requirements wherever possible.

- Maximising daylight and controlling solar gain – Electric lighting energy use is reduced by occupancy and daylight sensors and low energy fittings wherever possible. The central three storey glazed street is protected by brise-soleil on the southern façade. Solar control glass is employed on the rest of the south facing glazing.
- 'Visible sustainability' – It is not very common for building plant to be put on display, but the college wanted to actively encourage its students to take an interest in the environment through the use of 'visual' sustainability. Consequently the energy centre is placed in a prominent public location at the front of the building, with large glazed panels allowing good views of the Biomass boiler. An LCD display resides in the main entrance to display and monitor the performance of the PV panels and wind turbine, also linking this to its website. It is understood



Sunyani Hospital, Ghana



Gateway Sixth Form College, UK

that since opening the new college has attracted a higher quality of student.

- Biomass – The Biomass boiler can use wood pellets or chips as the fuel source. Though wood chip is being used initially. The fuel is sustainable and almost carbon neutral. The boiler provides 80% of the heating and domestic hot water maximum demand, with gas boilers providing the remainder 'peak' load.
- Natural ventilation – The building is predominantly naturally ventilated, and windows and equipment linked to the building management system (BMS) control heating and cooling. Most of the teaching pods off of the main atrium have exposed precast concrete plank ceilings. These provide thermal mass to help to moderate temperature changes. Night-time cooling is achieved via high level windows linked to the BMS.
- Photovoltaic glass and Wind turbine – The front entrance is almost fully glazed with photovoltaic laminate. In combination with the solar control glazing, the dense arrangement of the PVs as well as creating electricity, also contributes to limiting solar gain. A wind turbine takes advantage of the site's elevation. The turbine and PV's between them generate a respectable amount of power for the college. In between term times, these installations will continue to provide energy back to the National Grid, thus building up an additional saving on energy costs for the College.
- Sustainable drainage – Due to the impermeable clay soils allowing little absorption and poor surrounding drainage infrastructure, a large number of attenuation tanks and swales have

been installed to keep the water on site..

- Rainwater Harvesting – Rainwater is stored in an 8400 litre tank and used for flushing toilets in the teaching block. This can be topped up from the mains if required in a drought. The tank storage is also designed for fire brigade use if required.
- Materials – Many achieved an 'A' rating in the Building Research Establishments (BRE) Green guide to specification. This guide gives guidance on best environmental choices – materials and components on an elemental basis. It assesses from 'Cradle to Grave' on A+ to E ranking. It is now available free online to assessors, clients and design teams. See www.thegreenguide.org.uk

Environmental Assessments

A useful way of measuring success in terms of sustainability is by the use of environmental assessment methods, such as LEED (the United States Green Building Council (USGBC) Leadership in Energy and Environmental Design) and BREEAM (the Building Research Establishment Environmental Assessment Method), which can be used to help encourage sustainable building design and audit environmental credentials.

Keen to promote high quality sustainable buildings and their sites, Nightingale Associates has been proactive in promoting the BREEAM tool. We work closely with the Building Research Establishment (BRE) and have been active members of their steering committees for a number of environmental initiatives, including the development of a Sustainability

Checklist for Developments, the NHS Environmental Assessment Tool (NEAT) and its replacement, BREEAM Healthcare.

BREEAM provides a holistic approach to sustainability for new and existing buildings as well as community-scale developments, providing a robust methodology to benchmark and improve the sustainability of the built environment. Originally developed for the UK, it is the world's most widely used environmental assessment method for buildings and has now been extended to include BREEAM Gulf and Bespoke International. Nightingale Associates has trained BREEAM assessors who champion an integrated approach to sustainability on all our projects.

One of BREEAM's main advantages over the LEED system is that it is flexible and adaptable to local conditions yet can also be compared from one country to another. BREEAM Gulf, first published early in 2008, is specifically developed for the region, recognising local context and issues and detailing in its guidance the standards and codes that should be adhered to. It has been developed in collaboration with a variety of large organisations based in Qatar, Abu Dhabi and Dubai.

Similar to other BREEAMs it assesses a building's environmental impact through Management, Health and Wellbeing, Energy, Transport, Water, Land Use and Ecology, Materials, Waste and Pollution. Scores obtained for each section then combine to produce a single score, which is then translated into a 1-5 star rating, with 5 stars recognising the highest level of environmental performance. **TBP**

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