

# Case Study: Low carbon refurbishment of Westborough Primary School

## Summary



**The buildings at Westborough Primary had evolved through a fragmented and piecemeal series of building additions and adaptations that have occurred periodically since the school first opened in 1915.**

The school recently embarked on a pioneering project that explores how its carbon footprint can be reduced. Its goal is to become a zero carbon school - the first of its kind in the UK.

The children at Westborough are very concerned about their impact on the environment, and the plans for the school were inspired by the pupils' vision for an environmentally sustainable future.

The approach to the project was based on first making the school lean in terms of its energy demand, before addressing efficiencies and finally selecting low carbon energy supplies.

The refurbishment reduced the school's energy demands by improving the insulation and air-tightness of the building, and by selecting efficient lighting and electrical equipment. Renewable energy systems that have been installed at the school include photovoltaic panels, a solar thermal system and biomass heating. A wind turbine was also considered but was not installed.

A key aim is to ensure that occupants' behaviour recognises the need to save energy and carbon, and that there is sustained interest in the project's aims. This will be achieved through ongoing activities including a carbon footprint study, the pupil and school staff's participation in the project, and new management systems.

## Organisations Involved

**Cottrell + Vermeulen Architecture** - architectural design practice responsible for the overall design of the refurbishment.

**Partnerships for Schools** - the government's delivery agent for capital investment programmes in schools throughout England, which provided the majority of the funding for the project.

**Westborough Primary School** – the subject of the case study: a two class entry school with a Nursery that dates back to 1915.

**Southend on Sea Borough Council** - The education authority for Westborough Primary School and the client for the project.

**Balfour Beatty Construction** The main contractor for the project, which also part-funded some elements of the project.

**Buro Happold Sustainability** - mechanical and electrical engineering design consultants responsible for low-energy services and renewable energy systems for the project.

**OR Consulting** - designers who modeled the energy performance of the scheme.

## Context

The need for repair and refurbishment provided an opportunity to undertake an integrated upgrade of the school to meet its environmental vision while serving the needs of its community.

The school was due to be refurbished as part of the UK government's Primary Capital Programme (PCP). There were a number of general sustainability requirements within this national initiative, but the project team had greater ambition and aspired to deliver a refurbished school with zero carbon emissions attributable to its energy use.

The project successfully applied for additional funding to reduce its carbon emissions as part of a series of pilot projects initiated by the [Zero Carbon Task Force](#).

The school has been refurbished over two phases: the first phase rationalised the use of existing core spaces and enabled decanting (providing temporary accommodation for teaching and other aspects of school operation). The second phase involved refurbishing educational spaces, upgrading the existing building fabric and providing renewable energy sources.

A master plan provided the basis for a series of building programmes and research projects encompassing everything from the improvement of dining facilities and accessibility of the site. Previous initiatives at the site include the construction of the prizewinning Cardboard Building and the school received the 2007 regional teaching award for Sustainable Schools.

## Date

The design was finalised during late spring/early summer 2009, and the chosen procurement method allowed work to start on site during summer 2009. The refurbishment of the building was completed in September 2010.

## Process

The chosen procurement method was a two stage tender to allow works to start on site sooner than a single stage process – construction could begin before designs were fully complete.

Cottrell and Vermeulen Architecture have more than 16 years experience of working in partnership with Westborough Primary School, which has provided the opportunity to explore and test new ideas and ways of working. As a consequence an exemplary approach to collaborative development projects has been established, which has pushed the boundaries of sustainable design.

A holistic approach to reducing the carbon footprint during the refurbishment targeted: thermal insulation and air tightness; low energy lighting/ICT with system management; renewable energy (biomass, solar thermal and photovoltaics)

### SCI-Network Context

The SCI Network is a European project which brings public sector bodies together to find innovative and sustainable solutions for public sector construction procurement.

Five working groups have been set up within the network to identify solutions and encourage innovation.

The focus of Working Group 1 is innovation in sustainable renovation - application of environmental assessment tools.

A catalogue of relevant tools is being developed highlighting their application in the procurement process. User involvement in renovation processes is also being examined.

For further information, or to participate in the working groups, please see:

[www.sci-network.eu](http://www.sci-network.eu)

## Results

This refurbishment project has succeeded through an integrated approach to the design of the school which has simultaneously considered the building layout, its intended use, and its services. Through careful planning, the site has been developed to meet the needs of the school and its community, while simultaneously reducing their environmental impacts.

Carbon emissions and a dependency on fossil fuel have been radically addressed through a combination of measures to reduce energy demands and develop renewable energy generation. Overall, carbon dioxide emissions have been reduced by an estimated 67 tonnes (approximately 70% lower than similar schools)

Although several elements have contributed to the success of the project, a major factor is the long term relationship that has been established between the school and its architects. The redevelopment of the site has emerged from a considered estates strategy and master plan which has taken into account the development of the school. This allowed the designers to understand the needs of the school and fully explore the options available.

The project has provided and will continue to provide a valuable example of the effectiveness of carbon reduction strategies that can be applied to typical existing school buildings.

## Budget and Finances

The costs for the refurbishment of the school were €1.95 million (£1.65 million), representing unit costs of ~€880/m<sup>2</sup>.

The Department for Education (then Department for Children Schools and Families) provided additional funding of €600k (£500k) to invest in a range of measures to help identify new and cost-effective measures to reduce carbon emissions from schools. Balfour Beatty also donated €95k (£80k) because of the opportunities the project offered for low carbon research.

## Environmental Impact

The project primarily targeted reducing the carbon emissions associated with the school's energy use.

Annual CO<sub>2</sub> emissions of 108 tonnes were measured prior to refurbishment. This project aims to achieve the following estimated savings per annum:

### Energy efficiency:

15 tonnes CO<sub>2</sub> - thermal insulation and passive systems  
15 tonnes CO<sub>2</sub> - energy efficient equipment lighting and equipment

### Renewables:

7 tonnes CO<sub>2</sub> - photovoltaics  
30 tonnes CO<sub>2</sub> - biomass boiler

### Total anticipated reduction:

67 tonnes CO<sub>2</sub>

Widespread metering is installed and the outcomes are being independently monitored – detailed results will be made available from September 2011. The phasing of the project will allow the effectiveness of different measures to be separately quantified

## Lessons Learned

The key factors that contributed to the success of the project were as follows:

- An integrated design process which addressed its energy strategy through a systematic “lean, mean, green” approach.
- A thorough understanding of the needs of the school. For the architects this had been achieved through several years of working in partnership with the school.
- Willingness on the part of various sponsors to pilot innovative and potentially risky approaches to the project and its energy strategy – several of the renewable energy technologies had not been previously installed in schools on such a scale, and other low energy features needed to be correctly operated. The project therefore considered a number of ongoing activities to involve occupants and to help positively influence user behaviours.

A major disappointment was the exclusion of the wind turbine, which was expected to make a key contribution to carbon reduction targets. This failed to receive planning permission because of local objections despite a commitment to only using the turbine during the daytime. This highlights the need for extensive community consultation and input to site development plans.

The technologies adopted and processes applied within Westborough Primary School could be adopted for projects in other countries although performance of renewable energy systems and measures to reduce heating loads would have comparable results only in those with similar climatic conditions to the UK.

### Tools Used

#### Joinedupdesignforschools

A process for involving children in the design of their school building projects - Pupils are given the role of clients for a design project at their school to help develop their work and social skills

#### Lean, Green, Mean

An approach to design led by the following hierarchy:

*Lean* - reduce demand through passive features and high standards of Insulation and air-tightness

*Mean* - manage demand through energy efficient technologies and energy management

*Green* - use renewable and low carbon energy sources

#### Sustainable Schools Framework

Eight ‘doorways’ (sustainability themes) through which schools can establish or develop their sustainability practices. The framework allows sustainability to be fully considered in each of the following areas:

- Energy & water
- Buildings & grounds
- Food & drink
- Purchasing & waste
- Travel & transport
- Inclusion & participation
- Local wellbeing
- Global dimension

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## References

Westborough Primary School web-site: <http://www.thewestboroughschool.co.uk>

Primary Capital Programme (PCP):

[http://www.teachernet.gov.uk/management/resourcesfinanceandbuilding/Primary\\_Capital\\_Programme](http://www.teachernet.gov.uk/management/resourcesfinanceandbuilding/Primary_Capital_Programme)

Joinedupdesignforschools: <http://thesorrellfoundation.com/joinedupdesignforschools.php>

Sustainable Schools Framework: [www.teachernet.gov.uk/sustainableschools](http://www.teachernet.gov.uk/sustainableschools)

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