



The environmental impact of the building throughout its life will be a fraction of a traditionally constructed version and the occupants will have the knowledge that they are working and learning within a building that is responsive to the environment.

Occupants of a low energy building have additional benefits such as improved comfort associated with the increased daylight levels and availability of user controllable natural ventilation.

This school also provides an ideal opportunity for the students to learn about the responsible building technologies that will shape their future.

How Did the Design Team Realise the Project Goals?

For the success of any low energy building, the design team must work together as a single integrated unit.

The Department of Education and Sciences' Architect Frank Lewis and Senior Engineer John Dolan insisted that the school design result in a quality low energy installation, and worked with both clients and design team members to realise this goal.

Through the use of advanced energy and daylight simulation software, the design team were able to gain a better understanding of how the building reacts with its environment, and understand how these reactions can be used to improve the internal environment while minimising energy consumption.

Teamwork is vital to any low energy project and the Department were keen to make sure everyone involved in the project understood the project goals and implications. As part of this process they hosted a seminar for the contractor before the project began on site and had briefing meetings with the school management and teachers during the design process and at handover.

This project received funding through the Design Study Support Scheme and Model Solution Investment Support Scheme being administered by Sustainable Energy Ireland on behalf of the Department of Communications, Marine, and Natural Resources. These schemes provided funding towards the initial holistic energy design study and towards the energy efficient technology solutions incorporated into this building.

PROJECT TEAM

Technical Manager:

Martin Heffernan,
Department of Education and Science.

Senior Engineer/Energy Project Manager:

John Dolan,
Department of Education and Science.

Architect and Design Team Leader:

Pat Kelly and Frank Lewis,
Department of Education and Science.

Mechanical and Electrical and Energy Consultants:

John Doyle and Chris Croly,
Building Design Partnership.

Quantity Surveyor Engineers:

Stephen J Ahern

Structural Engineers:

Ken McGauran, Nicholas O'Dwyer & Partners

Main Contractor:

Portcastle Builders

Mechanical Sub Contractor:

Glow Heating Ltd

Electrical Sub Contractor:

John Fletcher Ltd



Gaelscoil An Eiscir Riada, Tullamore, Co. Offaly



Introduction

The objectives for this eight classroom school building were to provide a quality educational facility appropriate to its users requirements. This facility would not only encompass low energy design, but would also firstly, provide feedback to the Department of Education and Science on the operation of the school and its systems and secondly, act as a life learning tool that enables the

building to be an active learning resource for energy conservation and sustainability for the pupils and teachers.

One of the key aims was to develop a low maintenance building that takes due account of the selection of sustainable materials and provides detailed monitoring opportunities. The design team also aimed to create a building with energy consumption approaching 20% of the

energy used by a similar school built to current good practice standards for Irish schools, which would generate zero CO₂ in the operation of its services. This target will be assisted by the recent further deregulation of electricity in Ireland that enables the school to source its electricity from a wind farm scheme.

Passive Solar Architecture

The building plan has been orientated to take maximum advantage of early morning sun to pre-heat the building. This is assisted by the use of low emmissivity glazing on all of the classrooms.

Improved Insulation Levels

The thermal insulation levels are double those required by the present Building Regulations, to reduce the energy escaping from the building fabric.

Reduced Infiltration Levels

Infiltration is unwanted ventilation that causes heat loss from the building and is of particular concern during the night when outside temperatures are low. The building fabric has been designed to reduce infiltration levels to 20% of those usually experienced. The building's vapour barrier



Children at play in their new school with roof garden in background



Building Plan – Maximises Solar Gain



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Pictured in both images above, the results from Advanced Daylight Simulation

was employed as the main means of achieving a high level of air tightness and during the design stage a considerable amount of time and effort was spent developing the detailing with the architect, particularly the window and door junctions and the sequencing of the timber frame construction.

In addition to designing the building fabric to reduce infiltration, the completed building was subjected to air tightness tests. While this testing is not yet mandatory in Ireland, the Department of Education and Science Buildings Unit realised the importance of reducing air leakage.

The initial tests showed up a number of areas where remedial work was required. Larger gaps, for example at steelwork junctions, around high level windows and gaps in window framing were quickly identified and remedied. Final test results produced a figure of 4.6 m³/h/m² at 50 Pa being achieved, which was a considerable improvement on the initial results and justified the use of air testing on this project.

Attention To Materials Selection

A lightweight structure was specified with attention paid to the selection of materials to minimise the environmental impact of construction.

Natural Ventilation

Particular attention was paid to ensuring that adequate natural ventilation was available and BDP carried out detailed simulations to ensure adequate distribution of ventilation air within the classrooms.



Sun pipes provide natural light in corridors

Natural Day Light

Glazing levels and locations provide a daylight factor of 5% in all classrooms. This results in the possibility of operating the school for 80% of the occupied period without artificial lighting. Local manual light switching is provided along with lighting controls that automatically switch off lights when it is bright enough outside or when rooms are un-occupied to ensure maximum lighting energy savings are achieved.

Sun pipes are used to good effect within corridor spaces to maximise daylight transmission while minimising heat loss. The main advantage of sun pipes is that they are visually similar to a light fitting when viewed from inside the building and the occupants tend to accept that the main lights are turned off on this basis.

Heat Pump Installation

It can be more energy efficient to move heat from one location to another than to generate it from primary fuel. Heat pumps can be used to transform a low-grade energy to a more usable higher grade.

For this building a series of pipes were laid in the green areas beside the school and a heat pump is used to transfer heat from the ground into the building.

Four different loop forms with varying spacing and depths have been installed. These will be run simultaneously but are separately metered and their individual performance will be monitored to see how output is affected by depth, in terms of output per pipe area and length. This will form a separate research project.



Typical Ground Heat Collector

A heat pump to be economical needs to operate on peak night rate electricity. The heating distribution system must therefore be capable of thermal storage at night, thus the school is provided with an underfloor heating system.



High level atrium encourages natural ventilation and provides natural light deep into the building

During peak demand conditions the system is designed to achieve a coefficient of performance of about four. During warmer conditions, a greater efficiency is achieved. The electricity to run the heat pump and the rest of the building is taken from a group wind scheme therefore generating no CO₂ in the building operation.

Rain Water Recovery System

A rainwater-holding tank is installed below the ground that gathers water from the roof of the building and the adjacent ball court.

This water is pumped into a tank within the buildings roof space and is used for the flushing of toilets. It is estimated that all of the rain falling on the building roof will be used, saving a large quantity of water that would otherwise have to be treated and pumped by the local authorities.

The straining and pumping of water is an energy consuming process.

Monitoring

An advanced building management system is installed to gather information on the building performance and to assist the occupants in adjusting the controls to ensure minimum energy wastage.

The information gathered by the monitoring system will be a vital source of information to the Department's Buildings Unit for future school design.

The controls system contains a simple user interface, which provides the user with advanced information on the building's performance, allows them to view energy targets and make adjustments to time controls.

Educational Life Learning Tool

The project incorporates a touch screen display positioned near the school entrance that is linked to the BEMS and will provide the children and visitors to the building with energy and environmental information relating to the building. This commission includes the development of a cartoon character that is used to encourage the children to learn about the building construction and its day-to-day energy use. The touch screen system can also be connected to the Information and Communication Technology system and could provide BEMS information to any computer in the school.

Benefits of This Type of Building

This building will consume considerably less energy than a typical school. The energy saved will pay for all of the additional energy saving measures well within the life of the building.