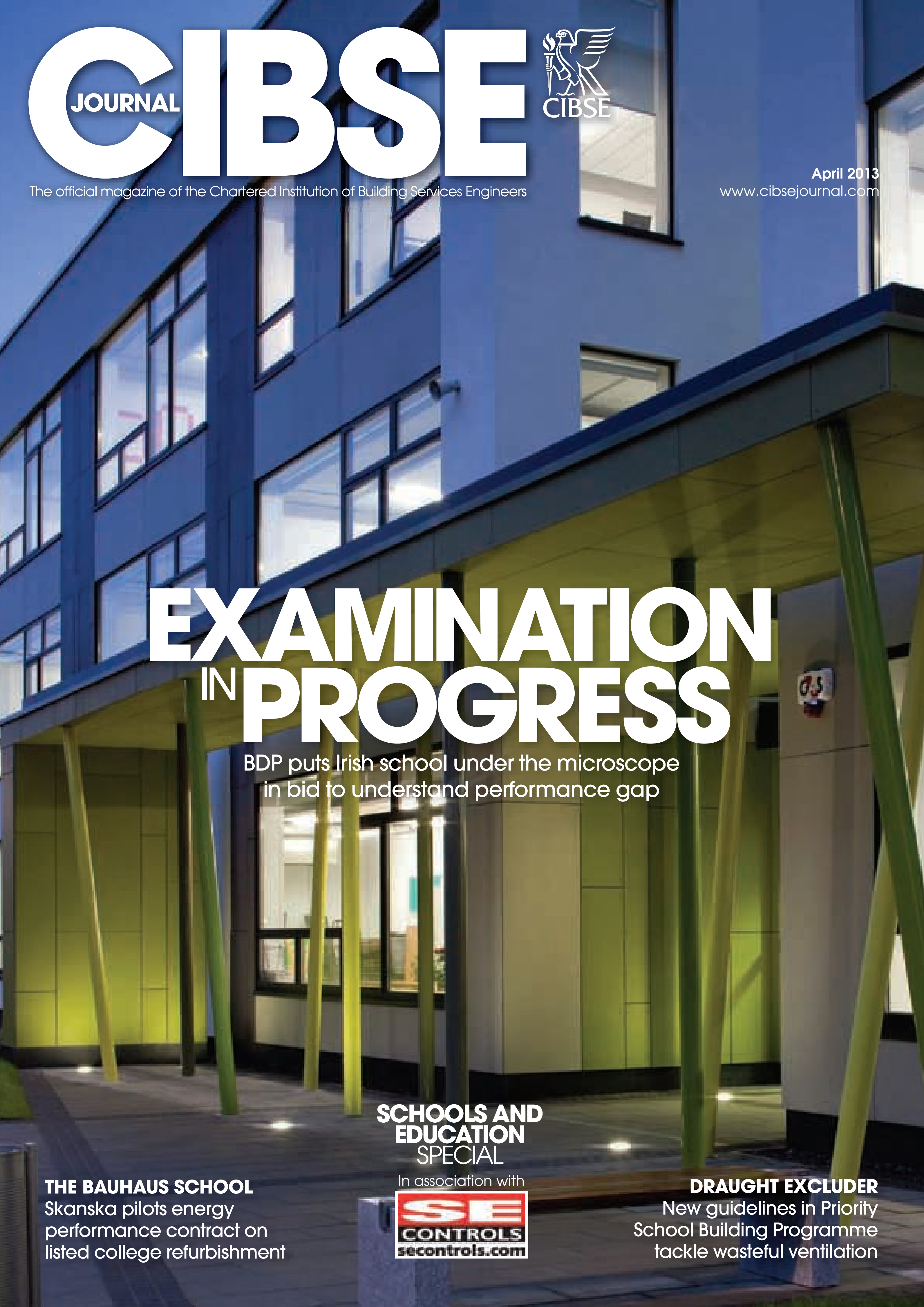


CIBSE JOURNAL

CIBSE

The official magazine of the Chartered Institution of Building Services Engineers

April 2013

www.cibsejournal.com

EXAMINATION IN PROGRESS

BDP puts Irish school under the microscope in bid to understand performance gap

SCHOOLS AND EDUCATION SPECIAL

In association with

SE CONTROLS secontrols.com

THE BAUHAUS SCHOOL

Skanska pilots energy performance contract on listed college refurbishment

DRAUGHT EXCLUDER

New guidelines in Priority School Building Programme tackle wasteful ventilation

ABSOLUTE CO_2NTROL FOR SCHOOLS

SIMPLE - COMPLIANT - PROVEN

Creating stimulating learning environments, by controlling **carbon dioxide**, **temperature** and **energy efficiency**, in classrooms and educational spaces, has just got simpler and more effective with NVlogiQ from SE Controls.

NVLogiQ constantly monitors indoor air quality, temperature and humidity and uses innovative algorithms to control the automatic operation of windows and vents within classrooms and educational spaces to improve learning and comfort while saving energy.

Capable of being used as a stand-alone classroom controller or networked throughout a school, **NVLogiQ's** fully automated operation enables a stimulating and comfortable environment to be maintained, while also providing a manual over-ride option.

Room conditions and status are constantly displayed on the integral LCD screen, while **NVLogiQ's** integral data logging feature enables detailed analysis against pre-defined design and performance criteria on both new build and school refurbishment projects.

- **Suitable for all learning environments**
- **Automatically monitors and manages CO_2, temperature and humidity**
- **Scalable from a single classroom to networked school solution**
- **Absolute control for natural ventilation in schools**
- **Simple, compact and easy to operate & install**
- **Constant display readout**
- **Configurable manual override and operation**
- **Compliant with key standards including CIBSE Guide A and BB101**
- **Advanced algorithms provide unrivalled control and accuracy**
- **Integral data logging for NV system analysis**
- **Post installation monitoring.**

Must do better

Schools are failing their energy efficiency exams, with data from Carbonbuzz suggesting that energy use is twice as much as predicted at design stage. While the exponential increase in IT is contributig a large proportion of carbon emissions, it's clear there is a discrepancy between school design and operation.

There are signs that the government, consultants and contractors are starting to address the yawning performance gap. Guidance in the Priority Schools Building Programme, released in 2012, tackles the issues around ventilation and overheating. Shaun Fitzgerald identifies use of radiators to tackle draughts as one of the major causes of wasted heat (page 18).

> Cutting energy use outside school hours could lead to significant energy savings

The emergence of energy performance contracts (EPCs) should force contractors and consultants to deliver what it says on the tin. Skanska is trialling its EPC on the refurbishment of Impington Village College, Cambridgeshire, and is taking on the risk of the project failing to deliver carbon savings. If successful, Skanska plans to roll the financial model across the UK, providing much-needed funding, as well as energy savings.

Meanwhile, BDP is closely monitoring a school for the Irish government in a bid to identify reasons for the energy gap. Early analysis reveals that cutting energy use outside school hours could lead to significant energy savings (page 10).

Alex Smith, Editor

CONTENTS

CIBSE JOURNAL

www.cibsejournal.com

Editorial
Editor: Alex Smith
Tel: 01223 273520
Email: asmith@cibsejournal.com
Deputy editor: Carina Bailey
Tel: 01223 273521
Email: cbailey@cibsejournal.com
Senior designer: Dean Farrow
Technical editor: Tim Dwyer

Advertisement sales
Sales manager: Jim Folley
Tel: 020 7324 2786, jim.folley@redactive.co.uk
Sales consultant: Mark Palmer, Tel: 020 7324 2785, mark.palmer@redactive.co.uk
Sales executive: Darren Hale
Tel: 020 7880 6206, darren.hale@redactive.co.uk
Senior sales executive: Paul Wade
Tel: 020 7880 6212
paul.wade@redactive.co.uk
Advertising production: Jane Easterman
Tel: 020 7880 6248
jane.easterman@redactive.co.uk

For CIBSE
Publishing co-ordinator: Nicola Hurley
Tel: 020 8772 3697, nhurley@cibse.org

CIBSE Journal is written and produced by CPL (Cambridge Publishers Ltd) Tel: +44 (0) 1223 477411. www.cpl.co.uk 275 Newmarket Road, Cambridge CB5 8JE.

Editorial copy deadline: First day of the month preceding the publication month

CIBSE, 222 Balham High Road, London SW12 9BS
Tel: +44 (0) 20 8675 5211. www.cibse.org

ISSN 1759-846X

Subscription enquiries

If you are not a CIBSE member but would like to receive *CIBSE Journal*, subscribe now! Costs are £80 (UK) and £100 (international). For subscription enquiries, and any change of address information, please contact Nicola Hurley at nhurley@cibse.org or telephone +44 (0)20 8772 3697. Individual copies are also available at a cost of £7 per copy plus postage.

The 2013 US annual subscription price is £100. Airfreight and mailing in the US by Air Business, C/O Worldnet Shipping NY Inc, C/O Air Business Ltd / 155-11 146th Street, Jamaica, New York, NY11434. Periodical postage pending at Jamaica NY 11431. US Postmaster: Send address changes to *CIBSE Journal*, C/O Air Business Ltd / 155-11 146th Street, Jamaica, New York, NY11434.

Cover: BDP

ABC audited circulation: 18,558 January to December 2012

SPECIAL measures

Why do so many schools perform so badly? BDP is closely monitoring Colaiste Choilm school to help the Irish government identify the issues affecting energy efficiency in the country's education buildings

We all know the theory behind the design of low energy schools and most of us have worked on them. I visited one of these exemplar schools in London recently and was impressed with the design – it ticked all the right boxes: airtight design, ground ducts, heat recovery, CHP and everything else that you would expect to produce a true performer.

However, the Display Energy Certificate showed that energy use was not much different from that of a school built 10 years earlier. This school is not alone. Much of the theory about what produces a low energy school often appears to produce relatively marginal results. Perhaps we don't understand our schools quite as well as we thought we did.

In Irish schools, the reduction in bottom line energy readings has dropped approximately 25% over a 10-year period – from about 80 to 60kWh/m^2/yr. The rate of improvement in energy saving has been partly masked by the dramatic increase in demand for IT in schools, and the provision of improved air and acoustic quality. School designs are doing more with less energy.

Colaiste Choilm is a new secondary school in Ireland that will be used by the Department of Education and Skills to provide an insight into how a modern school and the technologies applied are performing. The level of monitoring applied is significant, with more than 10 m readings recorded every year. This database allows for detailed study of energy and water performance and forms a useful dataset for simulations.

A typical school can use more than 40% of its electrical energy when closed. This helps to explain why calculated savings often contradict observations. If an engineer applies a technology that only reduces electrical energy during occupied hours, then the 40% used when the school is not in use remains untouched. For this reason, monitoring at Colaiste Cholm takes account of whether the school is occupied or closed. This is achieved by monitoring the building's security alarm and expressing data as occupied or unoccupied readings.

The new school was, therefore, designed to exceed the current building regulations by 50% for energy and 76% for carbon. The school was also the first secondary school in Ireland to achieve an A2 energy certificate.

Don't ignore IT

As expected, a 50% improvement in an SBEM result doesn't halve the energy being used. This is partly because the calculation ignores important elements of design, such as energy used by IT.

As engineers, knowing that IT systems are responsible for the largest proportion of carbon emissions for schools, we cannot take the view that IT specification is beyond our control and outside our remit. For this school, BDP requested permission to implement an environmental overlay to the IT package tender documentation.

The changes made to the IT specification reduced its capital cost, while, at the same time, resulting in one of the largest savings of carbon in the building. The virtualising of the school's four proposed servers was the most effective modification and reduced the entire communications room load to less than 1kW. The specification of energy standards for all equipment, along with ensuring that the energy saving software in all systems was commissioned, was also useful.

Project team

- **Client:** The Department of Education and Skills, Planning and Building Unit
- **School:** Colaiste Choilm, Tullamore, Co. Offaly
- **Building services engineer:** BDP
- **Project architect:** Coady Partnership Architects
- **Structural engineers:** Nicholas O'Dwyer Consulting Engineers
- **Quantity surveyors:** MJ Turley & Associates
- **Contractor:** John Sisk & Sons

IT equipment is responsible for the largest proportion of carbon emissions in a school

> While calculations clearly show that heat recovery ventilation can improve a school's energy performance, the exact benefits are open to debate

IT extends beyond computing – the classroom projectors had arrived with their energy-saving mode disabled by default; a subtle change was required that would not normally be noticed but had a significant effect on energy use.

Real air leakage

Schools in Ireland must all achieve an air leakage result of less than 5 $m^3/m^2/hr$ and this is achieved with relative ease and without any notable cost increase. For this school it was important to push air leakage to a higher standard, while still avoiding significant cost increases. The school achieved an air leakage result of 1.8$m^3/m^2/hr$ while using standard construction techniques, which is a credit to the contractor John Sisk,which had been set a target of 3$m^3/m^2/hr$.

The school also set out to improve on the practical meaning of air leakage, by measuring the air leakage under real operating conditions. The standard test procedure allows mechanical vents to be sealed and perma-vents to be closed, which leads to an inaccurate view of the building's real performance. It's unclear why the standard air testing procedure (particularly for a school-type building) doesn't test what it is actually trying to determine – how much air leaks out of the building during the night without any mechanical systems sealed and with all perma-vents left open, as they normally will be.

Airtight motorised dampers were used on all mechanical systems and the traditional opening at the top of the lift shaft was not installed, as it didn't seem to have a genuine purpose in this building. The result of the 'real' leakage test was 2.5$m^3/m^2/hr$ with all sealing removed and perma-vents open.

A third air test was required a year after occupation to test the long-term robustness of the sealing techniques used. The air test was supported by a full thermographic audit to assist in understanding the building's success in removing thermal bridges, through the use of external insulation, and to identify further potential improvements. One of the key areas identified for future improvement was the window-frames, as their installed performance didn't seem to reflect the factory-tested results. We suspected that hardware that compromises the air tightness of the frames, such as restrictors and handles, may not have been installed during the factory tests.

Passive design

Schools in Ireland are naturally ventilated by default and are provided with average daylight factors above 4.2% as standard. They must also demonstrate a clear commitment to passive solar design and this school was no exception. Floating ceilings with perimeters pulled back were also used in the school to optimise the area of exposed mass.

While calculations clearly show that heat recovery ventilation can improve a school's energy performance, the exact benefits – particularly in relation to its cost – are open to debate, with different engineers producing calculations that show significantly different results. In such a situation, it can be useful to supplement the calculations with some monitored results and the school contains a heat recovery test rig that allows the detailed monitoring of the performance of heat recovery ventilation systems.

Heat recovery ventilation is installed in two monitored rooms with two identical control rooms also monitored. Meanwhile, test rig couples are on a different orientation, allowing the results to offer interesting information on the effect of orientation on energy consumption.

The technology

The building features several technologies for testing purposes, some of which may be included in future schools as the demand for a reduced carbon impact increases, and some of which may prove to be impractical or too expensive for use in schools.

The school's roof hosts 120m² of PV panels

While biomass boilers offer an easy fix for reducing carbon, they have often under-performed in terms of their seasonal efficiency. This is partly due to the standard practice of running them almost continuously, which, in the context of a school with relatively short operating hours, leads to significant flue, buffer vessel and standing losses.

The biomass installation in this school was designed to give biomass the best chance of proving itself. There are two small boilers that run only when required and are sequenced to meet the building load. A buffer vessel and pre-heat period is still required, due to the slow response time from biomass boilers, but the boilers generally turn off in the afternoon when heating is no longer required.

The school also contains a gas-fired 50 kWe CHP unit for the purpose of studying the interaction of CHP with school energy demands, as well as the true efficiency and reliability of CHP within a school application. While gas-fired CHP currently offers carbon savings, it has a limited future in Ireland as a low carbon solution because Ireland's electrical grid is decarbonising at a rapid pace. The study of CHP in a school context is still useful, however, as it provides an insight into the performance of potential future replacements such as fuel cell CHP.

A 120m² photovoltaic rig is also provided on the roof of the building, which is the largest installation on an educational building in Ireland. While the cost of PV may seem high, its cost per kg of carbon saved is attractive compared to alternatives. It was also considered important to include PV on the building as an educational tool, as the building offers a single location to view and demonstrate various technologies that may feature in future buildings.

All new schools in Ireland have rain water recovery systems installed. This school was also used to trial 4/2L toilets and waterless urinals, both of which reduced the school's water consumption significantly. The mains water consumption of the school is only 2.3 L/pupil/occupied day and the school uses 6.8 L/pupil/day (including recovered rainwater).

The detailed monitoring of the water systems was also used to discourage the common practice of over-sizing rainwater collection tanks. The tank for this school was 12 m³ where manufacturers would typically recommend the use of a tank almost double this size. The 12 m³ tank is able to provide almost all the flushing requirements for the school from rainwater.

Air quality

Traditionally, all schools in Ireland rely on manual, natural ventilation and this school is used to test the maintenance implications of automating air quality control in an Irish context. The system uses a series of louvre faced opening sections. The automated ventilation is also used for night cooling in conjunction with the school's exposed mass. The vent controls are carefully programmed to take account of wind and rain conditions and are silent in operation.

An arrangement with a fixed internal louvre and an automated external door was selected because it minimises student distraction, as the students are rarely aware that the vents are operating. This arrangement also allows ventilation that is not blocked by blinds and offers secure night cooling.

While automating ventilation improves air quality, it also increases the energy used by the school, as ventilation air is the largest form of heat loss from a classroom. Traditionally, windows were not opened in cold weather and, while this was an energy benefit, it compromised air quality.

Differences between schools in Ireland and UK

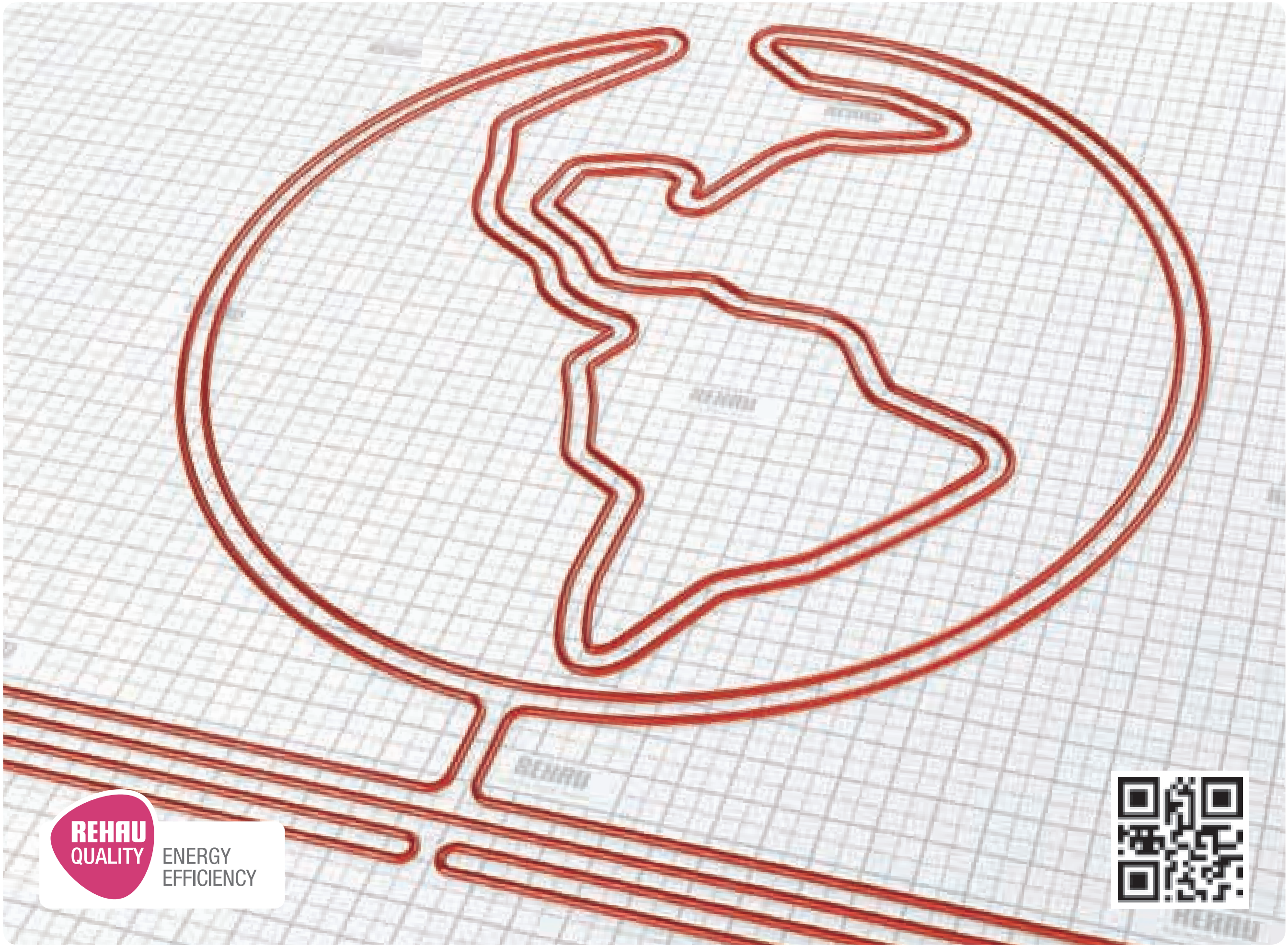
Operating hours: Core teaching hours are around 5-10% lower in Ireland.
School meals: Unlike the UK, meals are not generally provided in Irish schools. Meals at Colaiste Cholm are prepared at a local restaurant, avoiding duplication of cooking facilities and supporting local business.
Construction cost: Irish costs are around €900/m² (£777). In the UK it is about £1,250/m² – UK budgets have reduced recently.
Specialisms: Teaching spaces within Irish schools are generally designed to the same standard. UK schools can have varying requirements.
Complexity and flexibility: UK schools generally have larger break-out and circulation spaces; and raised floors are used occasionally instead of ceiling voids. Services within Irish schools are simpler, with radiator heating and natural ventilation generally being the standard. Schools within the UK regularly feature mechanical ventilation, because of heat island effects within urban areas and the need to control traffic noise.
Daylight: An average daylight factor of 4.2% must be achieved in Irish schools, which is much larger than the recommended minimum figure of 2% for UK schools.
Renewable energy: In Ireland there is no requirement to include renewable energy, while up to 20% of the energy must come from renewable sources in the UK.

Building Solutions
Automotive
Industry

REHAU
Unlimited Polymer Solutions

ENVIRONMENTAL CONTROL

ENERGY EFFICIENT HEATING & COOLING SOLUTIONS

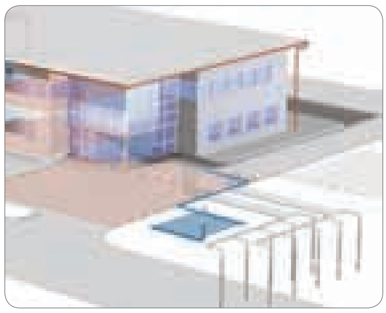


Whilst underfloor heating is undoubtedly an energy efficient way of heating and cooling buildings, the real efficiency of the system can only be realised through good design.

REHAU design underfloor heating and cooling solutions that benefit the construction process in the short term and the life of the building in the long term.

With low water temperatures circulating in the floor system, the distribution of heat only where you need it and reduced-on site maintenance, REHAU offer an energy efficient and cost effective solution.

Whatever you're working on,
work with REHAU.



REHAU Ground-source solutions integrating underfloor heating & heat pumps

IT'S UNDER CONTROL

To find out how REHAU can deliver a solution for you visit www.rehau.co.uk/underfloorheating

REHAU Ltd · Hill Court · Walford · Ross-on-Wye · Herefordshire HR9 5QN

> The first year of operation was spent tuning the building's control systems and ensuring that all of the building monitoring and data logging systems were working

The school has tested some new and innovative control routines, including a weather compensation and 'auto off' routine that takes into account solar gain and wind speed. This achieves a more accurate reflection of the external environment on building energy use than the traditional use of dry bulb temperature alone. The theory is that the heat demand of a school is heavily influenced by solar gains and that dry bulb temperature alone is a relatively poor metric for inferring a building's heat demand.

The controls include a morning set back of room temperatures to 190°C (over-riding local user control when the building is unoccupied) to allow the building to take advantage of morning heat gains.

The school's energy management team has been supported by the design team through a number of presentations to all school staff, explaining the building's conservation measures. The message has also been reinforced by the use of enhanced signage, energy display screens and a post-occupancy survey.

The design team was conscious that a large proportion of the school's energy is used during school holidays when the school is unoccupied. It produced a checklist for the school, with instructions on shutting down systems over the holidays. This is also supplemented by an electrical energy display close to the security alarm, so that school staff can check how much energy the school is using as they leave the site.

The school has teamed up with a local restaurant that uses its facilities to prepare healthy meals and deliver them to the site. The school is fitted with a servery, where restaurant staff serve the meals. This is a particularly sustainable model, as the restaurant's facilities would otherwise be under-utilised during weekdays and the school can support local business.

Fine tuning

The first year of operation was spent tuning the building's control systems and ensuring that all of the building monitoring and data logging systems were working correctly. It is vital that building metering is carefully tested, as meters often prove to be incorrectly installed or calibrated. Luckily, faulty meter readings are normally relatively easy to detect, and by the end of the first year all but one water meter was operating convincingly, allowing detailed monitoring to begin during the second year.

What lessons about school design has the project provided for the Department of Education and Skills?

The Department of Education and Skills formed an integral part of the projects design team and its detailed monitoring process will offer the department in-depth information on the school's performance, once the second year of monitoring is complete. It is already clear that there are two key areas in school energy design that form obvious targets for future savings.

The first is computing. If engineers want to reduce energy in schools, they must get involved in helping schools to select their hardware and implement energy saving software correctly. While hardware suppliers are improving their products, they will only make dramatic changes when customers start to insist on a better performance. For example, a number of energy-intensive projector-integrated document cameras were purchased after the building was completed. When in 'off mode' their energy use was measured at 4.5W rather than the good practice standard of under 1W.

Cameras in every room drew 4.5W continuously through the night and over the whole year. This unnecessary wastage demonstrates the need to continue putting pressure on suppliers and reject equipment that doesn't meet minimum energy standards.

The second key area with potential for significant savings is the tackling of energy use outside normal hours of use. As schools spend a considerable proportion of their life empty, even a small electrical load can add up to a large out-of-hours energy use. Engineers must identify how this out-of-hours energy use occurs and how they can address it.

Quick building stats

- **Area:** 5,531m²
- **Completed:** 01/09/2011
- **Value:** €5.4m (£4.3m)
- **Occupancy:** 625

Need a hand designing your heating system?

Hoval

...we can help you make sense of it.

We believe that detailed and informed planning is essential to a successful project handover.

www.hoval.co.uk

Responsibility for energy and environment

Impington Village College was designed by Bauhaus founder Walter Gropius but has higher CO_2 emissions than any other Cambridgeshire school. To upgrade it, Skanska has developed a pioneering energy performance contract, reports **Andy Pearson**

FROM Bauhaus TO BIOMASS

Impington Village College in Cambridgeshire is on a mission. Its carbon dioxide emissions are 99 kg/m²/year, giving it the dubious honour of being the school with the highest carbon emissions in all of Cambridgeshire. It was a situation that was bad for the environment and, with an annual energy bill of £183,000, it was extremely bad news for the school too.

Now the situation is set to change. Contractor Skanska has developed a retrofit solution for the secondary school's energy services which is set to slash energy consumption and reduce its carbon emissions by half.

The transformation, which will take place over the summer, will include new energy controls, new lighting and new biomass boilers. The changes will guarantee to yield the school more than £100,000 a year. Most importantly for the school's finances, this impressive turnaround will come at no initial cost to the college because the works will be carried out under an Energy Performance Contract (EPC).

Impington is one of the first schools in England to use energy performance contracting to retrofit energy-saving measures. 'This exciting project offers a potential carbon reduction in excess of 50%,' says Fran Difranco, the school's vice principal. If successful, the EPC model could be rolled out across thousands of schools in England and Wales. 'We believe this represents a unique and trailblazing opportunity, which, if successful, could become a model of good practice throughout UK schools,' Difranco adds.

An EPC is a self-funding mechanism that enables building owners and

> Future savings in energy consumption are used to finance the energy-saving improvements without the need for the school to provide up-front capital

occupiers to make engineered upgrades to existing energy plant and systems infrastructure to save energy. Under the contract used at Impington, future savings in energy consumption are used to finance the energy-saving improvements without the need for the school to provide up-front capital.

Better still, from the school's perspective, all risk transfers to the performance contractor, which guarantees the performance of the proposed improvements. As a result, any potential shortfall in energy-saving performance is made up by the contractor. And, if the measures perform better than predicted, the savings are the school's to keep.

The main reason the school was leaking energy so badly was that it has a Grade II listed building within its campus, which means its exterior appearance cannot be altered. It is listed because it was designed by Bauhaus founder and modernist pioneer, the architect Walter Gropius, working with fellow architect Maxwell Fry. Built on one level, the school features large expanses of single glazed steel-framed windows set into yellow brick walls. The school opened its doors in 1939 and is the only example of Gropius' work in Britain.

As a result of its listing, it is difficult for the school to implement simple, cost-effective energy efficiency measures such as external insulation or off-the-peg replacement double glazing, which made it hard to tackle the escalating cost of energy.

Skanska was invited to visit the school in March 2011 to discuss an energy performance contracting solution to its energy-saving conundrum.

To develop an EPC solution, Richard Byers, associate director at Skanska, first had to establish a value for the amount of energy consumed by the school and its CO_2 emissions for a typical year with typical usage by examining utility bills for both electrical and thermal consumption. Using these he was able to establish the baseline case, which was that the school currently consumes 1.1m kWh electrically and 2.3m kWh thermally and has CO_2 emissions of 99kg Co_2/m_2/year.

The task for Skanska was then to find the most cost effective ways to reduce this figure. This it did by modelling the impact of different interventions, a process which Byers refers to as 'optioneering'.

According to Byers, Skanska's usual approach to improving a building's energy efficiency is first to minimise its energy requirement by adding insulation to the walls, install double glazing and make the building airtight; then replace or upgrade systems such as controls and lighting; and finally to review the viability of renewable energy technologies.

The building's listed status meant refurbishing the exterior was not an option. To replace the extensive single glazing with a bespoke double-glazed solution would have cost close to £1m. 'Spending £1m on double glazing would have saved the school only 3p per kWh of energy, which means it would take decades to pay back the investment,' Byers explains. 'We had to turn our criteria on its head for this building,' he adds.

Instead of tackling the building's energy efficiency, Skanska set about reducing its carbon emissions. 'If we put in a biomass boiler to meet the existing heat load we are reducing its carbon emissions by half, and because of the Renewable Heat Incentive the investment can be paid back in about eight years,' Byers explains. He says that using renewable energy to heat a leaky building 'goes against the grain for an engineer,' but that it is the solution that makes the

PHOTOGRAPHY BY ALEX SMITH

most sense in a grade II listed building such as this. Skanska's solution for Impington cleverly maximised the revenues from the government's current funding for renewables. Rather than install a single, giant biomass boiler, which would have attracted a single grant of 4p/kWh, Skanska has sought to maximise revenue from the Renewable Heat Incentive (RHI) for the school by proposing the installation of three biomass boilers, each sized at 199kW.

The smaller boilers attract the maximum RHI funding of 8.3p/kWh, with a total income of almost £60,000 per annum. The three-boiler solution also has the advantage of reducing the number of trenches needed to conceal heat mains between buildings.

Payback on the biomass boilers is eight years but RHI payments will continue for 20 years, which means that from year nine the school will be able to keep the revenue. The new boilers will reduce the college's carbon emissions by approximately 30%.

In addition to new boilers, Skanska is proposing to install new low energy lighting and controls, to enhance the building management system. Skanska will also provide a facilitator to work with the school to instigate behaviour changes in both staff and the 1,400 pupils. The energy conservation measures are set to improve the school's Display Energy Certificate from an F to a C.

Skanska is also considering whether to implement voltage optimisation at the school once the impact of the other changes is clear, to ensure its implementation. Other energy saving measures have been considered, but the following have been chosen because they give the best performance against investment, or 'bang for your buck' according to Byers: photovoltaic panels, solar film on the windows, building fabric improvements, variable speed drives, geothermal heat pumps and a combined heat and power installation.

Under the EPC, Skanska guarantees

How Skanska developed its EPC model

Skanska is confident of the success of its EPC proposal for Impington because it is based on experience gained through the government's Building Schools for the Future (BSF) initiative in Bristol in 2004 and Essex in 2010. In Bristol, Skanska's design had to meet an emissions target of 50kg of CO_2/m^2/year, which Richard Byers, associate director at Skanska, describes as 'average' for a new school at that time (based on 2002 Building Regulations and Building Bulletin 87: Guidelines for Environmental Design in Schools, which has been superseded by BB101).

Over time, energy monitoring demonstrated that the schools were performing slightly better than their targets, with emissions averaging about 45kg CO_2/m^2/year, based on a building usage of 2,000 hours per year.

Several years later, when Skanska bid for Essex BSF, the emissions target the design had to aim for had dropped significantly to 27kg CO_2/m^2/year. 'This target was substantially less than the 45kg CO_2/m^2/year we were successfully achieving in Bristol,' Byers explains. The contractor took a step-by-step approach, by assessing each potential solution to reduce CO_2 emissions to see where it could get the biggest cuts for the lowest capital cost. There was a further challenge in the more onerous passive requirements required under the 2006 Building Regulations and the launch of Building Bulletin 101: Ventilation of Schools.

A change in government saw a line drawn under BSF work. However, rather than walk away from the education sector, Byers and his team set about finding new business opportunities to use their experience in schools' design. Two years later, Skanska had developed its EPC model for schools.

At the same time, Skanska was involved in the Cambridge Programme for Sustainable Leadership, a European Union Corporate Leaders Group, which was working to develop the Atlas carbon reduction toolkit for schools. Skanska presented its EPC model to the Sustainable Development Commission to show how it could significantly reduce energy consumption in schools in parallel with the self-help toolkit.

In the audience that day was Jake Reynolds, head of wellbeing at the Commission, who was also a governor at Cambridgeshire's least energy efficient school. He invited Skanska to visit Impington Village College to discuss EPC options. The rest, as they say, is history....

RETRO-FITTING LONDON'S PUBLIC SECTOR BUILDINGS

Skanska has just qualified as one of 13 suppliers for the Mayor of London's RE:FIT framework.

The initiative uses Energy Performance Contracting to retrofit public-sector buildings with energy-saving measures, to reduce their carbon emissions and achieve guaranteed annual cost savings. The framework will run for four years.

Initially, 42 pilot projects from organisations such as Transport for London and the London Fire Service and Emergency Planning Authority were used to test the RE:FIT concept.

These projects totalled 146,000 m^2 of building space, delivered 7,000 tonnes fewer carbon emissions and achieved an average reduction in energy consumption of 28%.

A large number of public-sector organisations have signed a memorandum of understanding to proceed with RE:FIT, including 23 of the 33 London Boroughs and 18 NHS organisations.

savings in CO_2 emissions, kWh of energy consumed and in the school's energy bill. 'We know the yield of the equipment we've proposed because we have modelled the performance so we can guarantee the savings', Byers says. He is keen, however, to emphasise that it is energy savings that will be guaranteed and not a reduction in the school's baseline energy consumption.

According to Byers, the biggest commercial risk for Skanska is in the use of the lighting. However, the CO_2 savings will be based on a mutually agreed annual operational timetable, so Skanska will be able to monitor how the building is being used to check this is in line with the usage assumptions.

'Any usage outside of those identified hours will not form part of the contract,' says Byers. 'If the consumption is more within the agreed contractual hours, then Skanska takes the risk on that shortfall in saving.'

In addition to CO_2 savings, the EPC guarantees energy consumption savings in terms of kWh saved. The school currently consumes 1.1m kWh electrically and 2.3m kWh thermally. The energy and emissions savings will be independently measured and verified. With the energy savings implemented, the utility savings are predicted to be worth £41,564 a year. When this figure is added to the revenue of £58,700 from the RHI for the biomass, the total income from the solution is £100,264 per annum against a capital expenditure for the retrofit works of £693,000, paying back the investment over the eight-year contract period.

The EPC also guarantees projected financial savings over the eight years of the contract. These are based on what Byers describes as a 'conservative energy inflation model of 4.5%'. Should energy prices rise by more than 4.5% a year, then the savings to the school will be greater than modelled. Conversely, if energy prices rise by less than 4.5%, Skanska takes the risk on that shortfall.

Funding for the project is provided by third party private finance. Over the eight years of the EPC, guaranteed energy savings and revenue generated from the new energy saving measures will be used to pay an annual managed service fee. 'We deliver the technologies on behalf of the funders. It's then up to Skanska to ensure the project delivers the savings required over the eight years,' says Byers.

Under the EPC, the school will be monitored remotely by Skanska and monthly energy performance reports produced. This will ensure that if a particular aspect of the project is not performing as planned, Skanska can take action to remedy the situation.

Skanska has also passed some of the contract risk to its supply chain. In the case of the biomass boilers, for example, the supplier has to guarantee the energy output. Despite the increase in risk for some suppliers, the supply chain is said to be keen to be part of the initiative. 'They are happy to be part of a holistic solution that incorporates their technologies, rather than having to approach the client individually,' he says.

The technologies are due to be installed in the summer holidays with implementation of the new scheme completed by Christmas 2013. Nine years later, once the EPC period is up, the school will be able to reap the annual £100,000 financial rewards for itself.

'Whatever we save on our utility bill, plus whatever we earn from the Renewable Heat Incentive and any Feed In Tariff payments, will be used to pay the funding company back. Once we've done that, we get to keep the equipment and the savings become ours,' says Impington's DiFranco.

Byers estimates the savings between year nine and year 25 could total £2m for the school. 'They should be able to afford to invest in new glazing at some point in the future, to make the building more energy efficient,' he says.

BACK to basics

Many new schools are suffering from overheating and high energy bills because of problems with ventilation design. New guidance from the Education Funding Agency aims to address the issue and finally deliver comfortable classrooms that don't waste heat. Breathing Buildings' **Shaun Fitzgerald** explains

> The problem of overheating in winter during the occupied day, with radiators being used for pre-heating, is exacerbated with higher insulation levels

The Priority Schools Building Programme marks a new dawn for UK buildings. The programme is accompanied by a new set of regulations covering various aspects of the design, including ventilation.

The reason for the new regulations stems, in part, from the fact that a number of schools built in the last five years have simply not been energy efficient. The energy consumption of the buildings has been significantly higher than the designers had predicted. Higher electricity bills resulting from greater use of IT equipment is perhaps understandable.

However, significantly higher than expected heating bills have caused consternation. How can buildings, which are built to higher insulation and air tightness standards, need more heating than older, leaky, poorly insulated ones? Secondly, a number of these buildings are still deemed to be overheating by occupants. The transition from BB87 to BB101 was supposed to herald a new era where school buildings no longer overheated.

The sad fact is that a number of schools still overheat – they do not meet the summertime overheating requirements of BB101. A greater number are still deemed to be uncomfortable by occupants even when they meet the BB101 criteria.

In large part, the excessive heating bills and summertime overheating issues have been caused by the use of inappropriate ventilation strategies or inadequately sized natural ventilation systems. However, the summertime overheating challenges have also arisen partly as a result of the building design not maximising the opportunities of night-cooling and exposed thermal mass, with the thermal benefits of such designs. The new regulations have, therefore, been developed to improve the ventilation performance all year round.

Winter

The challenges for winter ventilation:

- Provision of adequate amounts of fresh air
- Elimination of excessive overheating, thereby minimising energy use
- Prevention of cold draughts

The new Specification Document for Priority Schools has been developed to tackle all three of these challenges. Firstly, the 145-page document makes it clear that the supply of adequate fresh air must be maintained throughout the occupied day. The document stipulates that where natural ventilation is used, the system must be capable of providing enough fresh air so that the average concentration of carbon dioxide during the required period is less than 1,500ppm, and the maximum concentration does not exceed 2,000ppm for more than 20 minutes each day (2.8.84.1). Where mechanical ventilation is used, enough fresh air must be provided to achieve a daily average concentration of carbon dioxide during the required period of less than 1,000ppm, and the maximum concentration

must not exceed 1,500ppm for more than 20 minutes each day (2.8.83).

This latter note about maximum levels for no more than 20 minutes per day is important – it prevents spaces fluctuating in terms of air quality in order to satisfy an average level, with rooms becoming overly stuffy for extended periods.

The second point avoidance of excessive heating bills is important because many naturally ventilated schools have historically used radiators to pre-heat the incoming cold air. The problem with this strategy is that the heat gains in typical classrooms of 30 children are in excess of 3kW, and if the external air is pre-heated to say 16°C before it enters the space, then, if flow rates of 5 l/s/person are used, the interior temperature can rise to around 30°C. This is clearly unacceptable and so higher fresh air rates are used to sweep away the 3kW of heat, which in turn means that the radiators have to pre-heat more fresh air.

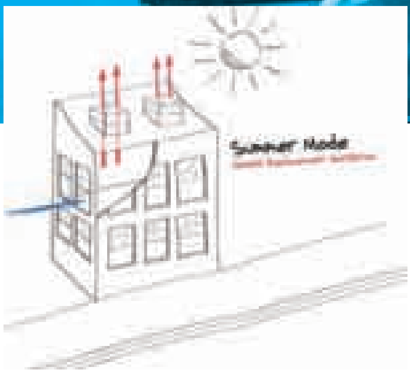
This is the reason heating bills in many new schools have ended up being higher than forecast. The modelling for Part L compliance usually assumes that the heat gains in the space are available to help keep the interior at a comfortable level. This is fine but it means a different natural ventilation strategy is required to mitigate cold draughts. The new regulations state that in naturally ventilated spaces the contractor must provide mixing of ventilation air with room air to avoid cold draughts in the occupied zone during wintertime (2.8.43).

This is really important because it enables the internal heat gains to be used to pre-heat the incoming air effectively instead of radiators, and the resultant heating energy savings are significant. Interestingly, the problem of overheating in winter during the occupied day, with radiators being used for pre-heating, is exacerbated with higher insulation levels. This reduces the amount of heat escaping through the fabric and so higher flow rates are required, resulting in excessive heating bills. While improved insulation certainly leads to lower heat loss at night, and hence less morning pre-heat, the heating requirements during the day are worse.

The alternative solution of natural ventilation without excessive heating bills has sometimes been to simply dump cold air onto occupants. In fairness, BB101 did not explicitly state draughts had to be managed, although one might argue that it was fairly obvious this was critical. The net result of systems that cause cold draughts is that they get turned off in colder weather and, given that schools have a large proportion of occupied time over a year below 16°C, it means that many classrooms can be inadequately ventilated for a lot of the year.

Finally, the issue of cold draughts has sometimes been addressed via mechanical

> How can buildings built to higher insulation and airtightness standards need more heating than older, leaky, poorly insulated ones?



ventilation with heat recovery. These schemes certainly help mitigate the risks of cold draughts, but the penalty has been the resulting fan power and increased maintenance requirements.

Summer

The new specification document has embraced the issues of thermal comfort and is the first time that perceived thermal comfort is being used across the board in the UK as the measure for assessment of overheating for a large number of buildings. Perceived thermal comfort takes into account a number of factors over and above the dry bulb air temperature. Importantly, it includes the effect of radiative heating or cooling from surfaces to which occupants are exposed.

In summer, if the exposed surfaces in a room have been cooled at night then these surfaces can remain cooler than the air temperature during much of a summer day and thereby provide a cooling effect. The new specification document stipulates that the contractor employs passive measures such as thermal mass where possible to reduce the possibility of overheating (2.8.53). It states that soffits in teaching spaces will normally be exposed to provide thermal mass to absorb heat and provide night cooling (2.7.44).

The reduction in air temperature combined with the ability of the surface to absorb heat radiatively from people will help the building to be comfortable without mechanical cooling. This is part of the requirement for contractors to design-in the optimal benefits of seasonal ventilation to design-out the need for active mechanical and electrical services (2.5.22.5). The document states that in naturally ventilated areas, the contractor shall provide cross flow natural ventilation for summertime ventilation and night cooling to minimise ventilation opening sizes and eliminate the need for mechanical cooling (2.8.91).

New guidance

The new specification document will lead to a significant improvement in schools design but it is daunting for some contractors and designers. The summertime overheating criteria are probably the most challenging in terms of design – not that they are overly difficult to achieve, but without the right modelling software it is difficult to assess design compliance. Breathing Buildings has an eight-page document that summarises key tenets of the output specification, and demonstrates compliance. Since the standard will likely be applied to a wide range of building types, there is great interest in this crib sheet.

Compliance with the summertime overheating criteria can be assessed using standard dynamic thermal modelling software, because the core ingredients of air temperature and surface temperatures are already determined. However, the assessment of whether the building meets two of the three criteria currently requires designers to undertake some post-processing of the model output.

Breathing Buildings has compiled the new criteria into a dynamic thermal modelling tool. The comparison of the different wintertime strategies of MVHR and natural mixing ventilation is interesting, with natural mixing ventilation proving to be the lowest energy solution. It also has a lower heating load requirement than MVHR. At first glance this may seem odd, or even plain wrong! But because the fresh air requirements for rooms ventilated using MVHR are nearly twice that of rooms that are naturally ventilated, then even with heat recovery efficiencies of 75%, the heating bills are in fact higher using MVHR.

● **SHAUN FITZGERALD** is managing director at Breathing Buildings

Indoor Air Quality In Schools

Is It Making The Grade?

By Nick Hudleston, Natural Ventilation Division Manager at SE Controls.

The new Priority School Building Programme (PSBP) Facilities Output Specification, launched last October by the Education Funding Agency, proposes some significant, positive and welcome changes to school ventilation specifications when compared to the existing BB101 standard.

Alongside ventilation and carbon dioxide levels, it also provides clear guides on specific performance standards for thermal comfort while recognising that indoor air quality, ventilation strategy, temperature, humidity and energy efficiency are all intrinsically linked.

However, will schools that fall outside of the PSBP and its associated funding find that their pupils suffer as 'legacy' classroom designs struggle to meet the new standards, particularly for CO_2?

Classroom carbon dioxide levels exceed BB101

In the last quarter of 2012, we ran a pilot test with a small number of 'non-PSBP' primary schools in the Midlands and Northern Home Counties to gauge the actual level of CO_2 in classrooms.

Using the integral CO_2 sensor and data-logging function in our NVLogiQ room controllers to monitor and record carbon dioxide levels for later analysis, the units also provided 'traffic light' warnings to teachers prompting them to manually open windows to improve ventilation.

When the initial data was analysed in January this year, the headline results raised some significant concerns and were as follows:

- For most days, the daily average occupied CO_2 level exceeded the recommended 1500ppm figure in BB101.
- In some cases the figure was between 2500ppm and 3700ppm on every day of the week.
- BB101's maximum 5000ppm level was breached four times per week, in some cases.
- A maximum reading of 7200ppm was recorded, resulting in CO_2 levels exceeding 5000ppm for almost 3 hours in one case.

While this is a relatively small pilot programme, the results appear fairly consistent and suggest that air quality in schools is probably not as good as it should be.

Control is the key

In 'post-test' de-briefings, teachers said they were too busy to constantly monitor and respond to 'traffic light' signals, so relying on manual opening proved to be unviable due to the intrinsic lack of precise control.

Unless automated ventilation solutions are adopted, such as window automation linked to dedicated monitors and controllers or a hybrid mixed mode system to provide additional backup, then it's likely that children and teachers will continue to work in poorly ventilated and noncompliant schools with the inevitable result of reduced learning performance.

By utilising devices such as NVLogiQ, which can be configured either to operate as a networked system or dedicated to individual areas, classroom CO_2 levels, temperature and energy efficiency can be managed as an integrated set of parameters to provide optimal ventilation while saving energy and money.

A learning environment

PSBP provides a tremendous opportunity to bring our schools up to date with quality facilities and better, more comfortable energy efficient buildings.

It's evident that the ventilation industry and the education sector have learned a lot since the original introduction of BB101, yet the issues identified in our classroom CO_2 pilot study suggest that while there are still some lessons to be learned, the ventilation solutions are already available.

SE Controls' 30 years of experience in creating and installing natural ventilation solutions in a diverse range of sectors, alongside an ongoing commitment to rigorous academic research, equips us with skills and technologies that can help make PSBP work, while helping improve building performance overall.

Advertisement feature

Heat Recovery Air Handling with Low Noise Ratings

Ecovent Acoustic - VES' Quietest Air Handling Unit!

The Problem – Air Handling Acoustics

Currently a large number of educational environments, new and old, have poor acoustic properties; unfortunately this is due to a multitude of different reasons. A large proportion of this can be attributed to improperly set up ventilation units. However, a greater awareness of how to solve ventilation noise issues can be achieved by referring to Building Bulletin 93 (BB93) – Acoustics for Schools, which is aimed specifically for education applications. This allows the appropriate design of air handling units based on desired acoustic performances for the given situation and environment.

Noise resulting from ventilation systems; which contributes to the acoustic issues, often requires specifiers and designers to compare manufacturers to determine who has the better acoustic unit which meets stated regulations.

With the different noise categories: Airborne, Case breakout, Duct-borne, Self-generated and Structure borne having an impact on acoustics; independent testing is necessary as it provides useful data about the noise emitted by ventilation products. This helps specifiers and designers make informed decisions when selecting products for installation. Full awareness of the factors contributing to noise and how this will impact the ventilation system's overall acoustics helps to ensure that the BB93 specification is met.

Air Handling Acoustic Testing

Along with designing low noise products, comes the challenge of accurately displaying the information in a meaningful way. Independent testing of VES' air handling unit was undertaken at the University of Southampton Institute of Sound and Vibration Research facilities. Testing was conducted to provide transparent data that allows accurate acoustic judgments to be made.

The units were tested in an anechoic chamber, in accordance to BS EN ISO 3744:2010 which is part of the ISO3740 Series - Determination of Sound Power Levels of noise sources, using sound pressure for machine, equipment and their subassemblies. These sound pressure values were then averaged and converted into octave bands so that the A-weighted sound power level was determined and associated Noise Rating (NR) level for the different operating conditions.

Initial results suggested that the noise sources within VES' air handling unit generated a higher sound and unwanted power level in the 100-250 Hz range which directly related to the fan blade pass frequency. Once this was understood and the problematic frequency was identified, the associated cause was subsequently found which allowed VES to develop the design of their air handling unit to reduce the overall noise level.

The Solution - Ecovent Acoustic – Low Noise Heat Recovery

Assessing the fan cradle design, case construction and acoustic materials helped to reduce the sound power generated and the sound migration through the case; case breakout. As a result VES' quietest heat recovery unit was developed, the Ecovent Acoustic, perfect for many educational environments.

- Independent Acoustic Testing to BS EN ISO 3744:2010
- Low Noise to meet acoustic requirements, including BB93
- High efficiency Heat Recovery, 70%+
- Low Specific Fan Powers
- BlueSense Intelligent Controls

About VES

VES has been supplying products for the HVAC industry for over 40 years and has the in-depth knowledge and resources to provide solutions to all ventilation related requirements, with a diverse product range specific to schools. As a substantial British manufacturing company, with over 250 employees and UK exposure, VES' product range encompasses all types of ventilation products.

VES also operates a Specialist Site Services division, which is a market leader in the repair and refurbishment of any make or model of air handling equipment, offering a number of specialist services:

- Kitchen Ventilation
- Swimming Pool Ventilation
- Maintenance
- Repair and Refurbish
- Site Installation Assistance
- Noise Control
- Post Install Check/Measure

VES

For more information call VES today on 08448 15 60 60 or email info@ves.co.uk www.ves.co.uk

Not your usual type

Endike Primary School chose a radical design for its new premises, and the choice of a gas absorption heat pump by Binks Building Services was pretty innovative, too

There's no danger of visitors missing the striking new Endike Primary School in Hull. The letters of the school name are writ large in the façade of the £6m facility designed by Surface Architects.

The design is unique, and as far away as possible from the concept of standardised school design introduced by the Education Funding Agency last Autumn.

The services solution is also relatively unusual in the UK. Binks Building Services (BBS), which was appointed by principal contractor Sewell Group, specified a gas-absorption heat pump to provide heat for the school.

Originally, Hull City Council considered biomass boilers but locals raised concerns over emissions, according to Tsonka Popova, designer engineer at BBS. 'We were tasked to review alternative options that would still reduce carbon, be cost neutral or better, and have similar or reduced running costs,' he says.

BBS liaised with Bosch Commercial and Industrial Heating and chose to install six GWPL38 gas absorption heat pumps in a cascade arrangement.

'The purchase and installation of any heating system in a public building is likely to be one of the more expensive investments made so it was vital that we made the right selection,' says Popova.

In traditional air-to-water heat pumps, electricity is used to power an induction motor that drives the refrigeration compressor. Gas-absorption heat pumps use a gas burner to drive the refrigeration cycle, which draws on the available energy from the surrounding air to increase thermal output above that provided by gas input. By drawing in free energy from the surrounding air the heat pump design helps to generate up to 65% additional heat.

Popova says the cost of these heat pumps was

> 'By drawing in free energy from the surrounding air, the heat pump design helps to generate up to 65% additional heat

> The refrigerant used in gas absorption heat pump technology is ammonia, which has zero global warming risk and zero ozone depletion risk

cheaper than biomass boilers and air source heat pumps. He says there was an additional saving over a biomass boiler as Sewell didn't have to build a remote energy centre/fuel store or provide groundworks for heating pipework.

Lukasz Bulawa, commercial technology consultant for Bosch, says the choice of a gas absorption heat pump would cut school fuel bills. 'As the technology utilises gas, which is around a third of the price of electricity, running costs can be cut significantly in comparison to the use of other comparable technologies, such as electric heat pumps,' he adds.

Popova says the ability to integrate the pumps into building management systems was valuable: 'Integration means that the performance of the heat pumps, as well as the temperature levels in each classroom, can be monitored and adjusted by the simple touch of a button from a centralised control system, making future maintenance and servicing work a lot simpler.'

The GWPL38 gas absorption heat pump is designed for external use, which meant BBS could free up more space for the school. 'We were able to utilise the ample space on the roof of the building, and not take up valuable floor space in an internal plant room,' says Popoya.

The heat output coming from the six units will cater for the heating demand of the school, without need to install a back-up heat source.

The Gas Utilisation Efficiency is more than 160% for gas absorption heat pumps, according to Bosch. During the peak heating season, when the average temperature is 7oC, an average of 0.5kW of free energy is absorbed for every 1kW of gas consumed. At similar temperatures, the heat output of a single GWPL38 unit can reach up to 38.3kW. When the temperature drops below freezing, each heat pump will work with an efficiency of at least 125%, with a single unit generating 31.5kW of heating output.

Gas absorption heat pump technology also minimises NOx emissions and so qualifies for BREEAM 5. The refrigerant used in gas absorption heat pump technology is ammonia, which has zero global warming risk and zero ozone depletion risk.

Linda Burrows, head teacher of Endike Primary School, says she is impressed by the level of service post-completion. 'The aftercare provided by Bosch has been second-to-none. Once the installation was complete they took the time to re-visit the premises, on more than one occasion, to ensure all relevant members of Sewell Group, BBS and the facilities management team here at Endike Primary had all the necessary training to be fully competent in operating the system. '

She says commitment to aftercare meant the heat pumps were running at 'optimum levels'.

To monitor performance, each bank of heat pumps has a sub-meter on the gas supply linked back to the BMS, which is monitored by Sewell and school caretaker staff. Data for the six month-old school is not yet publicly available.

New CO_2 sensors, BACnet multi-purpose control and natural ventilation from Titan Products

Titan Products has launched a new CO_2 duct sensor to add to its extremely successful range of CO_2 sensors. The range also includes room CO_2 sensors starting at £120, which benefit from options including LED indication for CO_2 level, optional resistance outputs for temperature and an optional 0-10V output for humidity. The CO_2 sensors from Titan Products are the perfect way to monitor carbon dioxide levels in school, office and hospital environments, where fresh air is extremely important. Titan Products also manufactures a Zigbee wireless CO_2 sensor, which can be used in conjunction with the TPZ-Net co-ordinator to create a wireless network. These networks can greatly reduce site wiring, commissioning and installation time. In addition to environmental sensors, Titan's range includes temperature, humidity, air quality, CO, light level, occupancy and pressure sensors. The CO_2 sensors can be used in conjunction with Titan Products CCM/MPC Multi-Purpose BACnet controllers, allowing heating, cooling or ventilation plant equipment to be controlled over a BACnet network. The CO_2 sensors also complement the Natural Ventilation BACnet controllers from Titan Products. Primarily used in schools, libraries and office environments, the CCM-204 controllers regulate the fresh airflow throughout a building, depending on CO_2 and temperature levels.

● Call 0161 406 6480 or visit **www.titanproducts.com**

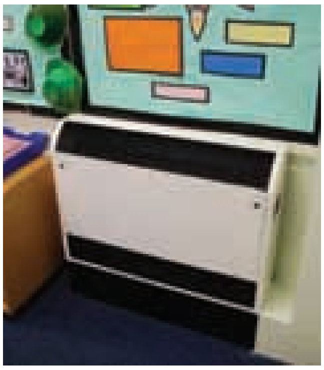
Making savings with Marflow Hydronics

One of the biggest problems facing the education sector is the need to create buildings that suit seasonal changes, while staying within budget. The simplest way to manage this is by monitoring the energy used in a building and then implementing a process to achieve optimum efficiency. Easy as it sounds, this often fails as the system isn't used properly. Marflow Hydronics produces solutions within the HVAC sector that can be easily implemented with energy management systems. Using the groundbreaking 'remote commissioning' concept, this can then be managed remotely, at any time or place to suit, making the management easier than ever before. With the Soft Landings Framework, end users get a much better understanding of their systems in the early stages. From classrooms to gym areas and halls, there's a large capacity to cover and tight expenditure to manage, and energy monitoring could be a vital tool to help. Marflow Hydronics is dedicated to helping organisations cut energy and save money, and actively wants users to have a better understanding of their systems.

● Visit **www.marflowhydronics.co.uk**, email **hydronics@marflow.co.uk** or call **0845 564 1555**

School benefits from Dunham-Bush EC fan convectors

EC motor drives are at the heart of more than 60 Dunham-Bush Avant-Garde fan convectors at Cliffdale Primary School, Portsmouth. 'This was the first winter with the new heaters and BMS controls has delivered a very pleasing result for both the school and Portsmouth City Council,' explains senior designer David Mitchell. The low temperature condensing boilers (50/30°C) will also help to reduce energy consumption into the future. The design authority was Portsmouth City Council and the supplier was Dunham-Bush, Havant. The award winning Avant-Garde Fan Convector, manufactured by Dunham-Bush in the UK, is available in 22 standard model configurations and seven nominal heating outputs. A chassis version is also available, where concealed installation is required. The Avant-Garde fan convector is ideal for applications where condensing boilers are installed, where full heating capacity can be achieved with return water below 55°C. Avant-Garde fan convectors are available with infinitely variable EC fans for optimum energy efficiency. The units are also offered with fitted control valves for integration into the building management system.



● Visit **www.dunham-bush.com**

New education gas safety range for laboratories and classrooms

S&S Northern has launched a comprehensive range of gas safety equipment for use in laboratories and classrooms in UK schools, colleges and universities. The range consists of four gas-pressure proving systems to meet all laboratory requirements, alongside a carbon dioxide detector, which can be used in science and food technology laboratories and standard classrooms. S&S Northern is a leading manufacturer and supplier of gas safety equipment for a wide range of industry applications, including commercial kitchens, car parks, boiler houses and shopping centres. The company also specialises in manufacturing and supplying gas-pressure proving systems for use in the education sector and thousands of its systems have already been installed across the country. S&S Northern's gas-proving range, for use in laboratories, uses a single unique electronic pressure-measuring switch, making the systems very reliable and easy and quick to install. These systems offer a safe start-up and ensure teacher control, the safety and protection of students during the school day and 24-hour building protection. S&S Northern's 'traffic light' CO_2 detector supports IGEM/UP11 and Building Bulletin 101, ensuring that laboratories and classrooms in the education sector are healthy and safe for students and staff, and protected 24/7.

● Visit **www.snsnorthern.com**, email **info@snsnorthern.com** or call **01257 470983**

The Priority School Building Programme

– automated windows the natural choice

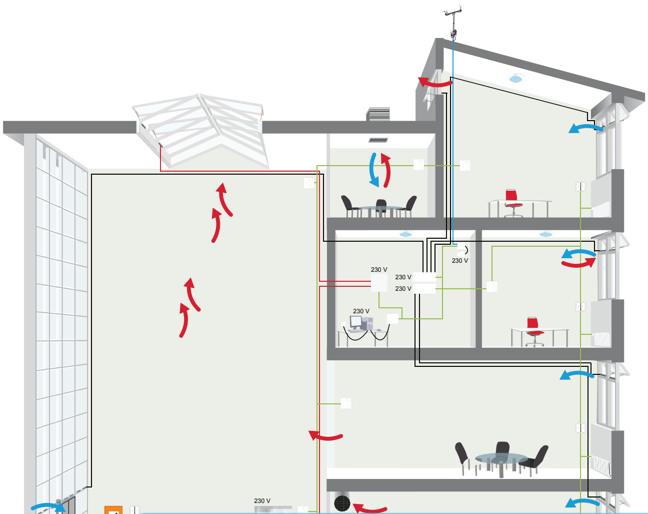
WindowMaster have been working with representatives from the EFA, design teams and main contractors to provide a cost effective and reliable solution to meet the output specification for the PSBP.

The challenge has been to find and prove a solution that meets:

- the demanding internal environmental performance
- the on going low energy consumption requirements
- the very limited available budget

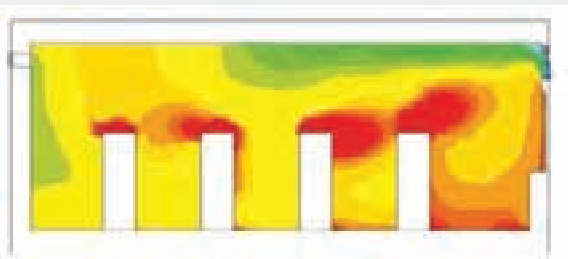
Natural ventilation with cross-ventilation can meet the requirements for internal temperatures and CO_2 levels and budget, but will the mixing of cold air in winter increase the energy use and create draughts?

Mechanical ventilation systems and hybrid ventilation (natural ventilation with a fan) have proven to make it very difficult to achieve the budget constraints.



For help with your school designs please contact WindowMaster on:
Tel. 01536 510990
Email: info@windowmaster.co.uk

WindowMaster have been able to demonstrate that by using their NV Advance™ system with MotorLink™ technology, it is possible to meet the demands of the output specification and overcome the perceived issues with automated windows.



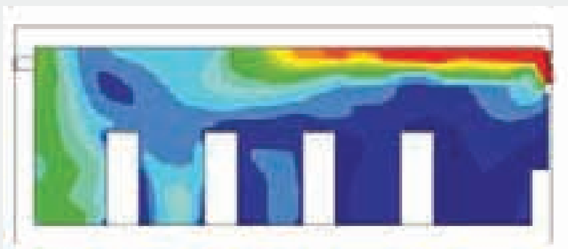
Air temperature

When windows are controlled precisely:

- Cold external air does not drop straight down
- Good internal temperatures can be achieved without the need for heating
- Heat recovery is not required

When wind speed and direction are monitored:

- Cold draughts do not occur
- Controlled mixing of the colder external air with the warmer internal air happens naturally
- Mechanical systems and fans are not required



Air velocities

UK +44 (0) 1536 510990 info@windowmaster.co.uk **Other markets** +45 4567 0300 info@windowmaster.com

www.windowmaster.com