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JOURNAL



The official magazine of the Chartered Institution of Building Services Engineers

December 2013

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Contents

NEWS

7 News

EU threatens UK over EPCs; Tories attack green levies; MPs back Code for Sustainable Homes

12 CIBSE News

Winners revealed: Young Lighter and SoPHE Young Engineer of the Year, plus a call for better simulation models at CIBSE seminar

OPINION

20 Landlords need a big stick

Hywel Davies says enforcement is the key if minimum standards for energy use in buildings for sale or let are to be successful

21 Feedback

A CIBSE Fellow starts a petition, and engineers debate the value of hospital PFIs on LinkedIn

22 Variable results

Algorithms used in SBEM need amending to better reflect energy savings of variable speed drives

LEARNING

57 CPD

The development of VRV/VRF systems

CLASSIFIED

62 Products

A round-up of gadgets and services for the industry

66 Directory

A guide to suppliers

PEOPLE AND JOBS

67 Appointments

Jobs at jobs.cibsejournal.com

70 Looking ahead

Young engineers in East Anglia look at the technical challenges of whisky distillation

30



Features

16 Change the Conversation

Communication skills are the key to success, concludes the latest CIBSE Young Engineers' Network debate

26 Under construction

BIM is paying dividends, but cultural and technical problems still need fixing, says Ben Roberts

30 Quay performance indicators

How an innovative ventilation strategy has helped a New Zealand bank cut power use by 50% at its new HQ

36 In the firing line

Increasingly 'intelligent' buildings are becoming sitting targets for cyber attackers. Hugh Boyes sets out the risks

40 Eyes on the load

An efficient multiple boiler strategy must have heat load control at its heart, argues Graham Smith



Read the Lighting Special with this issue

45 A little light reading

Unveiling the three new Society of Light and Lighting guides

50 It's not rocket science

Changing human behaviour can be the key to cutting energy use

52 Work light balance

Mike Ridler reviews the BCO's first Guide to Lighting



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Tied hands

Vote blue, not green. That appears to be the Conservative's revised message following comments David Cameron reportedly made in Downing Street. The party that previously called on the electorate to vote blue to go green, is now telling them to vote Tory to get a reduction in energy bills.

It's no secret that the Autumn Statement will see George Osborne take a knife to funding that helps fund energy efficiency measures. The prime minister's pledge to reduce 'green levies' has already seen projects put on hold and demand for insulation plummet. It has prompted pleas from manufacturers and others not to cut the ECO programme, which has so far helped fund the improvement of more than 200,000 low-income homes. (page 8).

The Conservatives may be changing their spots, but the party can't 'roll back' its legal obligations on Europe. Last week, the European Commission gave the UK government two months in which to ensure that Energy Performance Certificates were displayed in commercial buildings, in accordance with the European Performance of Buildings Directive. Only the UK government knows the specific concerns of the commission, but the fact that only two out of five commercial buildings that require EPCs, actually possess them, will have prompted concerns. (page 7).

The Code for Sustainable Homes was one piece of 'red tape' that was expected to be cut by the government but an influential group of MPs has said that it should be retained (page 7). CIBSE believes that the Code has driven significant innovation in the energy performance of new homes.

One key reason for underperforming buildings are the controls, according to Max Fordham's soft landing expert Tamsin Tweddell. She says that control specialists need to be involved in the tender stage if they are to be commissioned and used properly. Our cover feature highlights the mis-use of controls systems by a new generation of criminals who break into buildings via badly protected communication networks, rather than poorly secured windows (page 36).

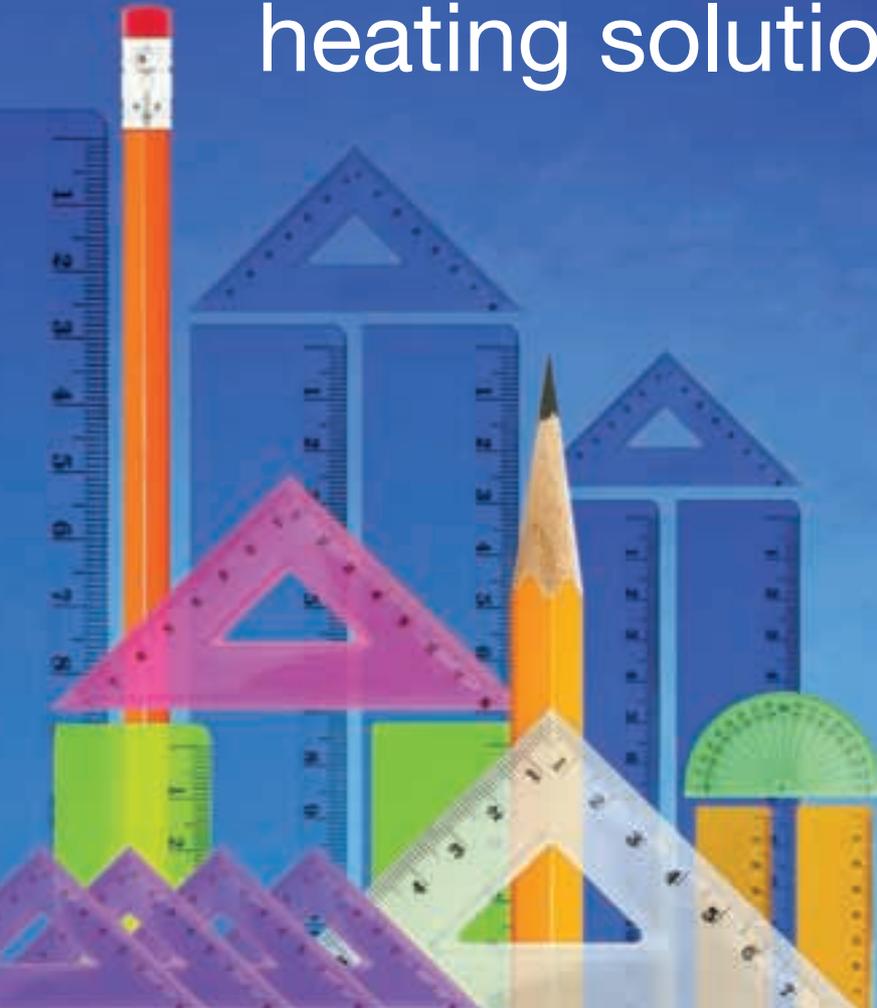
Cyber security expert Hugh Boyes has logged cases of CCTV cameras being turned off remotely while thieves clear out containers, temperature controls being modified illicitly through BMS, and alarm systems being disabled through the use of malicious software. It may sound like science fiction but the threat is real, and should be taken seriously – now.

Alex Smith, editor
asmith@cibsejournal.com



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UK risks breaking law on EPCs

● Government has two months to comply with legal obligations

The EU has threatened to take the UK to the European Court of Justice over the display of Energy Performance Certificates (EPCs).

In its latest infractions, published on 20 November, the European Commission said the UK had failed to ensure energy certificates were issued under the Energy Performance of Buildings Directive (EPBD).

At the moment, there is no requirement in Britain to attach a certificate to a property that is sold or rented. Unlike other Member States, the UK government only requires the EPC rating.

But the commission has warned that issuing EPCs is one of the key requirements of the EPBD.

The EU's 'reasoned opinion' as to why the UK is failing to implement the EPBD will not be made public.

But technical director Hywel Davies said it might be down to inadequate enforcement in the country.

'There is a shortfall. We at CIBSE think that only two out of five commercial buildings that require certificates actually have them,' said Davies. 'It may be that they feel the penalty regime is inadequate, and they may feel other aspects are deficient.'

In September, the commission asked the government to add EPBD provisions into UK law.

It has now stated that the UK may be referred to the

European Court of Justice if the government fails to provide a satisfactory response within two months.

An EPC must be

displayed if premises are rented or sold; if a building under construction is finished; or, if there are changes to the number of parts used for separate occupation, and these changes involve providing, or extending, fixed heating, air conditioning or mechanical ventilation systems.

● The Part L 2013 Approved Documents have been published. Davies praised them for their readability.

'It almost brings building regulations into the web age,' he said.

'The commission has warned that EPCs are a key requirement of the EPBD'

In brief

HIGHEST JUMP FOR CONSTRUCTION IN SIX YEARS

Construction activity has risen at its fastest rate for more than six years, according to the latest market research.

Residential construction is the strongest area of activity, but commercial projects are also coming back strongly, and job creation is accelerating at its fastest pace in six years, according to the Markit/CPS UK Construction Purchasing Managers' Index.

But the surge in activity has put pressure on prices, with overall cost inflation at its highest point since August 2011.

Construction output growth in October showed the steepest climb since September 2007, according to the index, which reached 59.4, up from 58.9 in September and above the 50 no-change threshold for the sixth consecutive month.

ONSITE GENERATION COULD SAVE £33BN

Electricity and heat generated onsite from renewable and low carbon sources could save UK businesses £33 bn by 2030, according to a new study.

Onsite energy generation will contribute 14% of the UK's energy needs by 2030 – up from 9% in 2011, according to the study commissioned by energy consultancy Utiyix.

Combined heat and power (CHP) and energy from waste are predicted to deliver the greatest savings at around £20 bn, but solar and tri-generation – the simultaneous creation of cooling, heat and power – are expected to grow the fastest.

YOUNG ENGINEERS' AWARDS

November's *CIBSE Journal* incorrectly said that Kathryn Dryden of Atkins was runner up at the CIBSE/ASHRAE Young Engineer of the Year Awards and Aecom's Emily Woodhouse was third. It should have stated that Emily was second and Kathryn third. They received bursaries from the Rumford Club of £250 and £500 respectively.

Code for Sustainable Homes must stay, says influential MP group

Plans to axe a policy that delivers low energy homes in the UK have been criticised by a committee of MPs.

The Environmental Audit Committee has urged the Department for Communities and Local Government to retain the Code for Sustainable Homes (CSH).

It criticised the regime proposed in the Housing Standards Review (HSR), calling it too weak to ensure that homes would be built to a robust energy standard.

Although optional, the CSH has been used widely by local authorities to drive up sustainable building and help reduce carbon emissions in the UK's housing stock.

But the government has proposed winding down the code to cut the red tape in house building.

Instead, it recommends using Building Regulations, or national standards, to improve homes.

In its report, published last



month, the environmental committee said that a new national baseline standard proposed in the HSR was unnecessary because the current Building Regulations already provided an effective baseline.

In its response to the HSR consultation, CIBSE said that a number of energy elements would have to be incorporated into Building Regulations, or national standards, if the government was to go ahead with its plans to scrap the code.

It added that the CSH was more than a way of setting standards of design and construction – it also provided benefits in quality control, without which performance gaps may arise.

'It should be acknowledged that the code currently serves a useful purpose in providing a requirement for a post construction review from an assessor that has passed a nationally recognised training course,' the response stated.

Smart grid ready

The difficulties of both matching intermittent renewable energy supplies to demand and managing peak loads are driving the development of smart grid technology, according to US expert Tom Lawrence of the University of Georgia.

'Peak demand management is becoming more important in buildings, and we now need to look beyond the single building cost,' Lawrence told the CIBSE ASHRAE Group. 'Demand response is the killer app for smart grid.'

Reducing peak demand at times of 'grid stress' – typically very hot or cold weather spells – will also be important, he added.

Keep it simple

Controls for intelligent systems that monitor and adjust building performance must remain simple, said UK BIM Task Group chairman Mark Bew.

'We've not done a good job so far, and the smart metering strategy needs more clarity,' he told CIBSE's technical seminar.

'The intelligent tools that are out there right now are clever; how we put them into buildings – and make them simple enough to use – is going to be the trick.'

'No system improves without a feedback loop, but what we mustn't do is make things so complex that no one can understand it.'

Guy Nevill, senior partner at Max Fordham, said that The Hive had been analysing performance through the BMS and online sub-metering.

He said: 'If we were going to do it again, we would definitely try and keep the controls a bit simpler.'

PV capacity to double by 2020

Annual installations of new solar PV capacity will more than double by 2020, growing from 35.9 gigawatts (GW) in 2013 to 73.4 GW in 2020, according to a report from Navigant Research.

Growing volumes have brought down the cost of the technology, and the Asia Pacific region, in particular, is maturing quickly.

ECO scheme under threat

● Scrapping initiative could hit £1.3 bn worth of refurbishment contracts

Legal experts believe energy suppliers – who must deliver a certain value of energy efficiency improvement projects for fuel poor and hard to treat homes – could be released from their obligation if the terms of the scheme are changed.

The ECO programme is being targeted along with other so-called 'green levies' by the coalition in a bid to reduce consumers' energy bills. But more than 200,000 homes have already been successfully refurbished under the ECO.

John Sinfield, managing director of Knauf Insulation, wrote to David Cameron telling him that the policy should not be 'shelved on a whim' adding that earlier versions of the scheme had helped reduce energy demand in more than 12 million homes since the early 1990s.

'Since the demise of the Warmfront scheme, ECO is the only policy that addresses the quality of the UK's housing stock and, more than that, the quality of the housing stock among the fuel poor,' said Sinfield.

He admitted that the present system had been 'designed poorly, implemented badly and had not delivered on its potential', but argued that it was not broken and could be fixed.

'Efficiencies can be gained by giving the supply chain better visibility of demand, by ensuring consistency of compliance across the Big 6 and by



KOSOFF/SHUTTERSTOCK

reviewing the measures available. This is a long-term policy that seeks to address some of the leakiest housing in Europe.'

At least five other organisations have written to Cameron expressing the same fears as Sinfield.

Industry urges Prime Minister to keep green levies in place

Senior figures from more than 50 leading UK companies and professional bodies, including CIBSE and B&ES, have written to the Prime Minister urging him to reconsider scaling back green measures paid from levies on domestic energy bills.

In a letter to David Cameron coordinated by the UK Green Building Council, chief executives from a range of firms – including E.ON, Carillion, Barratt Developments, Willmott Dixon, and Keepmoat – urged the government not to scale back schemes like the Energy Company Obligation (ECO) in a bid to reduce consumers' energy bills.

The 'powerful message' follows Cameron's shock statement in parliament that he intended to 'roll back' some of the green regulations and charges 'that are putting up bills'.

The letter argues that energy efficiency is the 'only sure way' to protect households against rising bills in

the long-term, and warns of 'severe consequences' for jobs. The industry leaders argue that rolling back ECO – which is designed to improve the energy efficiency of vulnerable and low income households and 'hard to treat' properties – would push up energy bills for these consumers.

The leaders also urge Cameron to consider using additional incentives, such as stamp duty to encourage uptake of the Green Deal, which could help reduce the cost of ECO.

'Cutting back schemes designed to boost energy efficiency is an incredibly short-sighted view, and one that will only result in higher bills in the medium to long-term for those most vulnerable from rocketing energy prices,' said Paul King, chief executive of the UK Green Building Council.

'Energy efficiency is the only guaranteed way to combat rising energy bills, and it defies belief that the Prime Minister is considering rolling back one of the government's biggest initiatives to achieve this.'



UKGBC's Paul King

Industry tells MPs to reform heat policies

● Accreditation scheme low in number and too complex, say MPs

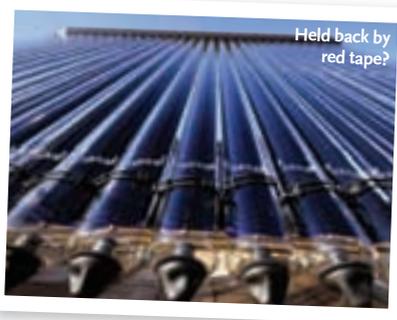
An influential group of MPs has heard evidence from industry experts that crucial heat policies are failing.

The Energy and Climate Change Committee – which oversees policy decisions at the Department of Energy and Climate Change (DECC) – was told that the number and complexity of accreditation schemes was undermining government initiatives to improve heating efficiency.

The Green Deal, in particular, came in for heavy criticism for being over-complicated and hard to understand.

David Frise, head of sustainability at the Building & Engineering Services Association (B&ES), said the Green Deal was seen as 'just another accreditation scheme by contractors and installers, so they are not participating and promoting it to householders'.

'To put a solar thermal array on the roof you have to be a member of three accreditation schemes, which is confusing and expensive – both for installers and consumers. It is much



JORDESACEDO / SHUTTERSTOCK

easier just to be a member of Gas Safe and carry on fitting boilers instead,' added Frise.

He urged DECC to underwrite the Green Deal financially to make it more attractive also asked the committee, chaired by Liberal Democrat MP Sir Robert Smith, to consider incentives such as lower rates of council tax and stamp duty for energy efficient homes.

Committee member Conservative MP Peter Lilley said the government was constantly being advised to invest 'billions of pounds' in subsidies for renewable technologies, but the UK was not getting the benefit.

He said the committee had received 'written evidence' that retrofitting insulation to old buildings was 'very expensive and unlikely to cut demand by more than 40%'.

Liz Laine, policy manager at Consumer Futures, told the committee that better control of heating systems should be the top priority.

'Solving that problem would save more carbon than fitting insulation,' she said.

Big data crucial for future cities

The future is urban, and the best way to prepare for it is by using big data, said Future Cities Catapult CEO Peter Madden.

In his speech at the CIBSE annual lecture last month, Madden said that urbanisation, resource crunches, and climate change, would pose big challenges for future cities.

He said big data would provide a 'pool of crowd-sourced insight and information' to help use resources and infrastructure more efficiently.

'It also allows us to manage complex problems because we can take data from multiple different sources and better understand the interactions,' he said.

Another challenge will be making very old building stock – often built in the Victorian era – much more energy efficient.

'We hope and expect that smart grids and sensors and data will help make existing buildings more efficient, and help us understand better how they're being used.

'We will have to educate consumers about keeping data and information and ways in which they can save money by behaving differently.'

He said that local and city councils – which hold public data on energy, transport, and pollution – are increasingly using it to run their cities more effectively.

'The idea is that if we can get city councils sharing data in similar formats, you will have more comprehensive data sets, so you can start to judge what's working better and why,' he said.

Read how New York is using data at cibsejournal.com or cibsejournal.com/app

Pump lobby forces Green Deal U-turn

Circulator pumps are to be designated an approved technology for Green Deal funding, following a U-turn.

The British Pump Manufacturers' Association has managed to force a rethink of the SAP ratings that had originally ignored advances in pump efficiencies. It said the decision was 'a victory for pump manufacturers, installers and homeowners'.

Gary Wilde, from the association's circulator pump group, said modern pumps could provide a quick win for homeowners, saving on average between £63 and £89 on average annually. More than a million are installed in UK homes each year.

'A traditional fixed 3-speed

circulator with an induction motor would require 65W of power. However, modern circulator pumps follow the system curve much more efficiently,' said Wilde, who works for Xylem Water Solutions.

'A new electronic circulator does not put power into the motor to rotate the shaft, and can therefore reduce the maximum power to between 4 and 35W.'

Wilde said the change of heart was 'recognition by the BRE of the vital role that circulators can play in a modern central heating system'.

'Without circulator pumps, a complete system approach to home energy efficiency, including boiler, heating controls and insulation, is impossible,' he insisted.

Lighting pioneer Phillips dies, aged 90

Derek Phillips FRIBA FCIBSE Honorary Fellow SLL, who has died at the age of 90, pioneered the independent lighting consultancy discipline in the UK.

His work included the lighting of the *SS Oriana* in 1960, The Mandarin Oriental Hotel in Hong Kong in 1963, Westminster Abbey in 1965, historic monuments in Sri Lanka as a UNESCO consultant in 1976, The Durbar Court/The Foreign Secretary's Office and Locarno Suite at The Foreign and Commonwealth Office,



London in the 1980s.

He gained a first class honours degree in architecture at Liverpool University and studied daylighting and architecture at Massachusetts Institute of Technology

before setting up his own architectural and lighting practice Derek Phillips Associates in 1958.

He was Illuminating Engineering Society president and vice president of the International Association of Lighting Designers (IALD). He became a Fellow of IALD in 2001 received the Lifetime Achievement Award in 2009.

Public escalates energy use at The Hive

Soft landings have detected higher than predicted electricity use at Worcester's new library The Hive, Max Fordham has revealed.

The Hive's electricity use, which has been monitored since the building opened in October 2011, is on average 10% higher than predicted.

Guy Nevill, senior partner at Max Fordham, said that lighting controls in particular had been a major issue post occupancy.

At the briefing seminar before the CIBSE annual lecture, Nevill said that when The Hive opened and the public entered the building, the energy use was almost double what was predicted in one particular month.

'We think probably as a rolling average we're about 10% over.'

But Nevill said that month on month consumption was reducing.

He said that soft landings helped to detect problems with missing controls and sensors, as well as daylight dimming and pumps turning on primary heating and primary cooling when there wasn't the demand.

Nevill said the firm planned to undertake seasonal commissioning once these systems were sorted out.

The building, which was contractually required to achieve a 50% reduction on Part L of the 2006 building regulations, managed to reach 65% – and 32% on 2010 regulations.

Nevill said Max Fordham was employed by the maintenance contractors to stay on board for the first year or two to help get performance on target.

'Once the energy is on track and the building is performing as we want it to perform, we want to start to do some occupant surveys to understand how people feel about the design, and how they feel it's working for them as users,' he said.

Controls main risk to successful soft landings

Computers will account for about 60% of Keynsham Town Hall's energy load



● Max Fordham engineer reveals handover strategy at new town hall

New buildings will fail to perform unless controls are properly commissioned, a leading soft landings expert has warned.

Max Fordham senior engineer Tamsin Tweddell said that M&E and controls subcontractors must be involved at the tender stage to ensure that buildings worked properly.

'M&E and control specialist are vital. Natural ventilation solutions may be designed and delivered by different parties. The problems happen at interfaces,' said Tweddell.

She was speaking at the launch of the *Soft Landings Procurement Guide* last month.

Usability of controls is one of the risks identified on an energy risk register that Max Fordham has created for Keynsham Town Hall in Somerset, as part of the soft landings process.

Tweddell said successful examples of good control should be highlighted at briefing stage, and that occupants should be taught how to use lighting controls correctly.

Max Fordham was using lessons learnt on previous projects to inform its approach at Keynsham. As a result of work on the Woodland Trust HQ, it is using thin client computers, to help minimise energy loads. Max Fordham estimate that unregulated energy from computer use will account for 60% of the energy load at the new town hall.

Tweddell said energy performance targets were being set for the contractor, but only in areas that could be controlled such as lux levels and maximum power density for lighting.

The *Soft Landings Procurement Guide* is intended to help clients and building operators ensure their buildings perform as the design intended.

At the launch, Rob Bunn, project manager of the Soft Landings Framework, said clients had to take the lead to ensure soft landings were embedded in contracts.

Bunn said that clients needed to spell out their requirements for the successful handover of buildings. 'Soft landings aren't just about one line in the client requirements, like fairy dust,' he said.

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CIBSE has four specialist societies, including the Society of Light and Lighting (SLL), the Society of Façade Engineering (SFE), the Society of Public Health Engineers (SoPHE) and the Institute of Local Exhaust Ventilation Engineers (ILEVE).

The societies provide news and updates tailored to specialist industry areas, as well as networking opportunities, through their extensive event calendars.

CIBSE student members can join any society free of charge. Affiliate membership of SLL and SFE is free to all CIBSE members; SoPHE and ILEVE affiliate grades carry a small additional subscription. See www.cibse.org/societies for more details or email groups@cibse.org to sign up.

Young engineers hailed at SoPHE 10th anniversary dinner



Paul Foulds (left) and Ian Fellingham

● Hoare Lea team wins Water Aid award for sanitary system in Africa

A team from Hoare Lea has won first prize in a competition to design a low-cost, urine management system for Africa.

The Young Engineer Award, sponsored by Water Aid, was announced at the Society of Public Health Engineer's 10th anniversary dinner last month, which was attended by 314 people – an event record.

The competition brief was to develop a urine management system that minimised contamination

in small towns where conventional sewerage networks were not appropriate or viable.

The winning team used a solar thermal heating system to pasteurise the urine and then evaporate it in a special 'trough'. This resulted in two end-products: water, and a urea-rich mixture, suitable for use as a fertiliser.

Foulds, and fellow team member Ivana Rusnakova, will visit the country where their design is being installed to verify the solution.

The dinner at London's Royal Garden Hotel saw the presentation of a SoPHE Honorary Fellowship to Prof Rodney Cartwright in recognition of his contribution towards safeguarding public health.

The event was supported by: ACO Building, Andrews Water Heaters; AO Smith Water Heaters; Blucher UK; Conex IBP Group; Delabie; DG Robson Mechanical Services; Geberit Sales; Girpi; Goodwater; Harmer Drainage; Heatrae Sadia; Honeywell Control Systems; Horne Engineering; Hydrotec; Lochinvar; Marley Plumbing & Heating; Pegler Yorkshire; Pipex; Polypipe Terrain; Roth. Saint-Gobain, Teekay and Zip Heaters

CIBSE member among TeamBuild 2013 winners

A team of young professionals solved a real-life construction challenge to win TeamBuild 2013.

Team CARBON was awarded £1,500 by the Worshipful Company of Constructors after wowing the TeamBuild 2013 judges with their consistent teamwork, professional presentations, and innovative approaches to collaboration.

The team included: Jago Boase; Fabrizio

Matillana; Omar Raza; and CIBSE member Shahadat Hossain.

TeamBuild 2013 challenged teams to plan, design, and deliver a student accommodation development at the Holyrood site in Edinburgh.

A weekend of quick-fire challenges on an exemplar BIM-led residential scheme provided the background for a series of taxing scenarios at all stages of the construction process.

Peter Hansford, the government's chief construction adviser, praised the way the competition integrated BIM and aligned with the aims of government construction strategy.

TeamBuild is an annual competition held in November, sponsored and supported by a professional institutions including CIBSE. Entries for the 2014 competition will open in June. Visit www.teambuilduk.com



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Young Lighter of the Year revealed at LuxLive

● Hoare Lea designer praised for her paper on hospital bed task lighting

Rachael Nicholls has been announced as the winner of the 2013 Society of Light and Lighting (SLL) Young Lighter of the Year award. The lighting designer at Hoare Lea impressed the judges with her presentation and paper on *Task lighting at the hospital bed*.

She was presented with the Young Lighter of the Year trophy and special Lux Award, in association with Phillips Lighting, at the Lux Awards dinner held at the Westminster Park Plaza, London, last month.

Rachael's presentation explored solutions for hospital lighting, particularly at the bedside, where she learnt staff sometimes had to use torches on mobile phones to help them perform tasks.



From left: John Moloney, Rachael Nicholls, Duncan Chamberlain of Philips Lighting, and Kevin Kelly

Philip Avery, GIA Equation won the best written paper award, which was selected by Institution of Lighting Professionals (ILP), for his paper on *Architectural lighting – Not yet dead*. David Kretzer, LEOX Design Partnership, who spoke on the subject Synagogue daylighting design took the award for best presentation, chosen by the

Worshipful Company of Lightmongers.

The awards, now in their 19th year, provide a unique platform for young lighters, whether society members or not, to address a lighting subject of their choice, honing their presentation skills, and raising their profile within the industry.

Each finalist gave a 15-minute presentation to a packed audience at LuxLive on 21 November.

In addition to free SLL membership for one year, each finalist received a cash prize, a certificate and a free lighting publication.

See the winning presentation at cibsejournal.com or www.sll.org



Work placement scheme up and running

A work exchange programme created by former CIBSE ASHRAE Graduate of the Year Angela Malynn, and sponsored by the CIBSE Patrons, was launched at the CIBSE Annual Lecture.

Patrons chairman David Fitzpatrick informed the audience that the first placement had begun, with Magda Witt, of consulting practice Atkins, spending three weeks working with contractor Imtech Meica.

The scheme gives young professionals the opportunity to gain experience working in a different part of the supply chain. Patrons member companies are providing the first placements, with consultants, contractors and manufacturers creating work opportunities for young engineers.

For more information about the scheme, or to become a member of CIBSE Patrons, contact cbrown@cibse.org

WiBSE celebrates female success in the City

Eight women have been named category winners at the Women in the City – Woman of Achievement Awards 2013.

Executives from London and the Home Counties were nominated for the award and took part in a rigorous three-stage judging process. The overall title will go to one the eight category winners.

Vanessa Brady, president of the Society of British & International Design, won the built environment category. She said: 'I'm thrilled to be a finalist representative of businesswomen celebrating the contribution women make to the built environment. Externally, as an industry sector, it could incorrectly be considered male

dominated. This award provides an opportunity to change that perception and champion women's success.'

The category was jointly endorsed by RIBA and the Women in Building Services Engineering (WiBSE) network of CIBSE.

See www.citywomen.co.uk for more information.



Vanessa Brady (right) received her award from Sarah Davis of WiBSE

daikin.co.uk/cibse

efficiency redefined

the revolution is coming

Simulation needs to get real, says Aecom's Wilson

● **Modelling software falling short through poor data and non-standardised reporting**

Simulation systems still have a long way to go before they can demonstrate 'real life', according to Ant Wilson, director at Aecom.

He pulled no punches at last month's design and simulation for zero carbon buildings seminar, when he discussed how software was falling short.

'We've tried to get a system which tries to get you more consistency – but more consistency doesn't mean it's accurate.

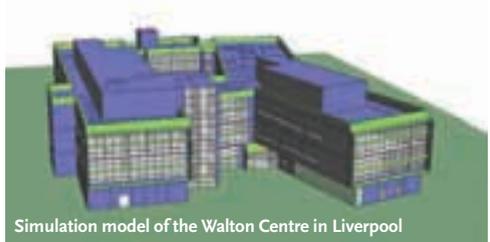
'You could be doing it right, following the procedure, but you could be doing it absolutely wrong because you're not trying to create reality.'

Wilson said he was optimistic about thermal dynamic modelling. 'But the further I've gone with it, the more I realised how bad it is.'

He said a lot of the problems were around data. 'And it's to do with getting the right data, or knowing it could be better. But what's the point of asking for more information if you cannot get it?'

He said climate data was notoriously out of date. 'Up to its last release in 2009, SAP took one average yearly data to predict your energy consumption, irrespective of where you are in the UK,' said Wilson. 'Even today, it doesn't matter where you are, you'll get exactly the same number coming at you out of SAP.'

'We've got to get away from giving a number and



Simulation model of the Walton Centre in Liverpool

give a range. We've got to get real with data.'

Wilson said tools like CIBSE's TM54 helped to give more accurate predictions by using bands. 'But that banding is made up of some very, very big bands,' he said.

Wilson said one of the biggest software flaws was that models assumed, by default, that there were always optimum conditions in a building.

'The reality is, with the kit you've got, you're never going to get it bang on. So what are you doing with a load that doesn't represent how it's actually going to be used?'

He said building regulations posed another problem when wrong U-values were used to meet the minimum standard laid down in Part L.

'Part L is driving some of the designs and they end up wrong. But you do it wrong to get a pass in Part L.'

Wilson said Part L was about conserving fuel and power but in reality it was about saving carbon. 'It doesn't even do that because you compare yourself against a different benchmark depending on what you're doing in the building,' he said.

Wilson said it was time to stop 'playing around with units' and start using standardised reporting.'

Prof Ljubomir Jankovic, of Birmingham City University, said calibrating models gave more accurate results.

He said: 'I think we need to give a bit of a thumbs-up to modelling as well. We still have a long way to go but I think we're getting there – it's kind of wrong to say everything is wrong.'

Wilson said: 'Things have improved, but nearly all the improvements in the software in my lifetime have been in the interface, and getting prettier pictures so it looks right. The actual mathematics behind a lot of the areas has not improved at all.'

Watch Wilson on simulation software at www.cibsejournal.com

Model calibration key to zero carbon

Prof Ljubomir Jankovic told the seminar it was possible to create zero carbon buildings through dynamic simulation.



Using the Birmingham Zero Carbon House as his evidence base, Jankovic said: 'Our method involves three things: technical design to make a building zero carbon; thermal comfort analysis to ensure that people are comfortable; and economic analysis to ensure that the building is economically viable.'

He said the method involved creating a base model, before running simulations using annual carbon emissions as performance criteria, and applying passive design principles to maximise energy efficiency.

Jankovic said: 'Make one improvement at a time, so that you know which measure results in which improvement.'

'And when you've exhausted passive measures of energy efficiency, then start applying renewable energy, evaluating thermal comfort, calculating lifecycle cost, and repeat all of that until you get a satisfactory outcome.'

'It's a bit like having a rough diamond to start with and then cutting it so that you get better and better performance with every step.'

He said post-occupancy analysis was essential for calibrating models.

His talk was based on extracts from *Designing Zero Carbon Buildings Using Dynamic Simulation Methods*, (Routledge, 2012).

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CHANGE *the* CONVERSATION

Building services engineers are often ignored because they lack appropriate communication skills, according to some of the participants in the latest CIBSE Young Engineers' Network debate. **Ewen Rose** reports

Do building services engineers spend too much time navel gazing?

The Institution of Mechanical Engineers (IMechE) was the venue for a YEN debate sponsored by CIBSE Patrons, which considered the motion: 'This house believes that building services engineers are too obsessed with building services'.

An animated discussion featured young engineers engaging with more experienced colleagues, including the presidents of CIBSE, ASHRAE, the IMechE, and the Institute of Refrigeration (IoR).

CIBSE president George Adams, who proposed the motion, said building services engineers continually missed the point by focusing on technology when they should 'talk about building performance and its impact on people'.

'Clients are baffled by what we are saying and keep us at arm's length. We don't speak a language that others can share, like architects and landscapers, so we are left out of the conversation.'

Obsessed

He described engineering language as one of the 'roadblocks to our getting involved earlier in the project process'. And he went on: 'The last thing anyone wants to talk about at an early stage is lots of nuts and bolts – they want to talk about colour and shape. Lots of engineers don't put themselves forward for that role. We need to be able to contribute to that conversation.'

However, 2012 CIBSE/ASHRAE Graduate of the Year Lee Tabis LCIBSE from NG Bailey, speaking against the motion, argued that other parts of the supply chain needed to pay more attention

to what building services engineers were saying. 'We are not obsessed with services... we consider all the aspects of the built environment. It is other members of the industry who are not obsessed enough.'

He complained that services specialists were constantly forced to compromise and were not taken seriously. 'We have to fit around other people's needs, such as trying to squeeze equipment into too little space because someone else has failed to plan the project properly.'

Debate chair Angela Malynn, the 2011 Graduate of the Year, said clients were often unaware of what building services engineers had to offer. 'Our role actually influences many other parts of the supply chain, but that is poorly understood.'

She also questioned whether engineers were the right people to manage other engineers: 'Do we make good managers? Are we good at managing a team, including people from other disciplines?'

IMechE president Patrick Kniveton countered that engineers were starting to gain more respect because of their role in the country's economic recovery, but needed to be more vocal about their achievements. 'We are getting recognition as wealth generators, but must drop technical 'jargon'. It is perfectly possible to describe quite complex things without the use of jargon, and that's the key to making your ideas more widely understood.'

'We are not doing as much communication as we should, but it is getting better. The institutions involve people from a wide range of industries and the cross-fertilisation of ideas is terrific.'

Kniveton, a nuclear specialist with Rolls-Royce, said building services engineers





It is perfectly possible to describe quite complex things without the use of jargon, and that's the key to making your ideas more widely understood
Patrick Kniveton

needed to be clearer about what they were selling. 'What is your product?' he asked. This proved his point by prompting a number of different answers from panel members before IMechE Young Members Board chair Ruth Shilston summarised it as: 'Creating comfortable spaces for people to use'.

'You make buildings live – without you it is just a structure,' added Kniveton. 'This message needs to be more clearly communicated.'

However, a number of panel members said the UK education system was at fault for not equipping young engineers with appropriate communication skills. YEN national representative Jonathan Page said this was because many engineering students didn't regard it as important. 'They would rather focus on technical things,' he said. 'They need to be encouraged to see this differently, because it is a growing problem.'

IoR President Graeme Maidment, a professor at London South Bank University (LSBU), agreed that communication should be a transferable skill from engineering degree courses.

Engage

'Communication is a key part of every module we run at LSBU,' he said. 'The two key transferable skills are being able to give a technical presentation and to write a report that people can actually engage with. We ask all our students to explain their technical ideas in a way a lay person would understand.'

ASHRAE President Bill Bahnfleth, who is professor of Architectural Engineering at Pennsylvania State University, added that it was possible to construct a curriculum 'that ensures engineering students work alongside other disciplines so they think about the whole building. Group projects are a good way of overcoming communication problems.'





It was also partly why I joined YEN as I knew it would improve my public speaking and give me experience of talking to other professions
Magda Witt

Shilston, who works for Arup, agreed, saying that her degree programme included a lot of presentation time. 'I would not have passed without being able to deliver quality presentations. The big consultancies only want to recruit people who present themselves well. That's what differentiates them from other people with equally good qualifications.'

On the other hand, Magda Witt – a young engineer from Atkins – said she had never been asked to 'speak out loud' during her degree course in Poland. 'Now I am improving in this area because I work in a multi-disciplinary environment and it is encouraged. It was also partly why I joined YEN as I knew it would improve my public speaking and give me experience of talking to other professions.'

The panel agreed that simplicity was the key. Arguably the toughest skill for an engineer is to take a complex problem and come up with a simple solution that can be explained on a PowerPoint slide in four bullet points, according to Paul Buchan, a young IMechE member and management consultant at the accountancy firm Deloitte.

'I realised early on that nobody was going to employ me if I could only talk about computational fluid dynamics all day long,' he said.

That is the 'black box' principle, explained Bruce Arnold, chairman of the IMechE Construction and Building Services Division. 'Clients just want a black box, but they don't need to know how it works. Engineers need to understand the detail,

but be able to explain it to the people who just want the box.'

However, Andy Ford FCIBSE, chair of the CIBSE Diversity Panel, said young engineers could not be expected to develop that skill in isolation – senior colleagues must provide support. 'You need to put people in stressful situations for the experience, but be there to catch them. A simple idea that solves many problems is the definition of a good job.'

He said there was a role for universities to provide the skills for small and medium enterprises (SMEs). 'Larger companies have these skills already in house, but smaller firms need to be equipped and they are crucial to the future of the industry.'

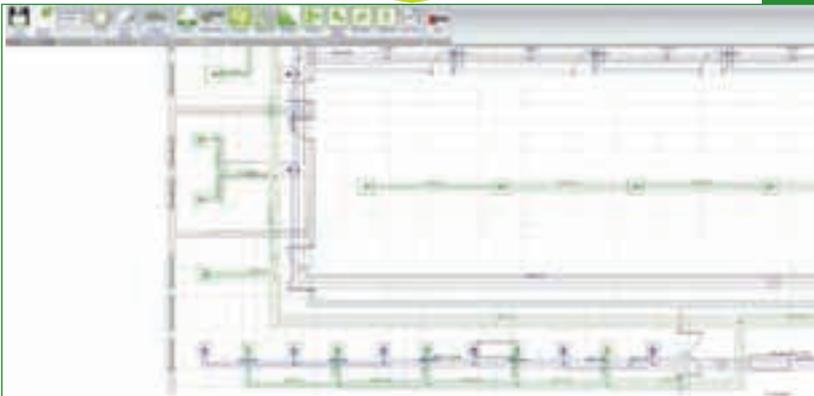
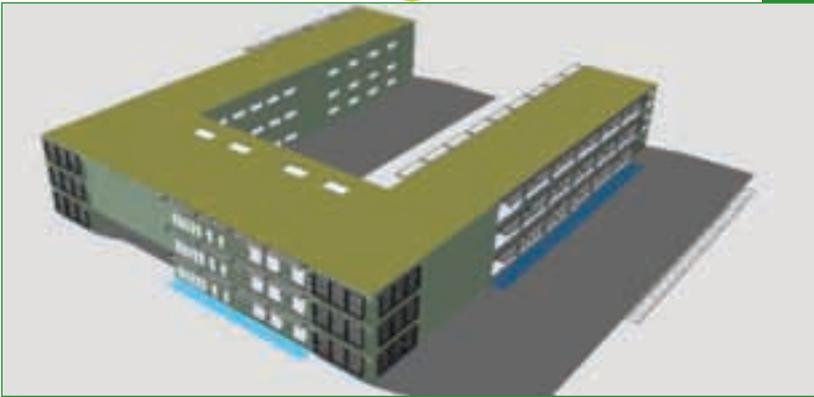
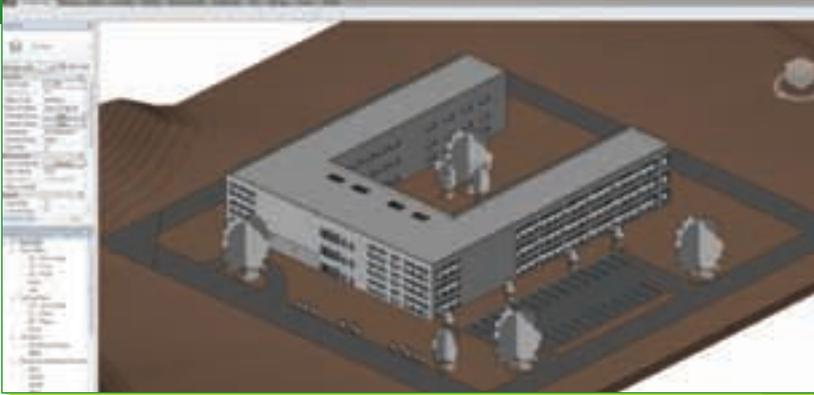
However, Tabis said he was concerned that the drive for clarity of communication could lead to 'over-simplification', which could have a detrimental impact on the final design.

'Simplification is the ultimate sophistication; and if we can explain what we do simply, without losing any of the technical accuracy, then we have succeeded,' he said. 'The big challenge for YEN is to get our message across more strongly.'

**The debate took place as part of the events that comprised the CIBSE Young Engineers' Awards 2013 at the IMechE. Later the same day, William Holley of Buro Happold was named CIBSE ASHRAE Graduate of the Year (succeeding Lee Tabis) and Max Fordham was named Employer of the Year.*

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LANDLORDS WILL NEED STICK FOR STANDARDS TO WORK



The Energy Act 2011 requires the setting of minimum standards for the energy performance of buildings being either let or sold, no later than 2018. Hywel Davies says enforcement will be key

The Energy Act 2011 requires government to introduce 'non-domestic energy efficiency regulations' covering non-domestic rented property, widely referred to as 'minimum building energy performance standards (MEPS)'. The powers apply to non-domestic private rented property with an energy rating falling below a certain level. This is currently expected to be an F or G rating.

Landlords of such properties will have to make 'relevant energy efficiency improvements'. If they do not wish to fund the work themselves, they will be expected to use the Green Deal, or any other financial instrument that the regulations may provide. These regulations must come into force no later than 1 April 2018.

The detail of how MEPS will work in practice will be set out in secondary legislation – to be published at a later date – which will be the subject of a further consultation in due course. Indications are that the Department of Energy and Climate Change wishes to consult soon, possibly before Christmas, to give early sight of their plans and to give greater certainty to the market.

A large proportion of non-domestic property was built before 1986, when Part L was introduced. Much of the stock built then is poor by today's energy efficiency standards, but with annual replacement rates for commercial buildings of 1-2%, around 60% of existing stock will still be in use in 2050.

Tackling energy performance in existing commercial property is a crucial – but so far relatively neglected – element of any credible strategy, either for reducing aggregate energy demand in buildings, or for mitigating the climate impact of commercial property, in line with commitments set out in the Climate Change Act.



The Minimum Energy Performance Standard is therefore a key element of policy to drive improvement. So what are the hurdles to be overcome in creating this scheme?

EPC ratings do not reflect operational use and therefore do not demonstrate actual energy performance or drive better energy management and behaviour in rented buildings. If MEPS are based solely on the calculated performance in an EPC, then measures that would improve actual energy use may not lead to any improvement in the rating. It will be interesting to see how the consultation addresses this.

In addition, the list of Green Deal-approved commercial measures exclude many services that support improved energy efficiency – such as rebalancing or recommissioning of the heating, ventilation and air conditioning systems, or recommissioning the Building Energy Management Systems. A regime that only supports installation of approved 'modelled' measures runs the risk both of distorting the market

and of not always delivering cost effective energy savings – and may not encourage innovation.

The quality of EPC ratings has improved since their introduction, but there is still evidence of inconsistency and differences in interpretation between assessors. This may undermine confidence that the right buildings are caught by the scheme.

There is reasonable evidence to suggest that, of non-domestic rented buildings which should have an EPC, only two out of five actually do. This has serious implications for MEPS, since having an EPC is a pre-condition of being within the scope of the scheme. Most larger corporate landlords will fully comply with requirements for EPCs, both now and in the future, and it is reported that many of them renew EPCs regularly for reasons of corporate reporting and risk management.

Meanwhile, a fair number of non-professional owners and smaller corporate landlords may not be fully aware of their responsibilities, or may risk fines rather than obtain EPCs. Introducing MEPS into this situation means that responsible landlords will be penalised for compliance, while the non-compliant benefit.

Introducing MEPS without action to improve enforcement of EPCs will be a disproportionate burden on the law-abiding participants in the property sector. This is an unfair and an unacceptable outcome, hardly compatible with the concept of better regulation. However, that is a matter outside DECC's control; the success of MEPS is critically dependent on the activities of the Department of Communities and local Government.

Finally, it is closely linked to the Green Deal. The Energy Act explicitly refers to it. So the biggest hurdle may be to get the Green Deal working for non-domestic buildings. That would be progress, if it could be achieved.

Introducing MEPS without improving enforcement of EPCs will be a burden on law-abiding participants

● **HYWEL DAVIES** is technical director at CIBSE www.cibse.org

@ Feedback

A CIBSE Fellow starts a petition, and engineers debate the value of hospital PFIs on LinkedIn

Landmark challenge

I fully support Hywel Davies' article highlighting the outrageous £5.7m compensation paid to Landmark (*CIBSE Journal*, November 2013). Clearly, better policing of DECs, EPCs and air conditioning inspections would have improved compliance and avoided this bill to the taxpayer.

These certification schemes are not EPBD 'gold-plating', but mechanisms to help achieve better buildings, create jobs and reduce business overheads. Fundamental to this is better benchmarks, and I challenge Landmark to contribute at least £2m of this windfall to help improve benchmarking.

Our benchmarks have been neglected by government and are in need of a serious upgrade to benefit our understanding of what is good/bad building performance. The fund could be used to gather data, develop and improve benchmarking techniques and

to set up a focal point for energy benchmarking.

I call on everyone in the industry to support the CIBSE Energy Performance Group's 'Landmark Challenge' campaign. Go to the poll on our LinkedIn Discussion Group or join the debate on Twitter @CIBSEepg

Come on Landmark, put just 35% of your windfall back into the pot – for the good of the industry!
*Phil Jones FCIBSE
Chairman of the CIBSE Energy Performance Group and member of the CIBSE Benchmarks Steering Group*

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CIBSE LinkedIn Group

Malcolm Wallace

What's the current status and industry view on PFI these days?

William Roberts

I think PFIs are poorly managed and cost the taxpayer even more. I have worked for PFI contracts and with places with PFI in place, and there are often issues about who actually owns what. Then there's the cost of repairs/maintenance.

Tony Johnstone

Being innocent, I thought the construction industry was embracing the 40-year lifecycle concept – working as an integrated team to deliver customer satisfaction long-term. It wasn't. The construction company did not

intend to 'own' the project beyond start-up. Its share was sold on to unsuspecting investment funds within five years. All buying and operational decisions were taken with that in mind.

John Coleman

The legacy often left from PFI projects is a client paying a lot more for the building lifespan than if the project had been procured, and maintained, traditionally.

Alistair Fisher

PFI is a means of transferring 'risk' to the private sector. In reality, there has been little risk transfer, but much reward. Consequently, most PFI deals represent extremely poor value for money.

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VARIABLE RESULTS

Algorithms used in SBEM are underestimating the potential saving of some variable speed drives by about a third, says **Esfand Burman**

 Demand-controlled ventilation is not being given enough credit in SBEM for its energy performance.

The algorithm defined in the National Calculation Methodology (NCM) does not take into account the power law relation between airflow rate and fan power, in instances where variable speed drives are installed on supply fans (SBEM Technical Manual 2011; NCM Modelling Guide 2010).

Fans are machines with variable torque load; variable speed control not only reduces the airflow rate but can also substantially reduce the specific fan power. The NCM uses a linear relationship between fan energy use and airflow to approximate the carbon savings. This can compromise the accuracy of energy performance assessments and underestimates the potential benefits where demand-controlled ventilation is used.

The fan cube law holds that fan power is proportional to the cube of its speed. In practice, using the cube law to calculate fan power often leads

to overestimation of energy saving, as it does not take into account part-load efficiency of motors, drive losses and other operational inefficiencies.

However, using empirical equations that reflect the variable torque property of fans, such as that prescribed by ASHRAE Standard 90.1, would give a significantly better approximation of potential savings, while remaining simple to implement. The following figure illustrates that SBEM underestimates the potential saving of variable speed drives controlled by gas sensors by approximately a third.

Although it is repeatedly stated that SBEM is not a design tool, the results generated are used as part of a decision-making process by design teams to assess options for the energy strategy. Where, for example, the benefits of demand-controlled ventilation are underestimated, this will lead to fewer such systems being installed. Most building services designers take into account the power saving potential of variable speed drives at part-load when



Although it is repeatedly stated that SBEM is not a design tool, the results generated are used as part of a decision-making process by design teams to assess options for the energy strategy

recommending this solution to their clients, and would be disappointed to realise this is not reflected in the calculation engine used to show compliance with Building Regulations.

According to the SBEM Technical manual and NCM modelling guide, a modified demand control fresh air rate (FAR_{dc}) is specified in the model where demand-controlled ventilation is supplied to a building:

$$FAR_{dc} = C_{dc} \times FAR_{tower} + ((1 - C_{dc}) \times FAR_{max})$$

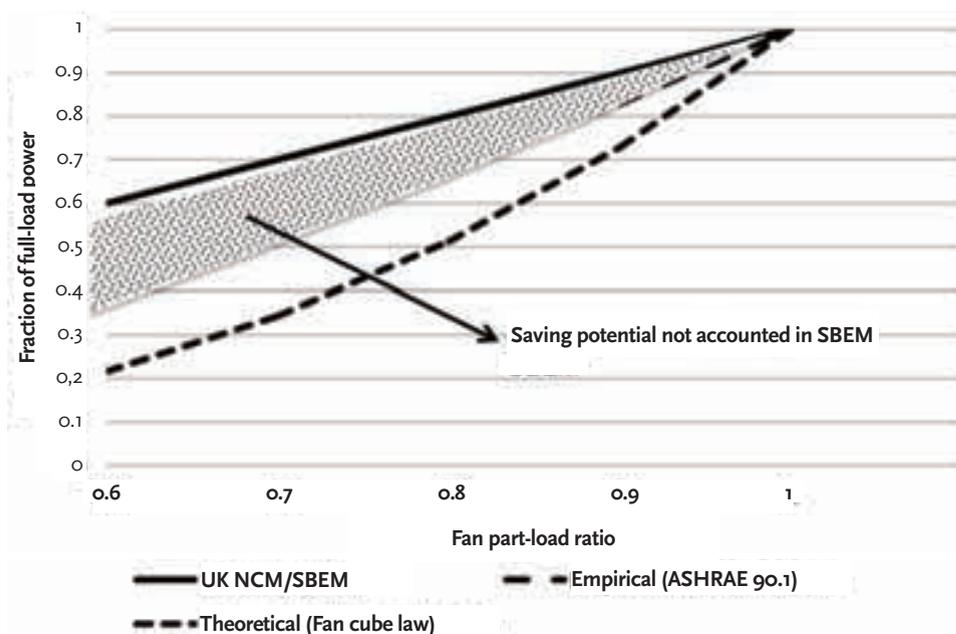
Where: FAR_{max} : is the ventilation rate per person from the NCM activity database multiplied by the maximum occupancy density during the occupied period.

FAR_{tower} : is the greater of either FAR_{min} or $0.6 \times FAR_{max}$; FAR_{min} is the ventilation rate per person from the NCM activity database, multiplied by the minimum occupancy density during the occupied period.

C_{dc} : is a demand control coefficient; where control is based on gas sensors, the demand control coefficient is 0.95.

This modified fresh air rate is used to determine the ventilation demand. As for the effect of demand-controlled ventilation on auxiliary energy use, after presenting the equations to calculate fan power at full load, the SBEM technical manual states (page 85): 'In addition to affecting the fresh air load (for example, energy to heat and cool the fresh air), demand-controlled ventilation can also affect the auxiliary energy. Where the air flow regulation uses fan speed control (such as using variable speed fans), the auxiliary energy calculation will use FAR_{dc} instead of FAR_{max} , but if the air flow regulation uses damper control, then the auxiliary energy calculation will not be affected.'

In other words, SBEM assumes a linear relation between fan energy use and fresh air rate, where variable speed control is specified. This is also confirmed by the thermal models developed to investigate how demand-controlled ventilation is modelled in NCM/SBEM.



The effect of variable speed drives on fan power



The fan cube law holds that fan power is proportional to the cube of its speed (CIBSE Guide B 2005):

$$P_2 / P_1 = (N_2 / N_1)^3$$

Where: P : is the fan power (W). N : is the fan speed (rpm).

The cube law does not allow for operational inefficiencies and may lead to overestimation of energy savings. The following empirical equation is used in ASHRAE 90.1 (2007) to derive the absorbed fan power from flow rate where variable speed drives are used:

$$P = 0.0013 + 0.1470 \times (Q/Q100\%) + 0.9506 \times (Q/Q100\%)^2 - 0.0998 \times (Q/Q100\%)^3$$

Where: P : is the fraction of full-load fan power. Q : is the flow rate (m^3/s). $Q100\%$: is the flow rate at full load (m^3/s).

Assuming an air handling unit only supplies fresh air to building occupants and is not primarily used to condition the space, SBEM predicts 38% reduction in fan power where the demand control fresh air rate is 62% of the full fresh air rate, which is the minimum demand control fresh air rate allowed in Equation 1. However, if the variable torque property of the supply fan is accounted for in accordance with Equation 3, then 57% saving could be achieved. Therefore, SBEM underestimates the potential saving of variable speed drives controlled by gas sensors by approximately a third.

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● **ESFAND BURMAN** is a CIBSE Low Carbon Consultant and engineering doctorate candidate at UCL. He is a CIBSE Graduate member



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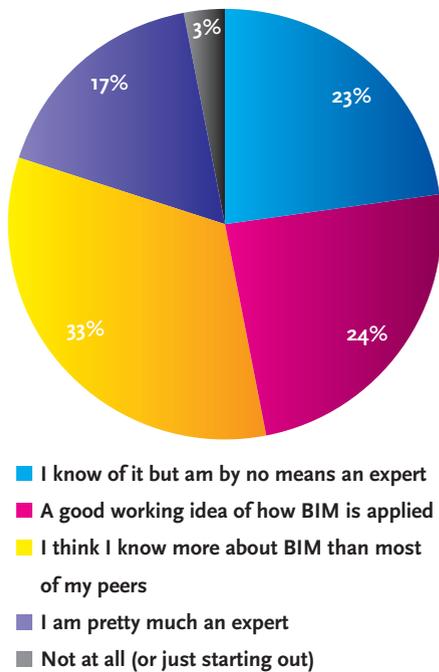
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From little ACORNS

This year's CIBSE BIM Survey attracted input from respondents who believe they are far better informed than those in 2012. **Tim Dwyer** has been looking into the results

Figure 1 How well informed do you think that you are about BIM?



This could mean that a more knowledgeable bunch chose to answer the questionnaire, or that the concepts of BIM are permeating deeper into the industry

Knowledge of BIM has grown exponentially in the building services sector over the last year. Respondents to a survey conducted by the CIBSE BIM Steering Group considered themselves far more knowledgeable than those who responded last year. Just 3% had little or no knowledge (14% in 2012) and half (just a quarter last year) felt that they knew more about BIM than most of their peers, or even considered themselves experts (Figure 1).

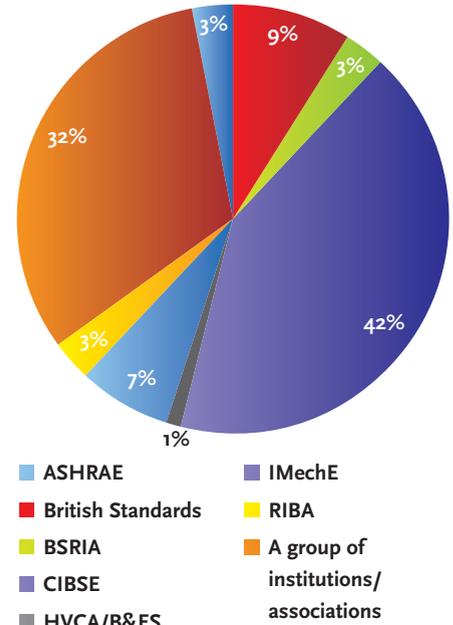
Since the two sets of data are from self-selecting groups, this could mean that a more knowledgeable bunch chose to answer but, more likely, the concepts of BIM are permeating deeper into industry.

The survey was inevitably dominated by the building services profession, but it was completed by a wider cross-section of the building community, so provides some useful indicators for the whole industry.

And when the findings from this survey are cross-referenced to recent survey output from the RIBA (by NBS¹), the IStructE², BIM4FM³, and RICS⁴, some trends are clear. The comparisons are made more interesting because the NBS survey has around 70% input from the architectural profession, whereas CIBSE's survey has a similar percentage for those who may be considered to be principally related to building services – with IStructE providing a further industry segment.

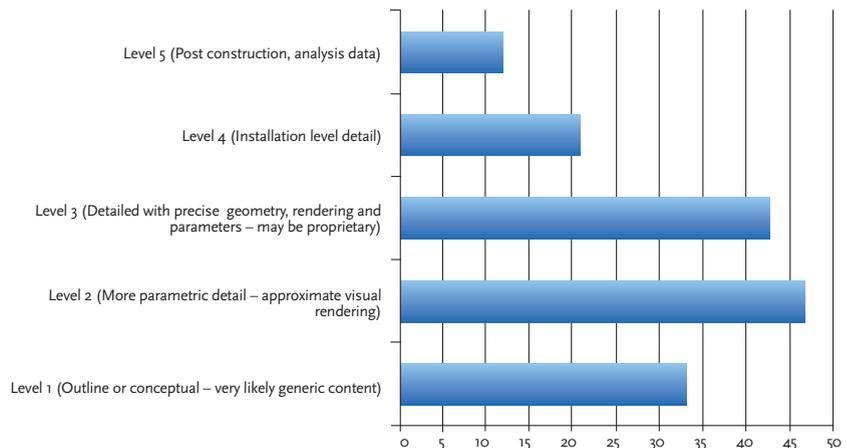
The CIBSE survey shows that there was an increase from 43% (2012) to 68% (2013)

Figure 2 Who do you think should take the lead in BIM standardisation for Building Services?



in those who were actively involved in projects using BIM, with just over 40% of all respondents having been involved in BIM application for just a year. This could indicate a shift in interest/application, as there is such a step-change in the adoption of BIM methods. The NBS survey indicates that 39% of the largely architecturally-based respondents are 'aware and currently using BIM' indicating that, in these survey sets, the building services profession is more actively employing BIM. This is against a background where less than 40% of the NBS respondents are using 3D computer aided drafting/design tools – the majority using 2D CAD or no CAD (36%). IStructE findings show that 75% of small companies in their survey are still to 'start their BIM journey' and the results BIM4FM (that might be thought as representing one of the

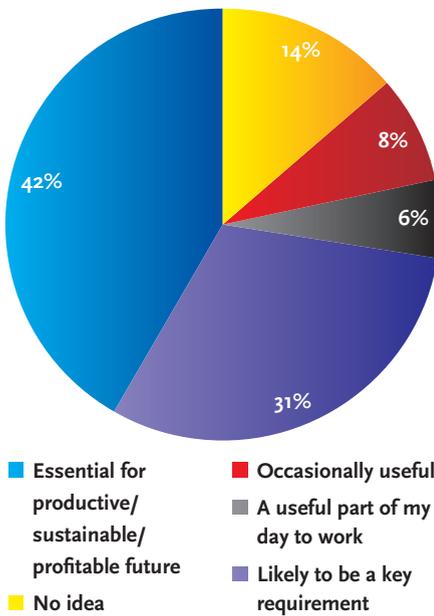
Figure 3 What level of detail (not UK Government maturity) do you use in your BIM content? (current users)



key areas that could benefit from BIM) had over 60% that were 'unsure of whether their organisation plans to use BIM in the near future'.

A common call is that there should be co-ordinated industry-wide activity, with organisations and professional bodies working together. This CIBSE survey (Figure 2) indicated a third looking for a collaborative approach between institutions, while the equivalent RICS survey figure was 55%. In the CIBSE BIM survey, nearly three-quarters of respondents thought there was a need for an independent library of generic building services BIM objects – reiterating the desire for information that could well be agnostic of individual professional bodies but, in any case, assured and independent. The NBS survey confirms that over two-thirds are looking for

Figure 4 How important do you think that BIM is likely to be in your future work? (non users)



'well structured generic CAD objects, not just manufacturer's objects' that ties in with the 57% of those in the CIBSE survey.

The choice of software tools that may be utilised for BIM – contrary to some popular opinion – is not particularly related to the professional sector. Autodesk products maintain a dominant position in both the CIBSE and NBS surveys, but the CIBSE survey indicated a broader range of other suppliers are becoming included in the 'BIM toolkit'.

Nearly 80% of those employing BIM in projects were working to the UK government's 'Maturity Level 2' (Managed 3D environment held in separate discipline BIM tools with data attached) or above. Conversely, IStructE's results indicated that, in their area of interest,

they perceive that there was still a 'lack of clarity about what Level 2 BIM actually is'. The level of detail being applied in BIM modelling is reaching higher, with nearly half of CIBSE respondents indicating (Figure 3) that they are producing models at Level 3 (detailed models with precise geometry, rendering and parameters) or above.

For those that were not already involved in projects utilising BIM, the majority saw that BIM was either 'essential' or at least 'likely' to be needed for future success in the industry (Figure 4) – and there was no uncertainty as to the need for guidance/training/opportunity to move BIM forward. However, there was no single pedagogic method preferred by those inexperienced with the application of BIM (Figure 5). A comparable question to those who already apply BIM evoked a very similar response. IStructE respondents were equally sure that BIM would play an important part in their future with 71% believing that 'clients will expect it to be incorporated into their work' and a similar response to the BIM4FM survey indicated that the 'majority of FMs, owners and occupiers (69%) recognise that BIM will become increasingly important in day-to-day working practices within the next 2-3 years'.

Overall the survey responses are, once again, a call for clear cross-discipline leadership in the standardisation and adoption of BIM with a requirement for assured generic and open source BIM components. However, to meet the demands that UK public sector centrally procured construction projects will be delivered using BIM by 2016 still appears to be beyond the expectations of some of the industry's key sectors. **CJ**

References

- 1 NBS survey bit.ly/1cqUHOI
- 2 IStructE survey bit.ly/1aelmhE
- 3 BIM4FM survey bit.ly/HYjip6
- 4 RICS survey from May 2013 bit.ly/1eOUfyz

WHAT THE RESPONDENTS SAID

'As an equipment supplier representing just one global, market-leading air conditioning manufacturer in the UK, I am concerned that the manufacturer we represent appears to demonstrate little or no interest in BIM (in Europe). Is BIM being hyped up?'

'Content quality and consistency is more important than perhaps CIBSE realise.'

"Guidance" should be "legislation" – and we should strive for uniformity.'

'I would like CIBSE to champion integrated education in this field, as that is how we will maximise potential of BIM.'

'There is very little advance information appropriate for operational engineers/facility managers/building operators.'

'M&E CAD is not BIM.'

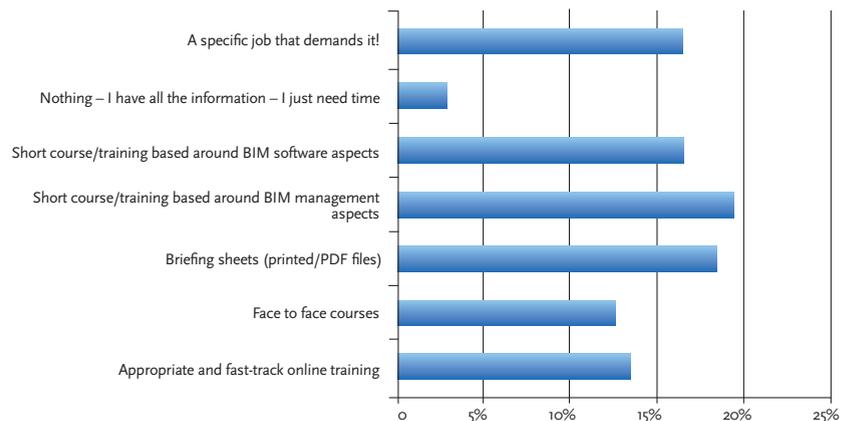
'There is too much rhetoric about the possibilities of BIM.'

'Too much emphasis is placed on the technologies enabling BIM.'

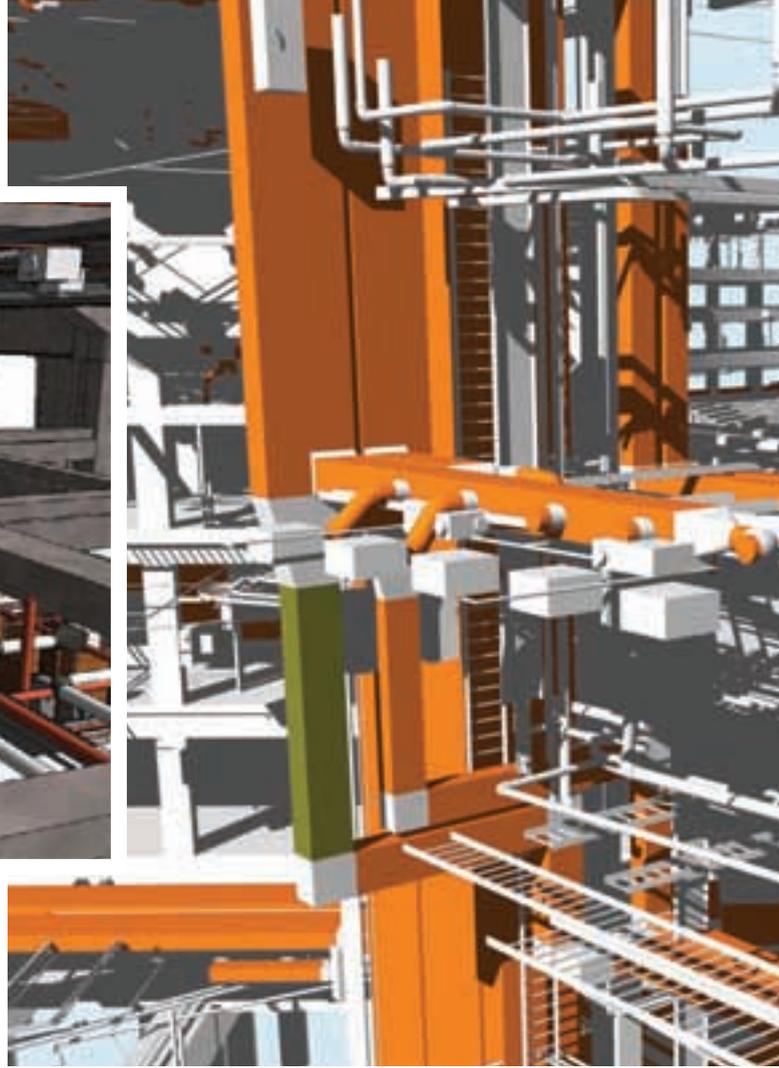
'Many air handling unit manufacturers say they provide BIM files, but few have much more than a 3D box with no volume, access, connection sizes or airflow direction to it.'

Nearly 80% of those employing BIM in projects were working to the UK government's Maturity Level 2

Figure 5 What do you need to advance the use of BIM in your work? (non users)



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UNDER CONSTRUCTION

BIM is already improving teamwork and efficiency in the industry, but there are still a few cultural and technical glitches to be ironed out, says **Ben Roberts** of Hoare Lea

Building information modelling is no longer an optional extra; instead it is becoming standard practice and, by January 2016, will be mandated on all public sector projects. So how is it working, how will it help us, and what are the pitfalls?

How does BIM enhance collaboration?

Having a virtual model of a project makes it easier for teams to discuss design issues and convey their intentions, while using a model to aid design workshops is a great way of seeing problems and solutions as a team.

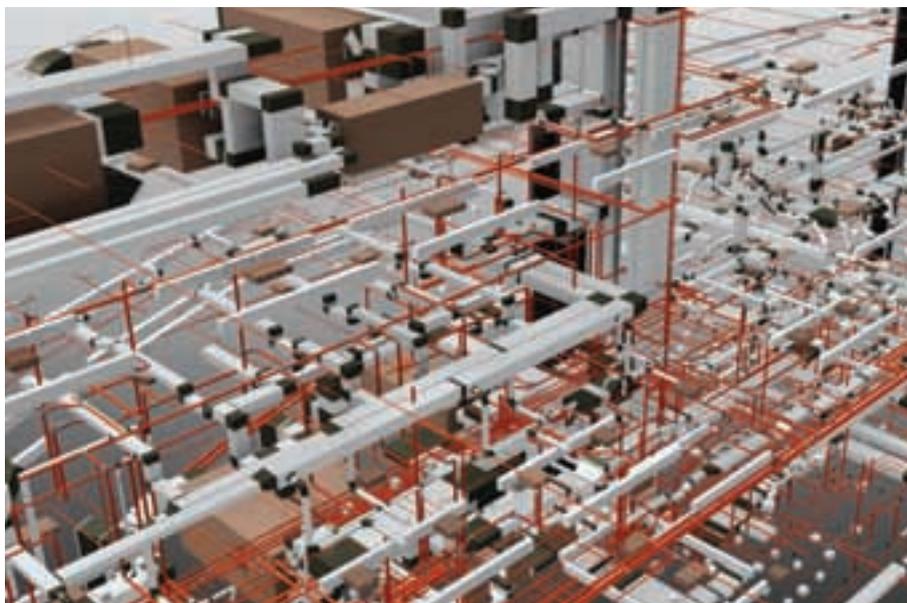
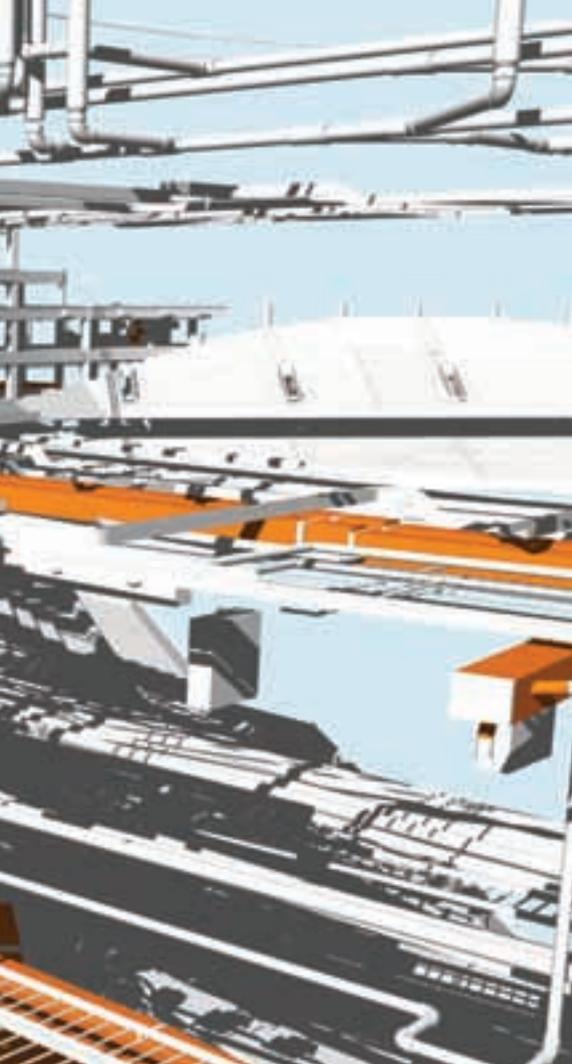
It also makes it obvious when one discipline's solution clashes with another, so you have to pull together to resolve problems. This becomes more apparent where separate disciplines provide information about the same elements. For example, a wall will have structural, acoustic and thermal properties, as well as a fire rating, finishes and

build-up. In this case, the team members are all responsible for what that wall is, and what it can do. In a BIM environment, everyone needs to work together to 'virtually build' that wall. BIM forces teams to collaborate.

How does BIM affect procurement?

Another key aim of using a BIM approach is being able to pass the model from designer to installer to operator. For this to work effectively, the designers need a better understanding of downstream requirements, so they can be considered at an early stage

For example, the installer may have certain constraints or requirements, such as prefabrication, access space or specific pipe preferences. Traditionally, these details would be amended after detailed design stage. However, it is easy for the designer to include these in a model as defaults or considerations while modelling, which saves a lot of time reworking the model later on. For



Anything can be modelled in 3D, with embedded symbols and information

the design model to allow for this transition, it is beneficial for the installer to provide such information before too much detail is added.

Similarly, if the client is intending the model to be used beyond practical completion for either facilities management, asset registers, metering or monitoring, the team will have to consider these requirements during the design and construction stages.

How does BIM improve efficiency?

There are efficiency benefits to be gained by each team member, and for the team.

Having data linked to your model (and therefore drawings) means schedules and quantities can be automatically generated. A pipe on a drawing is not just a line – it can have a material, size, length, insulation thickness, flowrate and jointing type, all of which can be scheduled or labelled on a drawing. Moving a pipe in the model will automatically update the schedule, so quantities can always be up-to-date and in line with drawings.

Using this data intelligently can give further efficiency gains to feed calculations, transfer into simulation/analysis software, or link with existing databases. Once calculations are established, they will update with, for example, a new partition layout or a change in airflow. This reduces both time spent on editing calculations, and the risk of

inconsistency across your design.

Geometry can be exported and imported between software tools to reduce time spent remodelling and rekeying information. Again, this enhances consistency between design and analysis models. In practice, there are currently some limitations with interoperability, which are outlined below.

As a team, time can be saved by using the model to communicate ideas and coordinate designs. Three dimensions are easier to understand than two; for example, in areas of complex detail or where you can see 'actual' electrical fixtures instead of 2D symbols. This enhances discussion at design team workshops and speeds up communication.

Using the model further downstream offers significant time savings. If the design model can be developed into an installation/O&M model, that will save redrawing everything after contractor appointment. If the FM provider can use the same model, then time and cost will be saved through better-informed decisions about maintenance and replacement of equipment throughout occupancy and use.

What is COBie?

The best way to think of the Construction and Operation of Building information exchange (COBie) is as a common vehicle for information for the whole industry. For example, a manufacturer will provide information in a COBie format. This is then combined with other information and sent upstream to the client in a COBie format. Wherever you are in the industry, if you need information about the facility, its spaces

or components, COBie is the vehicle. The information is organised by type, system, floor and zone. If everyone uses COBie carefully, confusion can be avoided. It is quicker to compare facilities, systems and products, and risks can be reduced.

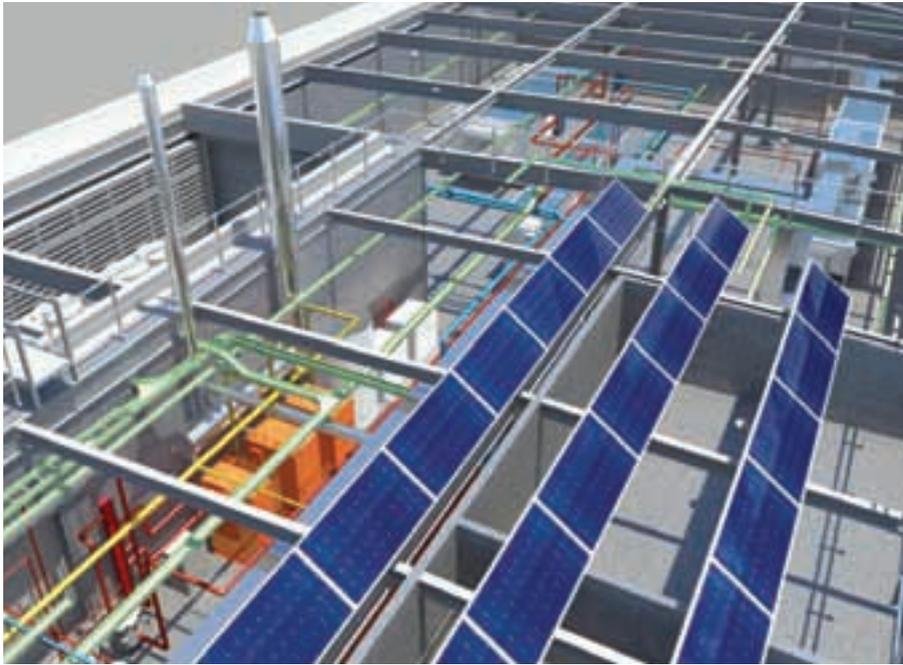
COBie is being backed up with work on common terms and a 'digital plan of work' which suggests when certain pieces of information are required by the client (data drops). Others within the industry can decide who generates that information and when, such as BSRIA's *Design Framework for Building Services BG6*.

The construction industry is one of the few industries that does not use this sort of data standard. Finance, retail, literature and aerospace all have common means to enable data sharing and monitoring. COBie is a step toward integrated working and delivering consistent data across the industry.

COBie has come under criticism for being confusing, having duplicated fields, and not including important fields. As such, COBie is scarcely used and will need to develop as it becomes more widely implemented. However, if we can agree a common industry language, there will be many possibilities for improving what we do with data.

What works in reality?

- Anything that can be modelled in 3D, with embedded symbols and information
- Using 3D models for coordination and clash detection
- Conceptual mass analysis for overshadowing, wind flow, basic energy and carbon comparisons



Using 3D models is beneficial for coordination and clash detection



Hoare Lea was named the Building Services Consultancy of the Year. The 2014 awards will take place on 11 February at London's Grosvenor House hotel. Join the best of the industry talent and be there on the night to see who will scoop the awards that celebrate the achievements across the supply chain. Don't miss your chance to be there. To book a table, visit www.cibseawards.org

- ▶ ■ Automated production information from the model, such as drawings, equipment schedules and bills of quantities
- Using the model on site to snag issues and monitor progress

The challenges

Issues often arise from models failing to meet expectations. A BIM project tends to exaggerate many of the issues we face on traditional projects, such as change management, not enough detail, too much detail or unclear appointment duties.

As such, BIM projects need careful planning to determine the information needed from team members at each stage. You will also need to establish how a model is going to be set up, shared and managed, and who is responsible for coordinating each bit.

One major technological hitch we currently face is in transferring models between

different software tools and file formats. In some cases, models transfer smoothly, but often there are glitches that need attention.

One solution is Industry Foundation Class (IFC). This is an open source format that can be read by any software. It is likely this will become the standard exchange format, but even this has problems if not treated carefully. And the results from your model are only as reliable as the information that you put in. The more information you add to the model, the more useful it is.

What is the future for BIM?

Once the industry is used to working with data in an intelligent way, there are many possibilities. The best opportunities are in early design and operation, with metering, monitoring and more intelligent controls leading to a better understanding of how buildings are used. The client must have a good understanding of what they want, provide a detailed brief and closely monitor what they are being offered.

Working to level 3 BIM will require big changes in the way projects are delivered. Currently, standard practice is to work on separate, discipline-specific models, sharing them at regular intervals via an extranet (level 2). Working to level 3 will mean hosting one combined model directly on an extranet. This will require better IT infrastructure but, more importantly, it will further necessitate the need for closely managing change and shared ownership of information.

To deliver a level 3 BIM project successfully, project teams will need to work directly with each other. This will force teams and clients to be even more collaborative and should result in built assets being cheaper, greener, of better quality and easier to run. **CJ**

BEN ROBERTS is a senior mechanical engineer at Hoare Lea and CIBSE Graduate member

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BIM: HIGH TECH MEETS RETRO

BIM's real value is the product data, says Paul Reeve, ECA director of business services

Smart virtual planning

In 2011, Manchester Council used Building Information Modelling (BIM) as part of a £48m refurbishment programme for the city's classically iconic, Grade II-listed Central Library. BIM is usually associated with new build, but this project shows its value on a tough refurbishment – which included significantly restricted site access, as virtually everything had to fit in through one window. As well as providing the design and building teams with opportunity to test the building's design and sequencing prior to installation, BIM helped produce more accurate costings, reduce sub-contracted risk, and deal with issues and variations before they became a reality.



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Ultra efficient buildings

Once the refurbishment is completed and the library reopens in 2014, staff members are looking forward to being able to employ the BIM data for more efficient facilities management. Even in simple scenarios, BIM can save money – for example, if a lamp fails, interrogating the BIM data rather than relying on a traditional lamp inspection has been shown to save £108 each time, and potentially reduce the investigation period from six weeks to just one day.*

Whole-life value

BIM technology has plenty to offer any major refurbishment programme, including the all-important building services design. Using BIM enables a thorough review of the building's access and available space, so that complex service installations can be virtually threaded through the existing structure. It is true that using BIM often requires additional time and investment upfront to obtain accurate laser scans and to

convert the original design into the model, but the practical and financial returns can be impressive. Then after the work is complete, the data-rich model that's been created can be handed over to the facilities management team for use throughout the operational life of the building. And this, really, is where its power lies: don't let the rotating 3D models distract you, the real whole-life value of BIM is embedded in the rich product data.

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INDICATORS

A vast funnel-shaped atrium is the key to an innovative ventilation strategy that is cutting a New Zealand bank's operational energy use by 50%. **Ken Grace** reports



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“An elegant and helpful traffic-light system notifies staff when it is OK to open windows

Working by the sea may sound romantic and jolly, but it also poses its challenges. As a case in point, when New Zealand bank ASB commissioned a new corporate head office on Auckland's North Wharf, it had to contend with living next door to a major fish-processing operation.

Matters were complicated by the fact that the bank and the building's owner, Kiwi Income Property Trust, were committed to developing a workspace that used passive design to set new standards in indoor environmental quality and energy performance. This made access to an abundance of fresh air virtually mandatory.

So how did the project team meet these tough sustainability requirements while creating an attractive, fish-free working environment?

At the heart of the office – which is a complex of two buildings – is Australasia's first fixed-bin displacement mixed-mode ventilation system. When weather permits – as it often does in Auckland's mild, maritime climate – windows can be opened for natural ventilation. When conditions are not favourable, occupants are advised visually to keep some or all windows closed. An elegant and helpful traffic-light system notifies staff when it is OK to open them.

The key to the control of airflow is a wide funnel-cum-atrium at the centre of the eastern building, which rises from the lower basement and extends 12 metres above the top floor. Warm air is drawn – more or less horizontally – from all quarters of the open-plan structure, then upwards and out through motorised louvres.



PROJECT TEAM

- **Clients:** ASB Bank, Kiwi Income Property Trust
- **Architect:** BVN Donovan Hill, in association with Jasmx
- **Main contractor:** The Fletcher Construction Company
- **Project manager:** Octa Associates
- **Services engineer:** Arup, in association with Babbage Consultants
- **ESD:** Arup
- **Structural engineer:** BGT Structures (Auckland)
- **Acoustics engineer:** Marshall Day Acoustics
- **Civil engineer:** Opus International
- **Fire engineer:** Holmes Fire
- **Mechanical contractor:** Aquaheat NZ
- **Independent commissioning agent:** HVAC Solutions
- **Electrical contractor:** Bishman Electrical
- **Building management system:** Schneider Electric NZ
- **Plumbing engineer:** DL Good Plumbers
- **Fire Detection:** AFS Total Fire Protection
- **Security:** Armitage Group
- **Vertical transportation:** Schindler Lifts NZ
- **IT and AV:** ITAV
- **Specialist lighting:** Lightworks
- **Funnel:** Yachting Developments
- **Green Star accredited professional:** WSP Group

➤ The whole building has been designed around this system. When the wind is blowing, motors open louvres on the leeward side and close those to windward. Besides ensuring that no gales roar through the workspace, this also creates negative pressure within the funnel, helping it to do its job.

Supporting features – including a seemingly random shading system on the building’s façade – reduce heat from the building’s glass and allow a fine degree of control over the total heat and light that enters. The façade itself contributes by way of a solar and wind barrier, supported by a weather-tight, operable inner skin that responds to conditions. And the funnel doubles as a large skylight, lending the atrium a warm, radiant quality.

ASB believes the new headquarters will save money and improve productivity. ‘The big drivers include sustainability and reducing operating costs,’ says Derek Shortt, general manager of property. ‘Operating costs in the previous HQ were about NZ\$145-149 (£75-77) per m². They’re now closer to NZ\$95 (£49) and, when the building is fine-tuned, likely to fall even lower.’

When all staff have moved in, there will be about 1,650 people working in the building. But thanks to a version of hot-desking called activity-based working (ABW – see box Future of work), the bank

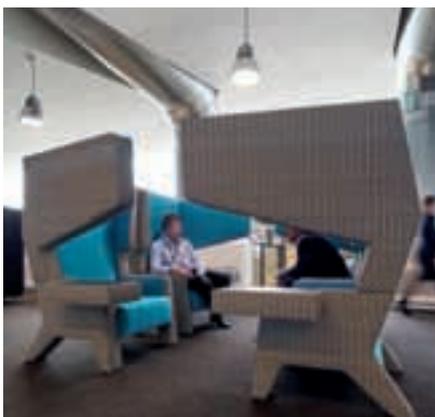
will only need about 80% of that number of desks – not even the chief executive gets her own office. The result is a workspace that feels like a cross between a university campus and a village, encouraging collaboration and chance meetings (what the bank likes to call the ‘bump factor’).

‘It’s not only a new way of working – we’ve moved to the digital phase,’ says Shortt. ‘We’ve all got mobility devices; our IT people have put everything into the cloud. And it’s a cultural change. Before, we were siloed and worked independently of teams. Here we work as a company, collectively, across all divisions.’

ABW also further reduces energy costs, says Alex Baidjurak, a mechanical engineer based at Arup’s Sydney office. The key, he says, is ‘a reduction of embodied energy in construction, as the building is optimised to suit predicted usage rather than the traditional approach, where space must be allocated for all staff simultaneously.

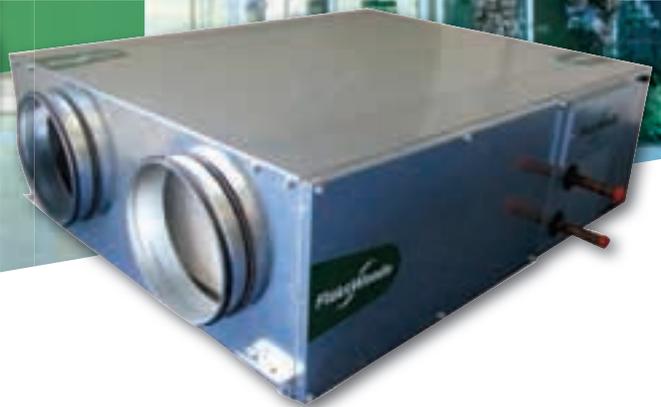
‘What’s more, occupants can find areas of the building that best suit the task at hand. The services design provides individual control over lighting and air conditioning to each space. Occupancy sensors ensure that spaces not in use are ‘powered down’ with minimum ventilation and lighting switched off.’

In line with the cultural change that comes with ABW, the bank wanted a space that would ‘provide transparency’. This



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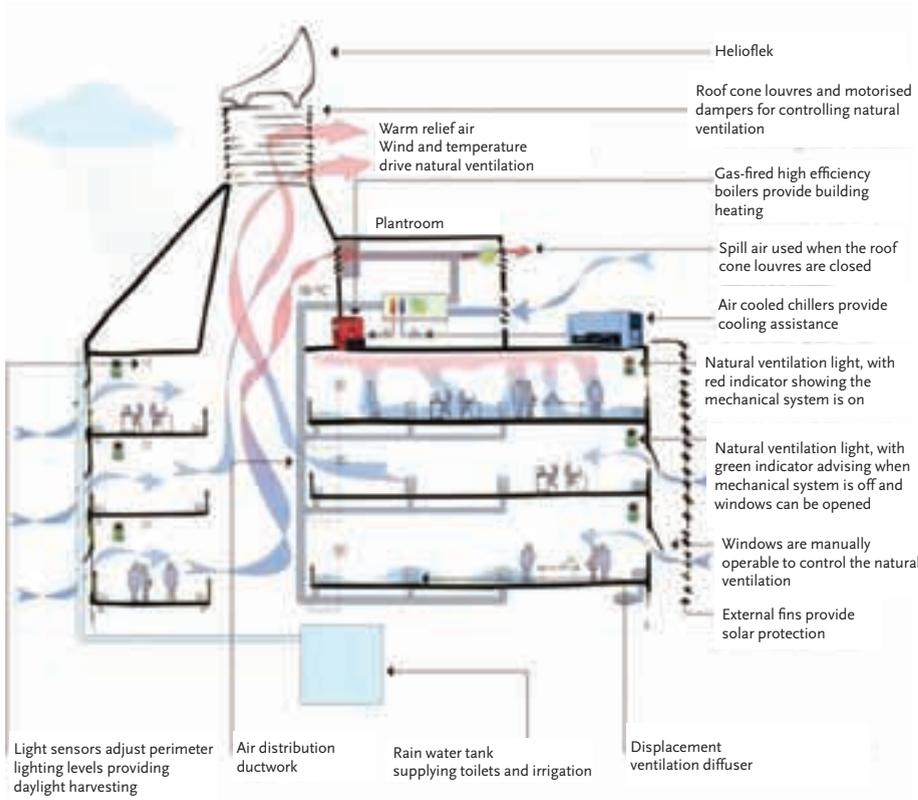
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“The building is optimised to suit predicted usage, rather than the traditional approach where space must be allocated for all staff simultaneously

THE FUTURE OF WORK?

Companies in every corner of the globe, including Microsoft, Rabobank, insurance company Interpolis and KPMG, are embracing or trialling activity-based working (ABW).

Philip Ross, author of *Activity-Based Working: The Hybrid Organisation*, says work is ‘becoming a process, not a place’. If that’s true, then what’s needed is an environment that frees people up to work with whoever they need to, whenever they need to, and wherever they need to.

The idea is that, because no one ‘owns’ a desk or office, a typical ABW workplace becomes more like a club than a classroom. Companies that adopt it report greater levels of trust and accountability, a more team-oriented approach, and better customer service. Paper consumption usually falls too, because no one has their own space to pile clutter. And, because it allows more efficient use of space and resources, operating costs tend to be lower as well.

That doesn’t mean ABW is for everyone. Without an appropriately designed workspace, it’s likely to fail – ASB couldn’t have managed it in their previous multi-floor, high-rise building. It must also be embraced from the very top of the organisation and the type of work must lend itself to ABW. That’s one reason few law firms have embraced it – their work revolves around paper documents, ready access to reference materials, and long hours of concentration by one person on a single issue.

led to the designers choosing to forgo false ceilings, instead leaving air ducts, pipework and cable trays in full view. While that may seem like more of a relaxed, informal approach, it actually involved greater planning. ‘It meant thinking about the positioning of services not only from a functional viewpoint, but also aesthetic,’ says Gemma Collins, senior services manager at Fletcher Construction. ‘And while an exposed cable tie is not normally an issue, in this case it was, which meant the guys installing the cabling had to be meticulous.’

Attention to aesthetic detail is everywhere. The funnel is not just a smart engineering solution, but has also been designed to mimic the shape of Rangitoto, the volcanic island that dominates Auckland’s Waitemata Harbour. (‘Standing inside it feels like you’re standing inside a volcano,’ says Baidjurak.) Air risers within the atrium resemble components from a merchant ship, and the exterior cladding, which plays a critical role in maintaining a comfortable environment within, resembles the leaves of the pohutukawa, a native tree that – for many New Zealanders – is synonymous with long, happy summer holidays at the beach.

The building’s energy efficiency and use of sustainability principles has resulted in a coveted Green Star New Zealand five-star design rating. A rainwater capture system takes care of toilet flushing and irrigation needs, and the natural ventilation system is so effective that it is expected to operate about 60% of the time, reducing HVAC energy use by 40-50%. Other energy-saving initiatives include low-energy lighting with daylight dimming, air-handling units with economy cycles, high-efficiency condensing boilers for heating, and high-efficiency air-cooled chillers for cooling.

The cumulative effect is impressive. ‘Our previous building consumed 240kWh/(m²·year),’ says Shortt. ‘ASB North Wharf requires just 120kWh/(m²·year), including tenant lighting and power – a 50% reduction.’

And that fish-processing plant next door? Ammonia detection equipment on the air-handling unit intakes ensures that – on the few occasions ammonia levels exceed a set threshold – the system switches to recirculated air or temporarily shuts off. So occupants can enjoy fresh air during the day, and still nip next door on their way home to pick up a tasty fish fillet for dinner... CJ

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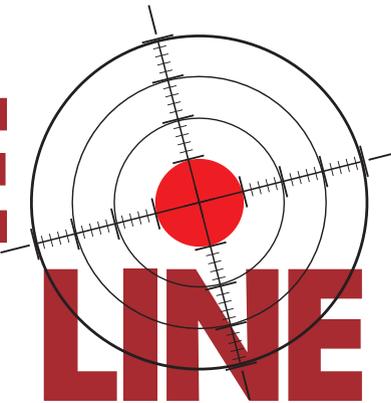
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IN THE FIRING LINE



Buildings are becoming more intelligent, which means they are becoming more exposed to the dangers of cyber attack from criminals, terrorists and enemy states. Security expert **Hugh Boyes** explains the risks

Buildings are under attack. Not just from the elements, but from cyber criminals hell-bent on breaking into building control systems to steal data and embed viruses. Details of attacks rarely come to light, but last month cybersecurity expert Eugene Kaspersky revealed that a Russian nuclear power plant had been infected by malware intended for the centrifuges in Iran's uranium enrichment programme.

The Stuxnet virus, which was discovered in June 2010 – and thought to be the work of Western intelligence agencies, has been found on computers across the world.

Even the International Space Station is susceptible to attack according to Kaspersky, after a virus designed to steal passwords was reportedly brought onboard by a Russian cosmonaut with an infected USB stick.

While the concept of an intelligent building has existed for more than 30 years, only recently has the convergence of technologies and system integration started delivering smart building systems.

Where, in the past, many technologies were proprietary and connections were hard-wired, we now use open standards, commercial communications and network components to deliver systems – changes with significant implications for the cyber security of building systems.

Cyberspace

The term 'cyber security' covers a wide range of topics – it is not just about hackers and malware. Cyber security is best defined as

encompassing the collection of tools, policies, security concepts, security safeguards, guidelines, approaches, actions, training, best practices, assurance and technologies that can be used to protect the cyber environment – including the organisation, the built assets and individual users.

The term 'cyber environment' effectively covers the interconnected networks of electrical, electronic, computer-based and wireless systems. For example, in an intelligent or smart building, if there is no back-up or standby source of power, the failure of the electrical supply can result in systems failure or malfunction, which may, in turn, result in damage to the organisation, to the building or to individuals. The damage can vary from impact on an organisation's reputation, to financial losses, or physical damage.

The discipline of cyber security is based on the CIA triad, which has nothing to do with US spying or criminal gangs. The CIA triad refers to three principles:

- Confidentiality – this encompasses both privacy and access control; for example, authorisation of access to data, and any ability to process, modify or delete data
- Integrity – which addresses the trustworthiness of the data or information storage, the authenticity of data and results, and the safe operation of electronic systems
- Availability – the accessibility of the systems and associated business functions when needed

From these principles it should be clear that cyber security involves more than simply





VECTOMART / CHUNCKING / SHUTTERSTOCK

FIVE CYBER THREATS

Attacks on building systems are not just something you can see in a film. Examples of criminal activity with a cyber security element include:

- Disabling CCTV systems to prevent the recording of a theft
- Hacking into a building control system and modifying temperature settings
- Using malware to disable an alarm system
- Fraud through manipulating meters to under report the amount of energy used
- Cloning access control cards to enable unauthorised access to sensitive areas

securing access to systems – it also addresses the resilience of systems – for example, the ability to adapt and respond to disruption and maintain functionality. From a building services perspective, it is the convergence of infrastructure technologies – for example, networks and sensors – increased connectivity and systems integration that create significantly increased cyber security risks.

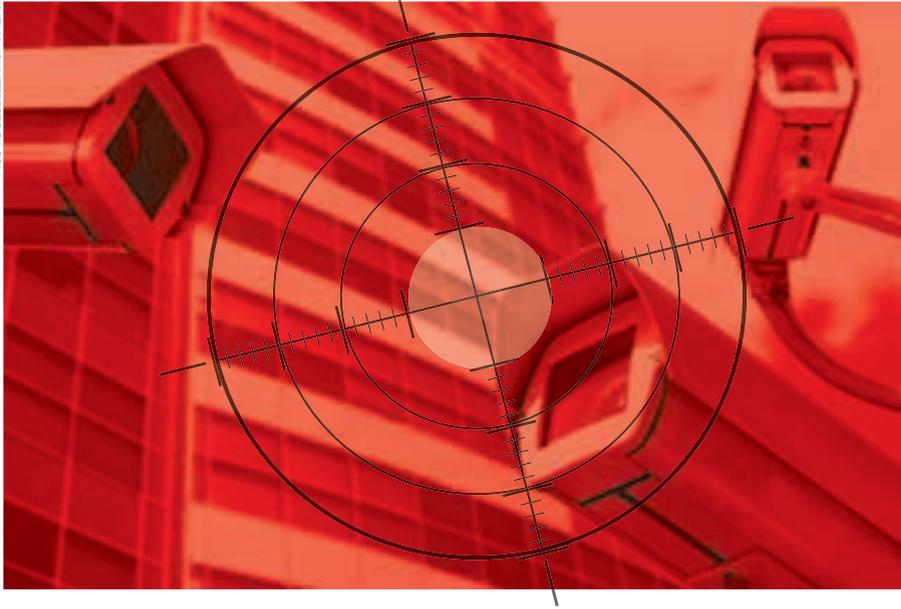
Cyber security threats to your building and systems will emanate from four types of threat agent: malicious outsiders; malicious insiders; non-malicious insiders; and nature. Threats from malicious agents range from the indiscriminate – such as distribution of malware or viruses – to highly targeted attacks attempting to compromise, disrupt or damage specific buildings or systems.

Malicious threats typically originate from the following: sole activists; activist groups; competitors; organised crime; terrorists; proxy terror threat agents with nation state support; and nation states. The order of the group reflects the increasing capacity for damage and sophistication of threats.

Malicious intent

The nature of malicious threats varies, depending on the motivation and objectives of a threat group. Their intent may be to cause commercial harm or to damage reputations, to steal intellectual property or cause disruption.

Threats from nature will relate to damage or interference to buildings systems arising from solar, weather, animal or insect threat agents. Threats from non-malicious insiders typically ➤



What would prevent an attacker with access to the telephone line from interfering with the safe operation of the lift?

EXPOSED ON TV

In a public building the output from a CCTV camera may be used by:

- An operator to monitor and observe individuals in the building
- Security systems to detect suspicious objects
- Alarm systems to detect movement in an area that is currently out of bounds, or not in use
- Building systems to save energy by restricting or shutting down environmental conditioning systems in unoccupied areas

These four discrete applications require feeds of digital data to systems with different security profiles and sensitivities, some of which may be located outside the building. Failure to implement adequate cyber security measures could result in data loss, with images being viewed by unauthorised individuals, or even broadcast over the internet. The exposure of the CCTV feeds may cause serious damage to the building operator or the reputation of the owner or user, particularly if individuals can be identified.

involve negligent or careless staff, visitors or contractors, who may cause significant disruption or damage – for example, by plugging malware infected removable media into a building or business system.

Within the FM team, failure to properly execute security procedures, monitor alarms and system logs, or to maintain security systems and access control will significantly increase security vulnerabilities.

The use of sensors within a building for multiple purposes shows how the increasing complexity of systems affects cyber security. (see panel on ways the output from a CCTV may be used and misused).

From a building services perspective, the greatest cyber security risk is likely to be from the potential impact on the building control systems, particularly loss of view or control.

BMS are typically designed to operate on their own dedicated network. Security is mainly provided through the implementation of access control on operator workstations – for example, limiting who can access the BMS through physical location and account log ins.

There may be little or no security implemented between control computers and sensors, or the systems being controlled. Unauthorised, direct access to this network by an attacker could allow interference with building systems, resulting in the loss of control or view. This may create significant safety or security issues – for example, an inability to shutdown mechanical equipment should a life-threatening incident occur.

Similarly, unauthorised modification of data could lead to system malfunction, or undermine a system's integrity, causing operator errors or loss of control. These situations could arise in a building if there is

inadequate security protecting any building management networks.

It is not just the network at risk, but also systems with a remote monitoring or control capability. For example, some lift manufacturers provide a remote monitoring capability, which comprises an advanced diagnostic and communication system. It is connected to a support centre via a modem and a telephone line.

The remote monitoring system collects, records and analyses lift performance and safety data on a 24/7 basis, communicating that information to the support centre. If this remote monitoring capability allows technicians to perform diagnostics and firmware updates, what would prevent an attacker with access to the telephone line from interfering with the safe operation of the lift?

Allowing FM to access email, or to browse the internet from the building management consoles, can result in systems being compromised. This can expose the BMS to risks of infection by email-borne malware, drive-by malware downloads from websites, or downloading of malware infected files.

Malware is becoming increasingly sophisticated, employing a variety of tactics to avoid detection by anti-virus software. Through social engineering, an attacker may target FM staff and, using carefully crafted phishing emails, attempt to get malware onto their networks.

Another channel for malware is the memory stick, laptop or tablet device used by a service technician as they move from site to site. The Stuxnet attack should be a warning – just because there is an 'air gap' does not mean that malware cannot get onto your building management system.

Cyber security threats to our building systems will inevitably increase, given the extensive use of technology to manage energy efficiency and enhance the use of modern buildings. In collaboration with the Centre for Protection of the Nation Infrastructure (CPNI), the Institution of Engineering and Technology (IET) has published a briefing document: *Resilience and Cyber Security in the Built Environment*¹, which is available for free download (registration required). Work is now under way to produce a Code of Practice for cyber security in the built environment, which will be published next year. CJ

References

1 www.theiet.org/resources/standards/cyber-buildings.cfm

HUGH BOYES IET cyber security lead



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Our Technologies, Your Tomorrow

Heat load control is the key to an efficient multiple boiler strategy, says **Graham Smith**. Here, he outlines the main points to consider

Traditional temperature-based control strategies are almost universally used for boiler sequence control. However, although limitations have been known for many years, they are often ignored. Here, we look at how strategies based on heat load, rather than temperature, can provide more stable control and efficient operation.

Most modern boilers, and some older ones, are more efficient at low loads than at high loads, yet most traditional sequence control systems modulate one boiler up to full output, followed by the next boiler, and so on. Improvement in efficiency at lower loads varies depending on the boiler, but is typically around 3%.

Condensing boilers are more efficient, with low return water temperatures, but unless the return water temperature is below 54°C, they do not work in condensing mode.

Maximum condensing operation does not occur until return temperatures are as low as 30°C, which can further increase efficiency by up to 8%. However, the mean temperatures necessary for most heat emitters normally preclude return temperatures that are quite so low.

“Most modern boilers and some older ones are more efficient at low loads rather than high loads

EYES ON THE LOAD

Burner selection

Boilers with modulating burners are common from domestic boilers upwards, and provide more efficient and stable operation at part load. However, single and two-stage burners are frequently used on larger boilers for reasons of cost. In my view, modulating burners should be used whenever possible.

Effective sequence control of boilers with single and two-stage burners is difficult and most two-stage (high/low) burners never work in two stages. However, heat load control can enable effective two-stage operation.

Demand-based control/boiler inhibit

Demand-based control systems and boiler inhibit have been available in various forms for many years. Secondary circuits should preferably only be run according to demand, although this can be less practical with larger systems where response needs to be considered.

The lead boiler and pump should be enabled according to demand from the secondary circuits (inhibited when there is no demand). With many systems, the

lead boiler can be started when there is a hot water system (HWS) demand, and/or when the compensated valve is open to heating. Minimum run times need to be incorporated for stable operation.

Variable-flow primary and secondary circuits

Modern boilers normally have individual pumps and are connected in parallel via a common header to secondary circuits. This creates variable flow in the primary circuit and increases temperature differential when not all boilers are running.

It is essential that the secondary circuit is also variable flow to prevent dilution of the secondary circuit temperature when all boilers are not on line.

This is often effectively achieved by creating a variable draw from the header via compensated circuit mixing valves, although alternative measures may be necessary with other systems.

HWS segregation

This offers many advantages in most buildings.

Condensing boilers can be operated

at lower temperatures, or directly compensated more easily where HWS is independent of heating. Pumping and standing losses are also reduced where heating boilers are shut down in summer.

HWS can be supplied by point-of-use water heaters, or by condensing gas-fired instantaneous/semi-storage units where demands are greater.

Traditional boiler sequence control systems

Traditional multiple boilers, controlled from the boiler primary circuit flow or return temperature, are often unstable or ineffectively controlled.

Control from return temperature is generally considered to be more stable, but can only be used where the primary flow is constant, as the return temperature is only representative of the load in such circumstances. This is still poorly understood by many system designers.

Flow-temperature sequence control can be effective with boilers that have modulating burners and individual pumps. Many modern boilers have a





Incorrectly positioned meter located just after an offset in pipework

➤ 0-10V control function, which permits either direct modulating control of the burners, or setpoint reset for direct compensation of the boiler. Where direct modulating control of the burner is used, the individual boiler controls should comply with BS EN 15502-1:2012 for gas-fired boilers, and should limit the maximum outlet temperature via burner modulation to a safe margin below the high limit temperature, regardless of the 0-10V signal.

Many packaged boiler controls use PID control loops that are pre-set to provide the most consistent burner modulation under all load conditions. Flow-temperature sequence control must allow for pumps/boilers being started and stopped, with stable control requiring careful commissioning. It is also possible to set up the output stages of flow-temperature

sequence control to provide more efficient operation.

However, poor commissioning of flow-temperature sequence control is common, and frequently ends up with all boilers operating continuously. An increase in proportional band and integral action time rapidly provides stable operation, but this might never be noticed without appropriate witnessing of commissioning.

Flow-temperature sequence control setpoints should be slightly lower than the boiler setpoint (or compensated) to avoid interaction between the sequence control and the boiler controls.

Heat load control

Heat load is calculated from flow and return temperatures and flow rate ($Q=MC\dot{f}t$), or via a heat meter which has an analogue heat output in kW. Most modern building management systems can calculate $Q=MC\dot{f}t$, so heat meters are not necessary, but can be used.

Magnetic flow meters are considered to be the most accurate and to have the greatest turndown. Ultrasonic are more common and normally used, for example, as an inherent part of heat meters for Renewable Heat Incentive (RHI) applications. Magnetic and RHI heat meters are insertion meters, while clamp-on ultrasonic meters are also available.

Clamp-on meters are less accurate than insertion meters, but flexibility to relocate to the correct location can be beneficial. Generally the minimum straight length of pipe is 10D upstream and 5D downstream. This needs to be of the same ID as the flow meter for insertion meters. Some ultrasonic flow meters ideally require 20D upstream and 10D downstream, but generally have been found to be sufficiently accurate with 10D/5D for heat load control purposes. CJ

GRAHAM SMITH MCIBSE, founder of Birling Consulting



BENEFITS AND DOWNSIDES OF HEAT FLOW CONTROL

Advantages of heat load control include:

- More stable operation of boilers, particularly at low loads
- More efficient operation of boilers, as control can be set in accordance with the most economic operation of the boiler, which is normally at low load above minimum fire
- No risk of interaction between temperature settings of boilers and sequence control, which frequently causes ineffective flow-temperature sequence control
- Effective control of high/low fire boilers is possible
- Effective control of combinations of different sizes/types of boiler
- Effective control where boilers do not reach their rated outlet temperatures
- Normally more rapid and effective commissioning
- Boilers are only enabled by the heat load control; therefore the stable firing of the boiler is entirely the boiler supplier's responsibility
- Direct boiler compensation (reset of setpoint via 0-10V signal) can be incorporated,

improving condensing operation

- Often the only effective method of control of bivalent systems.

Disadvantages include:

- Additional capital cost, but this is paid back with long-term effective control
- The systems integrators need to understand the principles of operation and take account of the factors that are essential for effective heat load control.

And the following factors are essential for effective heat load control:

- Flow meters must be correctly located and commissioned
- Matched flow and return temperature sensors are required
- The lead boiler should be enabled according to demand (or optimum start), as there is no load detected on system start-up when flow and return temperatures are equal. The lag, or subsequent, boilers are enabled according to heat load
- The boiler is normally controlled via its packaged controls, with respect to boiler outlet temperature.

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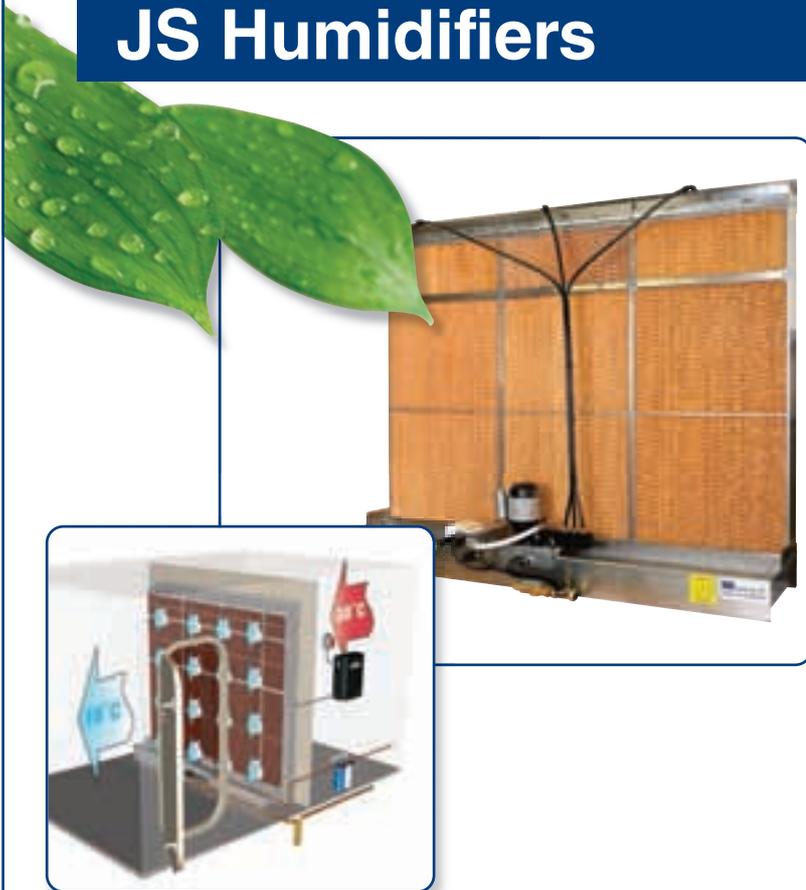
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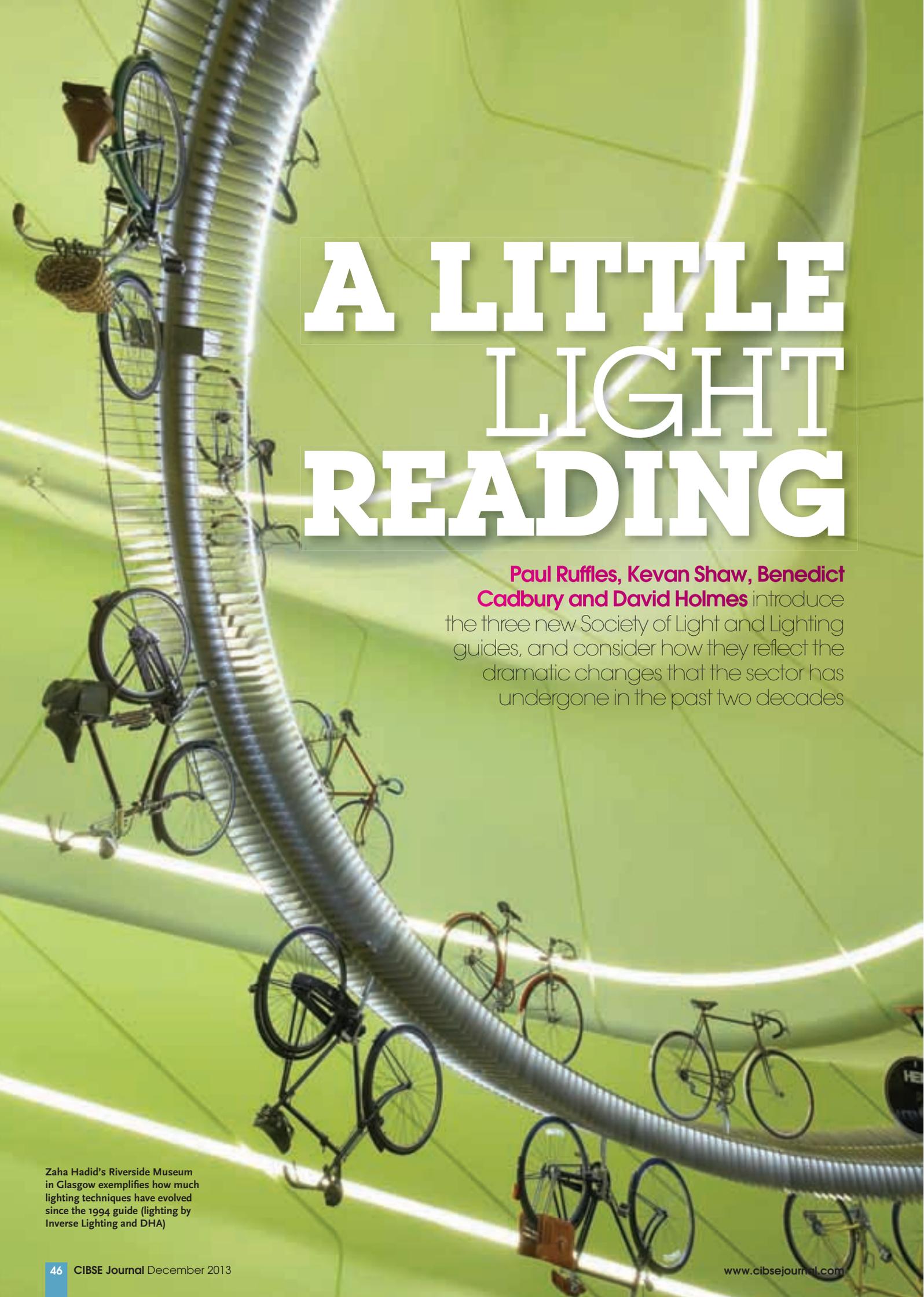
PATHS TO ENLIGHTENMENT

Guides shine light on museums, communal buildings and places of worship

ILLUMINATING TASKS
Office guide puts
daylighting centre stage

**LIGHTING
SPECIAL**

TAKING CONTROL
Study dissects behaviour of
Cambridge scientists



A LITTLE LIGHT READING

Paul Ruffles, Kevan Shaw, Benedict Cadbury and David Holmes introduce the three new Society of Light and Lighting guides, and consider how they reflect the dramatic changes that the sector has undergone in the past two decades

Zaha Hadid's Riverside Museum in Glasgow exemplifies how much lighting techniques have evolved since the 1994 guide (lighting by Inverse Lighting and DHA)

Object lessons

Lighting guide 8 – Lighting for museums and art galleries

The new LG8 takes the reader through the main issues involved in lighting a new or refurbished museum, gallery or historic house.

The first chapter looks at why it is important to consider the objects, the display space and the operation of the building when creating a successful lighting strategy. No-one likes to go into a gloomy space and not be able to read information labels, and no-one wants objects so brightly lit that they fade away before the next generation has a chance to appreciate them.

The heart of the guide is the chapter on lighting exhibits. This takes the reader through ways to select and position tracks, fixings and lights to bring out the best in different types of object. The chapter covers not only modelling, contrast with background and lighting levels, but also glare and access for maintenance.

The issue of lighting levels is covered in more detail in the material degradation chapter, where we see how light and heat can fade and physically degrade materials. We explain why, for instance, it is no longer recommended that fine silks and similar materials be on permanent display, even at 50 lux – the minimum lighting level for good perception of detail and colour.

The next two chapters go into detail about daylight and electric lighting, both as individual light sources and when combined. The daylight section covers big, complex rooflight systems, as well as typical side windows in historic rooms. The electric lighting chapter covers varieties of lighting equipment.

There is a useful chapter on ways to light showcases, either from outside or within. The standard solutions often leave a lot to be desired, and this chapter will encourage all involved in showcase lighting to improve the situation.

The guide ends with chapters on lighting control and issues around maintenance, energy efficiency and running costs. Easy control leads to better use of lighting, energy and running cost savings and, therefore, happier clients.

LG8 is scheduled for publication in late 2013/early 2014.

Paul Ruffles FCIBSE FSLL is principal of Lighting Design and Technology and co-chair of the LG8 committee

Home truths

Lighting guide 9 – Lighting for communal residential buildings

LG9 provides information about lighting for most constituent areas of communal residential buildings. These may be student residences, care homes for the elderly, hospices, NHS staff

accommodation or school boarding houses. Capacity can vary from a small flat shared between four students to a large residential home providing 24-hour care and all meals for 100 elderly people.

Since the original edition was published in 1997, the range of light sources suitable for this type of application has expanded significantly. LEDs are available in an increasing variety of forms; T5 fluorescents are showing significant efficiency gains (and slimmer, more stylish luminaires); metal halide has vastly improved in colour rendering, colour stability and longevity; and GLS lamps have vanished altogether. Parallel to this, lighting control technology has developed significantly, and building regulations have imposed much tougher lighting efficiency targets, one effect of which is to relegate halogen lamps to a few 'display' functions.

This guide is not about minimum standards, but instead outlines the sensible application of good practice, details of which are provided, together with some illustrations of bad practice. For example, students have frequently been forced to live with nothing but switch-start 2D fluorescent bulkheads in their rooms. These, combined with poor quality lamps, create a ghastly environment for study.

The principal purpose of the guide is to indicate the component details of good practice specification, and so provide clear guidance to specifiers. Particularly on design-and-build projects, clarity at that stage discourages

Lighting control has developed significantly, and building regulations have imposed much tougher lighting efficiency targets

LG9 is now available on the Knowledge Portal. LG8 and LG13 will shortly be available. www.cibseknowledgeportal.co.uk

CHASING SHADOWS

Updating LG8 has taken a long time. The last edition was published in 1994 and work has been ongoing to revise it since 2005. The past five years have seen so many changes in museum lighting that it has been very difficult to keep up.

The first challenge was to figure out how to incorporate the revised guidance on lighting in the conservation environment, published by the International Commission on Illumination – CIE157: 2004. Control of Damage to Museum Objects by Optical Radiation – and focus on the fact that it is exposure over time and not the specific light level that causes damage. This document introduced a new category of exhibits – so sensitive even at the low levels used, that they cannot be left on permanent

display without suffering unacceptable damage.

Throughout the period, we have seen the extraordinary development of LED technology. Back in 2005, LEDs were interesting gadgets that had very limited applications in museums with the exception of specific coloured lighting and dynamic displays. Each subsequent draft entailed a rewrite for the LED section; the final one rightly dealt with them as the light source most likely to be considered for museum lighting.

We have also seen a raft of European Ecodesign legislation change the lighting landscape. In 2009, the roadmap for withdrawal of conventional incandescent lamps was set, particularly affecting buildings with historic lighting. Meanwhile, the amusingly named DIM2

regulations have started to deprive us of the low-voltage tungsten halogen lamps that have been the weapon of choice for museum lighting over the past 30 years. Things will continue to change, and this edition of LG8 is very likely to have a considerably shorter life than its forebear.

LG8 has to serve a broad audience. As well as being a vital tool for professional lighting designers, it also has to be accessible to professionals across the museum world. We cover all aspects of museum lighting, with reference to other guides where appropriate. We hope the guidance will prevent the type of poor decision-making that results in bad lighting or, even worse, damage to precious objects.

Kevan Shaw MSLL is design director of KSLD and co-chair of the LG8 committee

▶ standard-issue lighting and/or subsequent 'value engineering' by contractors; it also facilitates effective checking at commissioning.

Care homes have frequently been criticised for failing to provide even 100 lux in residents' rooms, let alone suitable luminaires for reading in bed. The guide recommends three or four reasonably decorative luminaires per room, one of which should be for reading and have a local switch positioned within easy reach of the bed. Total illuminance should be around 200 lux. Lux levels are, however, only part of any specification: good colour rendering, colour temperature, effective control of glare and avoidance of dark spots in the room must all be included. Elderly residents may well suffer from cataracts or glaucoma, which makes it important to select luminaires with good diffusion, or to use indirect light, in living and circulation spaces.

Lighting plays an important role in the character of a room or area. When this is a person's living space, in which they may spend many hours a day, decorative luminaires need to be specified. Utilitarian options may well be efficient, cheap and robust, but they detract from the wellbeing of residents. The guide frequently emphasises the need for warm white light sources with good colour rendering, consistency of colour temperatures in large or linked spaces, and electronic controls to avoid the audible hum of many magnetic ballasts.

Daylight features in an early chapter. Best practice examples show innovative methods of maximising daylight spaces, such as an internal coffee area in a care home lit by a large skylight. Residents in care homes and hospices benefit greatly from access to a space that is brightly sunlit, such as a conservatory, since many are not able to spend much time outdoors.

Chapters on energy management and lighting controls cover different technologies and methods of control, operational advantages and disadvantages, and potential savings. Dimmable light sources, such as LED and fluorescent, in appropriately controlled luminaires – presence detection, daylight sensors – are the source of considerable operational savings – up to 40-50% compared with 24-hour electric lighting. The larger the building, the greater the benefits.

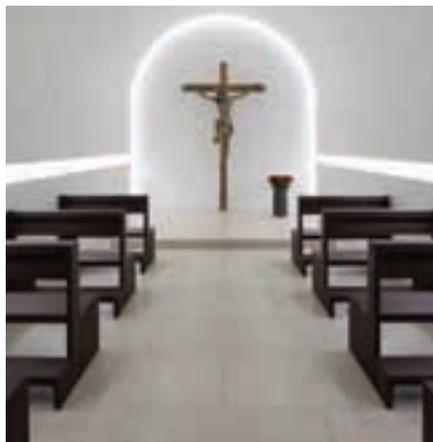
LG9 was published in October 2013. Benedict Cadbury MSLL is managing director of Lampholder Lighting Design and chair of the LG9 committee

Let there be light

Lighting guide 13 – Places of worship

This guide is the first to cover this sphere. To make it appropriate for a wide readership, it has been written as a reference document of

Philips Rijksmuseum:
The entire collection of the recently refurbished Rijksmuseum in Amsterdam is lit by LEDs (Philips Lighting)



John Pawson's Church of St Mortiz in Augsburg
(lighting by Mindseye)

experience, concentrating on giving proven solutions to real problems. Up-to-date legislation is included where relevant, and individual characteristics have been aligned to BS EN 12464-1: 2011 where possible. This includes making a distinction between task area and surrounding areas, and the subsequent recommendation of uniformity for those areas.

A place of worship is taken to be a building – or a room within a building – where people congregate to carry out prayer and activities. Associated areas such as offices, vestries, boiler rooms and bell towers are also considered.

Places of worship for various religions differ considerably in both size and design. The approach is to consider each religion or sect separately where possible, looking at the specific lighting problems posed by a particular activity or building layout.

The guide stresses it is important to apply the correct source of lighting as it is accurately to achieve a specified illuminance. The success of an installation should be judged not by light meters, but through the eyes of those who have to perform and watch ceremonies. Similarly, efficiency should not be rated by the effectiveness of gathering all the lamp lumens and exclusively directing them on to the task plane, but rather by the ease with which the task can be seen, and by the contribution of the lighting to making the environment more agreeable.

Anyone consulting the guide is urged to read the whole document, and not simply to turn to the tables of recommendations. Throughout the text, successful lighting techniques are discussed. Designers should learn to analyse the visual task and the lighting problem. If members of a congregation or assembly tend to sit in one particular area, then this should be focal to the design brief. If certain parts of the service or ceremony appear better with the aid of daylight, it is important to try to understand why.

It is hoped that LG13 will help designers, engineers and students develop an understanding of the many aspects specific to places of worship. Through this understanding we can create buildings that are not only functional and economical to run, but also interesting to those who visit them.

LG13 is scheduled for publication in December 2013. It will feature at the next SLL event on 10 December at Southwark Cathedral. **David Holmes MCIBSE MSLL is lighting applications manager at Hilclare and chair of the LG13 committee**



Concord

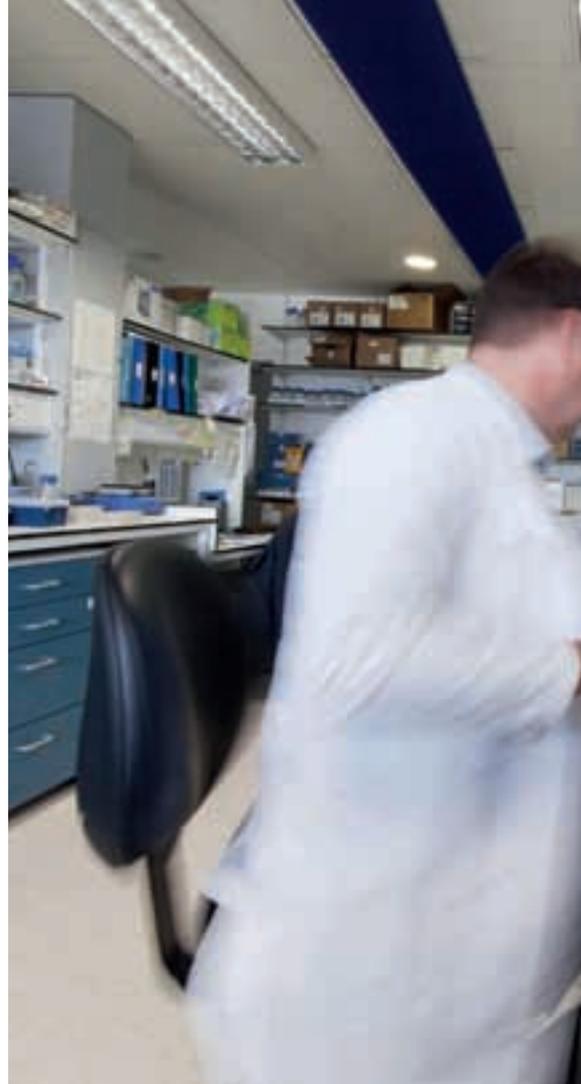
MINI CONTINUUM LED

STYLISH AND VERSATILE UNIFORM LIGHTING

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IT'S NOT ROCKET SCIENCE

Sometimes, the tools to slice spiralling electricity bills are at your fingertips. According to a University of Cambridge pilot study, saving energy through control systems can be as simple as altering human behaviour. **Francis Pearce** explains why cutting electricity consumption doesn't have to be difficult



The formula for cutting lighting bills involves a mixture of behaviour change and lighting controls, according to a project at the University of Cambridge.

The university's annual energy bill runs to more than £10 m, but it has an ambitious energy and carbon reduction project that aims to cut its energy use by more than a third by 2020, with 2005 as its baseline.

Among the five departments chosen for a pilot energy study was the Gurdon Institute, which specialises in cancer research. It uses about 705 kWh/m²/yr and, without changing the way it consumes energy, the Gurdon estimated that its part of the university's annual electricity bill could reach £1 m in 10 years.

'We use about 5 m kWh of electricity a year, but only occupy a 7,000 m² building,' explains building facilities manager Kathy Hilton. 'The Gurdon volunteered because we're aware that we are an energy-intensive building and we also have a biomedical facility. It has very close environmental conditions with lots of air turnover, heating and cooling.'

The Gurdon's research facilities are used round the clock. 'We wanted to reduce electricity consumption throughout the Gurdon Institute, but we wanted to do this without affecting the "good science" that is

done here in developmental biology and cancer research,' adds Hilton. The institute's research is paramount, states a university document. 'Environmental issues and energy reduction initiatives should not impact on our research.'

The institute began by focusing on behaviour change for the pilot, holding a three-day exhibition and asking staff to sign an energy-awareness pledge. Then, between March and September 2012, it ran a competition to see which lab could reduce its energy use most each month, using web-based energy dashboards to keep an eye on progress.

It worked. 'The key to keeping "switching off" front of mind was to maintain a high profile of energy awareness and reminders,' says Hilton. 'An iPad kiosk in the main entrance helped, as did behavioural changes. We began to see great results – one lab in particular achieved electricity consumption reductions of 50%, without compromising their research – by a complete shift in behaviour; this involved planning usage of equipment in advance, and leaving it switched off when not in use.'

Managing 'unloved' spaces

But there are parts of the institute where changing patterns of behaviour makes little difference. 'We still had a large number of spaces within the institute that I termed unloved,' says Hilton. 'These were the areas

“We wanted to reduce electricity consumption, but we wanted to do this without affecting the 'good science' that is done here



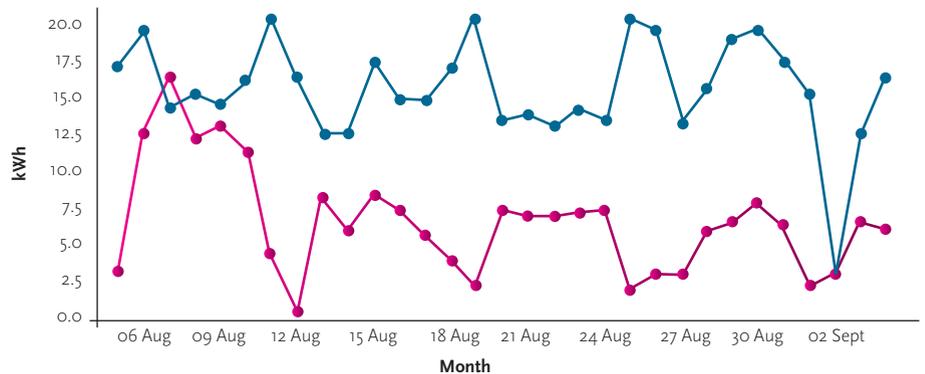
Sensors in Lab 328 revealed unexpected occupant behaviour

that were not the responsibility of any one person or research group, and so energy consumption in these areas was not owned by anyone. They involved a number of equipment rooms and general use laboratories.'

Hilton set up a trial in equipment lab 323, a 50 m² equipment room with no 'owner', that was visited only sporadically throughout the day. Leaving the existing T8 36W fluorescents in situ, energy monitoring and management company Building Sustainability (BSL) installed Lutron's Energi TriPak wireless retrofit controls in the lab, which houses scientific equipment. The set-up comprised a wireless Lutron Rania RF switch and two Radio Powr Savr wireless occupancy/vacancy sensors. These send out RF commands to load controllers that then switch, dim or integrate, depending on the information they receive.

BSL used its Workplace Footprint Tracker system to monitor electricity consumption with and without sensor control. The Dashboard is used to visualise the results of metering online, showing real-time energy use, and to communicate the results by blog providing warnings and alarms.

The results showed that an average of 16.39 kWh was consumed in each 24-hour period when the lighting was switched to manual control but, during the sensor-controlled phase, the average was only 6.45kWh, a drop



Total energy used for this period: 201.1 kWh, equal to 108.8 kg CO₂ or £18.1

Energy consumption per day ●

Total energy used for comparison period: 482.9 kWh, equal to 261.3 kg CO₂ or £43.5

Previous month ●

Workplace Footprint Tracker showing savings over one month

of roughly 60%. This would give an equipment payback of 1.5 years, assuming energy prices held steady.

'The blessing of a wireless system was that it was quick to install,' says Hilton. 'You could move the sensors around; there wasn't any wiring and so there was very little disruption. You could install it in about 10 or 15 minutes and it was matter of rewiring a switch. So you could do a lot of unloved areas quickly.'

The trial expanded into a working laboratory, lab 328, with unexpected results. This time, daylight-harvesting sensors and occupancy sensors were included. BSL installed Lutron's EcoSystem Energy Savr Node addressable lighting control, four occupancy and daylight sensors, and a tracking meter. The T8 36W fluorescents were also changed to lower-energy T5 28W alternatives. However, the early data results did not match expectations: at weekends, the lab was using more electricity in sensor control mode than in the manual mode.

'We had the Lutron system and we trialed another system in another lab set up to similar specifications,' says Hilton. 'With lighting controls, we reduced the maximum threshold. However, we had a meter put in to measure the kilowatt hours and we found that we were not saving what we thought we would.'

The explanation lay in researchers' working practices. 'Most of our labs are in the region of 100 m² and they are set in bays with peninsula benches,' explains Hilton. 'In the old scenario, the first person who came in turned on all the lights, so we were virtually at maximum from when the first person came in until the last left, which could be 12 hours.'

'We explored further and found that the lab occupants were traditionally in the habit of leaving the lights off while working in the lab during weekends, whereas the sensors were automatically switching on the lights. As we

had been encouraging behavioural changes for some time, the lab users had become used to only turning on lighting when they needed it, rather than doing it out of habit.'

The solution was to reset the occupancy sensors from presence detection to vacancy sensing, to accommodate the researchers' altered behaviour. The researchers' new habit of switching off had already reduced consumption to 360 kWh but, in combination with daylight harvesting, the reprogrammed system now brought that figure down to 160kWh, a reduction of 56% and – it was calculated – a payback of approximately two years at present energy costs.

Keeping science safe

'The advantage with the Lutron system was that the switches were wireless so we could reposition them into the corridors and set them to vacancy,' says Hilton. 'So, if someone wants the lights on, they have to switch them on and, if they have left, they go off automatically.' Further trials have led to the Gurdon retrofitting Lutron controls in 97 zones.

'The institute is pretty well 24/7, so we put sensors and light switches into offices where people wouldn't necessarily know that they were the last ones out,' Hilton explains.

The results impressed Hilton, who had been a little sceptical at the outset. 'You see places lit up like Christmas trees and wonder what the point is of saving a couple of kilowatts' she says. 'But we've shown that little savings from everyone make a significant difference.' The institute expects annual savings of £10,000, 100,000 kWh electricity, and 54 tonnes of carbon, with a payback period of two years on the £20,000 cost of the controls. In addition, says Hilton, 'we have shown that it is possible to cut energy consumption without any detrimental effect on the science.' ■



WORK LIGHT BALANCE

Mark Ridler reviews the BCO's first *Guide to Lighting* – and hopes it will lead to badly needed improvements in workplace illumination

Bland, uniform and oppressive: three words that – sadly – describe much of the UK's workplace lighting. The reasons for this are many: bad codes lazily applied; a desire for a one-solution-fits-all easy life; commercial inertia; and a lack of understanding, to name but a few. The good news is that this is changing, in part thanks to an improvement in the codes and guidance. And now there is a new kid on the block.

In late September the British Council for Offices (BCO) launched a lighting guide that aims to pull together existing guidance and good practice and align it to the needs of modern offices in the UK. It has been a long time in gestation, and Iain Trent - the senior project engineer at Land Securities who chaired the project - should be congratulated for the tenacity of steering it to completion.

Technically sound and detailed, it is also easily read and, therefore, accessible for non-lighting experts. It should sit on the shelves of developers, landlords, facilities managers and letting agents, as well as all those who design and engineer lighting systems in our workplaces. Why? Because it will aid the understanding of the impact of natural and artificial light on people's happiness and wellbeing. And, in so doing, it will increase their effectiveness and productivity, and influence their recruitment and retention. Its message is that the effective and timely planning and designing for light will reduce energy, maximise value and minimise running costs.

Recently there has been much good news in terms of the publication of regulations and advice documents. The British standard, *BS EN 12464-1: 2011 Light and lighting. Lighting of work places. Indoor work places*, now concentrates on dedicated task lighting, and demands that adequate vertical light is played on peoples' faces. It talks, for the first time, of modelling of facial features, which aids communication.

Part L of the Building Regulations is promised for 2014 and should incorporate the lighting energy numerical indicator (LENI), a

measure of energy consumed, taking account of usage, lighting control and daylight as an alternative to simple luminaire efficiency. The direction of travel is to create effective, flexible and sustainable lighting environments with due regard given to those that use them.

The BCO supports this by structuring the guide into three parts: daylight and energy; visual comfort and performance; and application of office lighting to the modern-day workplace. It is gratifying that daylight is put front and centre. It is the only truly zero carbon source of light, and medical evidence shows that access to it is essential for our health and happiness. In the context of the workplace, its absence can hugely impair effectiveness. It needs to be carefully controlled to avoid glare and overheating, and so the most significant call by the guide is for its earliest consideration in architectural and interior design.

The instinct for daylight seems to be a lost architectural art that has become shrouded in complex computation; it has become too much the exclusive preserve of the engineer or specialist. It is useful, therefore, that some of

the basic principles are laid out in the guide. Crucially, the importance of massing and orientation, facade design, fenestration, shading and space planning are addressed.

The joy of the second section is that its focus is primarily on lighting quality. The emphasis of recent lighting standards has changed to give more prominence to good general lighting rather than the traditional unhealthy obsession with blanket task illumination. The key message is that general office lighting should provide comfortable illumination to aid communication.

In energy terms we cannot afford to provide 500 lux and 70% uniformity across the entire floor plate. Typically, only 30% will be occupied by desks, which means that 70% of the lighting energy is being pumped onto a dark carpet.

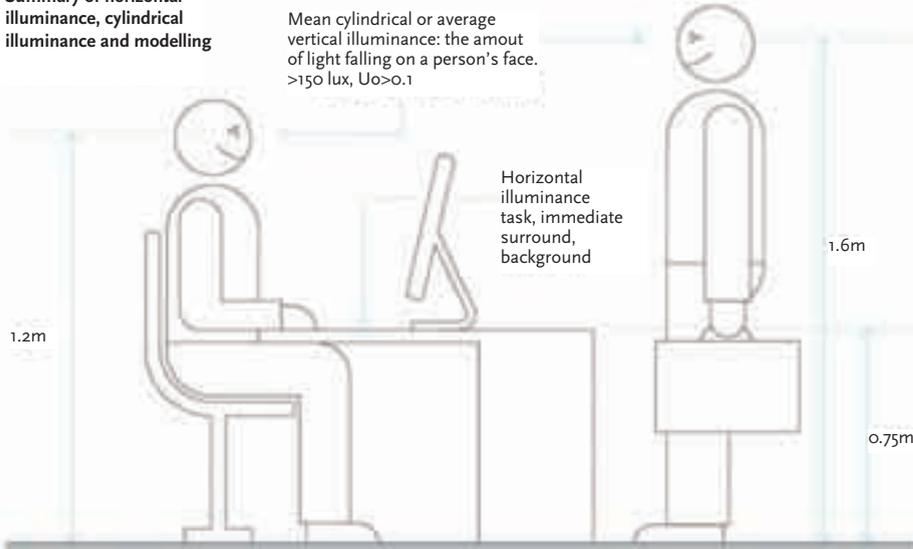
More consideration is given to lighting vertical surfaces (people and walls), as well as a more sophisticated definition of 'the task' and the demand for a tailored and flexible task-lighting strategy. Guidance is also given on the use of LEDs including the approach to maintenance factors, colour rendering and specification.



Ataro luminaire used in a cellular office at Weser Tower, Bremen, Germany. Despite being widely used in mainland Europe, the floorstanding fitting is considered controversial in the UK. Courtesy of Waldmann (From *BCO Guide to Lighting*)

The instinct for daylight seems to be a lost architectural art that has become shrouded in complex computation

Figure 2.1.3
Summary of horizontal
illuminance, cylindrical
illuminance and modelling



Modelling: ratio of cylindrical to horizontal illuminance target of 0.3 to 0.6



To underline its significance, daylighting is the focus of the first section: glass fins provide sparkle and visual interest for occupants both within the atrium and on the office floor at Plantation Place, London. Courtesy of Arup Associates. (From *BCO Guide to Lighting*)

Section three covers the practical lighting design aspects of a shell and core, category A and category B development. It looks at what constitutes good lighting in each case, breaking the office environment into specific areas – desks, reception, break-out spaces, restaurants – and addressing their individual requirements according to task and purpose. There are case studies to illustrate and inspire, from some of the most significant recent projects, and the most influential designers.

Winston Churchill once said: 'If you put two economists in a room, you get two opinions, unless one of them is Lord Keynes, in which case you get three.' Lighting designers are much the same, so the fact that the BCO has achieved a consensus is admirable, but probably accounts for why it has taken so long.

It will not, of course, please all parties. For example, much of the new BS is excellent but it still recommends an average task illuminance of 500 lux. In my opinion, this is far too high for general VDU use. Every client I've worked for, every post-occupancy review conducted, every worker I've asked, every environment I've commissioned has asked for – or demanded – 250-350 lux, some 40% lower. Yes, some users need more but not many and not for long, and their particular – and vital – needs can be easily, individually and locally catered for by the appropriate use of task supplement. The guide could not, in fairness, ignore the BS and so it suggests a lower lighting level and task light supplement rather than blanket provision.

Most of the lighting design community fairly uniformly has a big issue with the UK's system of category A/B provision. It has, historically, led to the cheapest, barely compliant lighting scheme being installed, then ripped out as

soon as the tenant moves in. The best scenario would be to wait until the needs and desires of the tenant are known and then combine the category A and B designs in one sweep.

However, there are strong cultural reasons in the UK lettings market that militate against such an approach, particularly in multi-tenanted buildings. I know a major developer who tried not to provide category A pre-tenancy and found that it lost prospective tenants because of the increased occupancy programmes that such an approach required.

Perhaps the guide will help educate the market and, in particular, tenants and letting agents. It would be unreasonable to expect the BCO to abandon the category A/B system and it has intelligently raised the issues and suggested alternative approaches.

In mainland Europe, there is an alternative approach to category A/B ceiling-mounted lighting. For a long time, they have employed more floor and furniture-mounted task-based lighting. It is considered controversial in the UK, but I find it difficult to understand why.

It is simple to implement. It provides flexibility – move the desk, and the light follows. Control is intuitive – the switch is mounted on the light, with no complicated interfaces required. It is sustainable – absence-detection can be easily integrated. It offers individual control. In terms of quality, it gives a balance of direct and indirect lighting that illuminates faces naturally and lifts the ceiling plane.

This approach should be an architect's and engineer's dream, because it leaves the ceiling clean and removes a complete degree of ceiling coordination. While the guide predominantly examines ceiling-mounted systems, it has fairly covered this technique as an approach, and so perhaps, it will be more frequently considered as an option in the future.

In summary, I think the guide can be considered a success and I recommend it to anyone involved in delivering workspaces in the UK. There is a danger, of course, that all this sophistication and good work will be rejected and filed in the 'too hard bin'; that easy numbers will be extracted and claims for 'BCO compliance' made. I sincerely hope not, because the BCO has made the strongest efforts to avoid this. It should make the provision of lighting that people love working in more likely. Fingers crossed. 🍀

● The BCO Guide to Office Lighting costs £65 for members and £95 for non-members. For more details go to www.bco.org.uk/research

MARK RIDLER is lighting director of BDP Lighting

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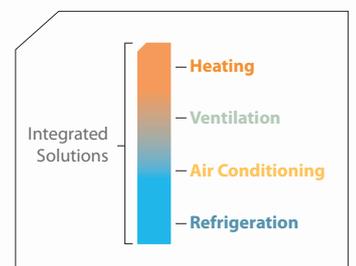
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Ensuring best performance in variable refrigerant volume/flow systems

This module looks at the development of VRV/VRF systems and how legislation and environmental assessment are shaping their implementation

Variable refrigerant volume/flow (VRV/VRF) systems have grown in popularity since their first introduction in the 1980s. Early systems had one outdoor unit connected to a maximum of eight indoor units, with relatively short interconnecting pipe runs. Today, this has expanded to installations that are far more extensive, typically offering the possibility of 64 indoor units being connected to three outdoor grouped units, with the freedom of up to 1,000 metres of interconnecting pipework.

This CPD will consider the current state of the UK marketplace and explore how legislation and the prevalent UK environmental assessment technique are influencing VRV/VRF implementation to ensure best performance.

Although new VRV/VRF systems are potentially extensive, currently installed systems are still often much less ambitious, typically with six indoor units for each outdoor one, as shown in the sales data in Table 1. These sales statistics indicate that there were likely to be approximately 16,000 outdoor units sold in the UK in 2012 and that this number is increasing year on year.

A variety of indoor units may be connected, ranging from water heat exchangers and thermal stores through to ducted or 'cassette' (ceiling mounted

Year	2010	2011	2012
VRF outdoor units	14,300	15,400	15,800
VRF indoor units	85,400	97,300	101,900
Outdoor/indoor ratio	5.97	6.32	6.45

Table 1: HEVAC sales statistics of VRF units¹

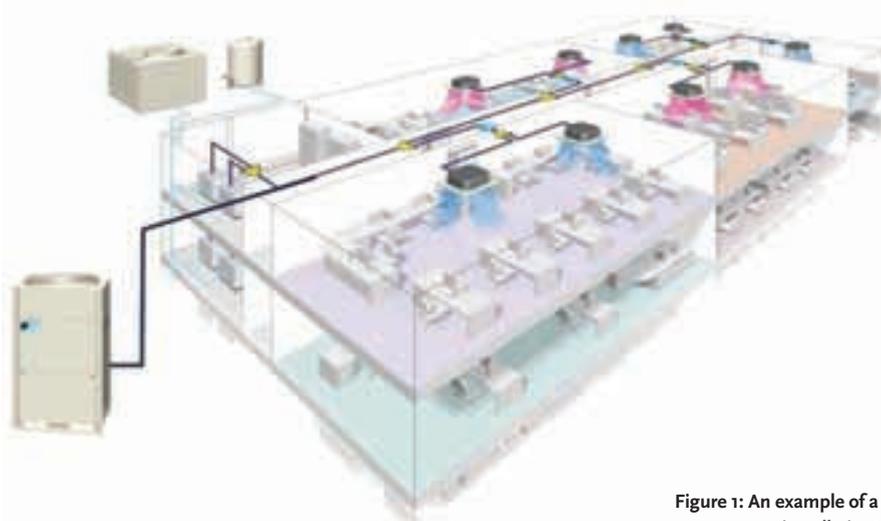


Figure 1: An example of a contemporary installation²

modular) units. An example of a typical system with an outdoor unit connected to DX fan coils and a heat recovery, low temperature water store is shown in Figure 1.

The fast rate of adoption of these units has meant that building designers, installers

and end users have to catch-up on how these complex DX systems meet the changing requirements of both new legislation and environmental assessment methods. In the UK, the considerations that affect these systems may be broadly divided into four

elements – and, of course, each one of these may interact with the others.

1. UK Building Regulations and associated supporting documents
2. EU legislation on the handling of F-gases and ozone depleting substances
3. The EU Energy-Related Products Directive (ErP)
4. Environmental assessment methods.

UK Building Regulations

Approved document Part L, Conservation of Fuel and Power, is the key element of the UK government's legislation leading compliance with the Energy Performance of Buildings Directive (EPBD) requirement to reduce carbon emissions by 20% by 2020. There have been several iterations of Part L published since 2006, the most recent being in 2013. Amongst other things, it sets a requirement 'to analyse and take into account the technical, environmental and economic feasibility of using high-efficiency alternative systems', which can include heat pump systems featuring VRV/VRF installations.

Part L sets aspects determining the thermal performance of the building design. However, considerations that affect complex DX equipment are detailed in the separate supporting document, the Building Services Non Domestic Compliance Guide (amended 2011), which schedules minimum performance requirements for specific equipment. The guidance provided in this publication may be used in full or in part or potentially even ignored, providing the building meets the requirements of the National Calculation Method³ (NCM) as calculated, for example, by using SBEM³ (Simplified Building Energy Model) software. Using the compliance guide is relatively straightforward but is dependent on specific test requirements for each product grouping – VRV/VRF systems are currently tested to EN14511.⁴ This specifies that the system data should be presented with the appropriate combined outdoor and indoor units. This is different to more traditional centralised water chillers with distributed fan coils, which are presented as separate systems – the chillers being tested against the same standard as VRF but the fan coils requiring a separate specific fan power (SFP) rating.

Actual performance will be subject to operating conditions. Both cooling and heating operation can be presented in the form of the energy efficiency ratio (EER) and coefficient of performance (COP). However, the compliance guide offers the opportunity to present a seasonally-adjusted EER (SEER). SEER attempts to take account of the operation of the system throughout

the whole operating season by applying weighting factors to simulate the actual energy consumption. The weighting factors may be based on fully modelled data for the application or by using 'typical' values for the building type, or using other derived factors – providing they are as rigorous as the prescribed method.

EU F-gas regulation and regulation on substances that deplete the ozone layer

The F-gas regulation first came into operation in 2006, with requirements that affect the work of designers, installers and end users, particularly when dealing with equipment containing more than 3 kg of F-gas (hydrofluorocarbon, or HFC) refrigerants. The regulation focuses on the records and maintenance of refrigeration equipment to ensure leaks are swiftly dealt with and refrigerant is properly recovered when removed from systems. It requires that any service personnel who install or maintain complex DX systems should be properly trained and registered with one of the government-recognised bodies, such as Refcom. Responsibility for enforcement of the F-gas regulation has recently moved to the Environment Agency,⁵ which will raise awareness and use risk-based targeting to check that individual companies are operating within the law. (The website realzero.org.uk

also provides some useful resources.)

Some manufacturers have embedded operational routines for their products that monitor, alert and recover refrigerant to the outdoor unit in the case of a suspected leak from a system.

As a result of the EU regulation on substances that deplete the ozone layer, new R22 systems have been outlawed since 2004. There is a final ban on R22 that comes into effect on 31 December 2014, when it will become illegal to repair a R22 refrigerant circuit; if a fault is detected, the equipment should be taken out of service and the refrigerant must be handled as a hazardous waste. There are several ways of replacing existing R22 systems that can reuse existing system pipework so that compliant HFC systems may be applied with limited disruption to the building. The F-gas regulation will continue to evolve, so the way that HFC refrigerants are handled will also change over the next 15 to 20 years. However, a complete ban on HFC is unlikely, as replacements currently cannot meet the energy efficiency requirements of the EU Energy Related Products Directive.

Energy-Related Products Directive

The Eco-design of Energy-Related Products Directive (ErP) and associated directives⁶ support the aims of the EU by encouraging the use of environmentally-conscious designs in order to reduce greenhouse gas emissions and their environmental impact. Air conditioning technologies, such as VRV/VRF systems, are affected by the directive across a number of the ErP 'Lots' including Lot 2, Lot 10, Lot 21 and ENTR Lot 6, in what can present rather a confused picture of domestic and non-domestic applications (for further details of the ErP and its 'Lots', see the November 2012, *CIBSE Journal* CPD article).

EN14511 defines the specific external design conditions that are applied for standard testing of units, and seasonal testing (to determine SEER and SCOP) is undertaken to standard EN14825.⁷ EC document 2012/C 172/01 provides a useful explanation of the required calculations.

For units up to 12 kW, the output must be shown on a product energy label (in accordance with EU regulation 626/2011, as illustrated in Figure 2) that includes both the design loads and seasonal performances. It shows the SEER value, a measure of cooling performance, and the seasonal coefficient of performance (SCOP), measuring heating performance, for up to three defined climate conditions: 'average', corresponding to Strasbourg; 'warmer', based on Athens; and 'colder', relating to Helsinki

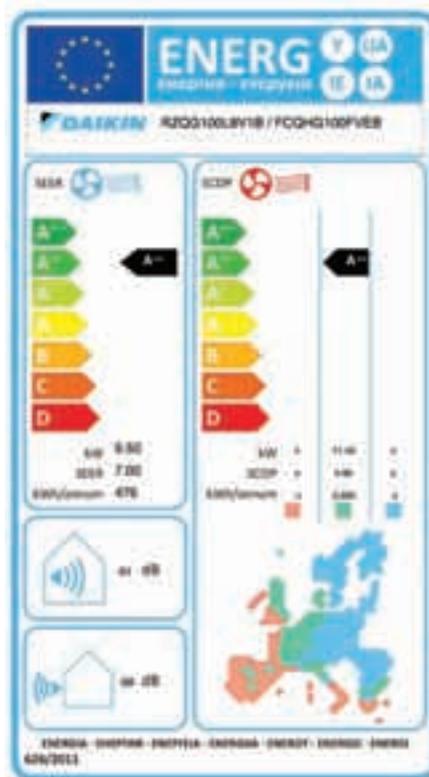


Figure 2: Example unit energy label showing SCOP and SEER as well as sound power levels

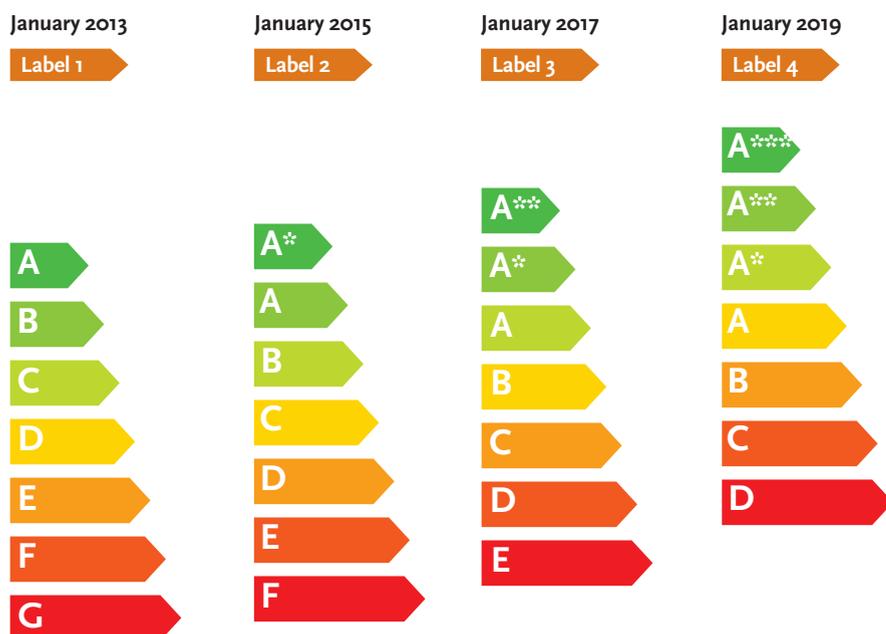


Figure 3: Published criteria changes for Lot 10 equipment split systems under 12 kW

(the ‘average’ climate profile is mandatory, whereas the other two are voluntary). Manufacturers must make the labels for their products freely available through the web.

Enhanced requirements are due to come into force in 2015, 2017 and 2019 (as indicated in Figure 3) that, for example, will mean that a G-rated product today will not be allowed to be sold in 2015, and that by 2019 the minimum SEER of 2.60 and SCOP of 1.90 will rise to a minimum SEER of 3.60 and a SCOP of 2.50. The use of a unified labelling system will help inform the selection of units – although the incremental changes may cause some interim confusion in the marketplace.

Environmental assessment methods

The Building Research Establishment Environmental Assessment Method (BREEAM) is often applied as the environmental assessment method and rating system for buildings both in the UK and worldwide.

VRV/VRF systems can help meet the design requirements of BREEAM, but the majority of the available credits require that the air conditioning system is an intrinsic part of the overall system in order to gain credits for free cooling and ventilation. However, there are targets for leak detection and refrigerant recovery, as well as reducing the amount of HFCs that are used within a system, that will provide a positive contribution to the BREEAM score.

For example, under the section that considers the impact of refrigerants that considers aspects of leak detection and refrigerant handling, a factor may be determined, the Direct Effect Life Cycle CO₂ Equivalent Emissions (DELCO₂e). This takes a number of parameters including how large the systems are, the refrigerant global warming potential (GWP), how much refrigerant leaks, the purging arrangements and the chances of a catastrophic failure. If the resulting value comes to less than (or equal to) 1,000 kgCO₂e · kW⁻¹, one BREEAM

credit is gained. An example of the calculation (employing the BREEAM calculator) is shown in Table 2.

Equipment manufacturers can advise on appropriate values to use in the calculation. To ensure that a given design for a VRV/VRF system meets the DELC calculation conditions, designers should aim to limit the size of system and the length of installed pipe work.

Although less directly linked to VRV/VRF systems, other BREEAM points that may also be gained from the application of VRV/VRF systems could include Ene O1, ‘Energy Performance Ratio for New Constructions’, a measure of the buildings CO₂ emissions; and Hea O3, ‘Thermal comfort’; this is particularly relevant to both the controllability and zoning capabilities of VRV/VRF.

Similarly, in the Leadership in Energy and Environmental Design (LEED) rating system,⁸ environmental assessment system points may be achieved particularly in the ‘Energy and Atmosphere (EA)’ and ‘Indoor Environmental Quality (IEQ)’ sections – the latter being strongly dependent on the associated ventilation strategies that work with the VRV/VRF systems.

Conclusion

The application of VRV/VRF systems is continuing to gather pace in the UK. To apply designs successfully, as well as properly operate and maintain the resulting installations, requires an understanding of an increasing range of legislation and guidance. However, developing a working knowledge of the supporting literature will empower the designer/operator to both create compliant innovative systems and reduce energy usage and operational CO₂ emissions.

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● Thanks to Graham Wright at Daikin for his guiding input into this CPD module.

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DELC CO ₂ calculation tool			
Refrigerant charge	=	60	kg
System life	=	15	years
Recovery efficiency factor	=	95	%
Annual leakage rate	=	5	%
Annual purge release factor	=	0.5	%
Annual service release	=	0.25	%
Probability catastrophic failure	=	0.5	%
Global warming potential	=	1720	GWP
Cooling capacity	=	135	kW
DELC CO ₂		=	754.9

Table 2: BREEAM calculation of direct effect life cycle CO₂ equivalent emissions (DELC)

Turn over page to complete module ➤

Module 59

December 2013



1. What is the approximate number of installed VRV/VRF indoor units for each outdoor unit typically installed in the UK?

- A One indoor unit for each outdoor unit
- B Three indoor units for each outdoor unit
- C Six indoor units for each outdoor unit
- D Nine indoor units for each outdoor unit
- E Twelve indoor units for each outdoor unit

2. What is the minimum mass of system HFC refrigerant that comes under the specific requirements of the F-gas regulations?

- A 1 kg
- B 2 kg
- C 3 kg
- D 4 kg
- E 5 kg

3. Which standard/regulation sets the specific requirements for the testing of seasonal performance of VRV/VRF?

- A EN14511
- B EN14825
- C NCM
- D EU regulation 626/2011
- E ErP

4. In the example energy label in Figure 2, what is the SCOP rating for the unit?

- A A***
- B A**
- C A*
- D B
- E C

5. What maximum value of Direct Effect Life Cycle CO₂ Equivalent Emissions would gain one credit in BREEAM?

- A 1 kgCO₂e · kW⁻¹
- B 10 kgCO₂e · kW⁻¹
- C 100 kgCO₂e · kW⁻¹
- D 1,000 kgCO₂e · kW⁻¹
- E 10,000 kgCO₂e · kW⁻¹

Name (please print)

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New Arla site laps up the attention

On a 115-acre site on the outskirts of Aylesbury in Buckinghamshire, a new £150m Arla Foods site is setting new standards when it comes to dairy processing. It is the largest fresh milk processing facility in Europe and will be one of the most environmentally efficient milk processing plants in the world. When it is fully operational, the dairy will employ 700 people and will be capable of packaging up to 1 bn litres of milk annually. Such an important development demanded only the best, and the volume of milk to be moved around the site and processed means pumps play a vital role. Recognising this, Grundfos Pumps has worked closely with NG Bailey – which provided all the M&E solutions – from the outset, to supply the entire pump solution.

● Email grundfosuk@grundfos.com, call 01525 850000 or visit www.grundfos.co.uk



The best of bio-fuel technology

This year-round multi-fuel condensing boiler has been developed and installed since the year 2000. There are now many hundreds of boilers burning natural gas, light oil, low pressure gas and kerosene. The boiler can now burn B100 bio-fuel, created from waste oil and rapeseed oil. Atlantic has also installed many dual-fuel condensing boilers, burning natural gas and B100 bio-fuel, or natural gas and light oil.

The boiler bridges the gap between gas condensing boilers and bio-liquid boilers, with efficiencies between 92% and 97% GCV, a range of 10 kW to 625 kW and a SEDBUK 'A' rating.

● Email info@atlanticboilers.com or call 01616 215960

Titan Products launches TPZ-Net Zigbee wireless range to monitor a building's health

The TPZ-Net is a new range of wireless environmental goods from Titan Products. Incorporating Zigbee wireless technology, the range claims extremely stable, self-healing mesh networking capabilities. The TPZ-Net range is designed to monitor temperature, CO₂, humidity, light and occupancy levels wirelessly, and to convey this information back to the Titan Products coordinator, where the information can be transferred onto a BACnet network, to other Titan Product controllers, or to input/output (I/O) devices.

● Visit www.titanproducts.com or call 01614 066480



Two decades of CableCalc Level P marked with a free version of new twin and earth calculations

To mark 20 years of CableCalc, Castline Systems has released a free version of its CableCalc program, which will calculate single-phase radial and ring circuits wired in twin and earth cable.

It includes free technical support by email. CableCalc Level P is a fully working, unlimited-use version and provides far more than just simple volt drop calculations. CableCalc Level P can be downloaded from the web address below.

● Call 012 9387 1751 or visit www.castlinesystems.com



CE marking could transform smoke vent market, according to Adexsi UK

The need for building services products to carry a CE mark is having a profound impact on the ventilation and smoke extraction market, according to Adexsi UK.

Since July, it has been mandatory for many products to carry a CE mark, in line with the new European Construction Products Regulation. Adexsi's CERtilam roof and wall louvres, CERtilux roof louvres, CERtilux wall louvres, CERtilight flap ventilators and CERticiel window ventilators are specifically tailored for the UK market.

● Visit www.adexsiuk.com



New digital Polypipe Ventilation product selector is launched, offering fast, efficient information

Polypipe Ventilation is pleased to announce the launch of its first digital System and Product Selector, featuring embedded web links, an easy-to-use search facility and useful 'share' function.

The online System and Product Selector is packed with Polypipe Ventilation's latest products and technical information.

The digital ventilation catalogue has been designed as a comprehensive guide to assist distributors, specifiers, developers, installers and engineers in the selection of ventilation systems that meet current Building Regulations and save time and money on site.

● Visit www.polypipe.com/ventilation or call 08443 715523

New Optergy Energy Management system by Marflow

Marflow Hydraulics has introduced the Optergy Energy Management system into its portfolio. Optergy provides a universal approach to a complete energy management system. Working in conjunction with a building management system, it provides energy management capabilities to help users optimise efficiency. It delivers industry-leading integrated energy management, building automation and security solutions. Optergy has numerous features, including: real time monitoring; total operations reporting and alarming; as well as auto set capabilities, which work alongside weather forecasting and room allocations.

● Visit www.marflowhydraulics.co.uk/optergy, call 0845 564 1555 or email solutions@marflow.co.uk



PEL Services supplies conference system for Welsh council

The Vale of Glamorgan Council now has new digital conference and sound reinforcement systems, thanks to PEL Services, which was responsible for the systems' design, supply and installation. As part of a major refurbishment of its main chamber from a traditional design to an accessible multi-use space, the council deemed the existing conference system to be outdated. Following recommendations from audio visual manufacturers and a competitive tender, PEL was appointed to undertake a complete refit of the chamber, accommodating 60 delegates, with a Bosch DCN Wireless Discussion System.

● Call 020 8839 2100, email – info@pel.co.uk or visit www.pel.co.uk or www.pelav.co.uk



Airedale International launches highest efficiency-dedicated chilled water precision air conditioning product

Leading British manufacturer Airedale International has launched a dedicated chilled water range. The SmartCool SD/SN/SR (11-233 kW) has been designed to optimise the internal heat exchange area, in addition to other energy-efficient enhancements. Units incorporate the latest EC fans, which are up to 70% more efficient than their AC equivalents.

The SmartCool is available in a number of configurations to suit varying specifications, including compact applications where space is limited.

● Call 01132 391000, email connect@airedale.com or visit www.airedale.com



New CIBSE CPD seminar is launched by Marley

Marley Plumbing and Drainage has launched its new CIBSE accredited CPD: *A guide to sanitary pipework design*. The CPD has been designed to help contractors and engineers further their knowledge of sanitary pipework design in a one-hour seminar, which explores a number of key objectives, including background information on sanitary standards and Building Regulation requirements, as well as terminology, system classifications and design calculations. The seminars can be held at delegates' premises and can take place throughout lunch hours.

● Email pradmin@cibcommunications.co.uk or call 01372 371800



JS Air Curtains at Reynolds Furniture

As part of a major refurbishment at its retail store in Bognor Regis, Reynolds Furniture selected JS Air Curtains' Finesse and Optima air curtains to maintain the internal atmosphere while complementing its interior design. The air curtains are ensuring customer and staff comfort throughout the summer and winter. As part of this installation, air curtains on the ground floor were an essential ingredient to maintain the ambient temperature.

● Call 01903 858656 or email sales@jsaircurtains.com



Secomak engineering support guarantees compliance with latest British Standards

The British Standard BS8487:2007 – developed in conjunction with global Gas Booster specialist Secomak – prescribes the latest maintenance guidelines to vendors or owners of one or more gas boosters, to ensure their ongoing safety and efficiency performance. The standard recommends that drive belts are replaced annually, flexible connectors are replaced every five years and that bearing assemblies are replaced every five years – irrespective of perceived bearing condition.

● Email sales@secomak.com or visit www.secomak.com



Modern diffuser developments by Gilberts

Gilberts has launched the Series GB range of barrel-type swirl air diffusers. It offers a fixed-size square fascia, designed to fit plaster ceilings and standard 500 or 600 mm² ceiling grids. A choice of three different 'list size' radial blade pattern configurations provide for a range of air volume selections. Each model provides a high performance swirl air distribution effect, which allows them to deliver high volumes of air into the conditioned space, taking advantage of its rapid entrainment and mixing capabilities. Manufactured in the UK, Series GB is complemented by a range of purpose-built plenum boxes.

The GB brochure is available from Gilberts head office or via area representatives.

● Call 01253 766911 or email sales@gilbertsblackpool.com



Precision ventilation control for Sheffield University NAMRC

Precision window actuators from SE Controls are being used as part of an energy-efficient natural ventilation system at Sheffield University's Nuclear Advanced Manufacturing Research Centre (NAMRC) in Rotherham, to help maintain a comfortable environment for researchers and staff.

Work at the NAMRC focuses on innovative research into metals and manufacturing engineering, rather than radioactive research, and the new BREEAM excellent-rated building is based around an open-plan, 5,000 m² workshop, incorporating cutting-edge manufacturing equipment and facilities.

As the building already employs low energy and renewable initiatives, such as 320 kW ground source heat pumps and a 900 kW wind turbine, the use of natural ventilation was an ideal solution, as the temperature and air quality can be maintained within clearly defined set points, while minimising the need for additional mechanical cooling.

● Visit www.secontrols.com or call 01543 443060



Remeha Commercial makes strategic appointment

Remeha Commercial has appointed Will Jones as area sales manager for the West Midlands, replacing James Porter, who will focus on national business development and account management. Jones brings extensive knowledge of the heating industry from his years at Grafton Group and Wolseley Centers. Chris Meir, national sales manager at Remeha Commercial, said: 'Will is a welcome addition to our experienced, knowledgeable team, while James Porter's new role will aid our plans for continued growth.'

● Visit www.remeha.co.uk, call 0118 978 3434 or email boilers@remeha.co.uk



New recruit Will Jones

Hargreaves launches high-purity pipework range

A high-purity pipework range has been launched by Hargreaves.

The core product range consists of high-purity stainless steel pipe, and is also available in Polyvinylidene Fluoride (PVDF) and copper. It is manufactured in a class 100 (IOS 4/5) clean-room facility at Newton Aycliffe to strict quality assurance standards, incorporating separate access and exits for PVDF, copper and stainless steel, dedicated areas for preparation and welding, and storage for completed spools within the clean room.

● Visit www.mw-hargreaves.net



Truro's new sports centre uses CP Electronic's Rapid control system

A new multi-million pound sports centre at Truro School in Cornwall has used CP Electronics Rapid control system with scene setting to great effect. Rapid was chosen as the system offers easy installation with simple control via standard light switches, handsets or from a central computerised source. The sport centre cost £4.2m to build and accommodates eight badminton courts, two squash courts, a dance studio and a fitness suite, in addition to providing accommodation for the school's existing swimming pool.

● Email enquiry@cpelectronics.co.uk, visit www.cpelectronics.co.uk or call 0333 9000671



Remeha boilers provide safe retrofit for asbestos-contaminated school

Remeha Quinta Pro boilers have been installed at Woodlea Primary School, Surrey, as part of an innovative solution to retrofit energy-saving heating safely and quickly at a school with ventilation, location and asbestos problems in its plant room. Three Quinta Pro 65 boilers were installed on a cascade, for fast assembly and installation, to ensure good management of the asbestos situation and to deliver reliable energy-efficient heating. The boiler enclosure, designed by Phil Clayton of Kier Facilities Services, Frederick So of Surrey County Council, and Remeha Commercial, allows future maintenance and operation to take place securely from the outside.

● Visit www.remeha.co.uk, email boilers@remeha.co.uk, or call 0118 978 3434



Airedale International Air Conditioning first to market with free-cooling chillers

A production range of free-cooling chillers, using the low global warming potential refrigerant R1234ze, has been launched by Airedale.

The TurboChill FreeCool offers twice as much free cooling as a thermosiphon free-cooling system, and can deliver free cooling for up to 95% of the year.

The range is being released alongside a 1,600 kW dual circuit TurboChill incorporating R134a, delivering redundancy back-up and quicker compressor start-up to full load in a 500 kW higher capacity model.

● Email connect@airedale.com, visit www.airedale.com or call 01132 391000



Aurista brings radiant light to office spaces

Trilux has launched Aurista, a recessed reflector luminaire that creates radiant and high quality lighting for offices environments. Furthermore, with its module dimensions and low initial investment, it offers an ideal solution for upgrading lighting from standard T5 and T8 luminaires.

Developed with Billings Jackson Design, the Aurista luminaire consists of a metal-plastic reflector frame and high quality, incremental LED lamps, generating a star-shaped emission of light, which helps to widen the area of illumination and ensure office environments are well lit.

The star-shaped design reduces the levels of contrast between the light source and peripheral surfaces. Instead, with a uniform light reflected across the panel, it generates a truly radiant light. Furthermore, Aurista luminaires reduces energy by up to 56% when compared with conventional luminaires.

● Visit www.trilux.co.uk



DW Windsor breathes new life into popular Thames crossing

DW Windsor Lighting's Garda LED illuminated handrail has been used to great effect on the Teddington Lock footbridge, which provides a direct link between Ham and Teddington in Middlesex. DW Windsor was approached by the London Borough of Richmond to improve the poor quality lighting on the footbridges, which was coming to the end of its serviceable life. In addition to existing illumination levels being poor, much light was being shed on the river below, to the detriment of the local bats and other wildlife.

● Visit www.dwwindsor.co.uk or email info@dwwindsor.co.uk or call 01992 474600



Versatility comes as standard with the MAXIS range of cylinders

MHS Boilers, part of ELCO Heating Solutions, has launched MAXIS – a new range of highly versatile cylinders, which are suitable for traditional boiler systems, heat pumps and solar applications. The new range is available in single and twin coil versions in capacities from 800 litres to 2,500 litres, as well as potable water buffer vessels in capacities from 800 litres to 3,000 litres. Manufactured from boiler quality steel and internally coated at 850°C with glass lined enamelling, MAXIS cylinders have been designed with durability in mind.

● Visit www.mhsboilers.com or call 01268 546700.



Fläkt Woods launches the ultimate all-rounder in integrated units

Fläkt Woods has launched the next generation of integrated heating and cooling units, Recooler HP.

Designed to be an integral component for Fläkt Woods' air handling units (AHUs), the new Recooler HP incorporates a reversible heat pump and a recovery wheel to provide a number of key benefits, including: quick and simple installation, high efficiencies and all-year-round energy recovery.

The Recooler HP can achieve a COP of up to 6.5, as well as full control of output from 10 to 100%.

● Visit www.flaktwoods.co.uk

HygroMatik products maintain high atmospheric standard

In Blutzentrale Linz (Transfusion Centre) Austria, the Upper Austrian Red Cross has installed eight adiabatic HygroMatik HDS systems, providing a cost saving of 86,331 per year. Two further HVAC facilities have also been equipped with HygroMatik HDS systems to humidify incoming air. The Upper Austrian Red Cross operates clean rooms with classes A to D over an area of 3,500 m². Here, stem cells and tissues are produced from organs that are subsequently reintroduced into the body.

The systems in the HVAC control room were converted to efficient high-pressure nozzle solutions from HygroMatik.

● Email info@hygromatik.co.uk, visit www.hygromatik.com or call 02380 443127



Vent-Axia launches the next generation of fans for kitchen ventilation

Vent-Axia has launched its latest energy efficient ventilation solution, the Lo-Carbon Kitchen Box Fan. Fully compliant for ERP2015, the Kitchen Box Fan also meets the new Part L Building Regulation requirements for reduced Specific Fan Power (SFP), while offering end-users a 12-month payback when upgrading from AC motor fans. Developed for kitchen extract systems, the Kitchen Box Fan is designed to operate in elevated duct temperatures of up to 120°C. The fan's motor is positioned outside the airstream, thus protecting it from grease and the elevated temperatures experienced in professional kitchens.

● Call 0844 856 0590 or email www.vent-axia.com

PRODUCTS & SERVICES

Telephone: 020 7880 7614 Email: Patrick.Lynn@redactive.co.uk



Vent-Axia wins with Lo-Carbon Solo Plus

Vent-Axia has picked up the Innovative Residential/Domestic Product of the Year award at the Electrical Industry Awards for its Lo-Carbon Solo Plus. The new Lo-Carbon Solo Plus centrifugal bathroom/toilet fan features a rise in efficiency levels, a reduction in sound levels and an improvement in ease of installation and maintenance.

'We are committed to continuous product development, which is why we improved our popular Solo Plus range to help meet the growing challenges the social housing sector faces,' said Jenny Smith, product marketing manager at Vent-Axia.

Specifically developed for through-the-wall and ducted applications, the Lo-Carbon Solo Plus is suitable for internal bathrooms, toilets and other small rooms.

● Call 0844 856 0590 or visit www.vent-axia.com



Mikrofill at Langley Park School

LJJ of High Wycombe has selected Mikrofill's advanced floor standing condensing boilers and HWS Extreme loading systems for Langley Park School. Two No twin burner Ethos FS 350 Kw stainless steel boilers were installed in the new school and these provided heating to numerous VT circuits, as well as providing LPHW to a bank of Rapide Extreme HWS loading systems. Two No Ethos FS 350 Kw boilers were installed to serve the Phythian and Sports Hall buildings, along with a Mikrovent 750 low-loss header, incorporating integral air and dirt separation.

● Call 08452 606020 or visit www.mikrofill.com

Ducting expertise at KE Fibertec

Textile ducting provides attenuation as well as producing little sound in operation. The soft material of the textile duct absorbs sound within a room to help meet criteria as low as NR20. KE Fibertec textile ducts were tested at the University of Southampton to find out how much attenuation they would offer. This information led to the product being selected for a number of schools to supply fresh air to all the classrooms.

● Visit www.ke-fibertec.com/uk



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Foster + Partners

Mechanical, Electrical and Public Health / Environmental Water Engineers

Foster + Partners has developed a unique approach to integrated design, with engineers working alongside architects and in-house teams from the earliest stage of concept design, developing projects through a shared BIM modelling platform. In this way, they are able to learn from one another and combine their knowledge to devise fully integrated solutions.

Our current team of around 80 engineers is engaged in designing buildings with advanced technologies, with a particular emphasis on sustainability, and is involved in a range of prestigious international projects at all design stages.

As a result of our increasing workload, we are expanding the team at a variety of levels of experience. Successful candidates will join a dynamic group, with opportunities for career progression. This is a unique opportunity to work on some of the most exciting and challenging projects in the world.

Mechanical Engineers (Ref: LME1113)

Mechanical Engineering candidates will be involved in all aspects of environmental design, including passive and active techniques, system optimisation and delivery, and the use of models and full scale mock-ups to develop and test solutions.

Electrical Engineers (Ref: LEE1113)

Electrical Engineering candidates should have a keen interest in developing integrated electrical systems and technologies, both within buildings and across large sites. An understanding or keen interest in vertical transportation and/or lighting design would be advantageous.

Public Health / Environmental Water Engineers (Ref: LPH1113)

Public Health Engineering candidates should have a keen interest in developing their skills in sustainable water and drainage technologies, both within buildings and across large sites. An understanding of the design of fire protection systems would be advantageous, but not essential.

Candidates applying for the above positions should be working towards Chartership or have already achieved Chartered Engineer status.

Job descriptions can be found on the website. To apply, please send a covering letter in English and CV stating the reference number to: careers@fosterandpartners.com

Foster + Partners is an equal opportunities employer Foster + Partners, Riverside, 22 Hester Road, London, SW11 4AN www.fosterandpartners.com

Director of Marketing £60- 65k pa, plus benefits



The Chartered Institution of Building Services Engineers (CIBSE), located in southwest London, is a professional membership organisation with 20,000 members.

An exciting opportunity has arisen for an exceptionally talented Director of Marketing to ultimately be responsible for the Institution's marketing activities and to oversee the development and delivery of an integrated marketing strategy.

You will contribute to the vision and strategic development of the Institution and deliver dynamic leadership with an energetic focus for our marketing activities. The ideal candidate will be innovative and driven, educated to degree level with a professional marketing qualification and have an outstanding commercial track record of success with the ability to identify opportunities and deliver.

To apply, email your CV with a covering letter to recruit@cibse.org for the attention of Emmanuella Oblitey. An informal discussion is positively encouraged; email eoblitey@cibse.org to arrange this.

Closing date: 16th December 2013. **No recruitment agencies please.**

Further details and a job pack can be obtained from www.cibse.org/vacancies.

CIBSE is committed to equality and diversity.



Electrical Design Engineer

Post Ref: 1749

37 hours per week

£32,072 - £35,784 p.a.

Closing date: 3rd January 2014

As an experienced Electrical Design Engineer qualified to a minimum of HND standard, you will be responsible for the design of electrical building services which could comprise of: Fire alarm systems, general and emergency lighting systems, small power, and data and communications systems.

To find out more about this post please visit our website.



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Associate Director (Mechanical) | City of London
£65,000-£70,000 Plus Package & Bonus

The Central London office of this multi-disciplined engineering consultancy are currently looking for an Associate Director to lead their mechanical teams on workplace / offices, residential and large leisure projects. The company is a fun and exciting place to work, and is renowned for working on technically challenging projects. Once you have demonstrated your ability, you will be given the opportunity to build a multi-disciplinary team. This is a great opportunity for a passionate and driven engineer to join a consultancy who can support their long term goals.

Project Associate Mechanical Engineer
Berkshire | £45,000-£50,000 Plus Benefits & Car All.

One of the most prestigious engineering consultancies with a large building services design department are currently looking for a Project Associate Mechanical Engineer to lead teams on major projects. Candidate will have experience leading projects within the hotels, bespoke residential and commercial sector. This is a great opportunity to join a well-known leading building services brand who have some of the top engineers in the industry working for them.

Associate Building Services Engineer (M or E)
Hampshire | £45,000-£50,000 Plus Package

A well-known medium sized engineering consultancy, with an expanding building services department, are currently seeking an Associate building services engineer. The right candidate will have experience of leading project teams on residential (high end), commercial and industrial schemes. This is a great role which will allow you to establish yourself within a well-known consultancy, where there is a clear path to Directorship.

Principal Electrical Design Engineer | Leeds
£42,000-£47,000 Plus Package

A large, international multi-discipline consultancy is currently seeking an electrical engineer to join them at principal level. The main purpose of the role is to assist the Director in controlling and developing the activities of the Practice, ensuring that quality, output and service targets are met within the agreed business and commercial objectives. This is a unique opportunity to join this consultancy who have recently moved their offices into Leeds City Centre, and who will be looking to build a team under the guidance of this principal.

Associate Mechanical Design Engineer
Nottingham | £45,000-£50,000 Plus
Benefits & Car Allowance

One of the large multi-disciplinary engineering consultancies with an office in Nottingham is currently seeking an Associate to lead their Mechanical team. This office is currently undergoing a major period of growth following multiple major framework / project successes. Candidates will be responsible for leading their Mechanical team through commercial, leisure and residential projects. Great opportunity to establish yourself with one of the leading names in the industry who, as a company, are experiencing successive year-on-year growth. Excellent promotion prospects to Associate Director of M&E for the right candidate.

Find more jobs online at:
www.conradconsulting.co.uk



For a confidential discussion about your career, contact george@conradconsulting.co.uk | 0203 159 5387



www.sefton.gov.uk/jobs

Sefton is a diverse and exciting borough where people can enjoy a great work / life balance. With 22 miles of coastline, stretching from Bootle in the south to the Classic Resort of Southport in the north, there is something for everyone from modern business and industrial centres to fun and relaxing leisure destinations, modern attractions and Victorian heritage.

Sefton Council works hard with its partners to ensure that the borough is a safe, clean and enjoyable place to live and work.

Mechanical Building Services Design Engineer
Full time - 36 hours. Permanent.
Grade 1, £31,160 - £34,894

Applications are invited for the position of Mechanical Building Services Design Engineer based in a multi-discipline team providing building construction design, project management and maintenance services to clients within the Council and beyond. The successful applicant will have the experience and knowledge necessary to deliver cost effective and sustainable mechanical / environmental service engineering design and maintenance solutions for varied installations throughout the Borough. They will be proficient in the use of CAD and possess a relevant technical / professional qualification. Applicants should be self-motivated, able to work flexibly, with innovation, and possess the focus and drive to ensure that the objectives of the team, and ultimately the end user client, are achieved to a high standard. The post offers excellent working terms and conditions and membership of the Local Government Pension Scheme. Job Packs are available from www.sefton.gov.uk/jobs or by telephoning our 24 hour recruitment line on 0845 140 1040, fax 0151 934 2388. Completed forms should be returned to Transactional HR, Payroll & Pensions, PO Box 158, Bootle, L20 3WA. Completed electronic application forms can be returned to recruitment@sefton.gov.uk. Please note we do not accept CV's in place of application forms.

Closing date: 13th December 2013

Sefton is an equal opportunities employer and welcomes applications from all sections of the community



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www.cibsejournal.com/jobs





**Merry Christmas and Happy New Year
to our clients and candidates from
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You must have a degree in the relevant Building Services Engineering discipline.

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You must be able to demonstrate at least 4 years' experience working in a consultancy environment and have a HNC, HND, BEng or MEng degree in relevant engineering discipline. Senior staff will be degree qualified, Chartered or working towards Chartership with a proven track record in operating in a similar position. We can offer the following benefits to suitably qualified staff:-

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- Flexible Working
- Relocation Package

Applications should be emailed to **julia.johns@sdsolution.co.uk** or posted to:

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The Millfields, Plymouth PL1 3JY

www.sdsolution.co.uk

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For further information and to apply, please call us on **+44 (0)203 176 2666** or email **cv@b-a-r.com**

Intermediate to Senior Mechanical Design Engineer

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Career changing opportunity working for an established consultancy with a structured and exciting business plan to grow the practice. The next 12- 18 months will see an increase in headcount within the company which in turn will create greater opportunities to progress within the practice and the platform to shape your career.
BAR1264/JA

Senior Electrical Building Services Design Engineer

£38k - 45k + Benefits, London

This position represents an excellent opportunity for a well-rounded electrical engineer or a senior electrical engineer to take a lead role on a range of challenging projects. You can join a well-established, award winning consultancy in Central London, with 8 offices across the UK employing more than 180 staff.
BAR1415/JA

Senior Sustainability Consultant

£35k + Benefits, London

Prestigious UK Building Services Consultancy seeking to add to their thriving London offering with a consultant who has experience of advising on large scale mixed-use developments, utilising an in-depth knowledge of BREEAM & CIBSE guidelines, with a history of pre & post planning design and a record of achieving BREEAM Excellent ratings.
BAR1506/TA

Intermediate Electrical Engineer

Circa £33K + Benefits, London

A top 5 international multidisciplinary consultancy seeks an Intermediate Electrical Design Engineer from a building services background to join their busy Central London team. If you are qualified with an MSc and would like to be involved in some of world's most iconic projects; then we would like to hear from you.
BAR/1454/CB

Intermediate Mechanical Engineer

£30k to £38k + Benefits, London

An independent award winning design consultancy are recruiting an experienced Intermediate Mechanical Engineer to join their busy London office. You will be required to lead project surveys, feasibility reports, design specification, on site supervision, and management of mechanical/electrical services installations under guidance from the Director.
BAR1476/KH

Senior Mechanical Engineer

£40k + Benefits, Birmingham

Join one of the UK's leading multi-disciplinary consulting engineering practices, providing mechanical services to a wide range of clients and market sectors. Successful candidates should be confident with passive building design from both an environmental and energy efficiency perspective, ideally be a low carbon consultant and have a good understanding of thermal modelling.
BAR1059/KH

Thinking of your future

www.b-a-r.com

Events & training

NATIONAL EVENTS AND CONFERENCES

CIBSE ASHRAE Technical Symposium 2014 3 - 4 April, Dublin

The popular Technical Symposium heads to the Dublin Institute of Technology. The event brings together leading academics and industry professionals to share experience and research.
www.cibse-mnw.org/events

CIBSE GROUPS AND SOCIETIES

For more information visit www.cibse.org/events

Energy saving by design and update on Part L 3 December, Kegworth

A technical event organised by the East Midlands region.
www.cibse.org/events

How can we make community heating deliver low carbon homes?

3 December, London
A Homes for the Future Group event, debating whether community heating with CHP is always appropriate for dense residential developments, and if the

intended carbon savings materialise.

Speakers include: Jeremy Bungey of E.ON Community Energy, Robin Wiltshire, technical director BRE, and Phil Jones, chair, CIBSE CHP and District Heating Group.
www.cibse.org/hfg

Meeting energy needs and reducing the rate of climate change 4 December, London

A Daylight Group event examining how we can best utilise the power of the sun. A talk by the chief scientific adviser at the Department of Energy and Climate Change.
www.cibse.org/daylight

SLL Master Class – Quality UP, Energy DOWN 5 December, Manchester

Focusing on energy reduction in quality-lit environments. Sponsors Helvar, Thorn, Trilux, Phillips and Wila will each deliver a presentation, followed by an SLL guest speaker focusing on daylight.
www.cibse.org/events

St George's Whisky Distillery tour

6 December, Norfolk
The Young Engineers Network, East Anglia host an evening of networking, with a technical insight into the distillation of whisky.
www.cibse.org/events

CIBSE Ireland annual lunch 6 December, Dublin

An opportunity to meet others in the industry, to network and to meet the CIBSE committee at the annual lunch at Alexander Hotel.
www.cibseireland.org/calendar

CIBSE West Midlands annual dinner 6 December, Birmingham

Celebrate with friends and colleagues at the prestigious International Convention Centre in the heart of Birmingham.
www.cibse.org/events

The Energy Related Products Directive 10 December, London

Elta Fans will review the impact of the directive on fan design and energy efficiency in the built environment. European Ecodesign legislation affects a wide variety of products, from space heaters to glandless circulators, pumps and fans. An evening event organised by the HCNW Region.
www.cibse.org/events

LG13 Places of Religious Worship – publication event

10 December, Southwark Cathedral, London
The highly anticipated new lighting guide LG13 is the first SLL guide covering religious buildings. To celebrate the launch, the SLL

invites you to Southwark Cathedral for an evening lecture, featuring guest speakers including, David Holmes of Hilclare – the main author of LG13.
www.cibse.org/events

Peninsular – Latest currents in voltage optimisation 11 December, South West

A presentation given by a power demand company explaining: the principles behind voltage optimisation; a historical review of past technologies; an introduction to variable voltage optimisation; and a look into future development we can expect in this area. An evening event organised by the South West Region.
www.cibse.org/events

Control of smoke and fire in ventilation systems 12 December, Dublin

An evening event organised by the Ireland Region in conjunction with the Fire & Safety Division of Engineers Ireland. The event will be webcast and login details will follow.
www.cibseireland.org/calendar

Dual IPS/UPS Systems 12 December, Merseyside

Chris Brunton of Bender UK gives a practical overview of the benefits of dual IPS/UPS systems.
www.cibse-mnw.org/events

The 4th Greater Pearl River Delta (GPRD) conference on building operation and maintenance – sustainable operation and maintenance for green buildings

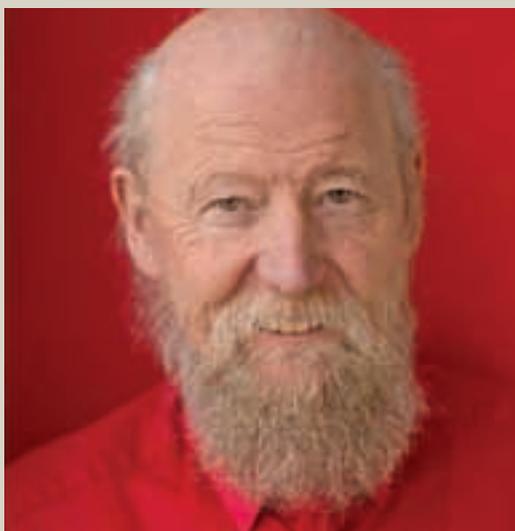
12 December Hong Kong
Organised by the Building Services Operation and Maintenance Executives Society and supported by the Hong Kong Polytechnic University, the Macao Institution of Electrical and Mechanical Engineers, and the South China University of Technology, this conference will focus on sustainable operation and maintenance for green buildings.
www.cibse.org.hk

ENERGY ASSESSOR TRAINING

For more information visit www.cibsetraining.co.uk/energyassessor

Air conditioning inspector training

2 December, London
This training will explain how to undertake such inspections in complex buildings and refer to *CIBSE TM44: Inspection of Air Conditioning Systems and the Occupational Standard*. Those who have completed the training, and are accredited by CIBSE, will be able to undertake such inspections.



Mike Davies CBE announced as guest speaker at Building Performance Awards 2014

11 February, London

Mike Davies CBE, founding partner of Richard Rogers Partnership and senior partner of Rogers Stirk Harbour + Partners (RSH), has been announced as guest speaker at the CIBSE Building Performance Awards (BPA) on Tuesday, 11 February 2014, in London.

Renowned for his work in Paris on the Pompidou Centre in the 1970s, Mike was commissioned in 2008 by the French president as project director for Grand Paris – a study that addressed the key social and environmental challenges facing Grand Paris in the 21st century.

Closer to home, Mike has also been

responsible for the strategic masterplan of both the Royal Docks in London and Terminal 5 at Heathrow Airport. RSH is also on the shortlist for one of the UK's most prestigious restoration projects – the Houses of Parliament.

The CIBSE BPAs bring together those who are redefining what building performance means today. It is a rare opportunity to recognise and celebrate the latest low energy innovations and advances in building services engineering.

You can view the shortlisted entries and book a table at www.cibseawards.org

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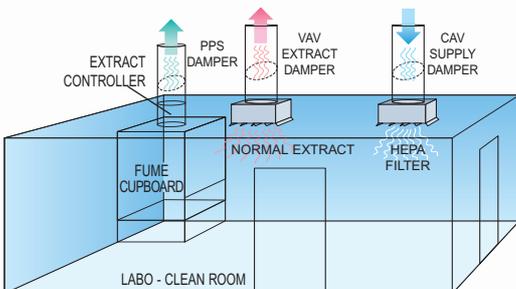


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