

# CIBSE JOURNAL



The official magazine of the Chartered Institution of Building Services Engineers

January 2015

## **BITTEN BY BYTES**

The high energy cost of ICT

## **RETAIL THERAPY**

Walgreens set to transform estate after net-zero pilot

# FLOWER POWER

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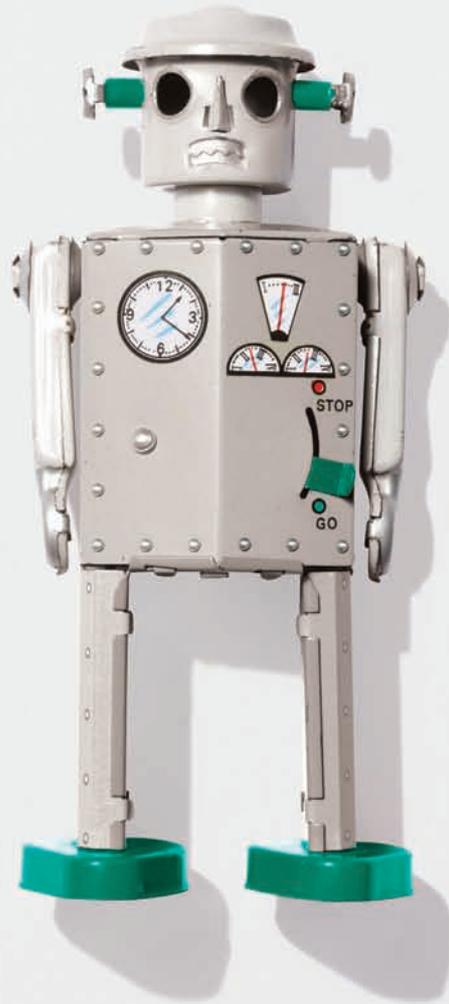
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# Wuhan's wonder

Anyone sceptical about China's intention to tackle carbon emissions could be persuaded otherwise by the recent flowering of the extraordinary central tower at the Wuhan New Energy Institute in central China.

The Chinese government hopes that up to 20,000 students and researchers working there on renewable and new energy technologies, will create a new generation of engineers who can help decarbonise China's built environment. What is encouraging is that the client went for a passive-first design, and only fitted renewables where they were of genuine benefit.

The visual reference to a Callas lily may be a bit too explicit for some Western architectural tastes, but form truly follows function in this design as the overhang of the roof in the funnel-like structure provides shading for the glass façades, reducing the need for cooling, and the angle of the roof slope is optimised for PV performance (page 32). Even the flower's protruding 'stamen' forms part of the building's ventilation strategy.

From Wuhan to Walgreens – the American retail giant has vowed to improve the performance of its huge estate and has completed its first store with net zero energy aspirations. The

Cyclone Energy Group designed the services strategy and its CEO Benjamin Skelton has described, in detail, the challenges of designing the low-energy building near Chicago. With more than 8,200 stores in America, Walgreens' potential to slash carbon is immense, and its willingness to share building data is to be applauded.

Skelton's paper on the store – 'It's not easy being green' – was named the most 'significant contribution to the art and science of building services engineering' at the 2014 Technical Symposium. Thankfully, the feature (page 20) is as insightful and entertaining as Skelton's presentation in Dublin.

The Woodland Trust HQ was another landmark low-energy building covered in the *Journal* ('Trees of Knowledge', October 2014). In the post-occupancy evaluation, Bill Bordass and his co-authors revealed how easy it was to lose sight of the energy used by ITC equipment.

An in-depth article by Tim Small explains how designers can help avoid unexpected energy loads in the computer room and at the desktop. As Robbie Burns almost said: 'The best laid plans of mice and microchips often go astray.'

**Alex Smith, editor**

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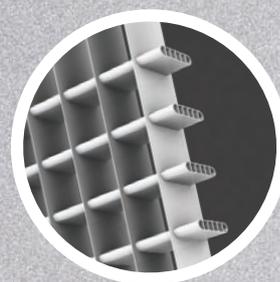
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## In brief

### ENGINEERS MUST GRASP PERFORMANCE 'NETTLE'

The failure of many buildings to meet their owners' comfort and commercial expectations is a blot on the industry's record, guests at the launch of *CIBSE Guide M: Maintenance engineering and management* were told.

CIBSE chief executive, Stephen Matthews, said professional engineers must now 'grasp the nettle by making sure buildings are operated properly'. He stressed that CIBSE members had a responsibility 'beyond design', and that if they failed to deal with this increasingly important issue for clients 'other people will come along and do it for us'.

### MANUFACTURERS OPTIMISTIC ABOUT GLOBAL GROWTH

Makers of building services equipment remain bullish about global growth prospects in 2015, according to an ASHRAE and the AHR Expo survey of 1,000 international firms.

The majority (87%) of respondents said their prospects for business were either 'excellent' (26%) or 'good' (61%) for the coming year. Just 13% rated prospects as 'fair'.

These results reflect a 17% increase in optimism over the previous year's survey.

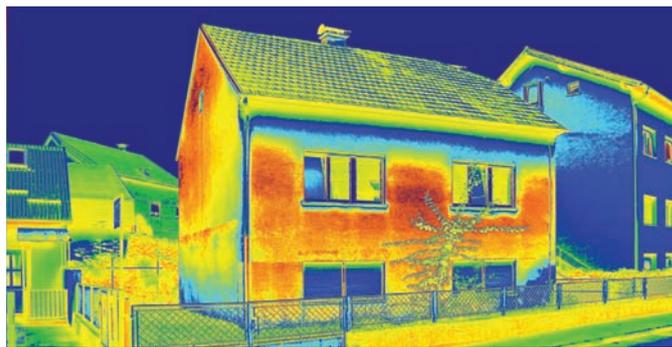
### COMMONS DEBATES ABOLITION OF RETENTIONS

The unfairness of cash retentions in the construction industry has been debated in the House of Commons for the first time.

Debbie Abrahams, MP for Oldham East and Saddleworth, moved an amendment to the Small Business Bill – instigated by the Specialist Engineering Contractors' (SEC) Group – as the latest stage in her three-year battle to reform supply-chain payment.

She has proposed that the current retentions system be replaced by one under which outstanding project money is placed in trust, rather than simply being withheld from supply-chain members and retained by clients and main contractors.

# MPs hammer government over 'failing' Green Deal



## ● Just 4,000 Green Deal plans have started producing 'negligible' carbon savings

The first 18 months of the Green Deal has been 'largely wasted', according to the House of Commons Energy and Climate Change Select Committee.

A detailed report produced by the cross-party group lamented the wasted opportunity to initiate a national programme of housing energy efficiency improvements, which it put down to poor communication and flawed economics.

'While we continue to support the principle of the Green Deal, the government must re-evaluate its approach and set out a clear strategy

## 3,000 Hull homes to get energy measures

Willmott Dixon's energy services business has secured the contract to deliver energy efficiency improvements to more than 3,000 homes in Hull, under the Green Deal. Improvements under the project, which is worth up to £60 m, will include external solid-wall insulation, other forms of insulation, heating, double glazing and renewables.

to revive the failing scheme,' the committee said.

'Unless the package is made more attractive to a wider group

of consumers, Green Deal finance is likely to remain unappealing to many.'

The committee described the Green Deal as 'a disappointing failure' partly because a range of funding misjudgements had created 'frustration and confusion' for consumers, and for the industry charged with delivering Green Deal projects.

It recorded that just 4,000 plans had started producing 'negligible' carbon savings.

'A combination of financial, communication and behavioural barriers has meant the policy has been slow to attract customers,' the report added.

'Costs associated with the Green Deal process have been repeatedly cited as prime reasons for the poor take-up of the scheme.'

'Households that pass standard credit checks can simply obtain cheaper loans elsewhere.'

The committee urged the government to look for alternative financial incentives, and consider other measures and regulations in tandem with the Green Deal – such as stamp duty discounts or variable council tax rates – that could encourage homeowners to aim for higher energy efficiency ratings.

# Contractors reject 'risky' clients

Contractors are turning down one in three bidding opportunities in London, according to a survey by the global construction consultancy Aecom.

It found that contractors were rejecting the chance to bid for a large percentage of projects with clients that they suspected of being adversarial or higher risk, in favour of working with 'collaborative clients'. There is also evidence that many firms are avoiding refurbishment and 'complex' projects.

Aecom said tender prices rose by between 5% and 6% in 2014, and predicts further inflation of 5.1% in 2015 and 5.3% in 2016. However, it added that overall price levels were still lower than in 2008, and will not reach that peak again until at least 2017.

The London Contractors Survey polled 28 firms, including Bam Construction, Galliford Try, Kier, Laing O'Rourke, Skanska, Wates and Willmott Dixon. They cited labour shortages as the main driver of price inflation, with specialists in concrete, brickwork, joinery and dry-lining in high demand.

Research by the London Chamber of Commerce and KPMG also revealed that London and the South East could be facing a 20% labour shortfall by April, creating a problem in servicing the predicted £96bn – worth of projects planned for the capital before 2017.

Aecom director Brian Smith said stable relationships between clients and contractors were becoming ever more important.

## DRAX ON BIOMASS TRACK

Shepherd has completed new biomass facilities that allow the formerly coal-fired Drax power station, in Yorkshire, to burn up to 14,000 tonnes of biomass – and generate up to 1,260 MW of renewable electricity – each day. Two of six generating units have now been converted to burn biomass, and a third will be completed in 2015/16. Annual carbon savings will be around 12m tonnes, and the groundbreaking facility will produce enough renewable energy to meet the equivalent needs of around three million homes.



## Air filtration for polluted schools

### ● Call for new guidance to prioritise air quality in planning decisions

Schools, hospitals and care homes are facing a major health crisis caused by deteriorating indoor air quality, according to experts advising the government.

The Environmental Audit Committee has called on the government to force the installation of air filtration in all existing school buildings that are close to pollution hot spots, as deaths linked to nitrogen dioxide (NO<sub>x</sub>) and particulate pollution soar.

It also wants Westminster to issue new guidance to ensure local authorities prioritise air quality in planning decisions, making sure new facilities are built away from

major roads because of the health risks from diesel emissions. The committee said air pollution was now a 'public health crisis' causing nearly as many deaths as smoking – an estimated 29,000 – in the UK every year.

NO<sub>x</sub> is known to cause inflammation of the airways, reduce lung function, and exacerbate asthma, while particulates are linked to heart and lung diseases, as well as certain cancers. Committee chair Joan Walley said the priority was to 'stop a new generation of children being exposed' to these risks.

Traffic is responsible for 42% of carbon monoxide, 46% of nitrogen oxides and 26% of particulate-matter pollution, said the committee, and the problem had become much worse because of the promotion of diesel vehicles in a bid to cut CO<sub>2</sub> emissions.

### GPs prescribe heating and home improvements

Doctors are prescribing better boilers and insulation as part of treatment for patients suffering from health conditions linked to living in cold, damp conditions.

A pilot project in Sunderland could now be rolled out across the country, as it showed that visits to the doctor fell by a third after patients' homes were made warmer and cheaper to heat – potentially saving the NHS millions of pounds.

The NHS is estimated to spend £1.5bn a year on dealing with problems caused by cold weather, and more than 18,000 premature deaths were linked to poor living conditions last winter. Rising energy bills have pushed more families into fuel poverty.

The pilot scheme was led by the social housing provider Gentoo, which has 28,500 homes in Sunderland. Energy bills in homes retrofitted as part of the project fell by £30 a month, but the temperature in the living rooms and bedrooms rose by more than 3°C – which, the company said, had made a 'massive difference to people's quality of life and health'.

## Health risk in refurbished homes

Raised levels of damp and mould in social housing that has been refurbished to improve energy efficiency are increasing the risk of occupants developing asthma and other respiratory problems, according to new research.

Data from 700 properties in Cornwall, assessed by the University of Exeter Medical School, revealed that residents – many of whom are in fuel poverty – are failing to heat and ventilate the retrofitted properties properly.

The study is the first for which



TOM GOWAN/DOCK / SHUTTERSTOCK

scientists have been able to combine detailed asset management data with information about occupant behaviour and health, to assess the factors likely to contribute to asthma. If mould is present, the risk of

respiratory problems is doubled.

Researcher Richard Sharpe said: 'Modern efficiency measures are vital to help curb energy use, and prevent heat loss through improved insulation. Yet some people, particularly those living in fuel poverty, are unlikely to heat a building enough – or ventilate it sufficiently – to prevent the presence of damp and mould.'

High humidity, and dust mites and bacteria were also cited as possible factors in increasing the risk of respiratory diseases.

## SOLAR WILL BE SUBSIDY FREE

Solar power will be a competitive energy source in Britain as early as 2020, according to the Berlin-based think tank Thema1. It concluded that solar farms, commercial, and residential rooftop installations will be economic – without the need for government subsidy – within the next decade, based on the comparative experiences of the German market.

## Two-thirds of firms unaware of ESOS

Only 33% of big businesses are aware of the impending mandatory Energy Saving Opportunity Scheme (ESOS), according to a survey by carbon saving consultancy Verismic.

All large companies will have to file ESOS reports by the end of this year, but almost all of the firms surveyed said the government needed to do more to raise awareness of this new regulation.

CIBSE Certification was approved to operate a register of ESOS Lead Assessors, and has already trained more than 200.

## Danes give Scots heating ideas

The Danish Energy Agency is to share its experience of district heating and energy efficiency with the Scottish government. Scotland aims to reduce its greenhouse gas emissions by 42%, and energy consumption by 12% by 2020, compared with 1990 figures.

# Southampton leads the way in energy efficiency league table

## ● Index designed to spur councils into action

Southampton City Council has come out on top of an energy efficiency league table for local councils.

The Local Authority Energy Index, developed by Knauf Insulation, analysed 25 English councils with a range of economic backgrounds.

It looked at how authorities influence local energy and energy-efficiency agendas, and judged them on four criteria: energy management of their estate, and energy in the community, housing, and infrastructure.

Joining Southampton in the top five were Kingston upon Hull, Peterborough, Leeds, and Coventry,



David Cameron meets apprentices in Southampton

FILKOR NUMBER 10

while Thurrock, Wirral, Brighton & Hove, Derby, and Swindon were at the bottom of the index.

The index is designed to highlight energy efficiency best practice, said Chris Witte, marketing director Northern Europe at Knauf Insulation. 'It looks at those successes and seeks to better understand the barriers that have prevented some councils from doing more.'

Dr Steve Fawkes, who undertook research on the index, said that some local councils have been cutting back on energy-efficiency resources.

He added: 'They spend too much on reporting CRC data, rather than developing actual projects. There's a lack of support and capacity.'

Fawkes said the index was useful for measuring performance, and spurring local councils into action, and added that more authorities should adopt ISO50001, which covers best practice.

'Energy management is the foundation stone for good energy efficiency. Only one council has adopted ISO50001 – we would like to see more,' he says.

For the full league table visit [www.laenergyindex.co.uk](http://www.laenergyindex.co.uk)

# Resource guidance explores impact of building services

CIBSE and the government's resource efficiency consultancy, WRAP, have produced joint guidance on resource efficiency in the built environment. *TM56: Resource efficiency of building services* reflects the growing pressure on resources, and the desire to create more circular economies. New regulatory requirements – and demand for lower-impact products – are expected to stimulate annual growth of 22.8% in the global sustainable building industry between now and 2017.

*TM56* explores the impact of building services in manufacturing, construction, maintenance and disposing of equipment at end of life. It describes the

principles and importance of resource efficiency, and sets out the opportunities for improving heating, cooling, ventilation, lighting, and lifts and escalators.

'The products we use will come under enormous pressure to be energy efficient,' said Sarah Clayton, head of products and services at WRAP. 'However, it is important to focus on more than just energy efficiency; some products use more energy in the extraction of raw material and in the manufacturing process than they potentially save throughout their operation.'

*TM56* is available free for CIBSE members (or to buy for non-members) at [www.cibse.org](http://www.cibse.org)

## The perfect combination..... P-Sensor and the CMR Velogrid



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# Axing Code will drive down standards, warn experts

## ● Gap in standards and restrictions on local authorities will have impact on quality of work

'Significant damage' could be done when the Code for Sustainable Homes is scrapped, experts have warned.

Industry professionals – who voiced their concerns at a debate organised by CIBSE Homes for the Future Group in December – said it would be difficult to promote the sustainability of new housing after the Code's removal. The government plans to replace the Code with upgrades to the Building Regulations and technical standards.

Despite being voluntary, the Code has been employed by many local authorities to drive up standards on air quality, daylighting and installing renewables.

Richard Hodkinson, managing director of Hodkinson Consultancy, said: 'Commercial pressures on organisations – if they're not constrained and don't have the regulations in place to support them in delivering high-quality homes – will drive down standards because of their profitability requirements.'

'We will still do the high-quality buildings, but we've got to accept there's a big mass market for low-cost housing.'

Optional regulations proposed by the government include water efficiency in areas facing shortages, and accessibility for wheelchair users. However, councils will no longer be able to impose local targets for energy efficiency, and minimum energy efficiency standards will



EXCENY MURTOILA / SHUTTERSTOCK

be set through national Building Regulations. Hodkinson said the big question was how long some standards will remain unregulated. 'The damage done without them will be significant,' he added.

Hywel Davies, technical director of CIBSE, said the difficulties in providing sufficient land supply meant that sitting back and leaving it to the market was not the right way to go. He added: 'There's going to be huge unintended consequences, and we need to spot them early and work out solutions.'

However, Simon Brown, from the Department for Communities and Local Government, said innovation was happening and not everything would come to a 'shuddering halt'. He said research on overheating and performance was ongoing.

## Design engineers are back in demand

A steadily improving economy will see construction firms recruit heavily in the next 12 months, according to the 2015 Hays salary survey for building services.

The study showed that 77% of industry bosses planned to expand their workforce next year. As a result, salaries are on the up – especially in London, which is leading the construction recovery, said Richard Gelder, UK director for property disciplines at Hays Construction & Property. He added that demand was also widening out to the Home Counties, the South and the South East.

Hays found that there is strong demand for design engineers, who are in short supply because of a lack of people entering the profession, and older employees retiring. The national average salary for a junior design engineer is £22,875, and £26,000 in

London. An intermediate design engineer can command an average of £29,167 (£35,000 in London), while the national average at senior level is £42,417 (£52,000 in the capital).

Clare Wildfire, technical director at Mott MacDonald, says the shortage of design engineers and BIM experts could be the tip of the



Scaling heights: The jobs market is looking brighter in the industry

iceberg. 'We kept a trickle of graduates coming in during the downturn, but the industry's overall intake has been down for the past few years because of lower workloads – so the next hurdle the sector faces is a widespread building services skills shortage.'

However, even companies that currently have the right number of employees should beware; 63% of construction employees planned to move to a new role in the next 12 months, in search of jobs closer to home or with better salaries.

The Hays survey showed that 65% of employees in construction are unhappy with their pay, but merely improving this won't be enough to retain some employees. Younger engineers will need support to become chartered, while others may be looking to move up the management ladder. For more, read 'Scaling the Heights' on page 13 of the Careers Special.

## Tiered tariffs for biomethane

The government is to introduce tiered tariffs for biomethane subsidies after a review of the Renewable Heat Incentive (RHI).

Biomethane injected into the grid attracts a flat rate of 6.75p/kWh – down from 7.5p/kWh last year – irrespective of installation size. However, the Department of Energy and Climate Change reviewed the policy to evaluate whether larger installations warranted a subsidy given increased economies of scale.

The amount of biomethane injected into the grid has doubled every year since 2011, and is thought to have quadrupled in 2014.

## Day of the flat-pack waterwheel

A waterwheel manufactured by Smith Engineering has started to produce electricity in the Lake District. The four-metre diameter, overshot wheel produces 6kW of power from a continuous water flow of 200 litres per second at The Langdale Hotel and Spa, near Ambleside. The design of the waterwheel was based on research by Smith and the University of Cumbria, and was delivered to site as a flat-pack kit, without the need for a crane.

## Chancellor missed energy opportunity

The infrastructure plan announced by the Chancellor in his Autumn Statement failed to promote energy efficiency, say industry observers.

The UK Green Building Council claims George Osborne's failure to link stamp duty changes to energy efficiency was the 'mother of all missed opportunities'.

CIBSE technical director Hywel Davies said: 'The Statement said little about how we are going to improve the performance of UK buildings in order to provide better workplaces and home.'

The Chancellor highlighted – as government priorities – making power, heat and transport 'affordable for households and businesses'; delivering energy security 'to support economic growth'; and continuing efforts to cut carbon.

## SoPHE young engineers flushed with success with WaterAid win

### ● Young engineers on way to Bangladesh with WaterAid

Catherine Minor, from URS, plus Jonathan Piatka and Emma Hughes, both from Yorkshire Water, won the Society of Public Health Engineers Young Engineers Award 2014, at the SoPHE annual dinner, in November.

The challenge, set in conjunction with WaterAid, was concerned with the impact of climate change – particularly flooding – on the fringes of developing cities, such as Bangladesh.

During such floods, one of the most significant disruptions residents face is access to water and sanitation, when toilets are inaccessible or when treatment facilities fail.

Entrants had to adapt existing system technologies so they would function in flood conditions, be accessible and prevent contamination, while taking capital



From left, Jonathan Piatka, Emma Hughes and Catherine Minor accepting their awards from Ian Fellingham, SoPHE vice-chair and SoPHE education committee chair

and recurring costs into account.

Judges were impressed with the standard of entries, and four teams were shortlisted to go forward to the final judging process. The winning team demonstrated its flood-planning expertise and research into disaster risk reduction work in developing countries.

Their proposal highlighted a number of technical, social and institutional solutions, which will

bring much value to WaterAid Bangladesh and other partners.

Their scheme accounted for variation between sites and had enough flexibility to be applied to a variety of different site scenarios.

The winning team will travel to Bangladesh with WaterAid, where they will experience the issues first-hand, and research the potential for implementing their proposals into the current urban programmes.

The three other shortlisted teams – Anna Hunter, Joseph Miller and Calum Lawrence; Stuart Brown, James Day and Ruth Howlett; and Julie Anne Walker, Tom Bunn and Isabelle Smith – were all highly commended.

SoPHE Honorary Fellowships were also presented on the night to WRAS technical adviser Steve Tuckwell and consultant David Harper, in front of 323 public health professionals.

The event was supported by: ACO Building Drainage; Andrews Water Heaters; AO Smith; Blücher; Conex Banninger; DG Robson Mechanical; Emmeti; Geberit; Girpi; Goodwater; Grundfos Pumps; Hamworthy Heating; Harmer Drainage Systems; Heatra Sadia; Honeywell Controls; Horne Engineering; Hydrotec; Lochinvar; Marley Plumbing & Drainage; New Haden Pumps; Pegler Yorkshire; Pipex; Polypipe; Reliance Water Controls; Rinnai; Saint-Gobain Pam UK; Teekay; Wilo; Zip Heaters.

## The Middle East – an engineer's canvas



The Middle East appears to be leaving what can only be described as a period of uncertainty. Gone are the days where pipe dreams became reality, or are they? Recent CIBSE Fellow Paul Crayford, associate director of Buro Happold, offers an insight into his exciting career working as a building services engineer in the Middle East.

'Having experienced the extreme highs of working within the world of building services

design that Dubai offered, it is amazing to have come through the other end wiser, stronger and still smiling,' said Crayford, who worked in the area for the last five years.

'The Middle East was once known for its endless supply of new, exciting projects, sustainable initiatives and commitments, and massive infrastructure projects.

'Fast-forward five years and the industry is in a

different place. Measured construction, driven by accurate and defined business cases, has made our role even more valuable.

'Construction levels in the Middle East are growing year on year – fuelled by the award of major global events, such as the 2020 Expo in Dubai and the 2022 Fifa World Cup in Doha – so fresh and enthusiastic building services engineers are needed more than ever.'

CIBSE plays a major part in setting the standard, said Crayford. 'It is refreshing to be part of an institution so well respected outside its home country.'

He added: 'With emerging markets a plane trip away, and the chance to work on some of the world's most ambitious projects, the question is: who wants to take CIBSE to the next level on the global stage?'

Contact [paul.crayford@burohappold.com](mailto:paul.crayford@burohappold.com) for more information. See more on working in the Middle East in the Careers Special.

# Young lighter shines at LuxLive

## ● Winning paper on daylight impressed judges

Janna Aronson, from RTLD Tel Aviv, has been announced as the Society of Light and Lighting Young Lighter of the Year.

The announcement was made at the Lux Awards 2014 dinner in November, at The Troxy, in London.

Aronson impressed the judges with her presentation and paper, *Daylight – Art – Atmosphere*, during the LuxLive exhibition.

Veronika Labancova, of Isometrix, won the Best Written Paper Award for *Possible Impact of Ageing Influence on Light Quality Perception by Human Beings*, and James Duff, from Arup, who was awarded Best Presentation for his talk, *Any Objective Metric to Determine Subjective Light Adequacy?*

These categories were judged by the Institution of Lighting Professionals (ILP) and the Society of Light and Lighting, respectively.

Now in their 20th year, the awards provide a

unique platform for young lighters and are open to all. They allow young lighters to hold forth on a lighting subject, hone their presentation skills, and raise their profile within the industry. Each finalist gave their 15-minute presentation to a full audience at LuxLive on 20 November.

To view all four finalists' video presentations on the SLL website, visit [www.cibse.org/sll](http://www.cibse.org/sll)



Janna Aronson with her award

# Teambuild winners revealed

A team of young professionals from KSS, Mott MacDonald, Gardiner & Theobald and BWB Consulting, solved a real-life construction challenge to win Teambuild 2014.

Entrants had to plan, design and present proposals for the revamp of Land Securities' Eastbourne Terrace site, next to Paddington Station.

Fletcher Priest Architects' original masterplan was used as the basis for a series of taxing scenarios at all stages of the construction process across the weekend challenge.

The 12 teams representing 27 top construction companies, made it to the finals through their professionalism, enthusiasm and dedication.



The winning team – Strata – included CIBSE Member Helen Payne, Samantha Barclay (RIBA), Emily Bonner (ICE), Sally Emery (RIBA), Aaran Ewin (RIBA) and Emillie Webster (RICS).

It picked up a prize of £2,000, awarded by the Worshipful Company of Constructors, after impressing the judges with its teamwork, confidence and professionalism in presentations while under pressure.

The Judges' Prize of £1,250 – awarded to the team showing the greatest improvement over the weekend – went to studioforma, from Buro Happold Engineering and Create Design.

Kaleidoscope, from Aecom, won The Procurement Strategy Prize of £1,250, while the Excellence in Construction prize of £1,000 went to Promoveo, a team from Hoare Lea, AHR, Sweett Group, Curtins Consulting and Galliford Try.

The Leadership Prize of £500 – voted for by both judges and competitors – went to Samantha Barclay, of KSS, and Lucy Townsend, of BDP.

The competition, supported by CIBSE, promotes cooperation between young professionals.

# Mike Garton receives Silver Medal

A CIBSE Silver Medal has been awarded to Mike Garton in recognition of his service.

The first to be made in Western Australia, the award was presented at the Western Australia Chapter of the ANZ Region Christmas lunch in December.

Mike held positions as a committee member and East Midlands region chair,

taking over as chair of the WA Chapter. He also held the positions of both ANZ regional secretary and regional almoner.

Peter Kinsella, CIBSE President, said Mike was an outstanding contributor, who went well beyond the call of duty.



# In brief

## MIKKEL KRAGH AWARDED SILVER MEDAL

Dr Mikkel Kragh has been awarded a Silver Medal in acknowledgement of his commitment and service to the Society of Façade Engineering (SFE) and CIBSE.

Since the inception of the SFE, Kragh has been highly engaged in developing its relevance, impact and visibility. He has served on the board for 10 years, chairing the society for three terms from 2009-12, and as vice-chair from 2007-09 and again from 2012-14.

He took the initiative to Australia and Hong Kong, and supported the creation of the Glass Supper industry event in London. He authored numerous articles and white papers, raising awareness of the relatively new discipline, and promoted professional accreditation through SFE and CIBSE.

Kragh was presented with his award by Graham Dodd, chair of the SFE, at the Glass Supper.

## TIME RUNNING OUT FOR APPLICATIONS

The next closing date for applications for the Associate (ACIBSE) and Member (MCIBSE) grades for UK-based members is Monday 2 February 2015.

See how others found the journey to professional membership at [www.cibse.org/memberscasestudies](http://www.cibse.org/memberscasestudies)

Carla Bartholemew, from Aecom, was featured in our Affiliate case study, and has since progressed to Associate IEng; Joshua Eckett, from Buro Happold, upgraded from Licentiate EngTech to Member IEng; Rafay Hasan, from Grontmij, went from Graduate to Member CEng; and Lee Tabis, from NG Bailey, has successfully upgraded from Licentiate EngTech to Associate.

Applicant help pages can be found at [www.cibse.org/applicanthelp](http://www.cibse.org/applicanthelp)

For full details of the requirements and application process for ACIBSE and MCIBSE membership, visit [www.cibse.org/membership](http://www.cibse.org/membership)

For more information email [membership@cibse.org](mailto:membership@cibse.org) or call +44 (0)20 8772 3650.

# @ Feedback

This month, CIBSE LinkedIn group members want to know if clients are interested in resource efficiency after the launch of TM56



The Bingham Canyon open pit copper mine in America

IMAGEWIKI / SHUTTERSTOCK

### Tony Thurgood

As usual, the big players will have people on their teams, somewhere, who are aware of such things [resource efficiency], and will be doing various things to mitigate. However, the vast majority of companies – the small ones, which have the greatest problems and costs associated with all of this – do not.

I suspect, also, that they are blissfully unaware, and do not have the time, the physical or financial resources, and manpower to do anything if they were so aware.

In addition, from recent surveys, and involvement in work development on 15+ sites for the same owner, I suspect they do not give a damn anyway,

and would not be in the slightest bit interested. Unless it comes with a legal obligation, the only things they are interested in is money spent on doing the absolute minimum to meet health and safety requirements – and not on preventative maintenance to ensure continued operation and minimum energy use, or the conditions in which the site staff have to work.

### Graham Smith FCIBSE

I have gone into this on a couple of major projects in the past, but – as Tony states – this is of zero interest to most clients. Knowing which project he is talking about, it's probably worse than he realises.

Decision-makers are only interested in the short term and in ticking boxes for sustainability

Unfortunately most decision-makers (clients or their appointed PMs) are only interested in the short term and, at best, in ticking boxes for sustainability, not doing the job properly.

### Tony Johnstone

Not sure how the average building services company can help when cost is the driver and most of the relevant decisions are taken at manufacture. But if designing for disassembly also means repair is a good option, could we get back to a quick diagnosis and repair service for our clients? That sort of service also becomes more realistic with a BIM environment. Made for each other, perhaps?

### Janet T Beckett MCIBSE

Q. 'How interested are your clients in resource efficiency?'

A. They're not.

### Tony Johnstone

They are, they just haven't realised it yet! They will be when the cost implications start prodding the finance director.

CIBSE's TM56 *Resource Efficiency of Building Services* can be downloaded from the CIBSE Knowledge Portal at [www.cibse.org/knowledge](http://www.cibse.org/knowledge) See more in news on page 10.

*CIBSE Journal* welcomes readers' letters, opinions, news stories, events listings, and proposals for articles.

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# ONE-STOP SHOPS BAR INTELLIGENT DESIGN



Building services skills are being overlooked by clients and contractors who increasingly value expediency over intelligent and innovative design, says Crofton Design's Marcos DeCastro

Building services engineers are the R&D department of the construction industry. They are innovative designers, whose skills lie in taking an overview of the systems that enable a building to function effectively, and devising complex solutions to integrate them into the building.

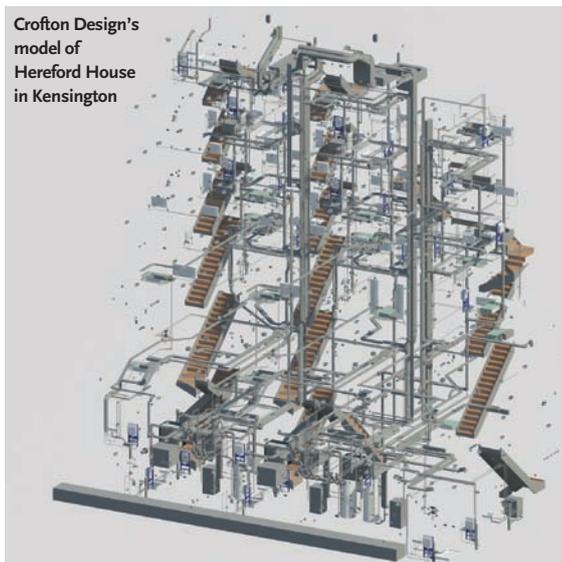
For example, they ensure that energy efficiency measures, daylighting, and heating and ventilation systems, work in accordance with a building's shape, floor plates and a client's budget. This requires consistent use of problem-solving, creative and visualisation skills.

However, I fear that the intelligent design skills of our profession are at risk of being significantly weakened. This is primarily because many contractors now see consulting engineers as just another subcontractor. They are increasingly integrating engineering consultancies into their businesses in a quest to provide 'one-stop shop' services to their clients.

More and more, contractors and engineers are starting work on projects at the same point, simply because many engineers are now part of the contractor's business. But by the time a contractor begins work onsite, it's normally too late to get the best from building services design.

Designing and building at the same time is tricky. If the best building services solutions are to be implemented, engineers need to explore different design concepts and decide on the right way before a contractor starts onsite.

True, contractors who incorporate building services divisions into their businesses can still benefit from their design services. However, the increased pressure contractors apply – because of the strict deadlines they work to – often leads to elements of the building services design (for example,



Crofton Design's model of Hereford House in Kensington

benchmarking compliance) being of a lower standard. It is often too simplistic, and gives little allowance for important initiatives, such as solar studies, that can improve a building's energy efficiency and occupier satisfaction.

Contractors are pushing engineers to become nothing more than process designers who deliver simple solutions as quickly as possible. This skews and confuses the industry's view of building services engineers, which increasingly sees us as the people who decide where radiators or pipework should be fitted, rather than experts who are fundamental to a project's success.

We are at risk of being taken less seriously and, ultimately, seen as less valuable. When we put forward pioneering design solutions they are increasingly ignored by other members of the project team because original ideas are no longer expected from us.

Industry attitudes and practices that encourage engineers not to put innovative ideas forward, will lead to younger engineers believing that their role is simpler than it should be. Of course, the issue is being exacerbated by

the fact that young engineers often have less time to develop the skills to enable them to become expert at what they do.

Contractors are great at procuring cheaply, managing specialists and estimating costs – that's their job. They are also capable of handling building services engineering teams that deliver fully coordinated technical designs from scheme designs produced by others. However, they don't appreciate the complexities and benefits of pioneering building services design and how it should be delivered.

In my view, clients and contractors need to reconsider elements of the 'one-stop shop' model. It risks hindering the industry's ability to deliver unique, quality buildings, because it places too much importance on completing projects as quickly as possible.

It is predominately an American model and may work well there because the country has sufficient space for more standardised products. However, in the UK, it is different. We are a densely populated country with more of a need to deliver irregularly-shaped buildings that require a complex design. We have fewer greenfield sites, and many more constrained locations that require more creative designs.

We must return to a point where building services engineers' skills are constantly evolving. Much of the responsibility lies with us and our ability to communicate to clients how our design services add value, which we are notoriously poor at doing.

For example, condensing plant space frees up floor area for other uses, potentially creating significant financial benefits for a developer. In addition, building services engineers with a strong grasp of BIM can add real value by helping to lower overall risks on construction projects. Clarity in where we add value is key to ensuring our skill sets are retained, and in showing we aren't just another subcontractor.

Clarity in where we add value is key to ensuring our skill sets are retained

MARCOS DECASTRO is a director at Crofton Design

# TENDER CARE

A new EU Directive aims to simplify and modernise public procurement. **Hywel Davies** explains the most significant changes to the Public Contracts Regulations 2015

EU Directive 2014/24/EU aims to simplify and modernise public procurement. The Cabinet Office consulted on draft Public Contracts Regulations 2015 (PCR2015) in the autumn of 2014, and the new regulations, which will comply with the directive, are expected to come into force in the first half of this year.

In 2011, the European Commission issued a consultative Green Paper on modernisation of EU public procurement policy. Although the 2004 directives covering public sector and utilities contracts introduced new approaches – attempting to modernise the rules at that time – in practice, they added complexity, uncertainty, and regulatory burdens.

Based on the consultation responses, the commission recognised the urgent need for a streamlined, flexible set of procurement rules to enable member states to deliver value for taxpayers' money, and obtain high-quality goods and services. Draft proposals were issued in late 2011, and these were followed by two years of intensive scrutiny, negotiation and debate.

Three new directives – for public sector contracts, utilities contracts, and concessions contracts – were adopted on 26 February 2014, published in the *Official Journal of the European Union* on 28 March 2014, and came into force on 17 April 2014. The UK and other EU member states have until 17 April 2016 to implement the new directives in national legislation.

The recent consultation focuses primarily on the new Public Sector Directive and the draft PCR2015. There will be further consultation on draft implementing regulations for the new Utilities Directive and the new Concessions Directive. However, as many of the provisions in the Public Sector Directive are analogous to provisions in the other two directives, the PCR2015 consultation covered



New rules will change the way the public sector procures

OLIVIER LEMOAL / SHUTTERSTOCK

procurement, increasing transparency, cutting bidding costs and enabling better value outcomes.

The main recommendations being implemented are: abolishing pre-qualification questionnaires (PQQs) for contracts below the EU Threshold; 30-day payment terms to be passed down the supply chain through a standard clause; a requirement to report on late payment of invoices; and making all public sector contracts accessible on Contracts Finder.

## The main changes

There are a number of significant changes, as follows:

- Public bodies can use Central Purchasing Bodies in their own, or another, member state
- There are rules for the awarding of contracts directly by one contracting authority to another without an advertised and competitive tender. These set out the extent to which a public contract may be changed before it becomes a 'new' or 'materially different' contract that must be put out for a fresh tender
- Contracting authorities must include a condition in all contracts allowing termination if the contract has been subject to a 'substantial modification'
- While the procedures for all procurement routes have been modified, a new procedure called 'Innovation Partnerships' has been added. However, government guidance suggests that, 'where possible', the open or restricted procedures should still be used
- A new 'light touch' procurement regime applies for social and other specific services, such as health, including nurses, home help, education, and training services
- A 'self-cleaning' provision will apply to organisations where a relevant ground for exclusion exists
- Contracting authorities can engage in

The draft regulations introduce measures to increase the participation of SMEs in public procurement

matters common to all three.

The draft PCR2015 has been prepared in light of the UK's policy position of maximising flexibility in the rules, deregulating where possible, and using 'copy out' of the wording in the directive. The latter is to avoid going beyond the requirements of directives – known as 'gold plating'. PCR2015 does not just refresh the Public Contracts Regulations 2006, which may be familiar. However, although the UK has until April 2016 to implement the directives, it is pressing ahead early because the new flexibilities in the directive are seen as deregulatory, so early implementation is acceptable under UK policy.

## Help for SMEs

The draft regulations also introduce measures to increase the participation of small and medium-size enterprises (SMEs) in public procurement, as recommended by Lord Young of Graffham, enterprise adviser to the Prime Minister. These are based on the conclusions of a 2013 consultation, and aim to give small businesses better access to public sector contracts by simplifying public



market consultations with suppliers before procurement, subject to rules to ensure that competition is not distorted by subsequent participation

- Government has taken the option not to require that contracts should be divided into lots, although authorities must explain such a decision in the procurement documents
- If a procurement is run with lots, contracting authorities can award a single contract to cover several lots, but only if it is clear in the procurement documents that lots might be combined
- For each tender process leading to the award of a public contract or framework, the contracting authority must produce a report detailing the process and decisions, and why the successful tenderer was chosen
- Documents relating to all procurement procedures must be kept for three years.

PCR2015 will only apply to new procurement processes beginning on or after it takes effect, and there have been no changes to the remedies section of the regulations. It is anticipated that the regulations will be published before the end of March 2015. The new regulations will change the way the public sector procures, so *CIBSE Journal* readers may want to be prepared.

**Further reading**

The new directives are:

Directive 2014/24/EU on public procurement, replacing the 2004 Directive for Public Sector Contracts; <http://bit.ly/1wvYIoL>

Directive 2014/25/EU on procurement by entities operating in the water, energy, transport and postal services sectors, replacing the 2004 Directive for Utilities Contracts <http://bit.ly/1BlqkJO>

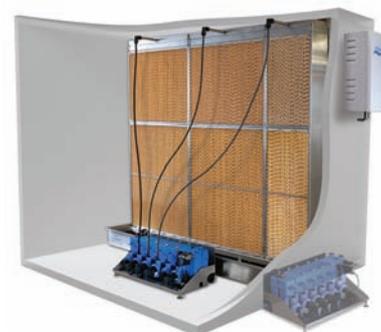
Directive 2014/23/EU on the award of concession contracts, which does not directly replace any previous directive <http://bit.ly/1uMyOSI>

To see the full Cabinet Office consultation, draft UK regulations and the technical guidance note, go to <http://bit.ly/1zVoug4>

● **HYWEL DAVIES** is technical director at CIBSE [www.cibse.org](http://www.cibse.org)



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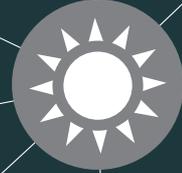
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# Holding OUT FOR A ZERO

Cyclone Energy Group's **Benjamin Skelton** explains what happened when the Walgreens drugstore chain set out to build the USA's first net-zero energy store – in one of the country's harshest climates



## TECHNICAL SYMPOSIUM AWARD WINNER

Benjamin Skelton's paper *It's not easy being green* on the design of the Walgreens store was named the 'Most significant contribution to art and science of building services engineering' at the 2014 Technical Symposium.

### Booking open for 2015 Technical Symposium

The 5th CIBSE Technical Symposium will be held on 16 and 17 April 2015 at University College London. The event encourages participation from both young and experienced industry practitioners, researchers and building users to share experiences and develop networks.

The 2015 Technical Symposium will address the theme: Simple buildings, better buildings? Delivering performance through engineered solutions.

To book your place visit [www.cibse.org/symposium](http://www.cibse.org/symposium)

**T**he American pharmacy and grocery chain Walgreens is one of the biggest retail brands in the world, with more than 8,000 stores. So when, five years ago, it decided to build the first net-zero-energy store in the US – in a way that would be as scalable as possible to the rest of its estate – the implications were enormous.

There were other factors that made the project particularly challenging: Walgreens didn't want to change the operational nature of the building, so it had to have a conventional interior layout of about 1,350m<sup>2</sup>, and be open, if not all hours, then at least 50% more than a typical office.

Because the company wanted to keep a close eye on the design and construction of the building, it was decided to site it in Evanston, near Chicago – close to its Illinois headquarters. With winter temperatures plunging to -24°C, and summers as hot as 35°C, it was hardly an auspicious location for a zero-energy building.

To be considered net-zero energy, the consumption of the store had to be 41% lower than the area average. The average annual energy consumption for a store in the Chicago area was 435,000kWh, so the building had to be designed to produce 256,000kWh in a typical year.

Working with a solar photovoltaic company,

Walgreens determined that the proposed building could produce this quantity of electricity using 840 micro-inverter panels on the roof, plus two 5kW vertical wind turbines. Given this fixed production capacity, the question was: how would the designers make sure the building's consumption was less than 256,000kWh?

### Fabric and lighting

All aspects of the design had to be considered to get the building's energy consumption below the solar production estimate. The two largest uses of energy in a typical store are lighting and refrigeration, so the Walgreens team carefully analysed the efficiency opportunities in these areas. The fabric design, for example, increased the opportunities for daylighting – although this created further challenges.

To maximise solar capacity, the store's typical rectangular design was changed to a tiered, multilevel, cantilevered roof with clerestory windows. This deviation from the standard brand design included significantly more glass. Moreover, a typical store has ribbon windows and a glass storefront, whereas this building incorporated an entirely curtain-walled west façade.

The west-facing fenestration meant that active and passive shading was needed. Glass



Walgreens' new store has west-facing fenestration, requiring active and passive shading



below 4.3m was treated with automatic shade controls, regulated by an astronomical clock, limiting sun penetration to 1.5m. Direct sunlight was limited to a small distance to prevent cosmetic products from melting. For the glass above 4.3m, a light-redirecting film was installed. This sent 90% of the solar light and energy up and into the store, while 10% remained on path. This provided a thermal benefit and prevented glare at the sales counter. The film was applied to a third pane of glass and installed in the framing system of the curtain wall.



The salesfloor has eight independent lighting zones with daylight-sensing controls

The wall and roof insulation were standard Walgreens specification, with U values of  $0.28\text{W}/\text{m}^2\text{K}$  and  $0.19\text{W}/\text{m}^2\text{K}$  respectively.

When it came to artificial lighting, Walgreens installed its first all-LED system in 2010, and that is what this store received. The salesfloor area has eight independent lighting zones with daylight-sensing controls. A typical store design includes 4kW of under-shelf LED lighting, to provide high levels of illumination on merchandise. This was identified as an opportunity for reducing energy consumption. Special fixtures chosen for the new store provide a unique light distribution pattern that produces adequate luminescence levels, and allows under-shelf lighting to be removed.

### HVAC and refrigeration

A standard Walgreens store uses constant volume rooftop units for heating, ventilating and air conditioning (HVAC). As the roof was covered with solar photovoltaic panels, all the equipment had to be internal. Also, as the store came right to the edge of the site boundary, there was only a very small balcony for air-cooled heat-rejection equipment.

With LED lights and daylight controls providing a minimised load, the largest remaining opportunity for energy savings was the refrigeration system. The design team searched for a system that could capture the heat rejection from the refrigeration system and create useful heat.

Chicago is a heating-dominated climate – with 6,536 heating degree days – and heating is the largest annual HVAC energy end use. Walgreens had completed a geo-

exchange store in Chicago previously, and this was considered the best means for capturing the waste heat from refrigeration and using it for HVAC.

Eight, 152m vertical geo-exchange wells were designed below the parking lot, and the design team considered several HVAC options, including distributed heat pumps and heat pump rooftop units. Ultimately, a chiller-heater central heat pump system was selected for this store, based on the whole-building energy analysis.

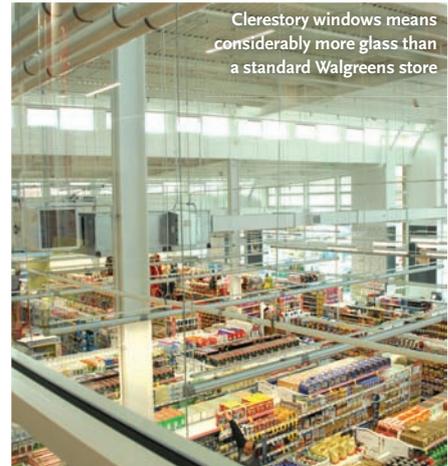
In addition to net-zero operation, Walgreens had set a secondary goal to create a store that uses only natural refrigerants. With a central heater-chiller heat pump, options existed for a system with a carbon dioxide ( $\text{CO}_2$ ) refrigerant. No manufacturers were available in the US, but a couple of options were found in Europe.

However, the decision to use this system was made only 10 months before the store was due to open. Aware that getting a custom-built heat pump from Europe posed a risk to the opening schedule, the design team had a US-produced substitute, R-134a-based central heat pump on standby.

One requirement of using a  $\text{CO}_2$  refrigerant heat pump was that the system had to meet Underwriters Laboratories (UL) testing requirements to be permitted for use in the US. UL certification is a common mandatory requirement of insurance companies and code jurisdictions, and requires that refrigerant piping and systems be tested and certified at five times the rated operating pressure. Given the high operating pressure of  $\text{CO}_2$  (80 to 100 bar), this requirement seemed

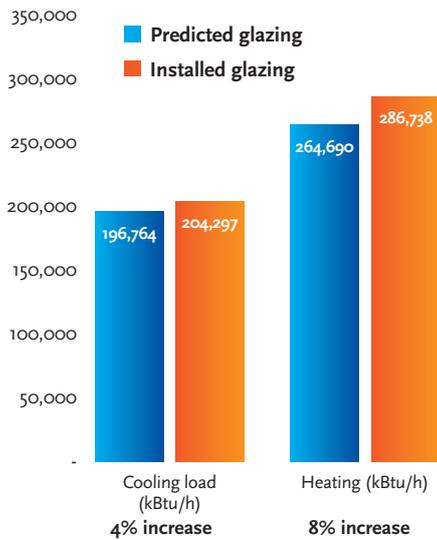


Walgreens' new store has a tiered, multilevel, cantilevered design, with a roof covered entirely with solar photovoltaic panels

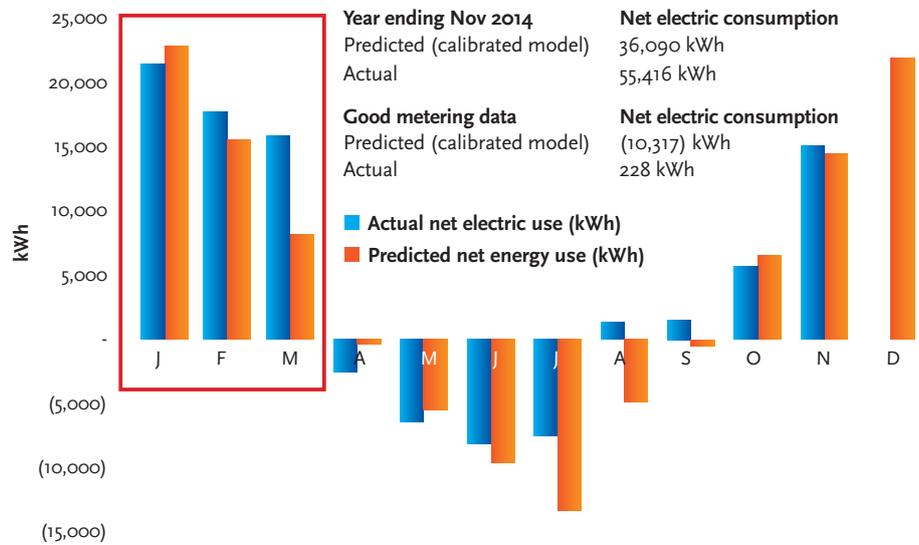


Clerestory windows means considerably more glass than a standard Walgreens store

Load difference between as-designed and as-built



Walgreens' Evanston net-zero store's year-to-date energy performance



Year ending Nov 2014  
 Predicted (calibrated model) 36,090 kWh  
 Actual 55,416 kWh

Good metering data  
 Predicted (calibrated model) (10,317) kWh  
 Actual 228 kWh

The building is not yet performing to net-zero, but no good meter data was available from January to March (red box above)

Using the measurement and verification system, and a calibrated energy model, the store is being fine-tuned to reduce energy consumption by 5,000kWh per month

excessive, but the system passed the tests. It was shipped to the US and made it through customs with no issues.

The transcritical CO<sub>2</sub> heat pump has three sets of variable speed compressors: low temperature, servicing the evaporators for the freezer; medium temperature, servicing the evaporators for the cooler; and high temperature, servicing the chilled water system. The heat rejection for the heat pump is used for hot water and service water. The geo-change serves as a battery, storing heat rejection from the cooler/freezer evaporators for use as heat when needed.

With the central systems determined, and a solution found to capture waste heat from the refrigeration system, attention turned to the comfort systems. With low-temperature chilled water and water heating readily available, a four-pipe fan-coil system was designed. Initially, a radiant heat design was included, but this was removed to help meet budget constraints.

The salesfloor area was split into three thermal zones with variable-speed, single-zone, air handling units hanging in the space. Ductwork was designed architecturally as a straight length off the air handling units, with diffusers discharging directly down into the space. The ductwork transferred air to the space effectively, but what wasn't anticipated was the noise level.

At fan speeds above 80%, the air handlers created significant fan noise – more than was acceptable for Walgreens' operations. So they were limited to 80% maximum speed, which did not have an impact on cooling, but severely hampered the ability to provide heating.

A dedicated variable air volume, outside air handling unit was provided to decouple the ventilation load. The unit regulates outside air volume based on demand. The store has a highly variable occupant load and, by using CO<sub>2</sub> sensors throughout the sales area, ventilation load is minimised.

## Measured performance

Walgreens recognised the opportunity to use this store as a research project. A central building automation system was installed, with remote monitoring and control capabilities. Additionally, a branch breaker, electrical sub-metering system was installed, to measure real-time loads from nearly every piece of equipment in the building. With a detailed measurement and control system, the team was able to monitor hundreds of data points, and find areas where the operation was deviating from the design.

After almost a year, the results show that – in the first 12 months – the store will fall short of net-zero energy consumption. There are several reasons for this.

Chicago experienced one of the severest winters in recorded history. The design energy model was created using average weather files (typical meteorological year) and included a buffer to account for weather swings. However, with a mean temperature of -8.1°C in January 2014, the extreme cold exhausted most of the buffer.

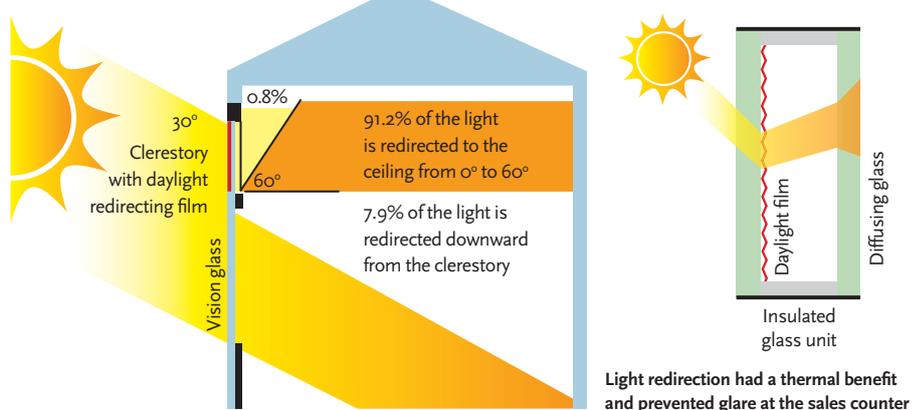
As-built documents detailed that the curtain-wall system underperformed against the design requirements. The installed system exceeded specified fenestration centre-of-glass performance; however, the framing system was not thermally broken, causing the assembly to underperform at peak conditions by 12%, further exhausting the net-zero buffer. The automated shades served as valuable insulation, and were used at night to help maintain space temperatures.

With a heat pump design never before attempted on this type of building, it was expected that there would be performance issues. The gas cooler – which was provided to help remove excess heat and prevent the geo-exchange field from becoming overheated in the cooling season – had problems with electrical overloading and was off for most of the first summer.

Also, it was determined that the compressors initially provided were oversized. The gas-cooler issue was resolved and the compressors replaced, and energy reductions are being observed.

Humans cause energy waste. This store is not used by high-tech engineers and, while the system is designed to operate automatically, the employees and customers have an impact on its energy consumption. A revolving door was engineered into the project, replacing an air lock, but it did not have good thermal properties, and was not well sealed. A disabled access door was still required, but this did not have an air

## Light redirecting film



lock. Rather, an air curtain was installed to minimise air infiltration when in operation. It was found that a high percentage of non-disabled customers used this door, and the air curtain proved ineffective.

Given all of these issues, the path to net-zero status is clear. Using the measurement and verification system, and a calibrated energy model, the store is being fine-tuned to reduce energy consumption by 5,000kWh per month.

Lessons are still being learned on this project, but the net-zero approach has been recognised with LEED Platinum status, Green Globes certification, and a Green Chill Platinum rating from the US Environmental Protection Agency. Walgreens' net-zero Chicago store could pave the way for radical changes in the US retail landscape. **CJ**

**BENJAMIN A SKELTON** PE MASHRAE is president and CEO at Cyclone Energy Group

**WALGREENS' PROJECT TEAM**

- **Client:** Walgreens
- **MEP:** WMA Consulting Engineers
- **Architect:** Engineer + Theodore
- **Energy consultant:** Energy Center of Wisconsin
- **Commissioning/energy consultant:** Cyclone Energy Group

## TEN KEY LESSONS

Here are the top lessons learned on the project:

Don't rush. The design team had less than one year to do something never done before and that is not enough time to evaluate opportunities.

When innovating, don't forget the fundamentals. Keeping systems as simple as possible will net best results.

Require total system thermal performance data on fabric systems. Getting a worse-performing curtain-wall system permanently impacts the performance of the store.

Engage all contractors early. While contractors knew the net-zero ambition, they were engaged too late in the process to feel any sense of ownership of the greater goal of the project. Many set-up and configuration issues could have been avoided.

Commission all building systems as early as possible. Once a building goes into operation

and is considered substantially complete, getting contractor support is very difficult.

Energy meters don't always tell the correct story. If not for calibrating the design energy model to the store operation, it may never have been noticed that our measurement and verification system was configured incorrectly.

Air locks perform better than revolving doors. Customers will go for the easy option, and revolvers require more work than hitting an automatic door-opener button.

Geo-exchange couples well with transcritical CO<sub>2</sub> refrigerant heat pumps as it provides a steady condensing temperature (<15°C).

Technology cannot overcome humans. No matter how well you design an automation system, people can make a mess of it.

Don't start your net-zero performance period in a historically severe weather season!

# COMPUTER SAYS: 'ARE YOU SURE?'

Engineers are becoming too dependent on technology and must get back to basic physics, according to participants in this year's CIBSE Young Engineers' debate. **Ewen Rose** was listening in



Dwyer: 'There are risks to inhabiting a virtual world'

“We are yet to see the full results of the BIM process and whether there are legal ramifications to come from completed buildings that don't perform as they should”  
*Morwenna Wilson*

**T**he availability of increasingly powerful communication tools and modelling software has been a huge benefit to the engineering community and its clients, but threatens to produce future generations of engineers who have lost basic skills.

This was the main message to emerge from this year's CIBSE Young Engineers' Network (YEN) debate sponsored by CIBSE Patrons and hosted by the Institution of Mechanical Engineers (IMechE) in London.

The panel, chaired by Arup senior mechanical engineer Angela Malynn – a former CIBSE ASHRAE Graduate of the Year – agreed that traditional skills are essential to ensure good quality information goes into models and that the results are actually buildable, and stressed that engineers must understand building physics and be prepared to challenge computer-generated results.

“There is a danger that we are not practising the fundamentals of engineering because we trust the technology too much,” said Buro Happold's William Holley. “It is important that we have good data going into our models. Technology can improve our final product, but we have to take a step back and make sure the younger generation is focusing on the fundamentals and on its communications skills.”

## Struggling

Holley, who won the CIBSE ASHRAE Graduate of the Year Award in 2013, said the technology was freeing up more time for engineers to develop their ideas, but the industry was still struggling to sell those concepts to clients.

Another former Graduate of the Year, Lee Tabis of NG Bailey, believes we are in danger of producing a generation of engineers ‘who are only good at software and pushing buttons... we need to get back to fundamentals’.

“There is an over-reliance on technology.

A building is only as good as the physics behind it,” he said.

However, the availability of high-quality computer models can help engineers have more influence on the project process, according to Ruth Shilston, chair of the IMechE Young Members' Board.

“We are starting to close the gap on architects,” she said. “They have always had the advantage of a much more visual product to show clients – and now we can do the same.” She warned that clients were also becoming dependent on computer modelling, but ‘may not always understand what they are getting’.

“It is a case of using the right tool at the right stage of the project,” she added. “You don't want to do a complete BIM model at the design stage... at that point it is much more about engineering judgement, but the technology really comes into its own later in the process.”

However, Morwenna Wilson, projects director at the developer Argent (and another former Graduate of the Year), said clients ‘love all the technology, because we like to visualise what is being designed’. She said 3D models allow contractors to ‘walk me through the project so I can make practical decisions’.

Malynn, who won the Graduate Award in 2011, asked the panel to consider the implications of this for contractual risk.

“We are yet to see the full results of the BIM process and whether there are legal ramifications to come from completed buildings that don't perform as they should,” she said. “There is potential for over-simplification with this technology and a question about whether we can be confident in the outcomes.”

Wilson confirmed that clients were acutely aware of the risk issue and mindful that computer models were ‘not contractual documents, so people can't be held to account’. The model is helpful, but it is not



The debate took place at the Institution of Mechanical Engineers' central London headquarters

enough to produce a complete building and operate it, because no-one will take responsibility for the information,' she said.

Contractors often assume that the BIM model at stage D and E of the design process 'is fixed' and so gives them a final picture from which they can build, but that is a serious mistake, according to Tabis.

'The model is still very fluid – even late in the design – and it is procurement-driven, so will change all the time,' he said. 'They assume the data is reliable, but there are often mistakes and changes in the project that have not been recorded in the model.'

### Practical

'It is important not to be totally reliant on the model,' says Tabis, 'because there will be lots of things that look right, but will not work on site. The guys with practical skills are hugely valuable because they have been delivering these things in the real world for years.'

The panel members were also concerned that things might be going wrong during the education process.

CIBSE ASHRAE Group chairman Tim Dwyer said there was a risk that graduates increasingly 'inhabit a virtual world and do not understand the underlying engineering fundamentals, to enable them to recognise whether something that is modelled is likely to work in practice'. And, he added: 'There is a lot more to engineering than running simulation packages.'

Institute of Refrigeration president Graeme

Maidment, who is also a lecturer at London South Bank University, said it was a major concern for universities and colleges that they might not be teaching young engineers to use the right software. 'Are we missing the next big thing?' he asked.

Apart from computer modelling, the discussion also looked at other technologies that are transforming the way engineers work. 3D printing stood out as a potential 'game-changer' because of its ability to produce manufacturers' prototypes quickly and cheaply; speed-up production of key components; and – eventually – complete project packages.

'3D printing is a great way of running concepts past customers and then translating those ideas directly into new products,' said Sam Whitfield, product design engineer at Monodraught. 'We can create our own tools, and that allows us to make pretty much whatever we want.'

Using this technology can free project design teams from the restrictions of conventional manufacturing – allowing them to be more innovative in the knowledge that manufacturers can keep up, Whitfield believes. Spare parts and building components can be quickly and easily printed, marking a step change for current delivery arrangements.

'It is also much more sustainable because you only make the parts you need, when you need them, without the waste. It's very cost-effective too,' he added.



iMechE engineering director Colin Brown and Ruth Shilston, chair of the iMechE Young Members' board



Graeme Maidment with Peter Kinsella behind



Former Graduate of the Year William Holley

There are a lot of exciting new technologies emerging, but we need to take a step back and find a way of managing basic things properly  
*Tom Phoenix*



Jairo Jaramillo (left) and Lee Tabis

Morwenna Wilson and David Fitzpatrick



Fellow young manufacturer Callum Jarrald, a graduate trainee at ventilation equipment supplier Air Diffusion, said GPS tools had transformed the way his sector operated by making it easier to communicate with a long and complicated supply chain, and to log information more successfully.

'We have the ability to deliver more integrated designs by building our technology into others,' he said, 'and we can provide information in a more portable format and make it easier to distribute.'

### Volume

But, ASHRAE president Tom Phoenix said that the sheer volume of information being shared was damaging quality.

'The number of emails we all receive makes it hard to keep up, and, to respond in a way that adds quality to the process,' he said.

'There are a lot of exciting new technologies emerging, but we need to take a step back and find a way of managing basic things properly.'

Tabis agreed: 'We can end up just reacting to things that are thrown at us, but we are creative people and need time to think and produce good solutions,' he said.



IMechE president Mark Hunt felt this less to do with the technology and more with the people using it. 'We need better discipline. We are not allowing the technology to enable because we are not disciplined in the way we use it. People should ask themselves whether all of these emails need to be sent.'

He felt that engineers were devolving too much responsibility to other team members, and eventually to clients, via email.

'Because it is so easy to do, they end up asking the client to make too many decisions they could easily make themselves,' said Hunt, who added that it was also becoming too easy to use a mobile device for calculations.

'We need to question the technology more – not always trust the results,' he added. 'That way we will also build confidence into the next generation to be more questioning and come up with better solutions,' he said.

However, Jairo Jaramillo, chair of CIBSE's London YEN, said the building services industry was yet to go through its 'data revolution'. 'We are a long way behind other sectors – like manufacturing – and, as a result, building services engineers are still performing heroics on relatively poor data,' he said.

'Buildings are the last bespoke products left. We have to react really quickly to make changes late in the process. We could drive it more successfully by insisting that the building will only work properly if we restrict how much detail is allowed into the design process.'

Managing data and resisting the temptation to throw everything into the design melting pot will be crucial to successful outcomes – particularly in the long-term operation of buildings, the panel agreed.

CIBSE Patrons chairman David Fitzpatrick felt the availability of properly managed data would help engineers to tailor solutions more closely to clients' needs. 'By using technology to share information, we can deliver solutions that are more relevant to our clients' businesses – and also to explain what we are doing in a way they will understand,' he said.

It is also important for employers to 'feed and nurture the passion of young engineers' and use communication tools to ensure they don't work in silos, but share ideas and information with the whole supply chain', added Fitzpatrick.

CIBSE president Peter Kinsella concluded that future generations would have to be trained to exercise 'an appropriate level of engineering judgement about what the technology can deliver and to question its output continually'. CJ

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THE PIONEER WHO RID

# Parliament

OF HOT AIR

In the first of a series of articles looking at the influence of pioneering engineers and buildings, Dr Neil Sturrock, chairman of the CIBSE Heritage Group, profiles **David Boswell Reid** – probably the first true building services engineer



David Boswell Reid – the ‘grandfather’ of air conditioning

**D**r David Boswell Reid is considered to be the ‘grandfather’ of air conditioning engineering, and was also a pioneer in acoustics and lighting design.

He is perhaps most famous for his involvement with the design of the UK Houses of Parliament, in Westminster, a project for which his official title was ‘Ventilator’. He is very often unfairly blamed for the failure of the system to provide satisfactory environmental conditions for the building, which he always argued was down to the lack of cooperation afforded him by the architect, Charles Barry.

Reid argued that Barry frequently acted without authority in making alterations that affected the large-scale air movement required for his system to work. Barry, on the other hand, was determined that Reid’s grand ideas should not be allowed to control the architecture.

What is rarely reported is that Reid – having been dismissed by the government – was exonerated by an enquiry in February 1852, and awarded more than £3,000 in compensation. He was then allowed to make more than 30 alterations to the building to try to improve matters, but it was never wholly



satisfactory, despite the varied attempts of other engineers over subsequent years.

Reid’s fascination with ventilation had begun after a fairly circuitous journey through the world of academia at Edinburgh University.

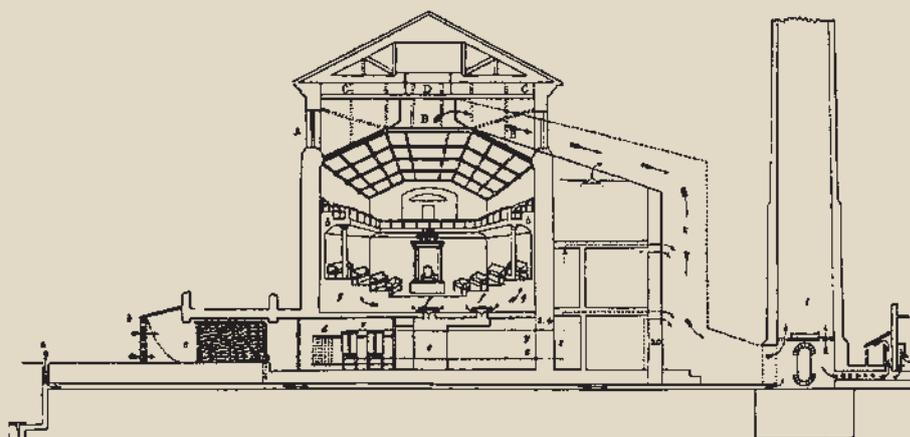
He initially went there to study medicine, following in the footsteps of his father, Dr Peter Reid – who lectured in the Department of Medicine – and his older brother. However, his main interest was in chemistry.

Reid was disappointed to discover Edinburgh offered no classes in practical chemistry, so, in around 1826, he started his own, in some outbuildings at Edinburgh High School. His reputation quickly grew and, in 1828, he was asked by Professor Thomas Hope to help teach chemistry at the university.



ENGLISH SCHOOL / GETTY IMAGES

### Temporary House of Commons 1836 – 1852



Reid's method of air movement control was by applying power to the extract rate using a furnace and a high chimney

able to give proper consideration to the extraction of fumes from his experiments – and, thus, began his life-long association with ventilation.

The laboratory's teaching space was about 24m<sup>2</sup>, and featured tiered seating for up to 300 students, a large demonstration table in the centre of the room, and numerous other benches for 'select' experiments and student use.

Ventilation and fume extract was achieved using more than 14 chimneys; however, much of the extract power came from one central chimney, which was much higher than all of the others.

Reid described the teaching space as having 'about 100 furnaces', which 'can all operate at the same moment'. Fume extract was usually downwards, and involved numerous ducts under the floor. However, baffles in some of the side chimneys allowed for general air extract.

To the left of this space was a series of smaller rooms, in which Reid conducted experiments to try to establish the amount of fresh air required for comfort and wellbeing.

In 1835, a year after a huge fire that had destroyed both Houses of Parliament, a committee of MPs was established to appoint someone to be in charge of the 'Ventilation, Warming and Transmission of Sound' in a new government building. There had been constant complaints about the lack of ventilation in the old building, and several attempts to remedy this had met with very little success.

Reid and several other scientists and engineers, including Michael Faraday, Robert Smirke and John Sylvester, was asked to submit his ideas for how the new building might be properly ventilated.

During his presentation to the committee,

Reid was questioned about conditions in the temporary House of Commons, which had been hastily built on the site of the destroyed buildings, to the design of Smirke. The MPs were so impressed with his proposals that it granted him funds to carry out some experiments in a chamber Reid had constructed within his laboratory.

The temporary House of Commons was then substantially altered to Reid's design, and the first large, truly air-conditioned space was created.

Reid had argued that installing a lowered ceiling would greatly improve the acoustics of the building, but this also gave him the opportunity to house a large, high-level extract duct behind it. The sloping sides of the false ceiling were glazed, and the central wooden area housed the extract openings.

Reid's favoured method of control of air movement was by applying power to the extract rate by means of a furnace and a high chimney. In the case of the temporary House of Commons, the chimney was constructed alongside the building (see illustration above), but was also used to provide extract power to some smaller rooms and, eventually, to the temporary House of Lords, which had been created in one of the picture galleries. Fresh air was taken in from Old Palace Yard, but only after a special pipe had been laid to take away the noxious odours emanating from a smelly drain.

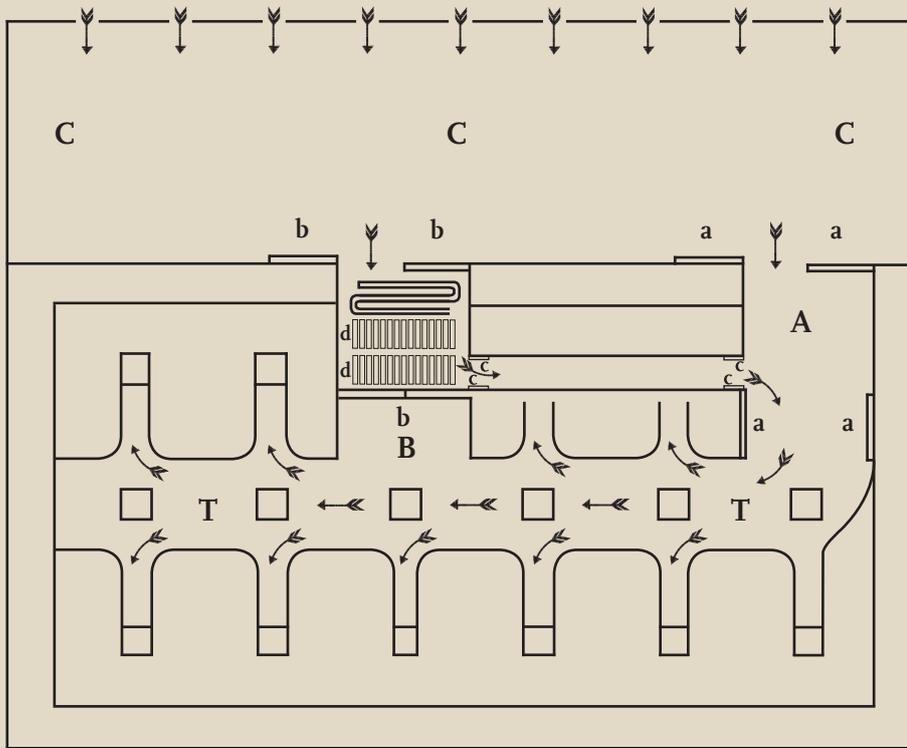
The air was first filtered by gauze, measuring 12.6m long by 5.4m high, before passing into a chamber, where it was washed and moistened by fine-water sprays. The passage of the air through the warming apparatus was then determined by the temperature required in the debating chamber. Reid's recommendation was that the House should be at 62°F (16.5°C) before

Reid had, by then, abandoned his medical studies, and had no formal qualifications for teaching undergraduates – including medical students. However, he was granted special dispensation by the university to continue his studies part-time, and in 1830 gained his Medical Diploma. The following year he was made a Fellow of the Royal College of Physicians.

In 1833, Reid applied to Edinburgh University Council to create a chair in practical chemistry, but his proposal was rejected, so he left the university to set up his own practical chemistry demonstration laboratory. His family's wealth allowed him to do this, although by now Reid also had a large following of paying students.

The laboratory was a major turning point for the Scot; for the first time, he was

Temporary House of Commons warming apparatus



The intermediate setting for providing tempered air to the House of Commons

The great improvements which Dr Reid has effected in the atmosphere of the existing House of Commons can be appreciated by every member of the House

occupation, and should not be allowed to exceed 70°F (21°C) during a sitting.

The illustration above shows the intermediate setting for providing tempered air (this space is the bottom level in the illustration on the previous page). A steam coil and hot-water coils are indicated in the centre of the diagram, with one valve (door) open to allow some of the air from C to be heated. Unheated fresh air passes through where one door is open on the right, and mixes with the heated air in chamber 'A', to give an intermediate supply temperature.

In very cold weather, all of the air would pass over the coils, and, in warm weather, all of the air would enter the balancing chamber through the doors on the right, the central doors being closed. In very hot weather, ice blocks were suspended in nets in chamber 'C'.

Air passed into the House of Commons' debating chamber through one million holes drilled into the floor to create a draught-free supply, and was extracted.

The rate of throughput of air was controlled by means of a single damper in the extract duct, and Reid records that the position of this damper may be altered as many as 100 times during a single sitting.

His attention to detail included providing the Speaker with his own, individual, air

supply and temperature control, arguing that the presiding officer would be stationary for long periods – whereas MPs tend to come and go during debates. It was also possible for the person in charge of controlling the system to check the air temperature by raising a thermometer into the debating chamber from below, using a rope-and-pulley system.

Reid kept a meticulous record of the operation of the system during each sitting, noting the outside and inside temperatures, as well as the temperature of the air in the extract shaft, the weather, the number of MPs present and the distance the valve had been opened.

The valve was 3m wide and 1.5m high, and its movement was up and down – that is, the maximum opening recorded was 1.5m.

The system operated successfully for more than 15 years. In the words of Charles Hanbury-Tracy, a member of the original 'ventilation committee': 'To the skill, zeal and determination of Dr Reid, it is owing that the members of the House of Commons can now pursue their senatorial duties without a sacrifice of health or comfort.'

In 1846, when the system had been operating for 10 years, the House of Commons committee reported that 'the great improvements which Dr Reid has effected in the atmosphere of the existing House of Commons can be appreciated by every member of the House'.

Even so, problems were encountered during the construction and operation of the permanent Houses of Parliament, and the animosity between Reid and Barry eventually led to the air conditioning pioneer being removed from the project.

- A comprehensive review of Reid's original system, and its many alterations, is currently being undertaken by Dr Henrik Schoenefeldt, of the University of Kent
- Reid's most successful air-conditioning system – in St George's Hall, Liverpool – will be the subject of a later article in this CIBSE Heritage Group series. **CJ**

References:

- 1 Much of the information in this article is available in Reid's *Illustrations of the Theory and Practice of Ventilation*, Longmans, London 1844. This is available to download, for free, from [books.google.co.uk](http://books.google.co.uk)
- 2 For more detail, read Schoenefeldt, Henrik, 'The Temporary Houses of Parliament and Reid's Architecture of Experimentation', *Architectural History*, 57 (2014) pp. 175-215

**DR NEIL STURROCK** FCIBSE is chairman of the CIBSE Heritage Group

**HOW THE PAST CAN INFORM THE FUTURE**

The CIBSE Heritage Group will be producing a series of articles looking at the influence of some of the industry's pioneering engineers and buildings, with a view to identifying lessons we can still learn from them.

Much of the information referred to in these articles is available on the Heritage Group website [www.hevac-heritage.org](http://www.hevac-heritage.org)

This month: minimising ICT loads, interview with Dru Crawley and Wuhan's New Energy Institute

## PUMP PRIMING



PICTURE COURTESY OF ROYAL ZOOLOGICAL SOCIETY OF SCOTLAND

Four Ecodan air source heat pumps have been installed in the rhino pool at Edinburgh Zoo. They replaced a gas boiler and, according to Mitsubishi Electric, running costs and emissions have been cut by 30%

With financial backing from the renewable heat incentive, heat pumps are predicted to become one of the most popular domestic renewables in the UK. Mitsubishi Electric's **John Kellett** answers questions on why his company is preparing for a surge in demand

**M**itsubishi Electric says there will be a large uptake in heat pumps, and has upgraded its Ecodan range of air source heat pumps in anticipation of rising demand.

As well as claiming to boost heat-up efficiency by 17%, Mitsubishi Electric says the new FTC5 range introduces remote energy modelling through its Metering and Monitoring Service Package (MMSP).

This will allow occupiers to make the most of the Renewable Heat Incentive (RHI), which offers homeowners an additional RHI payment of £230 per year for seven years, if heat pumps are metered and monitored.

Innovations include the replacement of the traditional internal coil with an external plate heat exchanger, which means water heats up and recovers temperature quicker. To use this method, Mitsubishi Electric had to develop a patented technology to overcome the problem of limescale building up on the plate.

We spoke to John Kellett, heating systems general manager, to find out more.

### By how much is the heat pump market growing?

Reports from BSRIA indicate that the market for stand-alone air source heat pumps will grow from 14,000 today to more than 50,000 by 2017, with monobloc systems accounting for the vast majority of this growth. Hybrid installs – where the heat pumps work with an existing high-carbon heating system – will also grow from a few thousand a year, to around 15,000 in the same period.

### What's driving the market?

Not only is legislation on energy use becoming more stringent, but despite recent falls, the long-term price of oil and gas are predicted to rise as well. This combination will drive more people to look at renewable technologies. The domestic and non-domestic RHI is helping increase awareness of renewable heating.

### Where will the growth occur?

The domestic sector is slightly easier to predict, and the market growth will depend

on a number of factors including: what replaces the Code for Sustainable Homes; how much energy prices rise; and how easy the application for RHI can be made.

Commercially, while more education is needed on the benefits of heat pumps, there is potential for significant growth as building operators realise the benefits in running costs and meeting energy legislation.

### How viable are hybrid systems?

Heat pumps in particular offer the ability to 'bolt on' to an existing, carbon-intensive heating system, significantly reducing both energy bills and carbon emissions.

With the latest advances in heat pump controls, these systems are also now much simpler for homeowners to operate.

### How is proper installation ensured?

We have always tried to ensure that anyone installing our Ecodan systems have been on our training courses. The MCS-Accreditation will be important as it sets the appropriate standards for design, specification and installation, to ensure that each and every system is working in the most efficient way for each individual property.

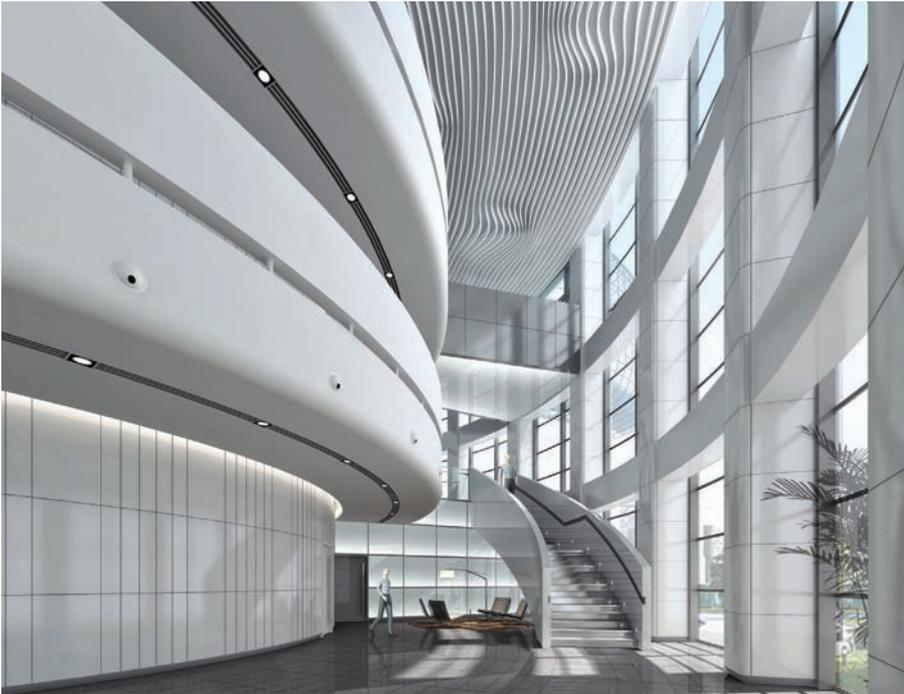
### How important is monitoring?

It is vitally important because, although heat pumps have been around for decades, and the modern inverter-driven systems have been on the market for six years now, they still appear 'new' to many people.

There's nothing that helps convince people more than seeing things with their own eyes. It's all about providing real, tangible evidence of the effectiveness of a heat pump, and that is why we, as a manufacturer, are pushing monitoring so much.

### Will the RHI mechanism encourage uptake of MMSP package?

The additional premium payment available for the government's MMSP is designed to make the whole exercise cost-neutral, so I don't think it will prove to be a massive incentive programme. **CJ**



# CHINA IN BLOOM

An extraordinary new sustainable building has sprung up in central China. The Wuhan New Energy Institute is designed to inspire a generation of engineers, to transform the nation's building stock, and reduce China's reliance on fossil fuels. **Alex Smith** reports



## PROJECT TEAM

- **Client:** Wuhan Future City Investment & Construction
- **Sustainable design, M&E and project management:** Grontmij Netherlands
- **Architect:** Soeters van Eldonk/ Grontmij Netherlands
- **Contractor:** China Construction Third Engineering Bureau
- **Façade supplier:** Wuhan Lingyun Building Decoration Engineering
- **PV panels:** Wuhan Rixin Technology
- **Air conditioning:** Carrier
- **Ground source heat pumps:** Hubei Energy Group

In the ancient city of Wuhan, in central China, an extraordinary building has just come into bloom. The Wuhan Energy Flower is the centrepiece of the city's New Energy Institute, and its striking appearance is highly symbolic. Its resemblance to a Calla lily is intended to show that China is serious about moving towards a more sustainable future in which cities are powered by the forces of nature, rather than by fossil fuels.

The 140m-high Energy Flower is the centrepiece of the 90,000m<sup>2</sup> Wuhan New Energy Institute and Exhibition Centre, which is backed by the Chinese government and the local Hubei province. It will research and develop sustainable methods of building using renewable sources of energy. It's a serious statement of intent – around 2,000 students and researchers will be based at the institute, representing a huge investment by Beijing in sustainable engineering.

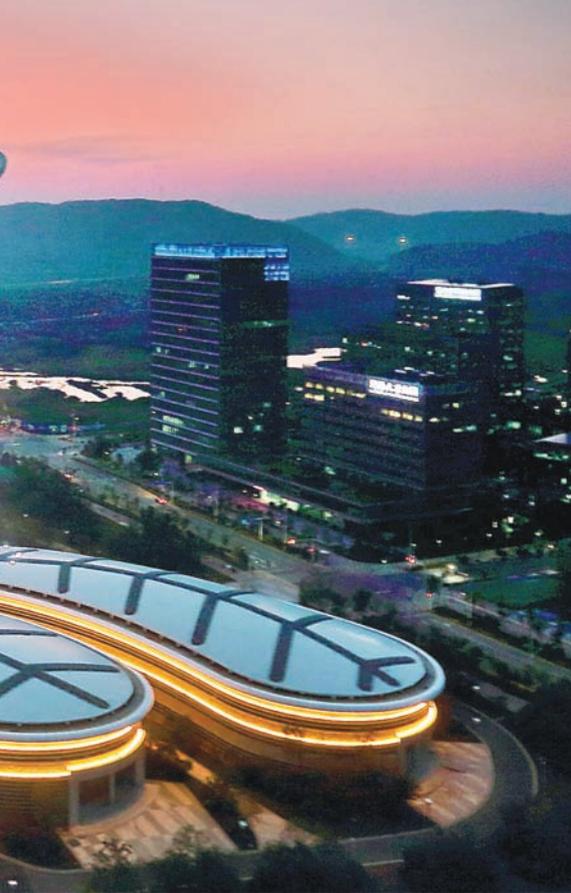
The international competition to design the Energy Institute was won by Soeters van Eldonk Architects and Grontmij.

Grontmij director of building services, Geoffrey Palmer, says: 'Grontmij was keen to ensure that the building was not only showcasing energy technology, but also passive, low energy design principles. It was this approach that helped influence the building's final form.'

'We wanted to make sure it was a low energy building, and not just a structure with renewables bolted on,' explains Palmer.

The form of the building developed as Grontmij considered its requirements alongside the extreme climate of Wuhan. The capital of Hubei province has a subtropical climate, and is known as one of the 'three furnaces of China' – the others being Nanjing and Chongqing – with temperatures peaking at 45°C. This meant the design team had the enormous challenge of creating a low energy building in a city that experiences a hot, humid climate for around six months of the year.

To minimise the need for cooling, Grontmij looked at building forms that could maximise shading of the southern façade. This was vital to reduce cooling loads because the designers wanted a



The 'leaves' around the base of the Energy Tower house laboratories will, eventually, feature green roofs



The Energy Flower 'stamen' houses the ventilation tube, which reaches temperatures of up to 80°C

glass façade to optimise daylighting. This was how the idea of an overhanging roof came about, because it maximises shading of the glass-fronted offices on the southern elevation during the summer.

In the winter, the south-facing offices get direct sunlight because the sun is lower in the sky. The building's funnel form ensures that the southern façades are angled downwards, away from the sun.

The Energy Flower benefits from the large overhanging roof for another reason – it maximises the area on which to install photovoltaic panels (PVs), which the Institute is using to express its sustainability credentials visually.

The electricity created by the PVs doesn't power the building directly, but instead goes

into a local smart grid, and the Institute is paid for the amount of energy it generates.

'The design was definitely borne out of the requirements for PVs, and it was also about enclosing the maximum floor space with the minimum perimeter – which led us to consider a round building,' says Breeam consultant Victor Pastor, who adds that the smaller perimeter reduces the area of façade exposed to sunlight.

As Grontmij sketched the ideas around a passive building form, the resemblance to a flower became apparent.

'Some bright spark saw the likeness. We didn't go through a horticultural catalogue and choose a flower on a whim, but – once you have an analogy – you run with it,' says design director Wouter Loomans. 'If you don't give a building like this a nickname, someone else will.'

### Potent symbol

The Energy Flower's protruding 'stamen' isn't there just to create a 'botanically' correct Calla lily. The 57m-high, steel-framed, yellow structure has two functions – one to house the vertical-axis wind turbine, and the other at the heart of the building's mixed-mode ventilation strategy.

A 3m-diameter tube – made from black aluminium panels and running vertically through the steel tower – is heated by the sun, generating temperatures of up to 90°C. It is connected to a glass tube that runs through the core of the building. As hot air rises through the central shaft, the stack effect causes air to be sucked through

the building via window openings, helping to ventilate space and cool occupants (see natural ventilation diagram, over page).

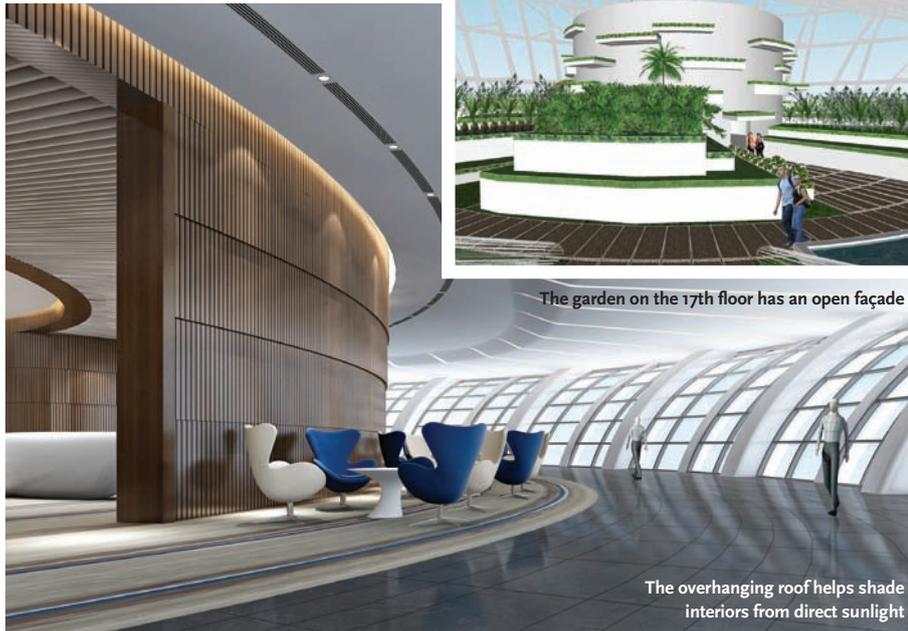
Occupants are able to open windows on the façade, but centrally controlled louvres ensure the ventilation system works without the need for mechanical extraction. The system is supported by two air handling units (AHUs). The stack effect will not generate enough cooling if the air in the core shaft is too cool. At this point, the AHUs step in to provide the necessary cooling, but they can also heat spaces if required.

There is very little wind in Wuhan, so the wind turbine had to be placed at the highest point on the building, says Loomans. 'Since the wind speed is very low, we also chose a model that has a vertical axle, which can operate at wind speeds of between 1 and 5m/s.'

### Garden in the sky

The low wind speeds in Wuhan allowed the designers to create a 'roof-garden' on the 17th floor, with an open façade that allows visitors and staff to benefit from cooling air blowing across the space. A viewing platform on the 19th floor gives people the opportunity to see the PVs, wind turbine and core shaft close up. 'It allows visitors to understand how the sustainability features work and are integrated,' says Loomans.

From the viewing platform, visitors have a perfect view onto the green roofs of six large, leaf-shaped laboratories at the foot of the building. The open 'veins' of each roof



The central tube is made from aluminium and glass, and has automated window openings

allow air to ventilate the HVAC plant on the roof below.

The heating and cooling of these buildings is not the responsibility of Grontmij, but Loomans hopes they will demonstrate sustainability best practice. The multidisciplinary consultant was responsible for a 350-space underground car park, where it has installed light collectors. These tubes bring daylight into the windowless space to help reduce the requirement for lighting.

The Energy Flower is the focal point of a vast new centre of sustainability research.

It is hoped that the knowledge and expertise developed here will help China to meet its international obligations to cut carbon emissions – and reduce the choking smog in its cities – as the country moves from fossil fuels to more sustainable energy sources.

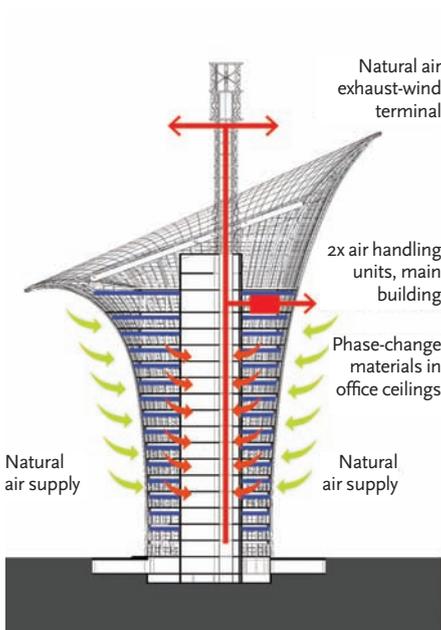
The structure has gained a Chinese Three Star Green Building certification, with a 99.8% rating, and is awaiting its BREEAM certification. However, the proof of the building's success will be revealed through its in-use performance, and the client is aiming to achieve a Chinese green

building in-use certification.

The Energy Flower will open this month, and should provide China with hundreds of low carbon engineers, and ultimately hundreds of thousands of sustainable new buildings. Palmer believes China has the resources to transform itself from bad-boy polluter to green paragon.

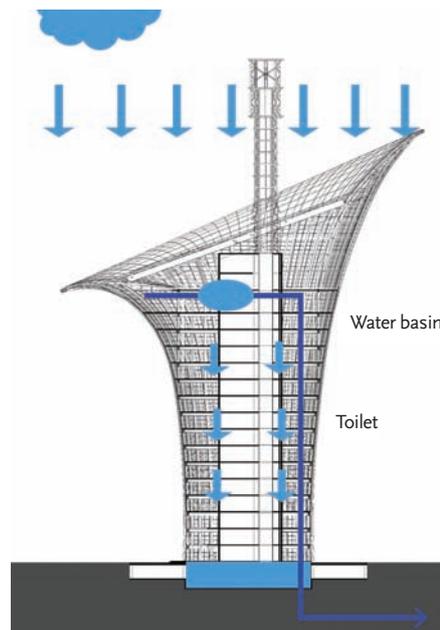
'We all hear about China building coal-fire power stations, but their high-end energy plants are as good as any in the world. Wuhan is very encouraging. There aren't many countries investing in 90,000m<sup>2</sup> energy institutes.' CJ

### Natural ventilation



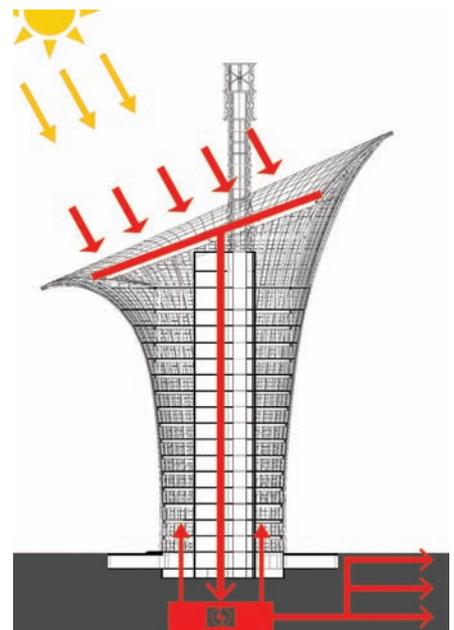
Air enters the building through window openings and is exhausted via the central ventilation shaft

### Rainwater harvesting



The greywater rainwater system has an upper basin providing water to toilets and the rooftop garden

### Roof-top photovoltaics



The Energy Flower is tilted towards the sun to maximise the performance of the 3,500m<sup>2</sup> photovoltaic arrays



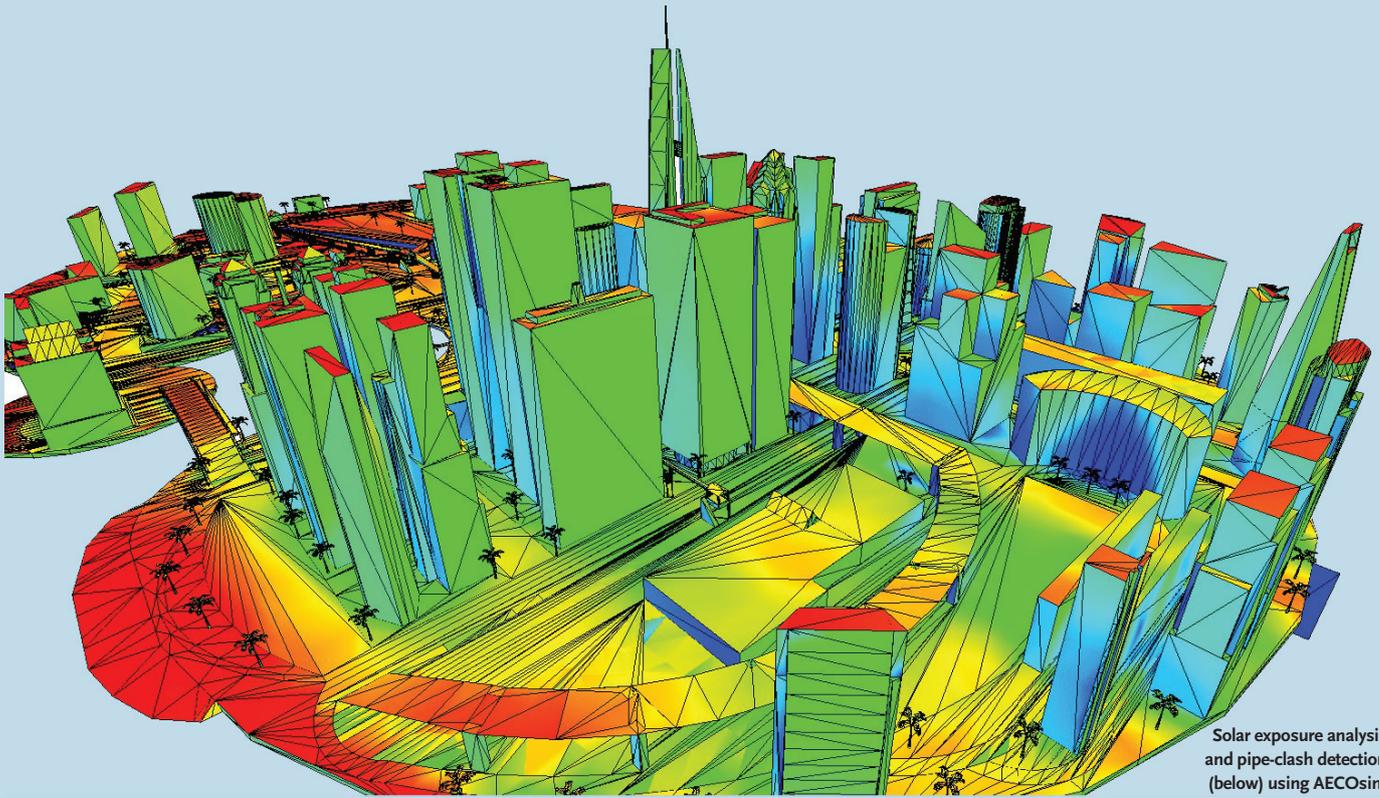
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Solar exposure analysis and pipe-clash detection (below) using AECOsim

# FROM BIM TO SIM

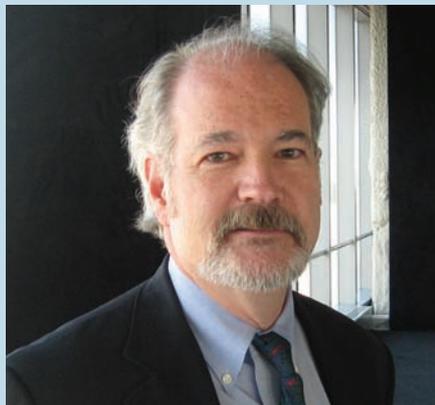
BIM will be cast aside by designers unless it can incorporate intelligent information to monitor buildings, says Bentley's Dru Crawley, who initiated the USA's energy simulation software EnergyPlus. **Liza Young** reports on the challenge of getting SIM into BIM

**B**uilding information modelling (BIM) is the most powerful tool designers have to inform the creation – and visualisation – of buildings.

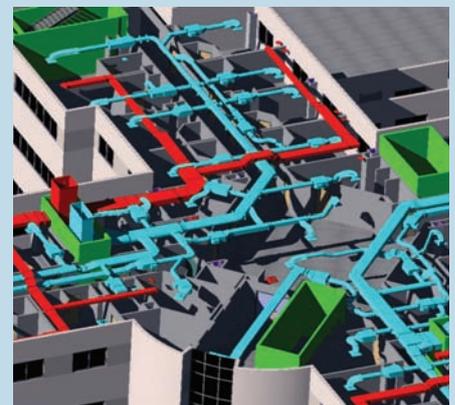
'Although BIM has got some foothold, it is sometimes seen as just the model, and, often, the "I" part gets left out,' says Dru Crawley (pictured), director of building performance products at Bentley Systems.

Formerly the commercial buildings team lead at the US Department of Energy (DOE), Crawley initiated and drove the development of the American government's EnergyPlus simulation engine, as well as the OpenStudio plug-in for 3D modelling program SketchUp, and energy analysis software Energy-10, and DOE-2.

At Bentley, Crawley is responsible for developing building energy and sustainability design simulation and analysis tools, while overseeing the firm's energy-performance products. These include Hevacomp Simulator V8i, Hevacomp Mechanical Designer V8i, and Bentley Tas Simulator V8i.



Getting geometry and data from existing BIM models is a significant challenge, he says, and often means building services engineers have to replicate the work of the architect and contractor. The challenge, therefore, is to keep driving innovations that will make it easier for all stakeholders to work from a single native model. The journey from BIM to SIM (simulation) is not straightforward – and key to achieving it is system interoperability.



## Data is king

When we design a building, we're designing 'our best guess about what it will be based on', says Crawley.

There's a difference between the model and modelling, he adds. A model is a digital representation of a building, while modelling uses BIM – and other related software, hardware and technologies – in a building information model.

'If you dig into most of the BIM models out there today, less than 5% have data describing the functional performance, in my experience,' Crawley says. 'When it comes to building information modelling, my philosophy is rubbish in, rubbish out.'

'You have to drill down into U-values, not depend on what some developer has set as the default, because you end up giving them complete control over your project.'

Crawley says not everyone looks on the model as one that can be used throughout the life of a building. In the US, the General Services Administration – the overseer of government buildings – has requested that an as-built BIM model be produced for all buildings as they are developed.

'BIM needs investment in the post-occupancy phase because, unless a model is kept bang up to date – as part of a maintenance procedure or FM [facilities management] – it's redundant,' says Crawley.

'Is BIM the modern equivalent of the pile of commissioning and maintenance manuals that used to sit in the corner, gathering dust, before becoming outdated and being thrown away?'

'As with any information, the BIM needs to be maintained and kept up to date, reflecting the changes in the building and its components. This will then intelligently inform the building operation and maintenance throughout the whole building life-cycle.'

### BIM to SIM

Building simulation allows easy comparison of the energy and environmental performance of hundreds of new, or retrofit, options. Because much of the data that simulation tools require already exists in BIM models, it is critical that simple methods for sharing that information are available.

Poor software interoperability has long been an obstacle to BIM adoption in the industry, says Crawley. It arises from continued paper-based business practices – or simply choosing to work from PDFs of building plans – a lack of standardisation, and inconsistent technology adoption among stakeholders.

Crawley adds: 'Quality simulation is critical in supporting design and operation of low- and zero-energy buildings, but it's only as good as the input. The more data you have about the building and how it works, the more confidence you can have that it's correct.'

'But getting data from BIM to SIM through interoperability is still a significant challenge. It's often incomplete – with black-box defaults – and inefficient for simulation.' ➤

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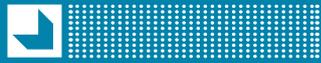


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**SIM CITY**

**Dru Crawley's contribution to Ireland's model cities**

With the development of simulation software, BIM's natural progression is leading to spatial infrastructure mapping that not only displays the objects and how they interrelate, but also their design attributes – and, ultimately, their operating performance.

The Netherlands has already established a national 3D standard – the OGC City Geography Markup Language (CityGML) – and Dru Crawley is working with Ordnance Survey Ireland, creating 3D maps of the country's infrastructure.

He says: 'With these sorts of things happening all over the world, we're slowly building a 3D model of the whole planet, which is incredible – and it's about time.'

➤ Constructions touted today as sustainable or 'net-zero energy' would not be possible without energy simulation, says Crawley, but no single simulation tool can model all aspects of our buildings.

**From front end to end user**

Another barrier to making BIM mainstream is the lack of a user-friendly interface. Crawley says the core of simulation has been worked out, but making it look good, making it accessible, and linking it to a model intelligently are still issues.

Bentley's AECOSim Energy Simulator package has an early design tool with just 12 inputs – for example, the defining parameters for building type, location, and HVAC system. Although simplistic, it is a detailed model that can be promoted to a full model.

'There are a lot of projects you don't know much about, but you will generally know these 12 defining things – which are enough to get you started at conceptual,' says Crawley.

'Whatever the tool, you must be able to drill down and look at all the data – it is the one thing I insist on. The model can be very simple, but you need to be able to look at what the assumptions are.'

Ideally, BIM should go beyond the planning and design phase of a project, and extend throughout the building's life-cycle and supporting processes.

Each professional should add discipline-specific data to the shared model, but this type of collaboration is rarely seen because 'everyone is trying to guard their territory'. Crawley says a model is often thrown 'over the wall' by the architect, and it may not be as complete as it needs to be for thermal modelling because architects are focused on other areas. 'What building services engineering can bring to the process is not just the knowledge about which data is important, but the ability to transform that data into something high-performing,' he adds.

The UK government will require the use of Level 2 BIM – 3D environment with accompanying data – by 2016, which means all BIM users will need product data, and many are already demanding it from manufacturers.

'We need early planning and decision-making, instead of designing our services as generic heating or cooling plans with vague and undefined boxes,' says Crawley. 'Our procurement set-up still seems to be disconnected from the BIM philosophy.' **CJ**

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# HOW TO JOIN THE SMART SET

To build intelligent buildings, designers must integrate HVAC systems with IT and internet networks that control lighting, home automation and security.

**Ron Bernstein** and **Grant Wichenko** explain the holistic approach taken by ASHRAE's updated guide



## MONITORING PERFORMANCE

While not new to the 2014 version, the Guideline includes a Performance-Monitoring Informative Annex. The rationale for this annex is that buildings now require ongoing monitoring of their performance to meet enterprise sustainability policies, or to comply with external standards such as LEED, ASHRAE 90.1, or EnergyStar. The Guideline defines three levels of performance-monitoring, based on the current capabilities of BAS front-end software offerings in the marketplace. Level one concerns data collection and trending. Virtually all BAS front ends have this capability. Level two is about trendlog data analysis. It uses data collected at level 1 and analyses it in more detail. The BAS software must support X-Y plots (for example, outdoor air temperature vs chiller kW/ton) or be able to export this data to a third-party tool like Microsoft Excel. Level three details equipment fault detection, diagnosis and event response. It includes the functionality of levels one and two, and provides the tools and additional data points to undertake equipment monitoring and fault diagnosis.

The ASHRAE SGPC-13 Committee has produced and updated the Building Automation System (BAS) Guideline Specification for more than 20 years. The guide is aimed at those involved in the design and specification of BAS systems. It provides guidance on the requirements for open, integrated building automation.

Addendum A (now out for public review) to the 2014 edition adds changes that reflect advancements in technology and information availability; these will enhance the adoption and implementation of smarter building systems and joined-up control environments.

While retaining and updating the original material on specifying BASs, the document is now IP and internet-ready, communication protocol neutral, and integrates lighting, fire and other building control systems into the BAS. It also provides guidance on legacy system integration.

The focus of building systems has shifted from direct digital control to being BAS and enterprise-centric. This reflects significant industry changes over the past few years as IT-based integration needs become mainstream.

BAS designers need to provide more IT network integration details in specifications, and the guideline provides helpful details. As more analytics tools, 'big data' tools, advanced

connectivity, and cloud services are entering the market, it is important that building systems be designed to help embrace and integrate easily into these enterprise services.

Much BAS equipment is now connected to the enterprise local area network (LAN) either directly or via control network interfaces. This allows critical data, such as alarms and meter readings, to be shared by users in the enterprise besides facility management personnel, who are normally responsible for the maintenance and operation of equipment.

Chapter 4 of the Guideline suggests how BAS designers can work with the enterprise IT department. For example, if the BAS is to be a system on the enterprise LAN, the installation must follow IT standards for cabling and identification. IP addresses must be assigned by IT. Most importantly, BAS designers must embrace IT concerns about network security and adhere strictly to protocols for remote access.

The protocols referred to in the document include BACnet, Konnex (KNX), LonMark (LON), Modbus, Profibus and ZigBee.

It is now common for other control systems – lighting, gas detection, fire alarm and metering (gas, electric, water) – to be connected to the enterprise LAN. It was assumed that these systems would be designed and specified by others as standalone or networked, but they would be integrated into the facility's common BAS.

The guideline employs a three-tier system architecture model as standard integration strategy (see more via [www.cibsejournal.com](http://www.cibsejournal.com)). BAS designers can apply this same design intent to other building systems such as lift monitoring or laboratory controls.

Chapter 12 BAS Device Network Design provides significant detail for designers to use in specifications. This chapter provides language for the integration of key building systems into the BAS.

Chapter 13 introduces information relevant for incorporating legacy systems. It discusses options and provides a checklist to help guide professionals in both understanding the issues and trying to extend the life of older systems.

The public review draft is open for comments until 5 January 2015 at [ASHRAE.org](http://ASHRAE.org) CJ

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# CHIP&SIN

Poor specification of ICT systems can undo all the good design work that goes into a low-energy office space. **Tim Small** explains how to avoid the pitfalls



## UP IN THE CLOUD

Put simply, the cloud means outsourcing – renting time on computers located elsewhere.

A common analogy is the electricity grid: only a few organisations find it economical to operate off the grid. The analogy is not perfect, however, and many organisations may not yet be able to make significant use of cloud computing.

Where viable, the cloud can greatly reduce sinful goings on in the computer room – in some cases, most onsite equipment can be dispensed with. This doesn't simply amount to moving the problem elsewhere, because doing ICT extremely efficiently is central to cloud computing providers' business models. Fortunately, many of the best tricks of cloud providers are also available to smaller ICT users.

As the energy performance of buildings improves, 'unregulated loads' – the equipment brought in by occupiers, and the services required to support them – can easily account for the majority of the carbon footprint.

Information and communications technologies (ICT) can be a large part of this, and The Woodland Trust's new headquarters, in Grantham, is a good example. (See 'Trees of Knowledge', *CIBSE Journal*, October 2014 issue.) Despite the building services team specifying thin client terminals, the ICT electricity use was still higher than predicted.

Building designers have often regarded information provided on such systems as a given – either to an industry standard, to the requirements of the client, or, their ICT service providers. However, it is increasingly clear that requirements need to be challenged for two reasons: first, the ICT experts may not be used to giving much attention to its energy efficiency and, second, if all aspects of building energy use are not considered at the time of design or alteration, the decisions made may be unbalanced.

Traditionally, ICT sales were dominated by desktop PCs. IT procurement rarely factored in life-cycle energy usage – the bill usually came out of someone else's budget, as did the costs of large cooling systems, or poor thermal comfort.

In the past five years, smartphones, laptop computers and tablets have come to dominate the market, and their sales now outstrip desktop PCs by more than 10:1, so



R&D effort has switched to extending battery life. Some of the resulting power-saving techniques have become widespread across desktop and server computers – energy use when idle is now commonly 30% lower.

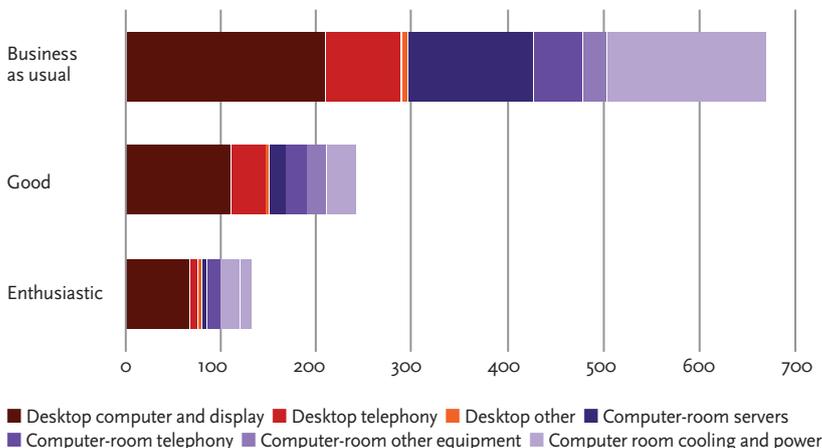
The computers that offer the highest compute performance (for a given capital cost) are also the most power-hungry. In the past, all equipment would cluster around the maximum-performance point, and share similarly high energy usage; significant savings only came with large performance penalties, or capital-cost increases.

Equipment that consumes half the typical power, while only incurring a performance penalty of around 20%, is now available. This equipment often has the lowest full life-cycle cost.

Significant power savings on the desktop can be realised using mobile technology – for example, laptop computers with accessories to improve ergonomics, or desktops built with components designed for mobile devices. Systems that return rapidly from a very-low-power 'sleep' allow further savings.

The amount of information that can be imparted to a user is largely determined by the number of pixels on the display. Smaller screens usually result in lower power consumption, since the total illumination is reduced. Changing a display for one with

## Generalised per-seat ICT power consumption (kWh/seat-year)



Relative annual electricity consumption (source: SEOSS in-house data, and modelling) kWh/seat-year based on single-shift, general-office users



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- longer efficient to operate
- Everything left on 24/7/365
- Inefficient cooling systems, with no hot-aisle separation and overly cool set points.

### Computer room cooling

Computer room cooling falls within the remit of the building services engineer. The accepted practice of improving efficiency by preventing hot exhaust air from mixing with cool intake air – known as ‘hot and/or cold aisle containment’ – is often neglected, especially in smaller installations. Simple solutions, such as foam blocks to plug gaps in equipment racks, offer rapid returns on investment.

Conservatism and simplified control systems frequently set the computer room at 19°C year-round. While optimal air intake temperature may be complex to model, and will vary throughout the year, simply adopting a set point of 26°C will create savings of 5% to 10% – and much more where ‘free’ cooling is available. On-site tuning is advised.<sup>2,3</sup>

ICT managers frequently lower set points to reduce the perceived risk of hard-disk-drive failures. Evidence is sparse, but a large-scale study, published by Google in 2009,<sup>4</sup> showed the minimum drive failure rate occurred at operating temperatures of around 40°C. Other studies have shown poor correlation, except for occasional makes and models<sup>5</sup>.

The UK climate is well suited to computer-room cooling with little or no refrigeration – examples include the University of Cambridge’s Department of Engineering<sup>6</sup>, and the Nottingham Trent University datacentre<sup>7</sup>. Similar technology has been deployed by large organisations, such as Facebook<sup>8</sup>.

### The biggest sins

Other issues require action by the ICT department, particularly under-use of equipment. Cloud service providers aim to exceed 50% average utilisation, but few other organisations exceed 5%. Ideally, software would be installed to monitor the use of equipment throughout the computer room; this will also aid ICT planning and troubleshooting. However, the profile of computer equipment electrical power usage will give a useful preliminary indication: modern servers use about half their maximum power when idle, and – in nearly all organisations – utilisation is less than 10% at some point during the week.

Another simple telltale sign is the ratio of computer-using office occupants to computer-room server computers. For most organisations, ratios of 40:1 are attainable;

ratios of 10:1 are common. This is a great opportunity for large reductions in both peak and annual computer-room power usage.

The most significant gains in utilisation can often be made using systems that dynamically allocate compute workloads and associated data across physical computers. These private cloud systems are often the same as those used by commercial cloud providers. For example, the Nasa OpenStack project.

### The responsibility gap

The cost of ICT power consumption is seldom borne by ICT departments, but forms a crucial lever to reduce the ICT footprint. Lower capital expenditure on electrical and cooling services may provide the impetus for management to close this responsibility gap.

Cooperation of ICT departments becomes more likely if the change can be structured to reward them – for example, with a share of any savings realised. Reducing the ICT footprint can then become an interesting opportunity, not a distracting annoyance. One organisation successfully doing this is the University of Cambridge<sup>9</sup>.

In many buildings, the energy use of ICT systems can be reduced radically (Figure 1). However, this potential is seldom realised. This creates a great opportunity for building services engineers to draw management’s attention to the capital and running-cost savings if people join together to address the responsibility gap. Unless this can be closed, significant improvements are unlikely. **CJ**

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- 8 A critical appraisal of the Facebook design by James Hamilton, vice president, Amazon Web Services [bit.ly/1uN2nCF](http://bit.ly/1uN2nCF)
- 9 The Electricity Incentivisation Scheme, University of Cambridge [bit.ly/1BT4dKn](http://bit.ly/1BT4dKn)

**TIM SMALL** is a director at SEOSS. More information at [seoss.co.uk/ICT-power](http://seoss.co.uk/ICT-power)

more pixels is normally more power-efficient than adding a second monitor. Automatically varying screen brightness in response to ambient light can reap further savings.

Voice Over Internet Protocol (VoIP) phones are now used in most organisations. Power consumption varies considerably between models, and the lifetime electricity bill of a phone can easily exceed its purchase cost. It’s nearly always possible to retrofit software that powers-off some – or all – phones while the building is vacant, saving 60%. More radical solutions include software phones on users’ computers, and using smartphones to provide VoIP service over Wi-fi.<sup>1</sup>

### Trouble in the computer room

The greatest excesses of the ICT department take place in the computer room. The worst sins are (in rough order of significance):

- Annual average equipment utilisation of less than 10% (frequently less than 2%)
- Equipment procured without factoring power use into the full life-cycle cost
- Old equipment retained after it is no



# Comfort Redefined

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# Professional development



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You can also complete the questionnaire online, and receive your results by return email.

## Maintaining comfort, as well as efficiency, with VRV systems

This module explores the provision of VRV systems to provide efficient, comfortable cooling throughout their lifetime, as demands change

The design and application of variable refrigerant volume/variable refrigerant flow (VRV/VRF) systems has been explored in previous CPD articles. This CPD will consider the provision of VRV systems to provide comfortable cooling efficiently throughout the lifetime of the system, taking into account both current demands and the increase in loads that climate change is predicted to bring.

Occupant comfort is the principal purpose in the design of many HVAC solutions. It is thought to be common practice that equipment is oversized at the design stage to ensure capacity can be met both now and in the future, as well as ensuring that the VRV units operate at optimum efficiency for the majority of their operational lifetime.

In a recent analysis<sup>1</sup> of sampled European applications of heating and cooling delivered by VRV equipment, 80% of the systems never exceeded 50% of installed capacity. The sample set included many different applications. However, the majority were installed in hotels that, by their very nature, tend to be designed for full occupancy – although that is consistently not the case.<sup>2</sup>

### System sizing to meet lifetime loads

An oversized system that employs variable volume direct expansion refrigeration will operate the compressor more slowly when it is running at part load (as there will be less refrigerant flow). This will improve compression efficiency and is also likely to increase the component life. Typically, VRV/VRF systems will be selected and installed with peak operating capacities beyond the maximum concurrent design room loads, to take advantage of this improved part-load performance.

An undersized system, at times of high demand, will not be able to meet the required load, so the controlled space will not meet its design condition. The deviation is dependent on the configuration of the system and its actual capacity. In a multi-split or VRV system, any deficiency in available capacity is likely to have the greatest impact in the room units that are most distant (in terms of overall refrigerant pipe pressure drop) from the compressor. Those rooms will be least likely to meet their design set-point during periods when the central plant is unable to meet the combined load of all the room units.

In typical VRV applications, such as offices in temperate climatic zones, the peak cooling load usually occurs only for a short period of time – typically between 2pm and 4pm, where building cooling loads are sensitive to solar gain – and this would be for just a few summer days. If the system was slightly undersized, this might mean that the controlled internal temperature would rise by less than 1K above design. Since such days would be hotter than a normal day, this may well not be noticed by the occupants as they adapt to the external climate. The period of under-cooling may still fall within reasonable limits – as defined by annex G of the comfort standard EN 15251<sup>3</sup> – and so meet comfort criteria. (For a discussion of human adaptation to increased internal temperatures, see CIBSE Knowledge Series 16, *How to manage overheating in buildings*.)

However, the actual period and magnitude of deviation will be dependent on the application. To explore the consequences of undersized systems, the following simulations<sup>4</sup> have been undertaken for a large open-plan area within an office building. The room design temperature is 23°C – at the lower end of

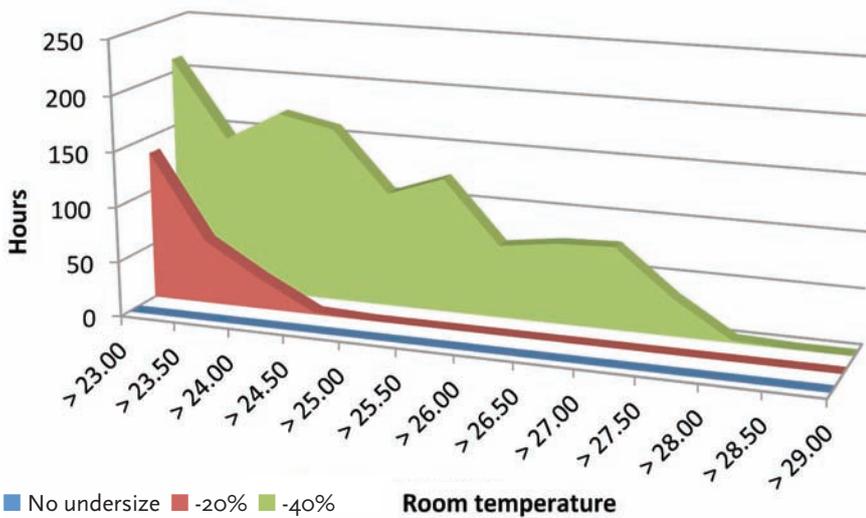


Figure 1: Room temperatures for example room with various capacities of installed cooling system

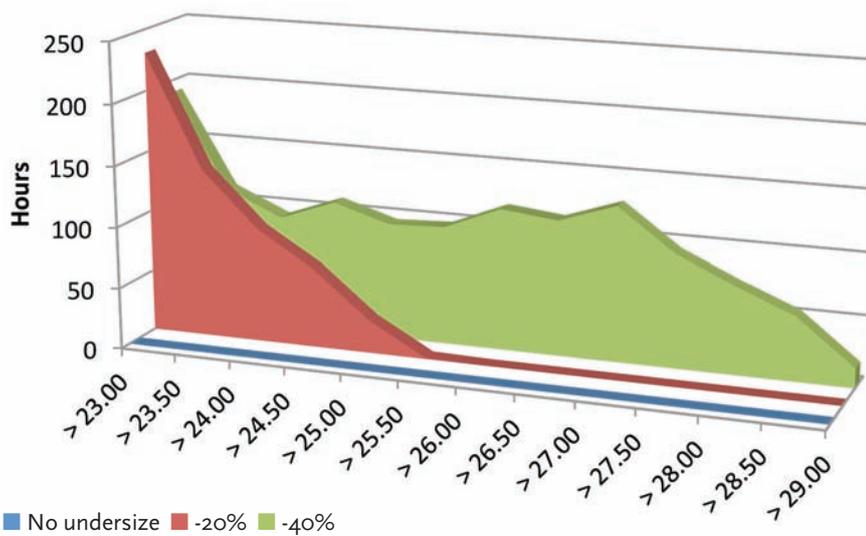


Figure 2: Room temperatures for example room maintaining same installed cooling systems sized on 2015 loads, but with predicted 2030 weather

the range recommended by EN 15251 for an air-conditioned office space. Figure 1 illustrates the output, based on three example installed system capacities:

- A VRV system that has been selected using current selection methods to match – or, indeed, slightly exceed – the room load. A VRV system will typically function most efficiently when operating below full capacity
- A VRV system with a capacity of 80% peak load (that is, 20% undersized)
- A VRV system with a capacity of 60% peak load (that is, 40% undersized).

The output from the model indicates that the system designed to meet – and, typically, slightly exceed – the peak room load would, as might be expected, provide room temperatures maintaining the design set-point (as shown by the red line). When a system is undersized to meet just 80%

of peak load, the room exceeds the desired room temperature for 224 hours and reaches a peak of 24.5°C. Depending on the rationale behind setting a (reasonably moderate) room design set-point of 23°C, this could well be seen as providing reasonable levels of comfort for most of the time. With a system undersized by 40%, the room reaches 28°C on the hottest modelled days and exceeds the room set-point temperature of 23°C for 1,158 hours per annum. For many occupants, this is unlikely to be acceptable for an air-conditioned space.

### Climate change

However, a VRV system lifespan is likely to be 15 years. As a check against the predicted impact of climate change, a weather file for the same location has been applied to the model, using predicted data for the year 2030 from IPCC climate model A1B<sup>5</sup> – 33 percentile – a

reasonably conservative prediction of climatic temperature change. The output of this is illustrated in Figure 2.

The system that was sized to meet – and slightly exceed – the present day loads is still able to meet the predicted load for 2030, and so maintain the design-temperature. This is because the selected system has spare capacity available – to allow the system to operate most efficiently at part-load for most of its operational time – and because VRV systems would typically have the ability to provide additional capacity to room units for short periods of time. It will mean, however, that the VRV compressor is running at high speed for long periods. Considering the 20% undersized system, the space temperature is above 23°C for 555 hours and reaches maximum temperatures of 25.5°C, while with the 40% undersized system, the room reaches 29°C and fails to deliver the room design-temperature for 1,283 hours. The 40% undersized scenario is unlikely to be acceptable, and the 20% undersized system will probably work at poorer levels of efficiency for long periods of time.

So, by virtue of the selection procedures for VRV/VRF, the unit that is designed to satisfy current loads is likely to cope with the increased external temperatures expected by 2030. It might be considered the ‘correctly’ sized system, but it is actually, by inference, being oversized for current loads. This is based on the premise that operating VRV systems at part load is more energy efficient. However, there is a limit to this as, when the load requirement drops below the minimum variable speed of the compressor speed controller – typically an inverter model – the efficiency will drop. For example, ‘hot-gas bypass’ will be used for further capacity management and the system may cycle. The point where a VRV system will reach this will be dependent on the system but, typically, when the system demand reduces to around 4 kW (for most commercial sizes of VRV/VRF), it is likely the system has reached its lowest inverter speed. From a comfort perspective, this can be experienced as slightly unstable swift changes in off-coil temperatures.

### Controlling supply air and room air temperatures

In the 30 years since VRF/VRV systems were introduced, room unit cooling capacity has traditionally been controlled by throttling the flow of refrigerant – latterly, by electronic expansion valves – to the room fan coil as the area approaches – typically, within 1K of – its set-point. This creates a reduction in capacity

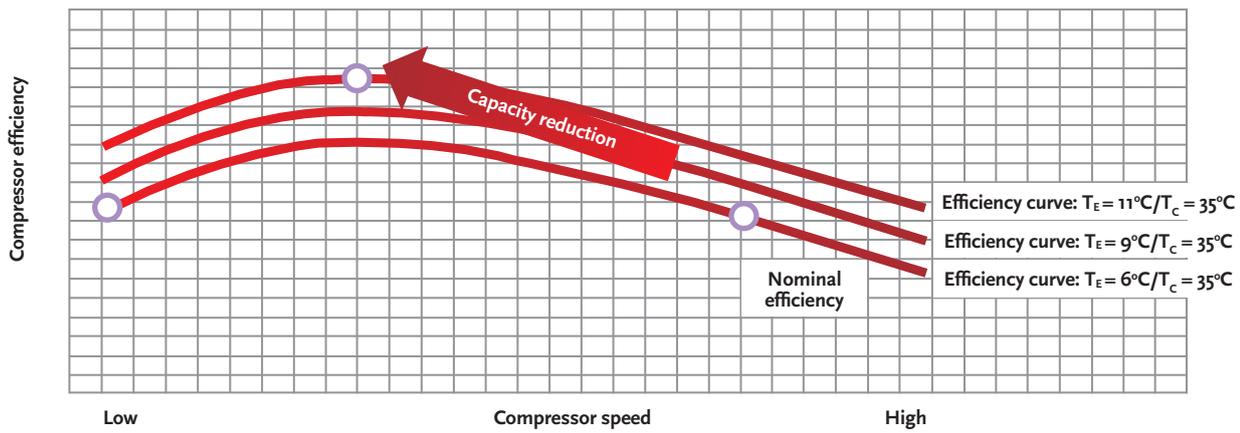


Figure 3: Effect of using evaporating temperature (Te) control to control capacity (at constant condensing temperature (Tc))

and raises the off-coil air temperature, but will not alter the evaporating temperature (or pressure), although it will reduce the overall flow of refrigerant.

However, there are significant benefits to the operating performance of a vapour compression refrigeration system if, rather than altering the flow of refrigerant, the evaporating pressure is increased – so increasing the room coil temperature. To take advantage of this, recently introduced techniques for VRV are employed to control the system-wide evaporating temperature directly – through an embedded computer-controlled combination of compressor adjustment and valve arrangements – to improve the seasonal performance of the units. This type of automatic control has benefits – particularly on comfort – since it will operate across the whole range of demand, gradually modulating the room coil temperature (and so supply air temperature), as well as improving efficiency.

The graph in Figure 3 illustrates this for an example application. In this scenario, as the overall demand reduces, the system evaporating temperature is increased (from 6°C up to 11°C) to cater for the reduced load. By doing this, the compressor efficiency is significantly increased at lower loads, ensuring a high seasonal efficiency by maintaining the most suitable compressor operation for a longer period of time.

In the example fan coil units in Figure 3, the temperature of the air leaving the room coil at the three example evaporating temperatures of 6°C, 9°C and 11°C was 12.4°C, 14.9°C and 16.4°C, respectively. This compares with a typical (traditional) VRV system with a single evaporating temperature of 6°C, and relying on refrigerant superheat to modulate supply air temperatures.

So, at times of high room load, there will

be the largest difference between the air supply and the room design temperature (with an evaporating temperature of 6°C). At these times, particularly where the load is modulating, the occupants may potentially welcome the cooling effect of the lower temperature supply air, rather than perceive it as an uncomfortable ‘cold draught’. This might be explained by the thermic alliesthesial effect, where the human’s thermal perception seems to be positively ‘influenced by changes in skin temperature, particularly when they serve to address an environmentally or metabolically induced thermal imbalance’.<sup>6</sup> As room temperature approaches the set-point, the VRV unit evaporating temperature will increase, so increasing room coil and consequent supply air temperatures.

As the evaporating temperature increases, the sensible heat ratio – the proportion of sensible/total cooling – rises, so the indoor unit predominantly undertakes sensible cooling. This is likely to be advantageous, rather than unnecessarily dehumidifying the room air.

### Eliminating cold draughts

It is, of course, possible to design for the complete elimination of ‘cold draughts’ from VRV systems. If the system is designed to operate permanently at a higher evaporating temperature, the supply air levels are always above a pre-determined value. However, compared with a system that varies the evaporating temperature with the load, a system with a high fixed evaporating temperature will require larger room fan coils.

Some systems can maintain off-coil temperatures by using a sensor that monitors the off-coil temperature, and then closes the expansion valve on the fan coil to restrict the capacity. These systems are not

suitable for the standard target evaporating condition of 6°C, as they could prematurely close the expansion valve – to try to satisfy off-coil temperature – before the room set-point had been met.

So, through appropriate design and selection, it is possible to provide VRV systems that not only deliver appropriately comfortable supply air temperatures, but also have both the flexibility and capacity to satisfy cooling demands across their operational life, while delivering acceptable seasonal efficiencies.

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● We gratefully acknowledge the input of Richard Green, VRV specialist in the product management and engineering group, Daikin UK, for developing IES models and providing core materials for this CPD article.

### References:

- 1 Daikin unpublished internal research report. See [http://www.ipcc.ch/publications\\_and\\_data/ar4/syr/en/spms3.html](http://www.ipcc.ch/publications_and_data/ar4/syr/en/spms3.html) for discussion of these weather scenarios
- 2 Tourism statistics – occupancy rates in hotels and similar establishments, [http://epp.eurostat.ec.europa.eu/statistics\\_explained/index.php/Tourism\\_statistics\\_-\\_occupancy\\_rates\\_in\\_hotels\\_and\\_similar\\_establishments](http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Tourism_statistics_-_occupancy_rates_in_hotels_and_similar_establishments) accessed 30th November 2014
- 3 Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics EN 15251:2007.
- 4 Results of simulation undertaken by Daikin employing IES Virtual Environment software, November 2014.
- 5 [www.ipcc.ch/publications\\_and\\_data/ar4/syr/en/spms3.html](http://www.ipcc.ch/publications_and_data/ar4/syr/en/spms3.html)
- 6 Parkinson, T., et al, Perception of transient thermal environments: pleasure and alliesthesia, Proceedings of 7th Windsor Conference: The changing context of comfort in an unpredictable world London, April 2012.

Turn over page to complete module ➤

# Module 72

January 2015



1. In typical VRV office applications in temperate areas, which of these times is likely to have the highest room cooling load?

- A 9am
- B 11am
- C 1pm
- D 3pm
- E 5pm

2. Considering the model used in the article, what was the maximum temperature in the room when applying a system that was 'undersized' by 20%?

- A 23°C
- B 24.5°C
- C 26°C
- D 28°C
- E 29.5°C

3. What was the predicted life of the VRV system in the example?

- A 5 years
- B 10 years
- C 15 years
- D 20 years
- E 25 years

4. Which one of these is likely to be true when using a traditional expansion valve for VRV control?

- A Does not significantly affect evaporating temperature
- B Significantly modulates the evaporating pressure
- C Makes significant alterations to the condensing pressure
- D Gradually modulates the room coil temperature across the whole range of room loads
- E Ensures that compressor is operating most effectively across the season

5. As the evaporating temperature in a VRV room unit is increased, which of these is LEAST likely?

- A The room unit increases the proportion of sensible to latent cooling
- B The likelihood of cold draughts reduces
- C The power consumed by the VRV unit reduces
- D The unit provides greater dehumidification
- E The compressor will work more efficiently

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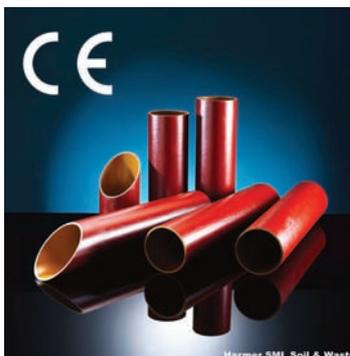
[www.aosmith.co.uk](http://www.aosmith.co.uk)

## Harmer Drainage – Setting The Industry Standard (double)

Alumasc's Harmer Drainage is a well-known brand in the building drainage market, representing more than 40 years of innovation. Built on the philosophy of continual development, the Harmer range is constantly adapting to suit the ever-changing demands of the marketplace. Harmer Floor Drain is a well-established range, which has been subject to extensive development and recent re-launch. It has long been the product of choice for high-demand applications and has been extended to include cast iron, stainless steel and aluminium.

Cast iron is ideal for plant room and other industrial applications where an asphalt or composite floor exists. The new stainless steel range is a versatile high-performance drainage solution, featuring floor drains, channel drains and shower and wet room drainage, whilst the aluminium floor drain range provides effective and attractive interior drainage solutions.

● Call 01744 648499 or visit [www.harmerdrainage.co.uk](http://www.harmerdrainage.co.uk)



## PCM offers thermal solution

Phase Change Materials (PCMs) are ideal for thermal management solutions. They store and release thermal energy during the process of melting and freezing – in the same way an ice cube maintains a prolonged cooling effect in a glass of water. This concept bridges the gap between energy requirement and energy use. When applied correctly, PCMs can offer free cooling, increased efficiency, and lower system running costs. PCMs between 8°C and 20°C can be charged overnight and used to handle daytime building loads.

● Call 01733 245511, email [info@pcmproducts.net](mailto:info@pcmproducts.net) or visit [www.pcmproducts.net](http://www.pcmproducts.net)



## Atlantic Boilers provides NO<sub>x</sub> Class 5 boilers to Georgian hotel

Atlantic Boilers of Lancashire has supplied a new heating system for the Wynnstay Hotel, Oswestry. Seb Siddi, general manager of the Hotel, decided to renovate the gas-fired heating and hot water plant, which consisted of a 30-year-old cast-iron heating boiler and two 15-year old direct-fired hot water generators.

Two new VF low NO<sub>x</sub>, pre-mix low NO<sub>x</sub> gas condensing boilers were recommended by carbon consultants Envantage of Manchester; each of them has modulating output between 26kW and 100kW.

● Call 0161 621 5960, email [nabeela@atlanticboilers.com](mailto:nabeela@atlanticboilers.com) or visit [www.atlanticboilers.com](http://www.atlanticboilers.com)



## Hamworthy condensing boilers and water heaters at hospital

With energy efficiency being a key driver at Sunderland's Hopewood Park hospital, the project manager specified Hamworthy Heating's condensing water heater – the Dorchester DR-FC Evo – and Fleet condensing wall-hung boilers. The products offer gross seasonal efficiencies of up to 98 and 97% respectively.

In all, six boilers and 12 water heaters, with varying outputs depending on heat demand and hot water use, were installed.

● Call 0845 450 2865, email [sales@hamworthy-heating.com](mailto:sales@hamworthy-heating.com) or visit [www.hamworthy-heating.com](http://www.hamworthy-heating.com)



## Timóleon appoints new UK sales director

Manufacturer of heating and cooling solutions, Timóleon, has appointed a new sales director to support its UK sales team and further develop its business capabilities.

Jamie Bomber, who holds an MBA, brings with him a wealth of experience in the heating and air conditioning industries, having previously worked as sales director for BOA Group, looking after HVAC projects worldwide. He was also international business development director at Tour Andersson and Engineering Appliances, and before this, national sales manager for Nu-Air.

● Call 01392 363605, email [emily.withers@Timoleon.co.uk](mailto:emily.withers@Timoleon.co.uk) or visit [www.hydronik.co.uk](http://www.hydronik.co.uk)

## Ruskin extends CE marked damper range

Ruskin Air Management continues to extend its range of CE Mark compliant products by completing the testing and accreditation for its range of CSS circular smoke and fire dampers. CSS dampers are manufactured by Actionair, a brand of the Ruskin group, and provide up to two hours fire protection. They fit within standard circular spiral duct systems where the duct passes through fire-rated walls. These circular bladed dampers are equipped with fail-safe spring closing and factory fitted electrical reset control modes located outside of the ductwork.

● Visit [www.ruskinuk.co.uk](http://www.ruskinuk.co.uk)



## Adiabatic air-inlet cooling



EcoMESH is a mesh and water-spray system that improves the performance of air-cooled chillers, dry coolers and refrigeration plants, while

reducing the energy consumption by up to 44%. EcoMESH has been fitted to troublesome units worldwide, where its patented water-spray technology eliminates problems and, once fitted, is virtually maintenance-free. It can be retrofitted to any model, make or size of air conditioning and refrigeration unit.

● Call 01733 244224 or visit [www.ecomesh.eu](http://www.ecomesh.eu)

## Kingspan Tarec helps Dunlop make itself at home



Dunlop Systems and Components recently moved from its historic Holbrook Lane site to

a new 60,000ft<sup>2</sup> manufacturing facility at nearby Prologis Park, Coventry, which is benefiting from Kingspan Tarec's premium performance Kooltherm FM Pipe Insulation. This new facility has achieved an EPC 'A' 21 rating and BREEAM 2011 'Very Good' accreditation. Some 1,000 linear metres of Kingspan Tarec Kooltherm FM Pipe Insulation were installed on the heating and domestic services pipework.

● Call 0808 168 7363, email [info.uk@kingspantarec.co.uk](mailto:info.uk@kingspantarec.co.uk) or visit [www.kingspantarec.com](http://www.kingspantarec.com)



## Lochinvar opens multi-purpose training facility

Boiler and water heater manufacturer Lochinvar has opened a multi-purpose training facility at its UK headquarters in Banbury, Oxfordshire. It has been designed to host pre- and post-sales training for contractors, specifiers and end users, broadening technical knowledge and product awareness across the commercial building services market. The facility boasts seven different Lochinvar products connected to

gas and water supplies for hands-on demonstration, training and familiarisation. Installation and maintenance training courses for contractors have been tailored for specific products, and to suit experience levels.

● Visit [www.lochinvar.ltd.uk](http://www.lochinvar.ltd.uk) or follow @LochinvarLtd



## Schools help launch new eco competition

Pupils from schools in Hatfield, St Albans and Stevenage in Hertfordshire, and in Bisham on the Buckinghamshire/Berkshire border, took part in an eco competition launch at the headquarters of Mitsubishi Electric in Travellers Lane, Hatfield. The Eco School Competition has seven challenges for pupils competing for a prize of £2,000-worth of environmental resources for their school.

The competition, created by Mitsubishi Electric, is open to all schools, as well as Scouts, Brownies, Guides, Beavers, Cubs and other youth groups.

● Visit [www.the-learning-curve.org.uk](http://www.the-learning-curve.org.uk)



## Sontay preserves history at Guildhall Art Gallery

The Guildhall Art Gallery in London is benefiting from temperature and humidity monitoring, thanks to Sontay's innovative SonNet wireless system. Installed with the minimum of disruption to the gallery space as part of the gallery's building management system, the new Sontay sensors are helping to lower energy costs, as well as protecting the famous artwork on display. The gallery was in need of temperature and humidity sensors to monitor the space conditions, control the energy being consumed, and protect the artwork.

● Email [sales@sontay.com](mailto:sales@sontay.com) or visit [www.sontay.com](http://www.sontay.com)

## Access all areas at LG Arena

One of the UK's largest multi-purpose arenas is delivering access to all areas with the opening of a new disabled toilet. The Birmingham venue has had a 'Changing Places' assisted accessible toilet on its wish list for some years, to complement a similar toilet in the main exhibition halls. Strategically located on the West Side concourse by the disabled ramp to Block 15, the toilet – supplied and installed by specialist firm, Clos-o-Mat – is bigger than a conventional wheelchair-accessible toilet and includes additional equipment.

● Call 0161 969 1199 or visit [www.clos-o-mat.com](http://www.clos-o-mat.com)



## Dorma launches electronic access control brochure

The brochure provides architects, designers and specifiers with technical, installation and performance details on its latest range of access and security products. Security is a critical element in the design and construction of modern buildings, and electronic access control is an increasingly popular specification for designers, with electronic fob and ID card systems offering enhanced security and flexibility.

● Visit [www.dorma.com](http://www.dorma.com)



## CP Northern gets control order from West Yorkshire Police

CP Northern has supplied sophisticated, bespoke, energy-saving lighting management systems for three new police stations in West Yorkshire. Each of the systems is designed to deliver optimum energy efficiency, combined with the inherent flexibility to meet diverse lighting control requirements and to provide automatic testing and monitoring of emergency lighting. Working closely with Interserve, CP Northern supplied and commissioned all three projects simultaneously,

covering more than 30,000 addressable DALI devices, including around 20,000 luminaires.

● Call 0845 0755884, email [sales@cpnorthern.co.uk](mailto:sales@cpnorthern.co.uk) or visit [www.cpnorthern.co.uk](http://www.cpnorthern.co.uk)

## GEZE UK strengthens automatic sales team with appointment of Andy Iredale

GEZE UK has strengthened its automatic sales team in the north of England with the appointment of Andy Iredale, who has 20 years of experience in the automatic, industrial and commercial door industry. Andy joins the company as technical sales consultant – automatic doors, and will be responsible for the sales of supply and fit automatic door products and projects, as well as developing business among new and existing clients.

● Call 01543 443000, email [info.uk@geze.com](mailto:info.uk@geze.com) or visit [www.geze.co.uk](http://www.geze.co.uk)



## Aerapu: ELCO's new MCS-accredited air source heat pump

ELCO UK has launched AEROPUR – a new air source heat pump, offering excellent COPs of up to 4.3. The product, accredited under the Microgeneration Certification Scheme (MCS), is available in four outputs, 6kW, 8kW, 12kW and 15kW, while its reversible capabilities enable it to provide both heating and cooling. Capable of operating up to 3-bar, the new AEROPUR is a compact, all-in-one, air-to-water unit benefiting from a single phase power supply and modulating inverter-driven compressor.

● Visit [www.elco.co.uk](http://www.elco.co.uk)





## Mikrofil at the Willows

Willows Academy in Grimsby caters to the educational needs of 5- to 11-year-olds and aims to provide learning that is both

enjoyable and stimulating. Faced with another large oil bill in 2011, it was decided that the existing plant and fuel type were to be changed. DMBS Design selected two Ethos 130kW gas fired condensing boilers to provide LPHW around the school. The stainless steel boilers offer class 5 NO<sub>x</sub> at 33mg/kwh and a seasonal efficiency of 96%.

● Call 03452 606020

## Remeha boilers prove perfect fit at Goodenough College

Three Remeha Gas 310 Eco Pro boilers have been installed at Goodenough College in Bloomsbury, London, at the postgraduate residence and educational trust. Procurement manager SolarVent specified the boilers because they can be disassembled easily into three parts, which facilitated access to the Goodenough College plantroom. SolarVent's Nabil Kamil said the Eco Pro was 'the only boiler suitable for the job.'

● Visit [www.remeha.co.uk](http://www.remeha.co.uk), email [boilers@remeha.co.uk](mailto:boilers@remeha.co.uk) or call 0118 978 3434



## Jaga Release Trench Heating BIM files

Jaga Heating Products UK continues to expand its catalogue of Building Information Modelling product data. The company, a manufacturer of award-winning energy-efficient radiators, has released the latest additions to its range of Building Information Modelling (BIM) compatible product files. The BIM files, downloadable from the Jaga website or directly through BIMstore, are for the Mini Canal, Mini Canal DBE, Micro Canal, Clima Canal and Quatro Canal trench heating solutions.

● Call 01531 631533, email [jaga@jaga.co.uk](mailto:jaga@jaga.co.uk) or visit [www.jaga.co.uk](http://www.jaga.co.uk)



## AireFlow™ indirect adiabatic air handling unit

The AireFlow™ AHU (100-440kW) is capable of 100% free-cooling under ASHRAE-recommended conditions (London, UK). Being an indirect system, the AireFlow also reduces dependency on back-up mechanical cooling, freeing internal space. EC fans modulate the ambient airflow rate. As conditions dictate, moisture is added to the warm air, lowering the dry bulb temperature. Where necessary, an optional mechanical system will 'top up' cooling capacity. An optional integrated fresh air inlet provides installation benefits and reduces footprint, while maintaining room pressure and air quality.

● Call 0113 239 1000, email [connect@airedale.com](mailto:connect@airedale.com) or visit [www.airedale.com](http://www.airedale.com)

## PEL refurbishes London health club's fire and security systems

PEL Services, one of the UK's foremost providers of commercial sound, fire, security and audio visual systems, has completed the installation of fire alarm, intruder alarm, CCTV and access control systems at The Third Space's Soho health club. As part of the building and refurbishment project, PEL Services has undertaken extensive work to design, install and commission modern security and fire alarm systems to protect this considerable investment.

● Call 0333 123 2100 or visit [www.pel.co.uk](http://www.pel.co.uk)



## Robur launches Gitié range of trivalent gas-powered packaged chillers and heat pumps

The Gitié range of trivalent gas-powered packaged chillers and heat pumps has three models, with 2, 4 or 6-pipe configurations for cooling, heating and domestic hot water (DHW). The units serve a wide range of applications, including cooling where there is a shortage of electrical power; or heating at efficiencies that save up to 40% against a condensing boiler and help with Part L compliance; or cooling and heating with the production of DHW.

● Call 020 8641 2346, email [info@roburheatpumps.co.uk](mailto:info@roburheatpumps.co.uk) or visit [www.roburheatpumps.co.uk](http://www.roburheatpumps.co.uk)

## Cogenco CHP unit cuts hospital carbon

Fairfield General Hospital in Bury, Greater Manchester, is to cut carbon emissions by some 700 tonnes per year, thanks to the installation of a new CHP unit supplied and commissioned by Cogenco. The CHP unit forms part of a new gas hot water system that will replace the hospital's ageing coal-fired steam boiler plant. The scheme will reduce emissions from the Fairfield site by 53%, and release savings in the order of £600,000 per year for reinvestment in patient services.

● Visit [www.veolia.co.uk](http://www.veolia.co.uk)



## Nullifire joins forces with Laydex for fire protection in Ireland

Fire protection specialist Nullifire has announced a partnership with Dublin-based merchant Laydex, which will distribute a new range of passive fire products in Ireland. With bases in both Dublin and Belfast, Laydex is a wholly-owned organisation that specialises in representing some of the world's leading construction materials brands. Laydex will now distribute Nullifire's market-leading range of fire stopping products, which includes intumescent sealants, penetration and movement joint seals, and PU foams.

● Visit [www.tremco-illbruck.co.uk](http://www.tremco-illbruck.co.uk) or [www.nullifire.com](http://www.nullifire.com)



## Myson ULOW-E2 and iVector represent the heat emitter industry at the Falkirk Training Centre for renewables

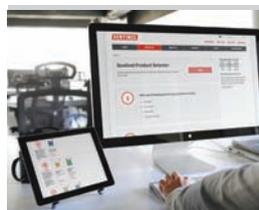
Myson are proudly representing the heat emitter industry within the new Plumb Center branch at Falkirk, which also happens to be Scotland's first highly successful renewables training centre. The products on show are the Myson ULOW-E2 and iVector, providing installers access to the very latest technology within heating emitters in one specialist location. Robert Beagley, Plumb Center's regional trading director, described the training centre as 'an outstanding success'.

● Visit [www.myson.co.uk](http://www.myson.co.uk)

## Water treatment wizard makes finding the right products easy

To achieve long-term protection for heating and hot water systems, professional installers know that it's important to use the right water treatment products for the particular job at hand – after all, installing a new boiler into an older, heavily corroded and scaled up heating system will require different products from a new heating system installation or regular boiler service, for example. To help installers pick the most effective products, Sentinel has launched an innovative product selector tool on its website.

● Call 01928 704330 or visit [www.sentinelprotects.com](http://www.sentinelprotects.com)



## Bosch water heater eligible under ECA scheme

Bosch Commercial and Industrial Heating's CWi47 continuous flow water heater is now included on the Energy Technology List, making it eligible for the Enhanced Capital Allowance (ECA) scheme. The heater, which provides instant hot water for high end residential, and both small and large commercial applications, can be cascaded with up to 12 appliances to offer a combined flow rate of up to 247 l/min. With no storage of water within the appliance, the energy loss is near zero, when compared with traditional hot water storage systems.

● Call 0330 123 3004 or visit [www.bosch-industrial.co.uk](http://www.bosch-industrial.co.uk)



## Hydronic systems warm Palmerston Fort

The famous Palmerston Forts arranged along the south coast of England were built to be solid enough to resist invasion by Napoleonic forces,

but the resulting thermal mass and exposed locations make them very hard to heat. It is, however, a challenge that has been effectively met using a selection of products from Timóleon's Hydronik range, linked to a hybrid renewable energy source. Fort Albert stands as a landmark installation for the Hydronik systems and Timóleon's expert support services.

● Call 01392 363605, email [emily.withers@timoleon.co.uk](mailto:emily.withers@timoleon.co.uk) or visit [www.hydronik.co.uk](http://www.hydronik.co.uk)

## Museums look to the future with the help of Grundfos

With UK statistics showing us that in 2012/13 the national museums alone had almost 50 million visitors, we can see how vital museums are to our lives, while providing a boost to the economy.

The recent international conference for IAMFA members, in Scotland, attended by many museum facility administrators from all over the world, discussed energy use and carbon footprints. With museums and galleries often emitting more than 1,000 tonnes of CO<sub>2</sub> per building per year, there are many opportunities for pumps to help reduce these figures.

This was the case when Jack Plumb spoke to Grundfos Pumps a few years ago about the National Library of Scotland where he is head of estates. This resulted in many Grundfos TPED pumps being installed, reducing energy use at the library.

● Call 01525 850000, email [grundfosuk@grundfos.com](mailto:grundfosuk@grundfos.com) or visit [www.grundfos.co.uk](http://www.grundfos.co.uk)



## Prestigious new build in Ghana chooses under-floor air conditioning

One Airport Square is a 20,000 m<sup>2</sup> mixed-use development in the commercial district of Airport City in Accra. The building comprises 2,000 m<sup>2</sup> of retail space and 18,000 m<sup>2</sup> of Class A office space. The building has been designed to high standards by award-winning sustainability designer Mario Cucinella Architects, and will be the first green-rated building, with the first underfloor air conditioning installation, in Ghana.

● Call 01342 310400, email [lucy@flexiblespace.com](mailto:lucy@flexiblespace.com) or visit [www.flexiblespace.com](http://www.flexiblespace.com)

## Bavenhill Mechanics demonstrate value of heat pumps to farmers

Agricultural engineering and heating contractor, Bavenhill Mechanics, has received a Green Gateway Award from Mitsubishi Electric for its work in applying heat pumps in farming. The awards – created by Mitsubishi Electric – recognise the contributions of its partners in encouraging energy efficiency in the built environment. 'Bavenhill Mechanics has been instrumental in highlighting the substantial benefits that heat pumps can offer,' said Steve Fleming, Mitsubishi Electric general sales manager.

● Visit [www.bavenhillenvironmental.co.uk](http://www.bavenhillenvironmental.co.uk)



## Sika investment receives royal seal of approval

Sika's new £2.5m research and development centre in Preston, UK, was opened on 26 November, 2014 by HRH Duke of Kent. Following the acquisition of Liquid Plastics and Incorex in 2009, Sika has continued to invest in this area of its business to support the development of technologically advanced liquid roofing membranes and new developments in its product technologies – such as the low solvent iCure range. From its Preston site in the North West of England, Sika exports these products all over the world.

● Call 01707 394444 or visit [www.sika.co.uk](http://www.sika.co.uk)



# PRODUCTS & SERVICES

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## Sheffield Hallam University chooses re-cooler for refurb project

When Sheffield Hallam University set about refurbishing its newly-acquired Arundel Building, it specified a ventilation system from Fläkt Woods UK. Comprising an eQ air handling unit and integral ReCooler heat pump, the equipment has replaced the existing natural ventilation setup in order to supply up to 2.5m<sup>3</sup>/s of conditioned air into a variable air volume system. The incorporation of the new heat pump is one of the first inverter driven compressor technology installations of its type in the UK.

● Call 01206 222555 or visit [www.flaktwoods.co.uk](http://www.flaktwoods.co.uk)



## Domus Thermal duct insulation range extended

Polypipe Ventilation has announced that its Domus Thermal duct insulation range is being extended to cover its 220x90 mm Megaduct Rigid Duct System. Megaduct is a range of large capacity rectangular ducting, suitable for larger installations. The system is particularly appropriate for applications that require higher air flow rates, associated with whole-house ventilation within larger domestic properties and light commercial environments. Previously, Domus Thermal was available solely for the 204x60 mm Supertube rectangular ducting range, as well as 100 mm, 125 mm and 150 mm round profiles.

● Call 08443 715523, email [vent.info@polypipe.com](mailto:vent.info@polypipe.com) or visit [www.polypipe.com/ventilation](http://www.polypipe.com/ventilation)

## Ideal Commercial Boilers helps council gain 'Excellent' BREEAM rating

British manufacturer Ideal Commercial Boilers has supplied 20 Evomax 150kW wall-hung commercial condensing boilers and five Frame and Header kits to Southampton City Council, which have been installed as part of a £14m investment in five residential tower blocks at International Way, Weston. Not only did the Evomax boilers meet challenging installation criteria, but their high efficiencies and advanced control systems will help the council reduce its energy use by up to 50%.

● Call 01482 492251, email [commercial@idealboilers.com](mailto:commercial@idealboilers.com) or visit [www.idealcommercialboilers.com](http://www.idealcommercialboilers.com)



# DIRECTORY Your guide to building services suppliers

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- References supplied

**Mike Gianfield 07624 346826**  
CV & portfolio: <http://tinyurl.com/kd4uvtr>  
[info@epsiloniom.com](mailto:info@epsiloniom.com)  
[www.epsiloniom.com](http://www.epsiloniom.com)

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# JOURNAL CIBSE JOBS

The official magazine of the Chartered Institution of Building Services Engineers

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### Associate Mechanical Design Engineer Cambridge

£50,000 Plus Benefits

Our client, an internationally renowned building services consultancy, have a fantastic opportunity for an associate mechanical design engineer to join them. Due to continued expansion, through well-known project wins, they would like to hear from technically sound engineers. Being an expert in business development, you will have the chance to work directly with key clients to identify solutions to their many needs in the built environment. You will play a vital role in constantly improving this office moving forward.

### Principal Mechanical Engineer Watford

£55,000-£60,000 Plus Benefits + Bonus

A highly successful building services team, who have an office based near Watford, have an opening for a Principal Mechanical Engineer to help lead the mechanical building services department. A great time to join the team in this prestigious consultancy, due to planned expansion and already confirmed workload for the whole of 2015 to support this.

### Principal Electrical Design Engineer Manchester

£48,000 Plus Benefits

A large award winning building services consultancy based in Manchester is now looking for a principal electrical design engineer. The role is ideal for someone seeking a lead engineer role, working on challenging and exciting projects, which will range in size and value. You will have 6-8 years' experience within a building services consultancy and knowledge of up to date software, and will be expected to perform a client facing role whilst retaining your technical "hands-on" duties.

### Associate Electrical Engineer Surrey

£65,000 Plus Benefits + Bonus

A large internationally renowned engineering consultancy is currently looking for an Associate level Electrical Engineer to work out of their modern offices in Surrey. This role comes with the opportunity to work on some of the most exciting and pioneering building services projects in the world. As Associate you will have full control of your Electrical department, working on projects within the airport, defence, leisure and rail sectors.

### Associate Director (Mechanical) Central London

£70,000 Plus Benefits + Potential Equity

An exciting opportunity for an Associate Director level mechanical engineer to join a newly formed building services team in Central London. With the backing of their well-regarded (large) head office, this newly formed team have recently won a number of large well-publicised hotel and commercial developments in London. This exciting position, reporting to the Director in London, is completely unique and offers the opportunity for equity after a short period of time.

### Senior Mechanical Design Engineer – 18 Month Contract Surrey

£40.00 per hour (Ltd)

One of the top 10 building services consultancies in the world is looking for a Senior Mechanical Design Engineer to join their world-class design team, on a contract basis. Current project wins are based upon a well-publicised rail project and, in addition, the team has secured more than 18 months' of work for the successful candidate.

Find more jobs online at [conradconsulting.co.uk](http://conradconsulting.co.uk)

For more information about any of these positions, please contact [george@conradconsulting.co.uk](mailto:george@conradconsulting.co.uk) or call **0203 1595 387**

For a confidential chat, call George 8am to 8pm on 0203 159 5387

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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**

**Electrical Associate**

**£55 – 65k + Benefits, London**

An instantly recognizable international multi-disciplinary consultancy with an enviable reputation for projects delivery and engineering excellence require an electrical associate to join their central London office. Our client has worked on some of the most prominent and innovative projects across the globe and they are currently working on a number of high profile commercial projects in London. BAR2332/JA

**Public Health Design Engineer**

**To £42 per hour, London**

An internationally recognised multidisciplinary design consultancy is currently looking for Public Health Engineers. They have exciting and innovative projects that you will want to get involved with. Experience of both above and below ground drainage is required. We would be happy to hear from Public Health engineers at all levels from junior to senior and principal engineer. BAR2304/KB

**Intermediate Electrical Design Engineer**

**To £32 per hour, London**

A major international design practice is currently looking for an Intermediate Electrical Design Engineer to join their London Team. Main area of focus will be on healthcare projects which require someone who has the relevant experience and background on similar schemes. This is a long term contract with an excellent company. BAR1557/KB

**Intermediate/Senior Mechanical Design Engineer**

**Bangkok, Thailand, 2,000,000 THB**

Large multinational multi-disciplinary consultancy with an outstanding reputation across Asia, heavily involved within the high rise, commercial, high end residential, leisure, industrial, data centre, mission critical, and healthcare sectors are looking to grow their mechanical engineering division. Successful candidates should possess 5 years' experience in a client facing role, be degree qualified, and have a strong commercial acumen. BAR2279/PA

**Senior Electrical Engineer**

**£45-55k + Extensive Benefits Package, London**

With a reputation for delivering prestige projects my client is seeking a Senior Engineer to be responsible for managing clients, developing engineers, and delivering design and consultancy services at a very high level. Established at Senior grade and preferably Chartered, with strong technical skills and experience developing design from concept this role will suit an engineer who is looking to work on high profile projects with one of the top consultancies in the UK. BAR2234/CB

**Mechanical Engineers**

**£300-400 per day DOE, London**

Due to a major Rail expansion project, I am looking for Mechanical Engineers for a long term assignment, to design and lead a project on multiple sites through to the construction stage. You will have extensive experience in rail projects and be able to work on a project from conception to completion. BAR2437/MA

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**Design Managers / Design Engineers – Mechanical & Electrical London | to £75K | ref: 6804**

Opportunity to join a blue chip engineering company with an enviable project reputation. With the railway sector representing a large portion of their global business, our client is currently seeking high calibre Design Managers and Engineers to build their rail division. You will have the opportunity to deliver some of the UK's most prestigious and challenging schemes on behalf of renowned rail companies. Excellent career progression with competitive packages.

**Associate Director – Mechanical & Electrical London | to £70K + Bens | ref: 6652**

A leading multi-disciplinary engineering consultancy seeks a lead Mechanical, lead Electrical and a Project Manager to deliver a signature project in Central London. You will be responsible for forecasting workload and planning resources, ensuring profitable delivery of projects and excellent client care. Previous experience of delivering prestigious projects in the commercial and residential sector is desirable.

**Junior/Intermediate Mechanical Design Engineer London | to £32LTD | ref: 6556**

Excellent opportunity to join a multi-million global engineering consultancy in London, to work on one of the most prestigious overseas rail projects on a 12 month contract. Hevacomp/IES will be required, however previous rail experience is not essential.

**Electrical Design Engineer | London | to £40LTD | ref: 6797**

One of the most revered multi-disciplinary consultancies is looking for an experienced engineer to join their Building Services team on a 12 month+ contract. Ideally you will have expert experience working on banking projects and designing critical system facilities.

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**Senior/Principal Electrical Design Engineer**

**London | £50k + Package | Ref: 15211**

We have been approached by a well-established practice of Building Services Engineers, who due to expansion are looking for a Senior/Principle Electrical Design Engineer to join their already busy team. The successful candidate will be tasked with overseeing various projects from concept to completion and including detailed design. You will be working on a wide spectrum of projects including Commercial and Data centres. This is a good opportunity for someone looking to move forward with their career. **Contact: Ryan Craig-Douglas on 01483 768 600 / ryan.craig-douglas@bsvrecruitment.co.uk**

**Senior Mechanical Design Engineer**

**London | £50k + Package | Ref: 15239**

We have been approached by a fantastic Building Services Design Consultancy based in Hampshire to recruit a Senior Mechanical Design Engineer to join their expanding M&E Team. The successful candidate will be required to deal with projects from inception through to Commissioning and Handover as well as be able to manage a small team. This fantastic opportunity offers a Competitive Remuneration Package, as well as the opportunity to progress within a well-established consultancy. **Contact: Kate Murrells on 01483 768 600 / katarzyna.murrells@bsvrecruitment.co.uk**

**Junior Mechanical Design Engineer**

**London / £26k + Package / Ref: 15219**

We have been approached by a Top Building Services Design Consultancy based in Central London, who due to the expansion are looking to recruit a motivated and enthusiastic Junior Mechanical Design Engineer to join their busy M&E Team. The right candidate must have a genuine desire to develop their current skill set and design experience. This is an exciting opportunity that will help and support the right candidate to build a successful career within the industry. **Contact: Matt Baker on 01483 768 600 / matthew.baker@bsvrecruitment.co.uk**

For more vacancies please visit **www.bsvrecruitment.co.uk** or call today.

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Matt, associate engineer

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Matt is one of Atkins' many success stories within our building services division. Since joining Atkins, he's taken on big challenges, experienced new things and never stopped learning. The team here has a good ethos with excellent support, so you'll always find the answers due to the superb technical expertise. You can demonstrate your technical competence with genuine responsibility and pass your knowledge on as you mentor others.

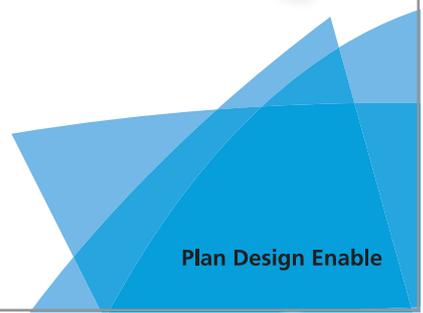
Join our building services team and, like Matt, you can push the boundaries and think innovatively. You'll get involved with all kinds of projects whilst working alongside our passionate team of mechanical,

electrical, public health, lighting, fire and building physics engineers.

So, help us to build a better tomorrow, whether your interest lies in business or project management, business development, or becoming a technical leader. Amazing projects. A great team spirit. And training, support and mentorship every step of the way. Your story starts here.



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We are recruiting a **Senior Engineering Consultant** who will be responsible for ensuring full compliance with the regulatory requirements associated with the ACoP L8, Water Fittings Regulations, and BSRIA guides including compliance with BSRIA BG29:2012, ensuring that agreed procedures/policies are followed.

You will have a degree in engineering (or more than 10 years' industry experience), and will preferably have membership of a professional institution with HNC/BTech Higher or equivalent.

Considerable experience of services associated with water and related regulations and guidance, along with detailed knowledge and experience of building services design, maintenance and operation is required. In depth knowledge of the regulations and standards of work and safety that are applicable to the building services industry is also essential.

You must be able to plan and implement positive action to deal with changing priorities and effectively manage a personal workload. Excellent verbal/written communication skills, as well as advanced interpersonal skills, are also fundamental.

You must have exceptional personal organisation/time management skills and the ability to provide excellent customer service. Holding a valid UK driving licence is also essential.

**Hours:** 37.5 per week Monday-Friday

**Location:** Greenwich, London

**Salary:** Circa £40,000 plus benefits including pension/life assurance.

**To apply please send a covering letter and CV to [katherine.walsh@latisscientific.co.uk](mailto:katherine.walsh@latisscientific.co.uk)  
Tel: 0208 8533900**

## Mechanical Services Engineer

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The Building Services Group provides a comprehensive design, project management and maintenance and improvements service to varied clients within the Local Authority and beyond.

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For application form and further details please go to [www.sefton.gov.uk](http://www.sefton.gov.uk). Completed forms can be emailed to [recruitment@sefton.gov.uk](mailto:recruitment@sefton.gov.uk).

If you do not have Internet access, then call our 24 hour recruitment hotline on 0845 140 1040, or call in to the Transactional HR Team, 1st Floor, St Peter's House, Balliol Road, Bootle, L20 3AB.

**Closing date is 26/01/15**



# Events & training

## NATIONAL EVENTS AND CONFERENCES

### CIBSE Building Performance Awards 10 February, London

The prestigious awards event returns to recognise the companies, teams and products that demonstrate engineering excellence. Book your table now to see who will win.

[www.cibse.org/bpa](http://www.cibse.org/bpa)

### Technical Symposium 16-17 April, London

Book now for the 2015 Technical Symposium.

[www.cibse.org/symposium](http://www.cibse.org/symposium)

## CIBSE GROUPS, REGIONS AND SOCIETIES

For more information, visit [www.cibse.org/events](http://www.cibse.org/events)

### North East Region: BIM Academy 13 January, Newcastle upon Tyne

An evening presentation by Sam Collard of the BIM Academy.

### West Midlands Region: Natural Vent 14 January, Birmingham

An evening seminar featuring Neil Oliver and Andy Harrington from Ruskin.

### YEN North West Region: Chartered Engineer Workshop 2015

### 15 January, Manchester

Three recently-chartered engineers from the region share their varied experiences of gaining professional accreditation. An ideal companion to the CIBSE HQ briefing, this event will tell you how our members have progressed their careers and give their top tips on how you can do the same.

### East Anglia Region: LED & Light Management Breakfast Seminar 15 January, East Anglia

To welcome in the new year CIBSE East Anglia is pleased to host a breakfast seminar covering the latest advances in LED lighting and light management.

### Building Drainage Conference 15 January, London [www.cibse.org/sophe](http://www.cibse.org/sophe)

### East Midlands Region: Fan Power Regulations 20 January, Northampton

An evening seminar arranged by the East Midlands Region.

### Yorkshire Region: Is your Building (Management System) as safe as you think? 20 January, Leeds

Chris Topham of Abtec Network Systems presents on how you can ensure that your projects don't create security issues.

### Energy Efficient Hydration in the Workplace 21 January, Manchester

A SoPHE event with speakers Adrian Hibbert, specification BDM north, and Andy Colley, training manager Zip UK.

[www.cibse.org/sophe](http://www.cibse.org/sophe)

### 24:00 - Arup Lighting Exhibition, Private View 21 January, London

As part of the International Year of Light and Light-Based Technologies 2015, SLL is holding a private viewing of the Arup Lighting Exhibition 24:00.

[www.cibse.org/sll](http://www.cibse.org/sll)

### Merseyside & North Wales Region: Lighting Controls 22 January, Merseyside

An evening seminar arranged by the Merseyside & North Wales Region.

### Ireland Region: Job-Seeking Skills Workshop 29 January, Dublin

Join us for an evening workshop on job-seeking skills presented by Hays Recruitment.

### West Midlands Region: Leadership & Motivation of People 4 February, Birmingham

With speaker Dennis Beard of Dennis Beard consulting.

### CIBSE Membership Briefing 5 February, Leeds

This briefing will focus on applications for the Associate and Member grades and registration with the Engineering Council at the Incorporated Engineer and Chartered Engineer levels. The session is an opportunity to meet

and greet members in your region with a CIBSE presentation covering the main points of the application and interview processes, followed by group or one-to-one discussion with CIBSE staff.

[www.cibse.org/briefings](http://www.cibse.org/briefings)

### North East Region: 'DIN SPEC Story', Biologically Effective Illumination 10 February, Newcastle upon Tyne

Presentation by Henrik Clausen.

### East Midlands Region: Military Infrastructure 10 February, Kegworth

[www.cibse.org/mcc](http://www.cibse.org/mcc) or call 020 8772 3640

## CPD TRAINING

For more information, visit [www.cibse.org/mcc](http://www.cibse.org/mcc) or call 020 8772 3640

### Energy strategy reports 13 January, London

### Practical HVAC controls 14 January, London

### Electrical services explained 19-21 January, London

### Energy building regulations 20 January, London

### Fire detection & alarm systems 27 January, London

### Mechanical services explained 27-29 January, Birmingham

### Practical project management 28 January, London

### Building services explained 28-30 January, Manchester

### Low and zero carbon energy technologies 29 January, London

### Power system harmonics 30 January, London

### The commissioning process 3 February, London

### Energy system: ISO5001 (ESOS compliant) 3 February, London

### Electrical Services Explained 3-5 February, Birmingham

### Energy Efficient Heating 6 February, London

### HSE Guidance to legionella control 5 February, London

### Building services explained 10-12 February, London

### Energy building regulations: Part L 12 February, Birmingham

### Practical HVAC controls 12 February, Manchester

### Lighting design principles & application 13 February, London

### Fire risk management system: PAS 7 2013 13 February, London

### Designing water efficient hot & cold supplies 17 February, London

### 25 ways to save energy in your building 18 February, London

### Emergency lighting for fire safety to BAFF SP04 19 February, London

### Intro to electrical services in buildings 20 February, London

### Air-con: Psychrometric charts application 24 February, London

### Mechanical services explained 24-26 February, Manchester

### Intro to commercial building services 25 February, London

## ENERGY ASSESSOR TRAINING

For more information visit [www.cibse.org/events](http://www.cibse.org/events) or call 020 8772 3616

### EPC Training 27-28 January, Leeds

### DEC Training 3-5 February, Birmingham

### ESOS Training 9 February, Leeds

### EPC Training 10-11 February, London

## Building Performance Awards 2015

The shortlist has now been announced – make sure you book your place for the 2015 CIBSE Building Performance Awards to see the winners taking a bow. The awards bring together those redefining what building performance means today. It is a rare opportunity to recognise and celebrate the latest low energy innovations and projects.

The event, at London's Grosvenor House hotel, will be an opportunity to celebrate achievements across the industry, and bring together professionals from every area of the built environment.

Join the best of the industry's talent, support those who have been shortlisted, and find out who will scoop the accolades.

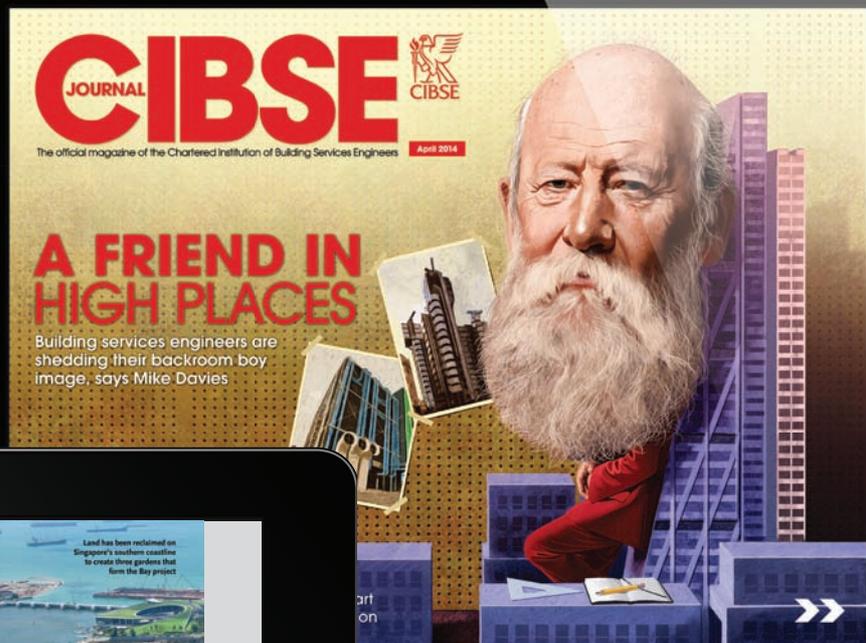
To book your place visit [www.cibse.org/bpa](http://www.cibse.org/bpa)



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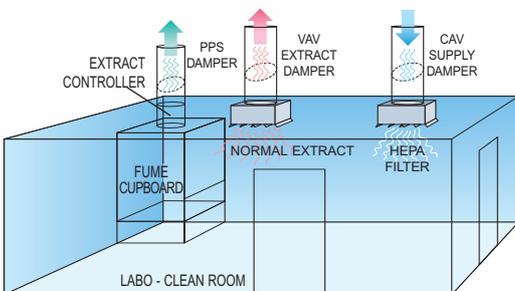


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