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HAUS MASTER

Architype's Jonathan Hines on perfecting Passivhaus and winning awards

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Setting the agenda

The CIBSE Technical Symposium was launched to connect academics with the research needs of the built environment sector. I have been to six of the eight events and, every year, the papers become more relevant as universities increasingly hone in on the challenges facing those responsible for delivering low energy, comfortable buildings. This year's crop of papers felt particularly topical and, in some cases, set agendas rather than simply being a response to issues (see page 20).

Popular subjects this year included: indoor air quality; the performance gap; circadian lighting; and the use of data to get to the root of poor HVAC performance. Some of the reasons for services failure would have been impossible to work out without integrating data. For example, Wim Zeiler (for Werner Vink – BAM Techniek) could not understand why a sustainable building in Holland was using so much energy. Then he examined the data more closely and saw a spike in energy used by fans when CO_2 limits in interiors were set well below 1,000ppm. The solution was to let CO_2 levels rise above 1,000ppm, so less fan power was required.

This apparent trade-off between an ideal indoor environment and low energy use was a recurring theme. Research by UCL's Esfand Burman uncovered the dangers of using natural ventilation in busy areas with high levels of pollution. He believes that sensors should be measuring air quality entering the building, so that windows can be automatically shut to protect indoor air quality from external NO_2 and PM 2.5.

It was encouraging to see so many papers using data to uncover hidden truths. UCL's Jenny Love examined pressure-testing data and found that nearly every home tested for airtightness passed, which she surmised could only happen if sealing was taking place during the test once holes in the fabric were identified. Love said sealing during the test suggested that fixes were only temporary and problems with the difficult-to-get-at primary air barrier were not being addressed.

We feature three papers in the *Journal* this month, including an acoustic solution for ventilation units designed for housing in North West Cambridge, and a paper on the Soft Landing process at the University of Leicester's George Davies Centre. This may be more familiar as the Centre of Medicine, which won the Project of the Year – Public Use at the CIBSE Building Performance Awards 2018. Willmott Dixon's Khasha Mohammadian explains how Soft Landings and a Passivhaus approach at the facility are helping ensure that performance is matching design aspirations (page 36).

Our interview with Architype's Jonathan Hines – another Award winner – looks at how his practice is continuously refining the Passivhaus approach, to design an increasing number of high-quality buildings that hit performance targets (page 30).

ALEX SMITH, EDITOR asmith@cibsejournal.com

CONTRIBUTORS

Hywel Davies discusses the likely impact on building services of decarbonisation of gas and electricity in the near future

Liza Young looks at whole-life carbon and how it's calculated in a new guide, and visits the Technical Symposium

Julie Godefroy introduces a new column looking at the latest consultation papers relevant to the industry

Tim Dwyer explores the impact of radiant heat transfer and considers radiant sails for room conditioning

CONTENTS

Commercial heating Special

The latest news in the heating sector plus articles on heat network design; gas CHP; best practice in boiler design; RHI changes; retrofitting boilers; and limescale prevention in hot-water systems CPD

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TALL BUILDINGS REACH NEW HIGH IN LONDON

A record number of tall buildings is under construction or planned in London, according to the forum New London Architecture (NLA). Its fifth London Tall Buildings Survey reported that 510 towers above 20 storeys are planned, with 115 under way; 458 are residential and could provide 106,000 homes. However, the survey suggests completing tall projects is more problematic, with only 18 finished last year – down by 30% on 2016. There was also a 25% fall in the number of project starts, to just 40 in 2017. NLA chair Peter Murray said: 'With demand for new homes getting higher, well-designed, tall buildings, in the right place, are part of the solution.'

New EPBD to pave way to zero-emissions buildings

Directive calls for uptake of smart energy systems and technologies

The European Parliament has voted to approve a revised version of the Energy Performance of Buildings Directive (EPBD). It aims to increase the number of building renovations and drive the market for smarter energy systems for new buildings. Officials want the changes to address the fact that almost 75% of buildings in Europe are considered 'energy inefficient'.

The revised directive calls for the wider use of smart technologies to increase the market penetration of automation and control systems, supports the introduction of new infrastructure for e-mobility in new buildings, and establishes a path towards zero-emissions buildings by 2050.

The European Commission said the revision would also introduce mechanisms to deliver the high level of investment needed to carry out the many building renovations envisaged.

Maroš Šefčovič, the Commission's vice-president for the Energy Union, said renovating and making buildings smarter would lead to lower energy bills, better health of occupants, protection of the environment and reduced emissions, 'given that more than a third of these are produced by buildings'.

'As technology has blurred the distinction between sectors, we are also establishing a link between buildings and e-mobility infrastructure, and helping stabilise the electricity grid,' he added. 'Another building block of the Energy Union has been laid today – let us continue ahead.'

UK should stick with European standards

The UK should maintain 'harmonised' technical standards with the rest of the world after Brexit, according to the Federation of Environmental Trade Associations (Feta).

At its annual lunch, chair John Smith said the organisation supported the BSI's ambition of staying within the broader European standards system to avoid 'conflicting standards being used in the UK and the rest of Europe'.

He committed the industry to supporting the Department for Environment, Food and Rural Affairs as it works out how to deal with 'the quirks' of the F-Gas regulation to maintain the UK's progress on reducing global-warming refrigerant gas use.

Material prices squeeze margins

Rocketing material prices are squeezing the margins of small builders, who are passing on the costs to customers with potentially serious consequences for the economy, according to the Federation of Master Builders (FMB).

SME builders are reporting waiting times of more than a year for boilers and bricks, as well as lengthy delays in the availability of roof tiles, insulation, slate, windows, blocks, porcelain, plasterboard and timber.

As a result, more than half of SMEs (56%) have had their margins squeezed – up from 32% in July 2017 – and 49% of firms have passed material price increases onto clients.

IN BRIEF

Stagnation before a bounce, says CPA

Construction output dipped by 1.6% in February, largely because of a 9.4% fall in infrastructure activity, according to the Construction Products Association (CPA). All sectors suffered, apart from private housing, which enjoyed growth of 2.8% – but output as a whole was down 3% compared with the same period a year ago. This was driven by the continued decline in repair and maintenance work, which fell by 2.6% in February 2018. The CPA believes the industry will 'stagnate' this year before speeding up in 2019 with growth of 2.7%. There will be a further bounce of 1.9% in 2020 as major infrastructure projects gather pace.

Gender diversity not just a women's issue

RIBA's Improving Gender Diversity in Architecture event revealed an average 36% gender pay gap in construction. It also showed that just 9% of engineers in the UK are women, and only three out of Europe's top 100 architecture firms are led by a woman – all in Scandinavia. Attended by more than 300 people, the event considered a range of tactics to achieve more balanced gender representation. These included promoting gender diversity for its positive effect on productivity and profitability, and the importance of organisations keeping diversity in mind when reviewing their succession and career-development plans.

Spie wins NHS refurb

Spie UK has been awarded the contract to strip out and refurbish the pathology laboratory in New Fountain House, for Tameside Glossop Integrated Care NHS Foundation Trust. The contract is worth £534,000, and will be carried out over a 10-week period.

Support for Aldous' bid to ring-fence retention payments

Petition is 'extra push' to convince the government to adopt MP's bill to amend Construction Act

A coalition of 76 trade bodies – representing more than 355,000 businesses – has delivered a petition to 10 Downing Street calling for urgent reform of payment practices in the construction industry.

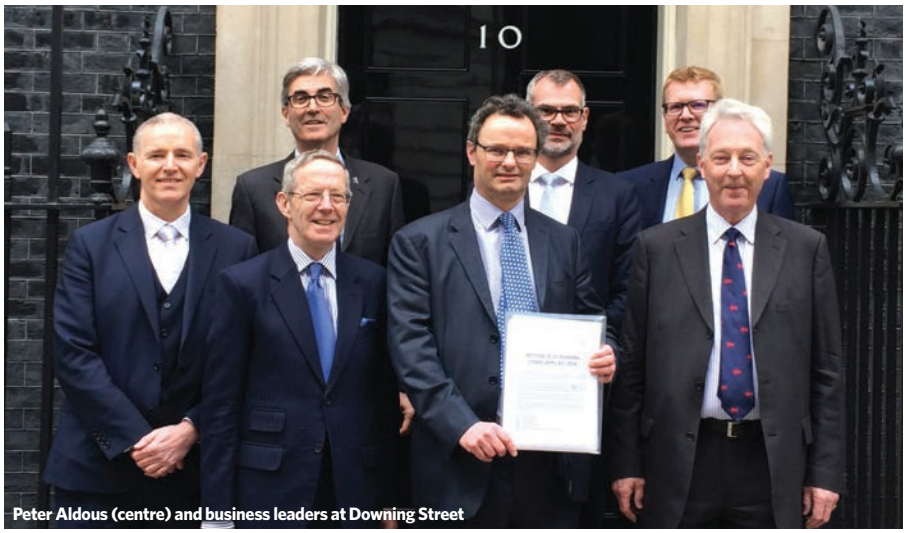
The delegation was led by Peter Aldous MP, who has introduced a bill to parliament that seeks to amend the Construction Act so that retention payments can be protected in ring-fenced trust accounts.

The petition called for the bill to receive a fair hearing and for its measures to be adopted to bear down on the growing problem of small business debt in the wake of the collapse of Carillion. 'We are stepping up the pressure on this crucial issue,' Aldous told supporters gathered in Parliament Square. 'We are seeking to level the playing field so small firms are not continually forced to go cap in hand to large contractors.'

Carillion was holding £800m of suppliers' money when it went into liquidation and this money has been designated as 'unsecured debt' by the company's liquidators – meaning it is unlikely to be recovered.

'Ironically, we were ahead of the game on this issue in 1993, when Sir Michael Latham carried out his first review of the construction industry,' said Aldous. 'If his proposals had been adopted, we would not have to be doing this now.'

Aldous said the petition was the 'extra push' needed to convince the government to adopt the bill and give it a significant amount of parliamentary time.



Peter Aldous (centre) and business leaders at Downing Street

Government considers barring bad payers from public sector work

The government has promised to 'level the playing field' for smaller businesses in the wake of the collapse of Carillion, and exclude bad payers from government work.

Minister for Implementation Oliver Dowden said he would exclude suppliers from major government procurements if they could not demonstrate 'fair and effective payment practices' with their subcontractors.

Small and medium-sized enterprises (SMEs) may also be given greater powers to report poor payment performance, and government suppliers will have to advertise subcontracting opportunities via the Contracts Finder website. They will also have to supply data showing how SMEs are being given opportunities to tender for central government projects.

'We have set a challenging aspiration that 33% of procurement spend should be with small businesses by 2022 – and are doing more than ever to break down barriers for smaller firms,' said Dowden.

The government has also promised to look at wider adoption of project bank accounts via a series of workshops examining how they could work on public sector projects.

Grenfell refurbishment work blamed for deaths

Fire-protection strategy undermined, allowing flames to spread, says leaked report

A report for the Metropolitan Police that was leaked to the press pins the blame for all of the 71 deaths in the Grenfell Tower fire on poor standard refurbishment work.

The report, by BRE Global, said the fire should not have spread beyond the flat where it started and would not have taken any lives if the tower's original façade had not been over-clad between 2014 and 2016.

Five clear breaches of the Building Regulations are alleged in the report, including: poorly installed cavity barriers; spaces in window frames filled with materials – such as rubberised membrane, uPVC lightweight panels, and even paper – that provided fuel for the fire rather than resistance; the use of combustible insulation and aluminum composite materials; and missing door closers. These weaknesses undermined the fire-protection strategy for the building and allowed flames to spread up the outside and then penetrate into other flats. The cavity barriers were too small in many places, which created a chimney effect on the exterior, according to the report.

The lack of door closers contributed to smoke filling the stairwells as occupants tried to escape. In addition, the report points out that the building should have had a wet riser main to help the fire crews, rather than a dry riser.

According to the report, which was leaked to the *Evening Standard*, it was the combination of factors – rather than individual failings – that led to the 71 deaths.

RIBA attacks Hackitt Review

RIBA has criticised the direction taken by the review, led by Dame Judith Hackitt, set up following the Grenfell Tower fire and called for a 'thorough rewriting' of the Building Regulations. The architects' body has raised 'serious concerns' and complained to the Secretary of State for Housing, Communities and Local Government, Sajid Javid, that its recommendations to the review panel have been ignored.

Former RIBA president Jane Duncan – who chairs an expert group on fire safety set up by the body to advise the inquiry – said its recommendations to ban flammable cladding, require sprinklers to be fitted and ensure there is a second means of escape for high-rise residential buildings 'seem to have been overlooked'. The group recommended that: external walls of buildings more than 18m in height be constructed of non-combustible (European class A1) materials only; more than one means of vertical escape from new, multiple occupancy residential buildings taller than 11m; and that sprinklers/automatic fire-suppression systems be retrofitted to existing residential buildings above 18m and installed in all new and converted residential buildings.

In its letter to the Secretary of State, the RIBA group said there should be a 'thorough rewriting of the Building Regulations and guidance on all aspects of fire safety, to avoid continuation of the regulatory failings that led to the Grenfell Tower fire'.

'Utter inadequacy' of safety tests exposed

The Association of British Insurers (ABI) has called for urgent reform of fire-safety tests for building materials after its research exposed 'the utter inadequacy' of the current lab regime.

In the wake of the Grenfell Tower blaze, the ABI asked the Fire Protection Association (FPA) to carry out controlled experiments, recreating more realistic building conditions than those in which the standard tests are done.

Currently, test fires are made up only of wood, whereas around 20% of the materials involved in modern-day blazes are plastic. Cladding materials, meanwhile, are tested as a sealed unit, but – on a building – would often include gaps and cover a greater area. Tested materials also tend to be in manufacturer condition, not pierced by things such as vents or ducts as they would be in actual use.

The FPA's experiments showed that overlooking such factors could have serious implications. For example, a fire it set containing plastic created flames that were one metre longer than a wood-only fire, and it was 100 degrees hotter. This means a blaze containing plastic is likely to spread faster and create higher temperatures – at which building materials, such as aluminium, lose strength. A lot of cladding, including that used on Grenfell Tower, is made up of aluminium composite panels.

Huw Evans, director general of the ABI, said: 'It is a matter of urgency that we create the right testing regime that properly replicates real-world conditions and keeps pace with building innovation and modern design.'

The ABI's full report is at: **bit.ly/2Fio1en**

Barratt to pay for Croydon cladding

Housing Minister Sajid Javid has urged other developers to follow the example of Barratt Developments and pay for the replacement of cladding identified as unsafe since the Grenfell Tower tragedy.

Barratt has agreed to cover the £2m cost of replacing unsafe cladding on the Citiscape development in Croydon, which made national headlines because of the distress caused to residents, who were told they would be liable for the work. 'I applaud Barratt Developments' decision to cover the costs of fire-safety works,' said Javid. 'They have listened to the concerns of Citiscape residents, engaged with government and have done the right thing.

'Other building owners and housebuilders in the private sector should follow their example to protect leaseholders from costs and begin essential fire-safety works. I want to see all leaseholders in this position get the peace of mind they deserve.'

New £72m innovation hub aims to link up industry and academia

Government project to develop and commercialise emerging technologies

Innovate UK is to spend £72m on creating a 'core innovation hub' designed to support collaboration between industry and academia.

UK-based research and technology organisations are being invited to compete for the funds. They must demonstrate that they can work with other construction bodies and businesses to address productivity problems and improve skills.

The hub is intended to develop and commercialise new digital and manufacturing technologies for construction. It will focus on: creating better-performing built assets; increasing the industry-wide adoption of emerging digital and manufacturing technologies; and designing new processes to improve productivity in construction.

The project is part of the government's Industrial Strategy Challenge Fund, which has been set aside to help construct buildings 50% faster, 33% cheaper and with half the lifetime carbon emissions.

'To be successful in their application, the research and technology organisations will need to demonstrate there is a commitment from the private sector to invest and use the hub once it is complete,' a government statement said.

BEIS may upgrade Boiler Plus scheme

The Department for Business, Energy and Industrial Strategy (BEIS) is already considering plans to extend the new Boiler Plus domestic efficiency scheme.

Aaron Gould, the department's senior policy adviser, told an event hosted by Baxi and Ecuity Consulting that BEIS had discussed the idea of a 'Boiler Plus Plus', which could build on the recently launched scheme.

Under the current programme, all boilers installed in UK homes must achieve heating efficiency of 92%, and combination boiler installations must be fitted with weather compensation, load compensation, flue gas heat recovery, or smart control with automation and optimisation.

'We've come pretty close to the limits of what you can do with the efficiency of a boiler, so we don't have plans to raise those standards further – but we could consider extending them, so that the energy-saving measures apply to all gas boilers, not just the combis,' said Gould.

He added that BEIS planned to evaluate the impact of Boiler Plus one year after implementation and again after five years.

'In five years, we will be conducting a more comprehensive evaluation and a report on the carbon saved and the reduction consumers will have seen in their bills,' said Gould.

Toshiba switches to R32 refrigerant

Toshiba UK is converting all of its residential and light commercial air conditioning products to the lower global warming refrigerant gas R32.

Managing director David Dunn has told distributors there will be no further shipments of R410A splits, multi-splits and light commercial units from Japan – and its existing stock of R410A units will run out later this year. Its variable refrigerant flow (VRF) equipment will continue to use 410A for now.

The phase down of global warming gases under the European F-Gas Regulation has led to soaring prices and supply restrictions for 410A. It has also raised safety fears, as some contractors have tried to retrofit equipment with unsafe gases. 'Unless we start cutting back on the use of R410A, the general consensus is that most manufacturers will hit a brick wall in the middle of 2019, if not earlier,' said Dunn.

'R32 may be a transitional refrigerant, but – as of today – it is the best alternative.'

More on refrigerants on page 51.

Movers and makers

Skanska's M&E business boss Russell Hallmark has left the Swedish construction firm as it slims down from eight to six divisions. London & South East and Central & Regions are being brought together, with **Steve Holbrook** (pictured) as MD.

Robin Vollert (pictured) has taken over as managing director of Swegon Group UK & Ireland, after the retirement of Kevin Munson. Vollert spent 16 years with IMI's indoor climate division before joining Swegon in 2013.

Engineering consultancy PSH has promoted four of its team in a restructure. **Andrew Haskins** (pictured) and **Ian Law** are directors for the mechanical team, **Charlie Cross** for electrical, and **Mark Whitfield** project management.

BakerHicks has appointed **James Chorley** and **Graham Furness** as head of mechanical and head of electrical, respectively. Chorley (pictured) will oversee the delivery of sustainable building services designs. Furness has more than 45 years' experience and has managed data centres for clients such as Goldman Sachs and Barclays.

Thomas Lindner has been appointed to manage information across the Hurley Palmer Flatt groups. He has more than 20 years' experience in property and construction, including standards compliance and performance measurement at BRE's Constructing Excellence platform.

IN BRIEF

ESOS and ISO 50001 go head to head during webinar

A webinar explaining the differences between ESOS and ISO 50001, and helping attendees understand which option is best for them, is now available on demand.

Presented by Andrew Geens, head of CIBSE Certification, and John Field, energy management director at Noveus Energy, the webinar discusses two main routes to ESOS compliance: Standard ESOS Audit Report and ISO 50001 Certification. It includes facts, guidance and impartial advice on which of these routes is most suitable for different organisations and why.

To view the webinar and the presentation slides visit **www.cibsecertification.co.uk/News/Webinar-ESOS-and-ISO-50001**

Awards recognise Hong Kong engineers

Two Hong Kong figureheads have been recognised with awards for their contribution to the industry.

CIBSE President Peter Y Wong was awarded an Honorary Fellowship of the Hong Kong Institution of Engineers (HKIE). He was presented with the award at the HKIE Annual Dinner in March, in recognition of his more than 30-years' contribution to the Institution and industry.

Wong was the founding chair of the Building Services Division of HKIE, and past chair of the Electrical Divisions and Electrical Discipline. He was HKIE president in 2008-09, and is currently chair of the Accreditation Board, representing Hong Kong. He had held the post of chair of the Engineers Registration Board with the statutory duty to oversee qualification and practice of all disciplines of engineers working in Hong Kong.

In April, Alfred Sit Wing Hang, was presented with a CIBSE Distinguished Steward certificate, for his commitment to the CIBSE Hong Kong region.

Sit is director of Electrical & Mechanical Services Department (EMSD) of the HKSAR government, and is responsible for introducing new technologies in healthcare, renewable energy and smart technologies.

Save the date

The 2018 Build2Perform Live event will take place on 27-28 November at London's Olympia. To receive up-to-date information, register at **www.build2perform.co.uk**

International Task Force to steer Institution

Group will help develop initiatives to build CIBSE's international membership

A new group has been formed to help steer CIBSE's international presence and influence. The International Task Force will offer guidance on where to focus efforts internationally, putting in place a formal structure to monitor and manage initiatives that seek to develop and support CIBSE's membership abroad.

The group includes CIBSE staff and volunteers from across the globe, including the UAE, Singapore and Sri Lanka.

Each individual brings with them a wealth of experience, skill and knowledge of their market and the various CIBSE international processes and structures that are currently in place.

The group, led by Lynne Jack, CIBSE vice-president and professor at Heriot-Watt University Malaysia, is keen to help develop CIBSE's international footprint.

She said: 'Although everyone is very active in their respective regions, there is a real opportunity to work collectively to support membership both in the UK and internationally. Forming this group is a positive step forward in developing CIBSE's presence across the globe and I look forward to the exciting initiatives ahead.'

CIBSE debate divides panellists

The linear economy wreaks planetary havoc – stretching new ideas are vital for sustainable future cities. This statement sparked a lively debate at the Technical Symposium in April.

Speaking for the motion, George Adams, UK engineering director at Spie, said we should design buildings that are flexible and adaptable for reuse. He said: 'In 2015, 9 million people died from pollution-related issues. We can't solve these problems by using the same thinking that created them in the first place.'

Clare Wildfire, of Mott MacDonald, who spoke against the motion, said we should focus on other things to cut emissions. She said if, as a species, we ate 25% less meat, we wouldn't exceed the 2°C global warming limit. 'It turns out that diet and land use can make a bigger difference than transport and buildings.

'If a billionaire can send us to Mars, surely we can make a more sustainable burger.'

CIBSE's head of sustainability development Julie Godefroy, who was for the motion, said we only have 6-7 years' worth of landfill space left in the UK. She added that offsite construction, data services for a sharing economy – such as Uber and Airbnb – could help counter this.

Tony Day, who was against the motion, said, as sea levels rise, the population will move inland. 'This means new infrastructure and new material needs. How will the circular economy meet this?

'All consumption creates entropy, so circular economy is impossible. But I like the idea of a progressive economy. We need a solution that takes human selfishness into account.'

Adams added: 'The linear economy brought us a long way but, if we're going to have billions of people, we need to share resources.'

The class of 2017: last year's CIBSE Young Engineers Awards winners

Enter the CIBSE Young Engineers Awards 2018

Graduate engineers get chance to shine in front of industry audience

Entries are now invited for the 2018 CIBSE Young Engineers Awards. The awards recognise the hard work, innovative thinking and skills of graduate engineers, while also showcasing employers who are committed to developing the industry's young talent.

The annual CIBSE Graduate of the Year Award is one of the industry's most sought after accolades, with the winning graduate receiving a trip to the ASHRAE Winter Conference in Atlanta, where they can take part in the meeting and explore the host city.

Two runners-up will be presented with cash bursaries by The Rumford Club and all other finalists each receive £100 courtesy of The Manly Trust.

Any engineer who has graduated in a building services-related field – at either undergraduate or postgraduate level – in the past two years is eligible to take part.

For the Employer of the Year Award, there are three categories – small, medium and large employers – giving all companies, irrespective of size, the opportunity to demonstrate how they place young engineers at the centre of their business, and invest in their career progression.

The judges will be looking for evidence of innovative methods of engaging and motivating young engineers, and encouraging them to fulfil their potential.

For more information and to enter the awards, visit **www.cibse.org/young-engineers-awards**

The Young Engineers Awards 2018 will take place on 11 October at the Institution of Mechanical Engineers (IMechE). They are sponsored by Swegon Air Management, Kingspan Industrial Insulation, Andrews Water Heaters and CIBSE Patrons, and supported by IMechE and ASHRAE.

New members, fellows and associates

FELLOWS

Chan, Hok Tung
Shatin, Hong Kong

Leung, Wing Hong
Hong Kong

Munson, Alan William
Colchester, United Kingdom

MEMBER

Lecci, Francesca
London, United Kingdom

Lai, Sai Yin
Hong Kong

Lo, Siu Wa
Hong Kong

Neary, Sean
Roscommon, Ireland

O'Sullivan, David
London, United Kingdom

Watson, Alan Michael
Weston-super-Mare, United Kingdom

Wong, Chun Kit
Tai Po, Hong Kong

Coolen, Kentish Cobarlen
Cork, Ireland

Cheng, Wing Ho
Tsuen Wan NT, Hong Kong

Leung, Kwai Wah
Tai Kok Tsui, Hong Kong

Lee, Lap Cho
Tsuen Wan, Hong Kong

Lam, Sheung Tai
Aberdeen, Hong Kong

Bailey, Scott Michael
Sai Wan, Hong Kong

Lau, Yiu Keung
Tseung Kwan O, Hong Kong

Leung, Chi Hang
Tai Wai, Hong Kong

Tang, Yu Kit
Ngau Tau Kok, Hong Kong

Chan, Kuen Yip
Tseung Kwan O, Hong Kong

Cheng, Kwong Wing
Hong Kong, Hong Kong

Kwok, Wang Yau
Tung Chung, Hong Kong

Man, Ho Hin Keith
Sha Tin, Hong Kong

Wong, Yee Mei
Ma On Shan, Hong Kong

LICENTIATE

Porter, Rachael
Cambridge, United Kingdom

Turner, Charles
London, United Kingdom

Gravett, Michael
London, United Kingdom

Shah, Rachit
Harrow, United Kingdom

Halliwell, Jemma Louise
Manchester, United Kingdom

Lenahan, Jake
Manchester, United Kingdom

Is your membership application ready?

The closing date by which engineers in the UK can next apply for the Associate (ACIBSE) and Member (MCIBSE) grades is 1 August 2018. Applicants must ensure their submission includes:

- Application form signed and checked by their sponsor
- Work experience listing/CV
- Practice report (4,000-5,000 words)
- Organisation chart
- Development action plan
- Qualification certificates, if required, signed by their sponsor
- Relevant fees

For details of the requirements and application process visit: **www.cibse.org/membership**

If you are looking to gain IEng or CEng registration - but are not sure if you satisfy the requirements - get in touch with details of your academic qualifications. We can then advise the best route to registration. If you do not have any academic qualifications, you can still gain IEng or CEng by completing a technical report or undertaking further learning.

CIBSE offers a wide range of support for applicants, ranging from workshops to briefing sessions, webinars and phone surgeries, visit **www.cibse.org/briefings** for details. There are sample reports, interview documentation and other useful information in the applicant help pages at **www.cibse.org/applicanthelp**

For further information contact **membership@cibse.org** or +44 (0)20 8772 3650.

ANZ Benevolent Fund contribution

The CIBSE Western Australia (WA) Chapter, of the Australia and New Zealand (ANZ) region, made a donation of $10,000 to the CIBSE Benevolent Fund.

The WA Chapter, chaired by Peter Whalley, holds a very successful Christmas Luncheon every December. This event has grown in popularity over the years, through the hard work and dedication of the committee. The surplus funds generated from this and other events over the past couple of years have contributed the $10,000 for the fund. Paul Angus, CIBSE ANZ chair, said: 'This cheque will make a key difference to those who need it the most.'

The Benevolent Fund offers help to CIBSE members, former members and dependants who are in need, whether through sickness, bereavement or financial hardship. For more, visit: **www.cibse.org/cibse-benevolent-fund**

FEEDBACK

John Moss: We must cut emissions as fast as we can to keep up with population growth

EPC ratings; meeting 2050 emissions targets; and controls are this month's topics

Get real

It was interesting to read other members' comments about EPC ratings in the Feedback section of April's *CIBSE Journal*. For about two years, I worked as an energy assessor, producing EPCs for domestic and commercial properties. I think EPCs are valid in the industry, but there is little transparency to the building owner or occupier about what an EPC actually is – just a benchmarking system based on lots of assumptions.

The SAP and SBEM calculation methodologies were a good step in rating building performance; however, the concept of bundling together building-fabric performance with the performance of the building services and resulting carbon emissions, in one calculation method, is not realistic when considering possible changes to the building systems, building use and carbon factors over the lifetime of the building.

Another issue seems to be that important decisions about the services specified are often based on the need to comply with the SAP and SBEM calculations, with little emphasis on the practicalities of equipment maintenance, service lifetime or in-service functionality.

EPC ratings and compliance should be based on the performance of the building fabric and good building physics, putting the emphasis on build quality. Building services should be covered separately in the Building Regulations, with system specification based on the progressive development of best-practice standards as lessons are learned from operational buildings and as new technology comes onto the market.

More emphasis should be placed on in-use energy and the quality of the indoor environment for the occupants.
Martin Skinner MCIBSE

Rising pressure

The UK's predicament in trying to meet the target of 80% reduction [in carbon emissions] cannot be overstated, and your April editorial deserved to be printed in fluorescent red. If the UK's population increases to the forecast 85 million in 2050 – from the 50 million in 1990 – we have to decrease our per capita emissions not just to 20%, but to around 12% of the 1990 values. This is a far more severe reduction than for the rest of the EU, and has to be made in a period when we will have to increase our industrial production just to trade for the same per capita imports as we do now. If the present population is around 65 million, industrial production has to increase by around 30% by 2050, even if the City's and tourism's contribution to the national income also increase, pro rata, with the population increase. As you say, we have to start cutting greenhouse gas emissions by all sources as fast as we can.
John Moss

LinkedIn members discuss system design and control strategies

Nick Skemp
At concept design stage, it's essential to consider from the outset system dynamic operation over the full load range, correct system layout/hydraulics, controllability and commissionability. These skills are not generally taught on building services degree courses, leaving engineers with a significant knowledge gap.

Mike Beanland
In my career, in large refurbishments, plant costs and value engineering were a severe restriction on the initial systems design. We, as engineers, must look at a complete system and its design history before final controls and building performance criteria are assessed.

Paul Norton
Lots of development is going on using node red (NR) and other open-source protocol, reliable, generic hardware and IoT. Design engineers will be writing the software forming part of the specification. By having a full understanding of open-source software, such as NR, there will be no more proprietary systems, no more front ends – simply apps on your portable devices. Such systems will become cheap to install and design engineers and clients will no longer feel helpless.

Nick Skemp
I've worked with colleagues in the process sector – oil, gas, pharma – and most of them look down on us building services and controls folk. Building systems and controls have to cope with huge changes in load because of weather and building occupancy. They also involve multiple plant interactions and can be very difficult to engineer. They are rarely properly funded.

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Emily Marner

Team leader

After winning the Yorkshire Region Young Engineer of the Year Award, **Emily Marner** explains what gives her confidence on site

Emily Marner joined SES in 2008, as an electrical apprentice. She attended Leeds College of Building, where she honed her practical skills and began her academic journey. Before completing her apprenticeship, Marner became electrical site supervisor at a school in Hull, in charge of managing SES's labour, ordering materials, attending programming meetings, resolving design issues, liaising with the main contractor and finalising operation & maintenance manuals. She then joined the SES Engineers Programme, which led her to complete the HNC in building services in 2016, and embark on the HND.

While completing the courses, Marner was site engineer on the University of Hull project, delivering the project electrically, procuring the specialist subcontractors and main items of electrical equipment, and presenting the technical proposals to the client for sign-off. She also regularly visits schools and colleges to encourage pupils to consider a career in the construction industry.

Q What was it like to win the Yorkshire Region award?
A I am still flabbergasted. It's such an honour to have my hard work recognised, and it really inspires me to progress, work harder, and achieve more.

Q What inspired you to become an engineer?
A My uncle works in construction and, after spending a day on site with him, I knew the industry was for me. I feel lucky to have found a job I truly enjoy; watching a building progress from a design to a fully commissioned, working facility gives me a huge sense of satisfaction.

Q You joined SES as an apprentice – why is this a good route into the industry?
A I couldn't imagine being on site, doing my current role, without having been an SES apprentice. The experience gives you invaluable insight into the day-to-day tasks of an engineer, and you learn a lot from experienced team members.

Q What is the biggest lesson you learned as the lead electrical engineer on the University of Hull project?
A To believe in myself. There are days when you face a problem and you really question if there is a way around it – but now I look back at those scenarios and it reminds me that there's always a solution. My time working on the project provided the largest of learning curves and, from tackling these problems, came the most valuable lessons.

Q What gave you the confidence to lead on site with experienced, older engineers?
A Every engineer, no matter what level of experience, deserves to be spoken to with respect, and I apply this rule at all times. I find that honesty with your peers is extremely important, so – if you're not sure about something – just ask. This helped me to gain respect from the team, as did working hard, and being positive and proactive.

Q Do you think it is essential to go on site?
A It's absolutely essential to carry out my role successfully. It's important to see the site, the people, and the workmanship first hand. It's also key for building relationships with other team members.

Q What would you like to do in the future?
A I am almost halfway through my degree, so completing that is my short-term goal – along with the successful completion of my current project.

I believe that experience is key to creating a well-rounded project engineer, so I plan to remain in this role for a few more years, and get involved in a wide range of projects, before considering progression to a more senior role.

Q Are women underrepresented in building services? If so, how can this be tackled?
A When I was at school, there was no mention of construction as a possible career option for females. I believe that if we wish to encourage more women into the industry, education is the place to start. For me, all it took was one person to plant the seed and an extremely exciting and satisfying career lay ahead of me.

EMILY MARNER is a student engineer at SES Engineering Services

For more information on SES apprenticeships visit **www.ses-ltd.co.uk**

Making the right choices for a low carbon future

How we generate electricity is changing; new storage media are emerging; combustion engines are giving way to EVs; and we are rethinking how we heat buildings. **Hywel Davies** looks at what this means for building services

The UK is committed by the Climate Change Act and Paris Agreement to reduce carbon emissions significantly. This has implications for the fuels used to generate electricity, how buildings are heated and connected, and how increasing mobility is powered. It must also have a fundamental impact on how much energy is used.

The UK is also committed to leaving the EU. Whatever that means for the future, its current membership of the union – as well as the Clean Growth Strategy – oblige it to review minimum energy efficiency standards for buildings, starting later this year. In England and Wales, this means the respective versions of Part L; in Scotland, Section 6; in Northern Ireland, Part F. The Republic of Ireland is already reviewing its Part L, and our members are busy with that review.

There is new legislation on the energy efficiency of rented buildings, seeking to drive improvements – and, in April, the European Parliament approved the final text of the revised Energy Performance of Buildings Directive, or EPBD. While this is not due to come into force until December 2019, it is highly likely to feature in the transitional arrangements as the UK leaves the EU.

The way that energy is distributed and buildings are interconnected is also changing, as we embrace 'smart' grids, cities and technologies. We are moving from a centralised energy supply and distribution system – perhaps epitomised by the name of the former Central Electricity Generating Board – to one in which a building can be a power station.

Finally, in England at least, we await the report on the Independent Review of Building Regulations and Fire Safety, led by Dame Judith Hackitt. Based on her interim findings, we can expect her to advocate significant changes in the way we build, manage, maintain and regulate buildings.

We are in a period of profound change – but what might that change entail for building services engineers, or for the Institution as we develop guidance and recognise competence?

"The challenge is to replace or decarbonise gas, which offers flexibility to meet extreme demand"

We talk about decarbonising the electricity grid, but it isn't the whole answer. To cope with the extreme peak demand during the recent 'Beast from the East' we needed 50GW of electricity plus gas. With fair wind and coal-fired power (due to be phased out by 2023) we coped. Just.

The challenge is to replace or decarbonise gas, which offers flexibility to meet extreme demand. Battery storage and smart systems can currently balance supply and demand for a few hours; the 'Beast' stayed for a few days –nearly a month in Scotland.

The Department for Business, Energy and Industrial Strategy is consulting on the options for our future approach to heating buildings and how they may work in different building types and tenures.

But it is not sensible to plan electricity generation based on a one in five-year event. We must instead reduce demand in our buildings to cut peak exposure and the cost of providing new low carbon energy supplies.

We must reduce weather-related

DR HYWEL DAVIES
is technical director at CIBSE
www.cibse.org

peak demands to make heat pumps viable gas-boiler replacements – and we must start now.

We have a very poor record on lowering demand. Apart from the introduction of condensing boilers, there has been little regulatory intervention in the energy efficiency of building refurbishment.

We must take a common-sense approach to the energy demand of our buildings, but common sense is not very common, most certainly not when it comes to energy efficiency in buildings.

Real improvements can be made, but require timely interventions, as they can be inconvenient and disruptive. We need to target the best moments to intervene, and offer a mix of incentives and regulation to create the right market conditions.

For example, what can be done when people buy a new-to-them home, have not got a loft full of 'stuff', and want to make their new place their own? They will have just paid a healthy whack in stamp duty – but what if they were offered a slice back in return for properly designed and installed energy efficiency measures? Could that generate scale and make energy efficiency attractive? We urgently need a large-scale programme to improve the energy performance of our building stock.

This is where the Committee for Climate Change comes in. It has made it clear that the UK is not on track to meet future commitments to cut emissions under the fourth and fifth carbon budgets – so junking energy efficiency measures next April because they came from Brussels is not an option; we already have a gap to close to meet the targets.

The revised EPBD may come in handy instead. It focuses on the need for much more building-energy retrofit work, and for governments to create the financial climate in which this can happen.

We must seize the chance of the consultation on future heat, review of Part L and the new EPBD to develop a clear strategy for an energy efficient built environment – and supply the guidance and competence framework to support those who will need to deliver it.

Read Hywel Davies' blog at **cibseblog.co.uk**

Recover, recycle and reuse gases

Industry must adopt the 3Rs to cut pressure on refrigerants supply, says **Graham Wright**

The weighted quota system introduced by the 2015 F-Gas regulations aims to reduce the use of refrigerants with the highest global warming potential (GWP) – and 2018 marks the first significant cut in these quotas.

On 1 January this year, a 37% reduction came into force, after two consecutive years of 7% cuts compared with the pre-2015 baseline value. This has placed pressure on the supply of many of the most commonly used gases and led to sharp increases in the prices of refrigerants such as R410A.

In the face of such restrictions and price rises, the industry will, inevitably, have to adopt lower-GWP alternatives to R410A. R32 is proving to be the main contender as the next-generation refrigerant, because it is a very similar gas to R410A, 50% of which is actually R32. Yet it has a GWP of 675, as against 2,088 for R410A. R32 is also around 10% more efficient and has a higher volumetric efficiency. This means units can deliver the same capacity with less refrigerant and systems can be designed with much smaller components.

As a result of all these advantages, it's hardly surprising that more than 12 million R32 units have already been installed worldwide. However, while R32 is being adopted in smaller split systems, manufacturers are still working on solutions for larger systems that meet IEC60335-2-40, the updated global standard covering the use of refrigerant in DX systems. So new installations of larger systems will continue to use R410A in the short term. This means it is critical that the industry takes steps to lower the pressure on the supply of virgin refrigerants.

With F-Gas regulations quotas only applying to products that are newly 'placed on the market', recycling a greater proportion of refrigerant from decommissioned systems – and creating a circular economy – could be the answer.

Ultimately, the industry needs to place more emphasis on maximising reuse and making it easier for engineers to recover the gases. This is a key focus for Daikin. We believe that, by fostering closer collaboration between members of the supply chain, it is achievable for all refrigerants to be recovered and recycled – thus reducing the environmental impact of the industry as a whole.

DAIKIN

GRAHAM WRIGHT is legislation and compliance manager at Daikin UK **www.daikin.co.uk**

Policy matters

This new column will keep you informed of CIBSE policy work and consultations. Make sure you have your say, urges **Julie Godefroy**

Why a policy column?

Under its charitable mission, CIBSE has a duty to promote best practice for the public good and this includes informing the wider policy and technical framework, including responding to consultations from government, parliamentary committees that scrutinise the government, and professional organisations such as BSI or the BRE.

This has involved a number of high-profile issues recently, such as Brexit, the government's plans for air quality, and the response to Grenfell.

Professional organisations with technical expertise and non-commercial interests need to engage to inform policy.

Our feedback may not always be taken into account, or only slowly over a few cycles of politicians and civil servants. Nevertheless, policy work is useful to gather feedback from members, collaborate with others, and identify where engineering expertise may be needed in the future.

All consultations we engage with are available at **cibse.org/news-and-policy/consultations**

We also publicise them in newsletters and special interest groups. Do contact us if you would like to contribute, ideally through the relevant group or otherwise directly. In addition, you can submit your own responses as individuals or through your organisation.

"Professional organisations with technical expertise and non-commercial interests need to engage to inform policy"

Table 1: Schedule of current consultations

	Deadline for input to CIBSE	Closing date
Update to *Heat networks code of practice* (2015), CIBSE & ADE for BEIS	See page 7 of Heating Special	
Draft revised NPPF, MHCLG	3 May 2018	10 May 2018
Draft *Acoustics, ventilation and overheating guide*, ANC	3 May 2018	11 May 2018
Approved Document B (fire safety): amendments to statutory guidance on assessments in lieu of tests, MHCLG	18 May 2018	25 May 2018
A future framework for heat in buildings, BEIS	25 May 2018	11 June 2018
Environment principles, DEFRA	tbc	tbc

RECENT CONSULTATIONS

London Plan

Mayor of London

We took account of a wide range of contributions, including the Trees Design & Action Group, the RIBA Sustainable Futures group, and air quality consultants. We also gathered views at a City Hall workshop. Our response included:

- Broad support for the mayor's ambitions
- The need for more specific targets and monitoring in key areas such as air quality and green infrastructure
- The need for a new approach to deliver carbon savings, moving away from Part L to more relevant metrics, and with monitoring and disclosure of operational performance. These recommendations are largely aligned with those from the London Energy Transformation Initiative (LETI)[1].

Improving Air Quality: Joint inquiry from the Environment Food and Rural Affairs, Environmental Audit, Health, and Transport Committees

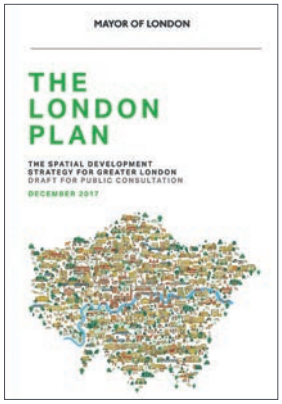
CIBSE pointed out a number of failings in the government's plans for air quality, including:

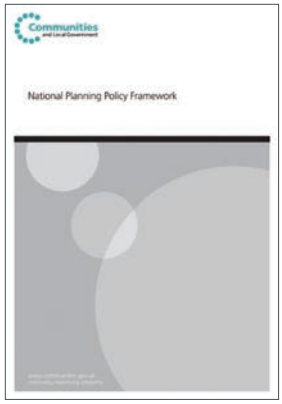
- Targets should be aligned with the health-based World Health Organization guidelines, which are more onerous than current legal targets
- In addition to reducing transport emissions through vehicle switch, we recommend introducing measures such as energy efficiency and planning the built environment to facilitate walking and cycling
- Lack of regulatory framework for indoor air quality.

Minimum Energy Efficiency Standards, BEIS

Private landlords in England and Wales must now ensure their properties meet Energy Performance Certificate (EPC) Band E or better. The Green Deal was initially meant to ensure this would be at no cost to landlords. The government now proposes to require some contribution from landlords, capped at £2,500. This means two-thirds of target properties would not reach EPC E.

We welcomed the principle of a landlord contribution, but recommended revisions so the majority of properties would reach EPC E. The government must show clear commitment to energy efficiency.





Heatwaves: Adapting to Climate Change inquiry, Environmental Audit Committee

We highlighted a number of gaps in the government's plans for adapting to climate change; we recommend current and future overheating risk should be better addressed in Building Regulations. CIBSE research manager Anastasia Mylona has now been invited to give further evidence to the Committee.

CURRENT CONSULTATIONS

Future Framework for Heat, BEIS

Heat decarbonisation is one of the most complex challenges to cut energy use and carbon emissions. The consultation seeks views on phasing out high-carbon heating in buildings off the gas grid during the 2020s, and on a longer-term framework for national heat decarbonisation. This is a significant technical and policy area, and we will be liaising closely with BEIS as we develop our response.

Acoustics, Ventilation and Overheating Guide, Association of Noise Consultants (ANC)

The ANC has drafted new guidance on balancing ventilation, noise, overheating and acoustics in residential development.

National Planning Policy Framework, MHCLG

The proposed revised NPPF intends to facilitate the government's plans for housebuilding; it introduces changes on issues including local plans and the presumption in favour of sustainable development.

Environmental Principles, DEFRA

The current Withdrawal Bill may lead to lower environmental standards and governance[2].

DEFRA has acknowledged these concerns, and a consultation on Environmental Principles is expected imminently.

References:

1 See also 'Leti and the London Plan', *CIBSE Journal*, January 2018, and details at **www.leti.london**
2 See 'Achieving a Green Brexit', *CIBSE Journal*, January 2018

JULIE GODEFROY MCIBSE is head of sustainability development at CIBSE (maternity cover)

Smart thinking a digital reality

The building services industry is only just scratching the surface, says **Robin Vollert**

We live in a 'smart' digital age, but it's hard to believe when you see how some buildings approach the control and maintenance of their services. Digital technology is already a fundamental part of how we live. It is also at the heart of some of the most exciting building projects.

Consider The Edge in Amsterdam, home to the Deloitte accountancy firm and rated among the 'greenest' office buildings in the world – and the smartest. It boasts Ethernet-linked lighting with sensors that measure temperature and carbon dioxide levels. Even the building's coffee machine is linked to the BMS and occupants can use an app to access every facility via their smartphone or laptop – it can even show them where to park their car.

That's at the cutting edge, but why shouldn't more mundane building tasks take inspiration from this kind of smart approach? We often hear arguments that it is too 'risky' to integrate smart tech into building systems – this is often code for 'too expensive'.

In fire safety, which is in the spotlight after the Grenfell Tower tragedy, you could argue it is more risky not to make this investment. For example, it has been possible for some time to ensure fire and smoke dampers in a building are tested and serviced regularly without physically accessing the ventilation system.

Maintaining dampers can be disruptive if someone needs to get into the ductwork, so this is often delayed or cancelled. Instead, a test can be instigated by the BMS linking on a regular, pre-programmed basis, without the need for human intervention.

Even finding dampers to see if they need servicing can be a tricky business – particularly in large and complex buildings such as hospitals. With remote monitoring, each one can be mapped and tracked – and in high-rise, residential buildings, landlords can arrange for testing to be pre-programmed, avoiding the need to disrupt the lives of tenants.

Control panels can be integrated into existing data networks and the client's building management strategy, which is essential for easing maintenance and reducing its cost.

As well as making buildings safer, an initial investment in smart digital connectivity dramatically reduces lifetime ownership costs. You couldn't really argue that it is cutting edge any more, but it is certainly smart.

Swegon Air Management

ROBIN VOLLERT is the new managing director of Swegon Group UK&I. **www.swegonair.co.uk**

INFORM, CHALLENGE AND ENTERTAIN

Indoor air quality, circadian lighting and decarbonisation of the Grid were among the topics at last month's CIBSE Technical Symposium at London South Bank University. **Alex Smith** and **Liza Young** highlight some standout papers


Tony Day

The 8th CIBSE Technical Symposium again demonstrated the enormous breadth of expertise within building services, as speakers presented papers on everything from underground salad farms to capturing heat from the London Tube network and energy efficient supermarket delicatessen cabinets.

Delegates gained insight into the latest guidance, legislation and rating schemes to affect their profession, including Design for Performance and Breeam 2018 (see panel 'Breeam 2018 targets actual performance').

A record 250 people packed the event at London South Bank University (LSBU), which was hosting a CIBSE symposium for the first time. The delegates were welcomed by LSBU's acting director of research and enterprise Andy Ford, who spoke about when the college was established – as the National College for Heating, Ventilating, Refrigeration and Fan Engineering – to help retrain military personnel after World War II.

The venue was familiar territory for many, including opening speaker Tony Day and Tim Dwyer, who spent numerous years teaching at the university, and architect Julie Futcher.

Knowledge exchange

The symposium was set up to encourage academics and practitioners to share expertise and experience, so it was appropriate that Day started the presentations by urging industry to work more closely with universities. Often, he said, there was risk associated with innovation and it had to be shared between the supply chain if radical innovation was to happen.

'Industry should be involved with a research project from the outset, and should be given assurances that they will own the intellectual property,' said Day, adding that there was no point in universities protecting patents if they were left to languish and go out of date. (See Day's article on page 24 of this issue's Commercial Heating Special).

In the following session, Verco's technical director Robert Cohen introduced the Design for Performance (DfP) rating scheme, which has cross-industry support. It is based on the Nabers rating scheme in Australia, which makes disclosure of energy performance in offices mandatory.

An accurate simulation model is essential to Nabers, said Cohen, as the building's performance is tested against the model during commissioning and operational stages, to ensure the building is optimised against the model. He noted that Australian designers use IES and EDSL in a way that isn't being done in the UK. 'They use Apache HVAC in IES to model in detail, but it's not used a lot in the UK, as you don't need it for compliance.'

Cohen said the findings from DfP pilot projects in the UK would be revealed in June and the Design for Performance rating scheme would be up and running next year, once suitable benchmarks were in place.

Clockwise from far left: CIBSE President Peter Y Wong presents Mike Page with his prize for best presentation; Robert Cohen; delegates network; Andy Ford; and a presentation audience

"Industry should be involved with a research project from the outset and be given assurances that they will own the IP"

Uncovering the facts

This year's Technical Symposium was notable for papers interrogating large industry datasets to uncover hidden truths. These included an examination – by Jenny Love, research associate at the UCL Energy Institute – of pressure-testing data on homes held by the Air Tightness Testing & Measurement Association (ATTMA).

Love found that measured airtightness was disproportionately concentrated in sharp peaks at design targets on the first test per dwelling. This, Love said, meant leaky homes were being sealed on site during testing.

'This raises questions about what kind of sealing is being applied and whether it will last,' she said. 'They're probably being done on the fly, and are not focused on the primary air barrier, which involves considerable work taking apart.' Love added that regulations differentiate between secondary sealing – which is allowed – and temporary sealing, which is not.

Another eye-opening presentation, by Esfand Burman, UCL lecturer in complex built environment systems, looked at the energy performance and indoor environmental quality (IEQ) of eight offices, schools, hospitals and apartments.

Burman said that, while buildings with Soft Landings and energy performance contracting were doing well in terms of energy performance, they did not necessarily have good IEQ. An integrated view of energy and IEQ is often missing, he added, and that was usually a trade-off between low CO_2 with high ventilation rates, and high levels of pollutants NO_2 and PM2.5.

Burman concluded that there should be control strategies – such as sensors and filters – to ensure pollutants from outside do not compromise the health of occupants during natural ventilation.

There is currently a debate about whether consultants should be designing energy systems using gas or electricity. So it was fascinating to hear Aecom associate director Michael Lim's case study, looking at gas versus electric heating systems in relation to capital costs and life-cycle operational cost, fuel consumption and CO_2 emissions on a student accommodation scheme.

Lim's study demonstrated that combining continuous flow hot-water heating with a range of gas and electricity space heating results in a more efficient solution in terms of cost, fuel and CO_2. But he said the »

Sophia Flucker spoke about life-cycle assessments in data centres

SHINING A LIGHT

Expert lighters were well represented at the Technical Symposium, where Dr Kevin Kelly and Antonello Durante, of the Dublin Institute of Technology, proposed a new lighting design method that applies mean room surface existence (MRSE) as a metric.

Kelly said research had shown that MRSE – the quantity of reflected light within a space – better relates to the user's perceived sensation of brightness, and can be easily measured using high dynamic range (HDR) imaging. Currently, lighting designers direct light downwards, using ceiling lights, he added. If MRSE is used as the metric for brightness, however, light would need to be directed onto the highest reflectance surfaces in the room – often the ceiling.

'The most effective way of lighting a room is to throw light on the most reflective surface, not direct it from above,' Kelly said.

Since the discovery that intrinsically photosensitive retinal ganglion cells (ipRGC) influence the body's circadian rhythms, there has been a desire to quantify this effect for lighting designers, said Gordon Lowry, associate professor at LSBU.

The effect of lighting on building occupants' circadian rhythms has implications for their health and wellbeing, as well as for workplace productivity and absenteeism. However, there is no universal way to account for how different lighting choices might determine these effects.

Lowry said: 'A standard approach will need to be agreed that provides a valid and reliable measure of circadian effects sufficient to safeguard occupants' wellbeing.'

Rebecca Ward

» operational CO_2e emissions over 20 years showed dramatic differences between gas- and electric-based heat sources, with electric heating shown to be lower carbon over the medium to long term than gas solutions. However, predicted changes in CO_2e intensity would require continual investment and the uptake of renewable technologies over the longer term to deliver projected Grid decarbonisation. (Read also Martin Crane's article on why gas CHP still measures up, on page 16 of this issue's Commercial Heating Special).

Alex Paurine


Esfand Burman

Food science

Rebecca Ward, research associate at the University of Cambridge's Energy Efficient Cities Initiative, investigated the impact of plants on energy demand and air quality in her paper. She used data gathered from Growing Underground – a hydroponics farm, situated 33m below ground in Clapham, that grows micro-greens for hotels, restaurants and supermarkets.

Although the temperatures forecast using the model were in reasonable agreement with the mean temperature monitored at the farm, Ward said the predicted moisture content of the air was slightly higher than observed, while CO_2 concentration levels were much higher than the monitored values. (Read more from Ward in next month's *CIBSE Journal*).

Still in the food sector, LSBU senior lecturer Alex Paurine found that supermarkets were responsible for around 3% of the total electrical energy used in the UK, with 50% of this consumed by delicatessen cabinets. In his research for Tesco, Paurine found that low-emissivity glass – with the reflective surface facing inwards – reduced both the temperature of food and energy consumption significantly.

'There could be a saving of between 13.5% and 20% in energy consumption when low-emissivity glass is implemented correctly,' he said. 'There is also potential to considerably improve the quality of food.'

Improving processes

Several presentations looked at how the construction process might be changed to improve performance outcomes.

Dr Terry Keech, partner at CalfordSeadon, examined the issues around commissioning and installation on low carbon homes. He has surveyed and interviewed installers, and found that onsite training and monitoring »

BREEAM 2018 TARGETS ACTUAL PERFORMANCE

BRE principal consultant Christine Pout told delegates at the Technical Symposium that the 2018 update to the Breeam environmental assessment tool will move away from compliance-based assessments and towards recognising actual performance. She said this would involve carrying out more accurate modelling of energy consumption, measuring the actual performance, and comparing it against the targets.

Breeam 2018 has reduced the credits available for compliance modelling and, instead, added credits for carrying out detailed energy modelling and for post-occupancy assessments, Pout told the audience.

The Breeam methodology is based on existing standards, including the national calculation methodology and CIBSE's TM54, and draws on the Australian ratings initiative Nabers.

'We are allowing freedom to align performance targets with existing benchmarks,' said Pout, adding that the target will need to be adjusted based on the actual weather.

The post-occupancy monitoring element will aim to incentivise energy modellers to reflect actual energy use, said Pout. 'The key is to ensure the metering strategy and modelling results are comprehensive and detailed enough, so they identify the discrepancies between the model and the actual performance.

'It is also to encourage setting challenging energy targets and the requirement to report what the actual performance is compared to the target, and feed that information back up the supply chain.'

The post-occupancy assessment will require the collection and analysis of data for one year, within two years of the first occupants moving in, or when 80% occupancy has been achieved.

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Paula Morgenstern


Symposium chair Tim Dwyer

» could greatly increase housing quality. He said that the fragmented nature of the housebuilding industry meant site knowledge was quickly lost when subcontractors left for new jobs.

In his presentation, Ollio founder Edward Murphy said building users feel design is being done 'to them' – not 'with them' or 'for them' – which is why we cannot reach the 'performance sweet spot'. The solution, he added, is to involve the client and users in more immersive ways throughout the project, instead of gradually diluting and squeezing out what they want as the project moves through the stages. Murphy said the Agile for Buildings (A4B) methodology chooses people over processes, customer collaboration over contract negotiation, and response to change over following a plan.

This approach should start with a 'pre-occupancy evaluation' to analyse problems at the beginning, not at the end. User input should be collected – with highest-value and lowest-cost options taking precedence – before a prototype is created in a medium, such as BIM or virtual reality (VR), with which the client can interact.

Energy-performance contracting

A number of papers at the Technical Symposium remarked on the effectiveness of energy-performance contracting in improving build quality.

As part of an energy performance contract, Imtech energy manager Tony Cookson looked at the energy-saving technologies installed at 12 North West Ambulance Service stations. Before assessing the energy-saving measures, historic consumption data was gathered to determine the baseline for each site and identify uncertainties or anomalies.

Cookson said they first addressed ways to reduce demand for energy – for example, with insulation or by improving controls – before looking at more energy-efficient equipment, such as high-efficiency boilers and LEDs. The final step was considering renewable technologies.

After the cost and payback period was identified for each measure, Imtech discerned the most effective set.

'It's important to adopt a range of energy-saving measures across electrical and gas technologies, to ensure a lower-risk profile should one technology fail to deliver the required savings,' said Cookson.

Although the micro combined heat and power (CHP) system and electronic thermostatic radiator valves (TRVs) didn't produce the expected savings, measures such as LED lighting, free cooling and the solar PV ensured a 28% annual gas reduction, 41% electricity reduction, and £179,000 of annual savings, with a payback of 6.5 years. CO_2 was also cut by 6,000 tonnes.

It is impossible, in these few pages, to adequately convey the depth of excellent research at the 2018 Technical Symposium, so the *CIBSE Journal* will present the best papers in more detail over the next 12 months. In the meantime, catch up on the slide presentations at **www.cibse.org/symposium** CJ

See a paper on data centre life-cycle assessments, by Operational Intelligence's Sophia Flucker, on page 45 of the April 2018 *CIBSE Journal* and a paper on hybrid ventilation POEs, by BAM Construct UK's Paula Morgenstern, is on page 7 of the April issue's Education Facilities Special.

VIEW FROM THE CHAIR

By Tim Dwyer

One of the privileges of chairing the CIBSE Technical Symposium is that I am able to see the development of the abstracted thoughts of contributors through to the final posters, papers and presentations.

A downside of being a hands-on chair is that I am rarely able to concentrate on many of the 70-plus presenters as they share and debate their ideas with delegates.

However, there were some sessions where I was so transfixed by the discourse that, for a few minutes at least, I neglected my formal duties and reverted to being an absorbed delegate.

If one has even the slightest interest in a particular topic or sub-discipline, then there is little more captivating than the spectacle of an expert who has inhabited their specialist realm for months – if not years – bursting forth.

The speaker's ability to entertain, inform and challenge are skills that entwine and offer an essential triumvirate that, from my fragmentary view of the presentations, are attributes that do not necessarily relate to age, life experience, gender, physique or, indeed, subject matter or length of delivery.

We were fortunate in attracting numerous skilled presenters, one of whom was recognised with the honour of being voted by delegates as having provided the most effective delivery of material – congratulations to Mike Page, of the University of Hertfordshire.

But the joy was that the CIBSE Technical Symposium 2018 offered a platform for numerous, extraordinarily effective and knowledgeable presenters, who have now inspired more than 250 delegates to explore, question, research, develop, apply and communicate with others – so that we can further stretch the envelope to deliver sustainable future environments.

TIM DWYER is chair of the Technical Symposium planning committee and technical editor of the *CIBSE Journal*

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THE BIGGER PICTURE

Whole-life carbon assessments help to create a complete picture of buildings' carbon emissions over their lifetime. **Liza Young** finds out how embodied and operational carbon are intrinsically linked

If the UK is to achieve its ambitious target of an 80% reduction in carbon emissions by 2050, closer attention will need to be paid to whole-life carbon in the built environment.

Buildings have inherently long lives, so a whole-life perspective is crucial for projecting a more complete picture of their carbon emissions over their lifetime.

This beginning-to-end perspective means calculating both the operational and embodied carbon (see panel 'What is whole-life carbon') in a building.

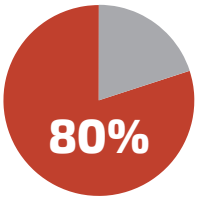
Although the concept is not new, one of the main barriers to measuring and quantifying embodied carbon had been the lack of a common methodology.

RICS' professional statement *Whole-life carbon assessment for the built environment* – which comes into force this month – attempts to standardise and simplify the concept.

The document focuses primarily on embodied rather than operational carbon, but the same diligence needs to be placed on assessing both.

Many synergies exist between the two types of carbon so, in many cases, reducing the embodied carbon of a building will ensure it performs better operationally.

Carbon target



The reduction in carbon emissions the UK has to achieve by 2050

Operational v embodied

Based on international standard BS EN 15978, RICS' professional statement aims to highlight carbon reduction opportunities that can be made by taking into account the impact of construction materials and how they are sourced, as well as their durability, reuse and circular economic benefits.

Simon Sturgis, lead author and managing director at Sturgis Carbon Profiling, says the guide highlights the embodied costs of operational improvement. 'It creates the understanding that the drive to net-zero and zero carbon comes at a price. A building can be carbon neutral or zero carbon, but the question of how it got there should be factored into the equation,' he says. 'We tend only to look at energy use and how it can be reduced, and do not factor in the energy costs of getting that reduction.'

Triple glazing and internal insulation improve building performance, but they might also increase the carbon cost, says Sturgis. He adds: 'Natural-fibre and artificial-fibre insulation may get the same operational performance, but the embodied performance will be different. We need to move towards a lower embodied carbon solution to achieve low-operational carbon.'

Julie Godefroy, head of sustainability development at CIBSE, agrees, but believes that, if embodied carbon assessments are used to make decisions that affect operational carbon, then operational carbon must be assessed with the same diligence as its embodied counterpart.

Google has included whole-life carbon as a key performance indicator in its London UK headquarters, under construction in King's Cross

She says pitting one against the other relies on many assumptions – for example, how long the building will last, how it will be used and where the materials will be sourced – which can confuse the situation and divert attention from real opportunities to reduce embodied carbon. 'We need to be aware that many decisions on embodied carbon – for example, to reduce insulation – will have an impact on operational carbon. In addition, other aspects that need to be considered – such as the high levels of thermal performance in Passivhaus – are also valued by occupants,' she says, adding that assessments should be carried out on a project-by-project basis.

Sturgis says designers need to look at their options holistically and, to avoid over-simplifications, operational and embodied carbon need to be considered together.

A steel or concrete structure of a new building will have the highest carbon content, followed by the services and the fit-out, he says. 'However, if you look at the life of the building over 60 years, the structure hasn't changed, while the services get replaced every 20-30 years, and fit-out every 10-15 years. When you add that up, the replacement cycle of the fit-out or the services may be greater than the structure, which may no longer have the single biggest impact.'

Godefroy says designers should focus on the many synergies between reducing operational and embodied carbon, rather than creating conflict between the two. One of the biggest opportunities is to reduce the waste of materials, followed by considering lower carbon materials and creating leaner, more efficient building shapes. 'To achieve very low energy consumption levels, the form has to be more efficient, so the insulation depth may be a bit higher – but it is applied over a smaller heat-loss area,' says Godefroy.

> "We tend to look only at energy use and how it can be reduced, and do not factor in the energy costs of getting that reduction"

University of East Anglia's Enterprise Centre

Designers should also focus on reducing peak energy loads, steering clear of over-sizing plant and equipment, avoiding over-complicating buildings, creating designs that facilitate repairs and refurbishments, and reducing construction waste. 'These are all win-wins for reducing operational and embodied carbon.'

Assessing embodied carbon

The RICS guide, which allows for Grid decarbonisation in its calculation, helps designers compare the environmental impact of materials, based on their composition, recyclable content, and where they are sourced.

'Resource depletion is a parallel issue to embodied carbon. Recycled content that's sourced locally, for example, would bring the carbon cost down. Similarly, planning for buildings to be dismantled and reused impacts positively on how the project is assessed,' explains Sturgis.

Even considering how bricks are put together has a positive benefit, he says. Cement mortar is so hard that bricks cannot be reused but, if a softer lime mortar is applied, bricks are easier to dismantle and reuse. 'If your design allows for recycling and dismantling, you will create a building that is more valuable in the future.'

Choosing between an anodised or a powder-coated finish for aluminium is another example. This may seem, principally, an issue of colour, texture, durability and cost, but the choice can have a direct impact on embodied carbon because aluminium with a powder coating can be used as recycled content, says Sturgis.

He says architects and services engineers must work closely together to optimise the relationship between the façade and its performance.

However, the database of embodied carbon present in M&E plant and equipment is still relatively patchy, says Godefroy. 'Engineers should help build knowledge by getting involved in whole-life carbon assessments, and asking for information from manufacturers and contractors – such as Environmental Product Declarations for M&E kit – to start building a better database of M&E-embodied carbon,' she says.

'The more we demand that information, the more it will be supplied, adds Sturgis.

Calculating operational carbon

The RICS guidance suggests using Part L as one of the possible ways to calculate operational carbon. But Godefroy says Part L should not be used to estimate operational carbon because it would lead to significant underestimates of the building's in-use emissions. She says energy

assessment methods such as CIBSE's TM54 *Evaluating operational energy performance of buildings at the design stage* are recommended.

But Sturgis says that if you calculate operational carbon using TM54, you would have to work out the carbon cost of all the unregulated emissions – the IT equipment, photocopiers and so on – as well as their potential replacements over 60 years.

To make the process balanced, the same diligence will then have to be applied to the embodied carbon assessment, meaning fit-outs, including each and every plug load – plus its potential replacement – would have to be assessed, which becomes very complicated and is 'outside the scope of the design team'.

Godefroy says that, beyond the treatment of plug loads, there are many reasons why Part L is not appropriate to assess energy use – for example, set occupancy patterns and ventilation rates. She says more suitable frameworks for operational energy prediction can be found in TM54 or, for base-build energy use, in Nabers and its UK pilots, Design for Performance.

Sturgis says project teams need to work together to think past practical completion, and understand how a fit-out with different rates of life-cycle would fit in with the life-cycle of the building's structure. Both agree that input from all branches of the construction team can make a difference.

As much as architects need to understand the supply chain and where materials come from, building services engineers need to speak out in project team meetings and explain the benefits of using – for example – insulation or blinds.

In the meantime, Godefroy says we need to start gathering more information on embodied carbon in M&E plant. 'Little by little, that would generate the data we need.' **CJ**

WHAT IS WHOLE-LIFE CARBON

This beginning-to-end perspective comprises operational carbon and embodied carbon. These represent the areas in which carbon is likely to be released and/or produced during the true life-cycle of a built asset.

Operational carbon refers to the carbon produced by a building during its operational or 'in use' phase. This includes the energy used for controlled emissions – such as heating, cooling and lighting – and uncontrolled emissions, including items such as computers and other electrical appliances.

Embodied carbon is the carbon generated to produce the building. This includes emissions caused by extraction, manufacture/processing, transportation and assembly of every product and element in a building. It may also include the maintenance, replacement, deconstruction, disposal and end-of-life aspects of the materials and systems that make up the asset.

'The demand for Passivhaus is client-driven, but there will come a tipping point – the legislators will make it happen'

JONATHAN HINES, ARCHITYPE

With two Passivhaus buildings winning 2018 CIBSE Building Performance Awards, **Andy Pearson** speaks to architect Jonathan Hines about the rise in popularity of the accredition system and why he thinks it may one day become mandatory in the UK

'We've now won the CIBSE Building Performance Award three times with Passivhaus schemes and we've been highly commended for another scheme, which is proof of how well Passivhaus works,' says Jonathan Hines, managing director of architect Architype.

The practice worked with building services engineers BDP to develop the design of the Enterprise Centre, a Passivhaus scheme for start-up businesses at the University of East Anglia. It won the Commercial/Industrial category at this year's awards.

It was one of two Passivhaus schemes that triumphed at this year's ceremony; the other was the University of Leicester's George Davies Centre (formerly the Centre for Medicine), designed by Associated Architects working with engineer Couch Perry and Wilkes for contractor Willmott Dixon [see page 38].

Hines is unsurprised by the awards success of Passivhaus schemes. 'People expect buildings to work and very often they don't; the great thing about Passivhaus is that people know they will get a building that will work,' he says.

Its assured energy performance is one reason for the growing uptake of the low-energy Passivhaus design standard in the UK. 'The energy savings are an attraction, as are the low running costs,' says Hines. He adds that, in its first two years of operation, heating energy consumption for the Enterprise Centre was 'less than 11kWh·m^{-2}·per year, well below the 15kWh·m^{-2}·per year Passivhaus target'. If further proof were needed, the scheme has also been awarded a DEC A for its energy in use.

The success is one reason Passivhaus is gaining momentum in the UK. Hines says that 70% of the projects Architype is currently working on are Passivhaus, including the UK's first Passivhaus-certified secondary school for the London Borough of Sutton. 'I would say it is moving into the mainstream – I am constantly amazed at how many people have heard of it and know what it is,' says Hines.

Architype's involvement goes back almost a decade. At the time, it was striving to find ecological and energy efficient ways to build. It had also started to monitor its completed schemes. 'They were performing pretty well compared to bog-standard Building Regulations-compliant schemes, but it made us realise that there was a lot more we could do to improve their performance,' Hines explains.

A desire for a more energy-efficient solution led the practice »

The Passivhaus Enterprise Centre, at the University of East Anglia, won the Project of the Year Commercial/ Industrial at the CIBSE Building Performance Awards 2018

» to investigate Passivhaus. 'Compliance with the ready-made Passivhaus standard pretty much guarantees that a building will perform in terms of internal comfort and energy consumption, which should be no surprise given that Passivhaus was invented in Germany 25 or so years ago, by building physicists, for exactly that reason,' he explains.

The first Passivhaus-certified scheme completed by Architype was Oak Meadow Primary School for Wolverhampton City Council. The practice had already designed several successful schools for the council, so when it won the commission for Oak Meadow, it used the opportunity to design its first Passivhaus project.

'We said to the council: "Passivhaus will give you lower running costs and improved comfort for the teachers and children,"' says Hines. 'They said: "If you can do it for the same price and within the same time, that would be fantastic, otherwise don't bother."' Architype duly rose to the challenge.

'The assumption is that a high standard like Passivhaus always costs more,' says Hines. 'My theory is that if you start a project thinking it is going to cost more, then it will; whereas with a tight, fixed budget the design is developed to deliver it to that budget.'

Architype adopted a rational and simplistic form for the school and used the savings in envelope costs to balance some of the additional costs of Passivhaus. These included enhanced thermal insulation and better-performing windows. 'We showed it was possible to deliver a Passivhaus school for a conventional school budget,' explains Hines.

The successful design of this and a second Passivhaus school – Bushbury Hill – for the same client were to prove a watershed in

"We showed it was possible to deliver a Passivhaus school for a conventional school budget" *Jonathan Hines*

the way Architype approached low-energy building design. 'A lot of the things we now do in all of our projects can be traced back to these schemes, including the creation of a more compact, rationalised form to minimise external area, and simplified detailing. Details cost money regardless of whether a scheme is Passivhaus or not,' he says.

Architype's involvement with the schools did not stop with their completion: it then monitored the finished schemes. 'They delivered what we'd said they would, in terms of energy and running costs, and provided incredibly good internal comfort, which gave us the confidence to promote Passivhaus more widely.'

Monitoring also showed internal heat gains in the schools were higher than in Germany because, in the UK, different space standards mean more children are squeezed into each square metre of floor space. 'We discussed this with the Passivhaus Institute in Germany and they allowed us to tweak things slightly, so our second generation of schools had less glazing because we needed less solar gain,' explains Hines.

Internal comfort was better in the Passivhaus schools than in the Breeam-compliant schools Architype had designed previously, which were mostly ventilated naturally. 'Naturally ventilated schools rely on opening vents to bring in fresh air to keep CO_2 levels down; if it's cold outside and the windows are not opened, then CO_2 levels rise dramatically. With the mechanical ventilation with heat recovery (MVHR) systems used in Passivhaus, you get a constant supply of fresh air,' Hines says. 'Natural ventilation sounds lovely, but it is often just random, uncontrolled ventilation – from our monitoring, MVHR is a winner every time.'

Lessons learned were incorporated into the design of Wilkinson Primary School – another CIBSE Building Performance Award-winning scheme. For this second-generation Passivhaus school for the same »

Heating energy consumption at the Enterprise Centre was less than 11KWh·m-2·per year, below the 15KWh·m-2·per year Passivhaus target

» client, Architype developed the design with the same building services engineer, structural engineer, and landscape architect, and it used the same contractor to build the scheme as it had for the previous two Passivhaus schools. This continuity ensured the design and construction process resulted in a reduction in thermal energy demand compared to the first-generation schemes (see: A lesson in Passivhaus – award-winning Wilkinson Primary School, *CIBSE Journal*, March 2016).

Its success with Wolverhampton City Council led to Architype designing Passivhaus schools for other clients. The architect has also designed Passivhaus housing projects, a church, factory, archive and records store, and the University Enterprise Centre.

'Passivhaus is a one-way journey because, as an architect, if you've learned to detail a building to eliminate thermal bridges, you don't start putting them back in deliberately,' says Hines. 'I would say that every building we design, whether or not it is Passivhaus, is better because of the technical knowledge we've gained through working with Passivhaus'.

So what makes a successful Passivhaus design team?

'Passivhaus is no different from any other scheme – you need a full team working together from the very beginning, a committed client and a decent contractor,' Hines says. Passivhaus encourages close, integrated design from the outset because the building has to be designed to do the work of many of the services. 'Some M&E engineers can be the sticking point because they like all their kit and they don't like designing it out,' he says.

Unlike Breeam, it is not necessary to prove a scheme's performance in use to gain Passivhaus certification. A scheme's design and construction are Passivhaus-certified. Designers have to use PHPP, an Excel-based modelling spreadsheet, to certify that the design meets all the requirements. Construction is also monitored and evidence is supplied that the constructed scheme complies with the design intent, with certification issued accordingly.

It is a built-in quality assurance system with no requirement or need for post-occupancy feedback. 'There is enough post-occupancy monitoring to prove that it will perform as designed,' says Hines.

How important is it that a Passivhaus scheme is certified?

'It is not important, because you can design a building to meet Passivhaus standards and just because it has not been certified doesn't mean it won't perform to those standards. But the only way you can prove a scheme meets the standard is to have it certified,' Hines says.

Certification is good because, if the designers and contractor know that the scheme will be certified, then 'they know they have to comply with that standard'.

According to the Passivhaus Institute, there are currently 830 schemes in the UK that are Passivhaus-certified, but the numbers are increasing rapidly. In Brussels, Passivhaus is now the Building Regulations standard. In the UK, building to Passivhaus as the minimum is still a long way off. 'In the early days, it was us persuading people to go Passivhaus. Now the majority of clients come to us because Passivhaus is what they want,' says Hines. 'The demand for Passivhaus is client-driven at the moment, but there will come a tipping point where the legislators will make Passivhaus happen.' **CJ**

THE BUILDING SERVICES ENGINEER'S PERSPECTIVE

The Enterprise Centre at the University of East Anglia (UEA) is a Breeam Outstanding scheme and Passivhaus-certified. It has been designed to last for 100 years, and built on a brownfield site using 70% bio-based materials, many of which have been sourced locally.

It even exceeds the local planning requirement for 10% of the building's energy to be from renewables, with a 480m² roof-mounted photovoltaic array, predicted to generate 44MWh a year. Consequently, over its lifetime, the building's embodied carbon is predicted to be one quarter that of a conventionally constructed building. Thatch cladding features on every elevation of this two-storey, E-shaped building. The 3,400m² building's form was the result of the need to maximise the amount of daylight available internally. The top and bottom elements of the E are formed by the building's two main wings, one of which is used for teaching, the other for start-up businesses.

The façades of those wings face north and south. A mainly transparent block links them, in its centre, and one block housing a 300-seat auditorium forms the middle of the E.

COMMAND PERFORMANCE

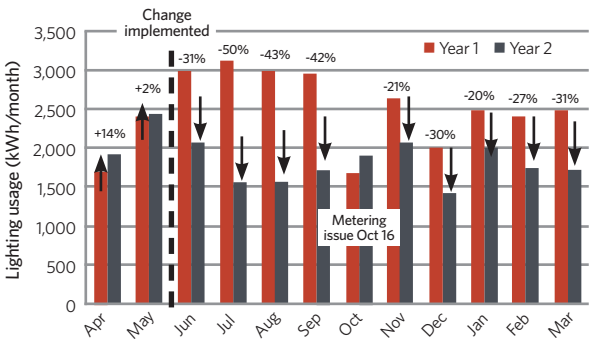
Soft Landings helped the George Davies Centre to a DEC A rating after completion. Willmott Dixon's **Khasha Mohammadian** says Passivhaus resulted in significantly lower heat demand than on other higher education projects

Passivhaus buildings are known for their level of thermal comfort, energy efficiency and build quality. As with any other type of construction, however, the way end users interact with the building determines the ultimate success or failure of a project. The occupant factor was particularly significant at the George Davies Centre (formerly the Centre for Medicine) at the University of Leicester because of the high level of automation in the building.

Striking the right balance between automation and user control was key to achieving the design targets. This was recognised by the M&E consultants Couch Perry Wilkes and the University of Leicester estates and campus services teams, who involved end users in the early discussions through a Soft Landings framework. Under this arrangement, building users, the University of Leicester's division of estates and campus services, Willmott Dixon, the M&E contractor, consultants and other parties have stayed involved with a three-year in-use monitoring and fine-tuning programme.

Blinds, ventilation, lighting, heating and cooling are all controlled by the building automation system based on a range of factors, such as external weather, internal temperatures, CO_2 levels and occupancy. Getting such a complex and intelligent system to work at its best is challenging, and requires good communication and collaboration between all parties. Once the control logic has reached its optimum state, however, it will unlock other savings for the building's lifetime.

Figure 1: Lighting second floor



Energy reduction in lighting following 'fine-tuning' of controls after handover

Optimisation for comfort

To cater for individual preferences, users can override the controls within a defined range – for temperature and lighting, for example. One issue we experienced at the start of the project was that these settings would revert to default when users left the room. The powerful KNX building control system, however, allows changes to be made easily for a group of rooms, so we were able to work with the university's facilities management (FM) team to implement this.

Passivhaus does not dictate how overheating risk is minimised, but it favours passive means over active cooling. External blinds are one such measure often seen in Passivhaus projects. They stop solar gains from entering the building and are more effective than internal blinds. Along with thermal mass and other passive-cooling features, these have helped to maintain a stable temperature in the building.

Debbie Oldham, departmental manager and one of the Soft Landings team members, said: 'When we have had ambient temperatures as high as 30°C, the temperature in the building has been substantially cooler than others on the campus.'

Optimisation of energy use

The building's energy use is measured by more than 90 submeters. Each month, this data is analysed and compared against targets. In year one, these targets were based on predicted optimum usage from NG

The George Davies Centre won the Project of the Year – Public Use Award at the CIBSE Building Performance Awards 2018

Bailey's dynamic model to meet the Display Energy Certificate (DEC) rating of 'A'. In year two, we are comparing performance against last year's and aiming to exceed this performance. This feedback loop is invaluable in understanding which controls, settings or general design decisions work well and which don't. The first step in diagnosing a problem is identifying the symptoms – and, to do that, a good metering and monitoring system is vital. This process will also allow learnings to be passed on to future schemes.

Lighting has been an interesting and challenging aspect since handover. Metered data highlighted it as a high consumer of energy. Light fittings in the building are operated by passive infrared sensors and equipped with daylight-linked dimming. To reduce lighting usage, a new strategy was trialled in a small zone, based on actions from the Soft Landings meetings. This involved changing the switch-off time delay in corridors from 15 minutes to one minute; however, this can be harsh on the eye or shorten the equipment's lifespan. The university's maintenance electrician, Matt Boylan, overcame this by adding a five-second fade up and fade down time, which resulted in a smooth transition from light to dark. This was tested on a floor and, after positive feedback from users, was extended to the whole building.

Another interesting fine-tuning exercise took place in the offices. Here, the lighting was commissioned to come on when users enter their rooms; the building management system (BMS) would then adjust lighting output based on the level of daylight available. We discovered this approach was missing the potential for more energy savings.

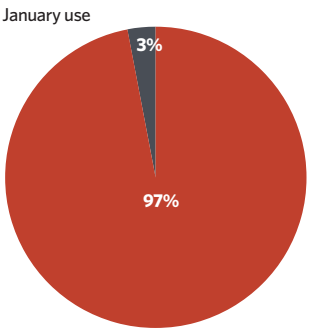
Changes were made so that the natural light was measured first and the amount of artificial lighting – if needed – was supplied accordingly. This, however, meant that lights would not come on if adequate daylight was available. Most users were not used to this, so it took a while to get the message across and to roll out this feature. Even so, these changes have resulted in approximately 30% energy savings for lighting on the second floor, compared with the previous year. (See Figure 1.)

At Willmott Dixon we have developed our own benchmarks, based on a number of post-occupancy evaluations carried out on a range of sectors. The George Davies Centre has achieved a significantly lower heat demand than all our previous higher education projects. This can be attributed to the huge emphasis on airtightness, thermal insulation and thermal bridging by the Passivhaus standard.

The building has already achieved a DEC rating of 'A' ahead of the three-year post-completion deadline, with energy use of just less than 60kWh·m^{-2}·year^{-1}. We believe the Soft Landings framework has been key to achieving this challenging target. The fact that it has been reached in little more than a year gives all parties involved a sense of pride and is a testament to the ability of Passivhaus to minimise the performance gap between design and as-built.

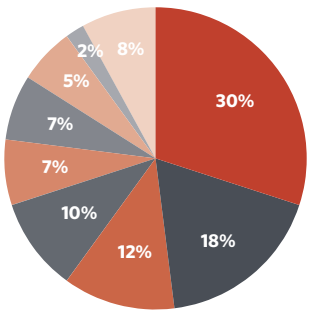
Total electricity supply kWh

January use



- Elecricity imported 45,093
- PV 1,297

Electricity use breakdown kWh



- Lighting 13,790
- Small power 8,558
- Plant: chillers 5,553
- Server rooms 4,737
- Plant: ventilation and pumps 3,218
- Catering 3,291
- Hot water 2,528
- Lifts 824
- Metering inaccuracy/ unmetered use 3,891

Lighting accounts for 30% of total energy use at the George Davies Centre

Lessons learned

The George Davies Centre has been the start of a new wave of large-scale, non-domestic, Passivhaus buildings in the UK. As a main contractor, we have learned a lot about what works and what does not.

One key lesson is that, for a Passivhaus scheme to succeed, design has to be far more advanced than is usual on a project – and it is best if any design changes take place before site activities start.

We are currently building another large-scale Passivhaus scheme – a new secondary school in the London Borough of Sutton. We have been able to influence its design and construction through earlier involvement, which allows for a simpler process. The needs of end users should always be put first and getting them involved from the start is the easiest way to achieve that. CJ

KHASHA MOHAMMADIAN is an assistant sustainable development manager at Willmott Dixon

This paper was presented at the 2018 CIBSE Technical Symposium **www.cibse.org/technical-symposium-2018**

Read a case study on the George Davies Centre at **bit.ly/2HFvCJj**

THE FUTURE IS HERE

UCL Here East is an ambitious attempt to fuse engineering and design in a hi-tech research environment. **Alex Smith** looks at how the university aims to inspire radical innovation from its new base in Queen Elizabeth Park

University College London's cavernous new manufacturing and testing facility, located within the former London Olympics broadcast centre, marks a new era for the 192-year old institution.

UCL Here East supports the first collaboration between the Engineering Faculty and the Bartlett, which is the university's faculty of the built environment. 'This is where architecture and engineering collide,' says Tom Noonan, associate at Hawkins\Brown, the architect behind UCL Here East. 'It's the first time they've come together to share space.'

Students from both faculties will be encouraged to collaborate on research projects at the new facility, which features some of the most advanced manufacturing and testing equipment in the country. Departments across the two faculties that will have a presence at UCL Here East include the Bartlett School of Architecture, the Institute for Environmental Design and Engineering, UCL robotics, UCL computer science, and UCL civil environmental and geomatic engineering.

'The space is designed to be used by students who would not normally work together,' says Professor Alan Penn, dean of the Bartlett, UCL Faculty of the Built Environment. 'It makes it possible for us to develop ways to intervene in the built environment at extreme scales; from full-scale construction components to tele-robotic engineering at a cellular level. This research and teaching is vital to advancing the skills in design, creativity and collaboration that future graduates of the built

Environmental testing chambers allow wall build-ups to be tested under different weather conditions

environment will need to master in order to resolve the challenges we face.'

In tandem with the opening of UCL Here East, the university has created a new four-year MEng engineering and architectural design course, run by the Bartlett School of Architecture and Institute for Environmental Design and Engineering, alongside the engineering faculty's civil environmental and geomatic engineering department.

There are also Bartlett postgraduate design courses with a heavy engineering focus, including MArch design for manufacture and MArch design for performance and interaction, and the Bartlett Real Estate Institute is being housed at UCL Here East.

'The aim is to break down the barriers between engineering and design, and create radical new futures,' says Penn (see panel 'Where architecture and engineering collide'.)

UCL Here East occupies a 30x100m section of the 400m long x 100m deep Olympic broadcast centre. UCL is next door to BT Sport's TV studios, and other high-tech neighbours include Ford's Smart Mobility Hub and Ladbrokes Coral's tech and innovation hub. The V&A has unveiled proposals for a new collection and research centre there.

UCL's faculty has office space and a student studio area overlooking a square. It shares a glazed elevation with the new UCL Bartlett Real Estate Institute on the floor above.

Large doors open onto an auditorium with capacity for 350 people, and this looks over a 10m-high fabrication and manufacturing space at the heart of the building. Running the length of this space on two floors are laboratories and chambers containing robotics and advanced prototyping spaces. These contain CNC routers, milling machines, water-jet cutters and nano robotics, which are capable of working at cellular level. Behind the auditorium are thermal laboratories, where people's responses to changing temperature, humidity and lighting can be measured. (See isometric drawing of facility on page 39).

The architect Hawkins\Brown and consultant BuroHappold converted the original broadcast centre into Here East after the Olympics, and have a long association with the building, but configuring the unique technical requiremnts of the various UCL departments still »

The floor of the manufacturing space is reinforced to take a bridge testing rig (left), while robotic arms will be a common sight

DISRUPTING THE REAL-ESTATE PROFESSION

The new UCL Bartlett Real Estate Institute will be based at UCL Here East. There will be short courses aimed at educating property professionals about the value of intangibles, such as heritage sustainability, urban place making and good design, according to Professor Alan Penn, dean of the Bartlett, UCL Faculty of the Built Environment.

'It will give real-estate professionals and financiers the ability to value these things, so they can fund them in developments,' says Penn. The aim is for the Institute to create methodologies to allow funders to value sustainability and heritage in projects, and attract ethical investors, he adds. 'The key here is to disrupt the real-estate professions and financiers.'

The space is designed to reflect an airport business lounge, but the Real Estate Institute shares its entrance with the students in the studio space, which was important says Tom Noonan, associate at Hawkins\Brown.

'We tried hard to make them connected. We encouraged the Real Estate Institute to share its entrance, because the activity in the studio whets the appetite of visitors.' There is also a visual connection between the Institute and the other spaces, with windows overlooking the large auditorium.

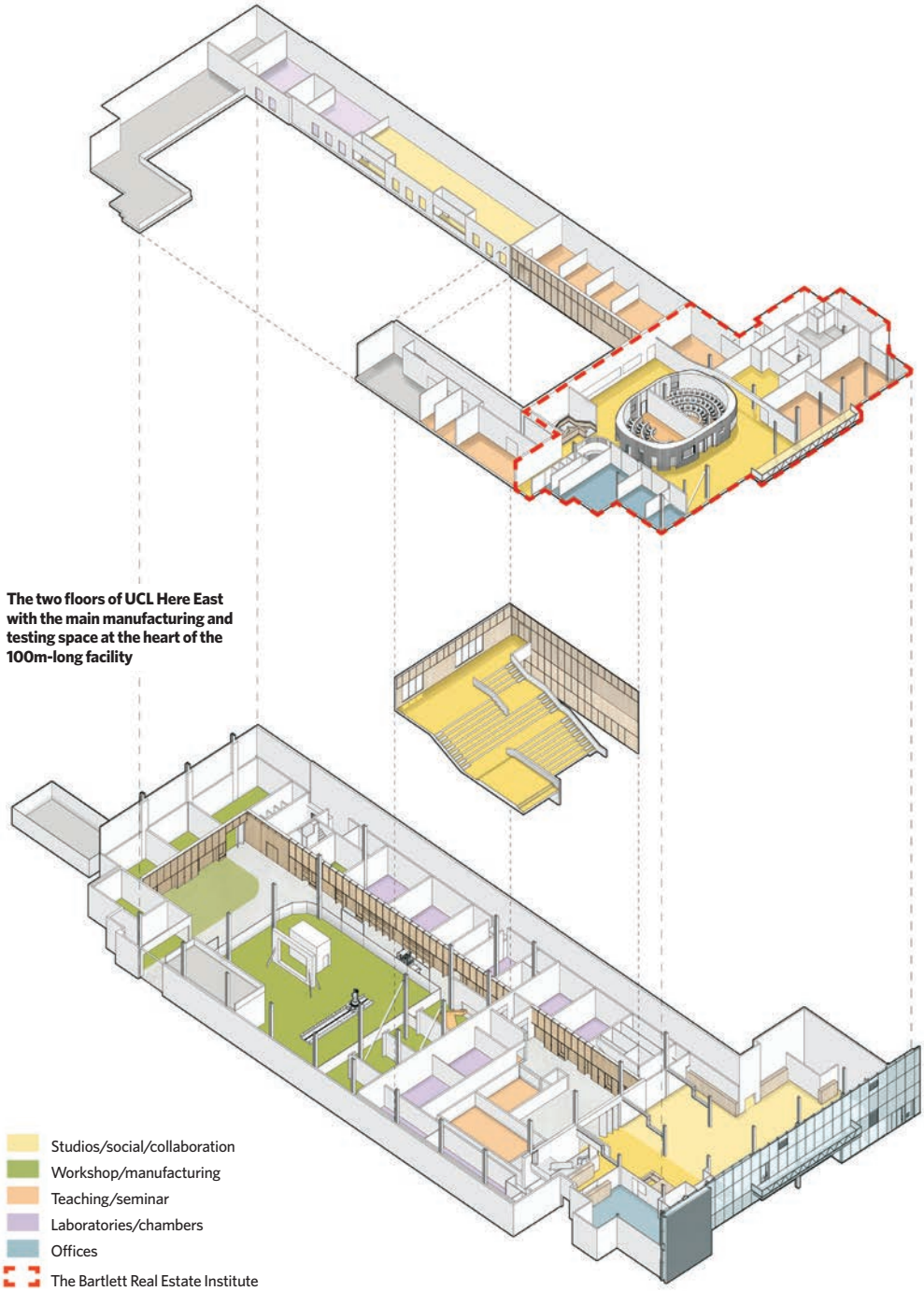
The Institute comprises two lecture theatres, each with a capacity for 40 people, breakout space, seminar rooms and office space. This was more than was designed for.

'Originally, this space was a CAT A fit-out office,' says Kenichi Hamada, associate mechanical engineer, BuroHappold . 'We had some fan coil units and one air handling unit, which wasn't enough capacity from a ventilation point of view.'

BuroHappold reused the fan coil units and created mezzanine-level plant rooms for three AHU units. Two of these served air systems in the individual lecture theatres, while the other served a seminar room.

'By doing this, we are controlling the environment differently in each space. The lecture theatres have a very high acoustic performance requirement, so we used air systems rather than relying on fan coil units.'

Openings in the lecture theatre's acoustic wall offer breakout spaces in the Real Estate Institute



The two floors of UCL Here East with the main manufacturing and testing space at the heart of the 100m-long facility

» provided a challenge for the design team.

'The accommodation at UCL responds to specific course requirements, ranging from big robotic testing workshops and laboratories, through to the auditorium, and meeting and seminar suites,' says BuroHappold senior mechanical engineer Thomas Pilkington.

'That, coupled with the building constraints, is what really challenged BuroHappold to provide a space end users and the students could learn and flourish in.'

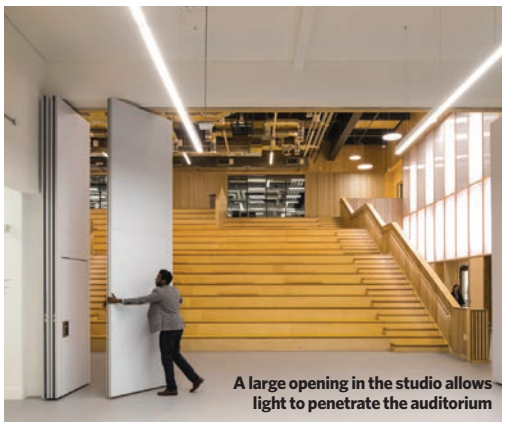
The services were zoned to reflect these different spaces. Two air handling units (AHUs) in an external plant pen at the rear of the premises serve the workshop and laboratory areas, supplying fresh air on a process-led basis.

Three further AHUs located throughout the floorplate are demand-driven and controlled via CO_2 sensors. Two of these serve the studio and office spaces and another unit is dedicated to the auditorium.

The energy for the AHUs, along with the fan coil units that serve the space, are supplied by the Queen Elizabeth Olympic Park district energy scheme. The UCL space is supplied with heating and cooling connections from the landlord system, with terminal units controlled on a 2-port system using pressure-independent control valves. The BMS is connected back to UCL's Bloomsbury campus, from where energy data is monitored.

Future capped connections have also been provided in particular rooms to enable equipment fit-out as courses develop.

Some specialist end-user equipment requires specific services. A chilled-water connection is supplied to the environmental testing chambers and another cools the hydraulic oil system used in the actuators of the bridge-testing rig. Compressed air is supplied to the curing room and wet trade room, with oil and water-free compressed air to clean laboratories, such as those housing nano robotics equipment.



A large opening in the studio allows light to penetrate the auditorium

Creating a flexible electrical installation was a key consideration during the design period. For example, in the main fabrication and manufacturing space, the electrical supply had to drop from the ceiling, to make way for large components such as airplane wings and bridge sections.

In the front-of-house area, drop-down power is available on a movable racking system, to serve students at desks and be returned to a higher level when students require more studio space.

BuroHappold acoustics and fire engineering teams worked with Hawkins\Brown to offer the necessary fire protection and acoustic separation between the 'clean' and process spaces. The idea was to maintain a close connection between the spaces, despite their different uses.

The BuroHappold lighting team and Hawkins\Brown wanted to mimic natural lighting within the windowless testing and manufacturing space. 'We wanted to create a feeling of light just being outside rather than being

One of two lecture theatres in the Real Estate Institute

"The space is designed to be used by students who would not normally work together"

far away. The timber panels, and the large doors [between the auditorium and entrance] give a sense of the outside,' says Noonan.

Noonan is well qualified to compare the new UCL space with that of the Bartlett when he was studying to be an architect. He finds it much more conducive to collaboration and broader thinking. 'The other UCL building had cellular accommodation. You would have three to four colleagues, but you didn't see anybody else. There was a healthy competition between you, but it wasn't a healthy environment.' CJ

WHERE ARCHITECTURE AND ENGINEERING COLLIDE

'There has been a call from industry for a course of this kind,' says Professor Alan Penn, referring to the Bartlett's new postgraduate degree, MEng engineering and architectural design, which includes elements of building services, architecture and civil engineering.

Penn says the culture of design is different for engineers and architects, and says collaboration would help architects take reality into account in their designs.

'In design terms, engineers like well-defined objectives, where they can apply the laws of science to prove their design will function,' says Penn. For architects it's about creating a vision of what can be achieved, he adds.

There's no danger of the architects being hampered by engineering reality. 'Constraints allow architects to be creative – there's nothing harder to design on than a greenfield site,' Penn says.

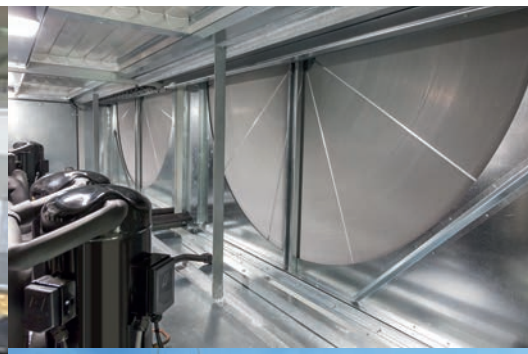
Penn believes the MEng will help break down barriers at UCL Here East and the new facility will encourage those from different backgrounds to work together. 'To create a culture of trust and engagement, soft skills will be important,' he says. 'We're not just sharing a building, we're sharing a room. We're asking people to go out of their safety zone.'

EcoAir Box

EcoAir Box enrols at a London College

Customer Imtech

Project: St. John Bosco College, London



The proposal of an alternate ventilation solution for the new St. John Bosco College – London has added energy efficient benefits and shows who is top in class.

EcoAir Box has supplied three ground breaking packaged air handling units, incorporating a built-in reverse cycle heat pump combined with a side by side double wheel solution offering very low fan pressure drop, small footprint and reduced power input, which in turn reduces noise levels.

The packaged solution didn't just offer better performance and better payback, it omitted the LPHW and chilled water requirement altogether.

The innovative Hygroscopic Thermal Wheels are able to provide increased efficiency of heat / cool recovery from a previous 60% to 78%. The hygroscopic wheel enables moisture recovery, which enables cooling in the summer and heating in the winter, taking the load off the compressors in the air handling unit and reducing the need for humidifiers.

The thermal wheel provides increased efficiency compared to the original proposal of a plate heat exchanger and when combined with a built in reverse cycle heat pump, the EcoAir Box unit boasts as EER of 6 in cooling mode and 12 in heating. The side by side orientation enabled the whole unit to keep a low profile and deliver full performance whilst keeping under height limitations.

A fully packaged intelligent control system is supplied with the EcoAir Box unit, so the wheel inverter control that varies the speed of the wheel to optimum efficiency transfers information seamlessly; so correct humidity and temperature levels can be maintained.

The whole solution will enable the college to benefit from an increased energy efficient heating and cooling unit, which provides fresh air and a comfortable working environment for staff and pupils.

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OPEN TO ADVICE

Ventilation strategies relying on residents opening windows falter if there is too much external noise. **Anthony Chilton** reports on a new guide designed to balance the needs of acoustics, ventilation and overheating

It is becoming increasingly clear that overheating and inadequate indoor air quality are serious issues for new-build housing. In both cases, the influence of noise can be a contributory factor. With overheating, high external noise levels can make opening windows undesirable, and effectively leave occupants with no viable means to control summertime temperatures. A reluctance to open windows will also affect indoor air quality, as will noisy mechanical ventilation systems, with research showing that occupants will turn off plant equipment if they find it too loud.

The design process is not helped by the fact that indoor air quality, thermal comfort and acoustic comfort are often considered independently, sometimes by different design consultants.

To address this issue, the Association of Noise Consultants (ANC) has produced a guidance document entitled *Acoustics, Ventilation and Overheating – Residential Design Guidance* or the AVO Guide. A draft version was released in February for consultation and is available via **goo.gl/r7iKSQ** The consultation is open until 11 May and views on the draft can be submitted via the online questionnaire, which can be found at **goo.gl/XqogVG**

The AVO Guide seeks to encourage a design and assessment process that recognises the interdependence of acoustics, ventilation and overheating. It includes the following elements:

- An explanation of ventilation requirements described in Approved Document Part F (ADF)
- An explanation of the overheating assessment methodology described in CIBSE TM59
- Acoustic guidance relating to the different ventilation and overheating conditions
- A worked example, including indicative design solutions.

> "The guide aims to promote a collaborative design process with good communication and timely coordination between the different disciplines"

The key issue for the acoustic guidance is that it suggests different (elevated) noise levels for the overheating condition relative to those for the ADF ventilation condition. The reason for this is that the overheating condition occurs for only part of the time and occupants may accept a trade-off between acoustic and thermal conditions.

The contribution to internal noise levels from external transport sources and mechanical services are considered separately and independently because there is evidence that occupants have a different tolerance for each.

For external transport sources, the AVO guidance for the overheating condition suggests risk categories based on the resultant internal noise level. The risk categories are summarised in Table 1.

In the daytime, the 'high risk' category results if internal levels exceed 50dBA, on the basis that speech communication will be significantly affected. At night, the 'high risk' category relates to the World Health Organization Night Noise Guidelines level for which »

» 'adverse health effects occur frequently and a sizeable proportion of the population is highly annoyed and sleep-disturbed'.

However, it is important to note that the values presented in the table should not be regarded as fixed thresholds and the risk of an adverse effect occurring will also depend on how frequently, and for what duration, the mitigation of overheating is likely to result in increased internal noise levels.

For mechanical services, it is suggested that the internal ambient noise levels given in Table 1.5 of CIBSE Guide A should be achieved for ADF extract ventilation conditions. For the overheating condition, reference is made to the additional guidance in Section 1.10.10 of CIBSE Guide A, which states that a range of +/-5dB on the Table 1.5 values may be acceptable, depending on the particular situation.

The mechanical services noise targets for the overheating condition are based on systems operated to meet the overheating criterion (such as TM59). It may be acceptable for systems to have a boost mode (included for occasional use with louder fan noise) provided that this does not form part of the strategy for meeting the overheating criterion and is under occupant control.

The AVO Guide suggests that testing should be undertaken to confirm that the installed mechanical services meet the target noise levels. The intention is to avoid the situation where installed services are considered too noisy by occupants and therefore not used appropriately.

The worked example sets out the typical design process in terms of:

- The activities that would be undertaken by the acoustic consultant
- The information that the acoustic consultant should be supplying to the other members of the design team (for example, locations where simple opening windows are not likely to be a viable means for controlling overheating)
- The information that the acoustic consultant may need from other members of the design team in order to make their assessment (for example, the area of façade openings and the number of hours that they are required to be open to meet the overheating criterion).

Table 1: Level of noise risk

Internal ambient noise level (overheating situation)		AVO Guide risk category
$L_{Aeq,T}$ during 07:00-23:00	$L_{Aeq,8h}$ during 23:00-07:00	
< 35 dB	≤ 30 dB	Negligible
> 35 dB	> 35 dB and ≤ 35 dB	Low
> 40 dB	> 35 dB and ≤ 43 dB	Medium
> 50 dB	> 43 dB	High

Suggested risk categories based on the resultant internal noise level

The guide aims to promote a collaborative design process with good communication and timely coordination between the different disciplines. This is hopefully consistent with the integrated design approach advocated by the recently released CIBSE TM60 *Good practice in the design of homes*. It is acknowledged that on challenging sites, it may be necessary to develop the design iteratively to arrive at a scheme that best addresses acoustics, ventilation and overheating.

To assist designers and environmental health officers, the worked example gives guidance about approximate external noise limits for which each of the Part F template ventilation systems would be appropriate. Similarly, the guide gives examples of passive ventilation solutions that offer a higher level of sound insulation than simple opening windows. These include the use of balconies/winter gardens, attenuated windows and acoustic louvres.

Given that environmental design and building services are so integral to the AVO guidance, the authors would appreciate any feedback from CIBSE members through the online questionnaire, available at **goo.gl/XqogVG**.

DR ANTHONY CHILTON is a senior partner at buildling services engineers Max Fordham. He says his goal is to find acoustic solutions that help make buildings more comfortable.

Read more on attenuated ventilation panels on the North West Cambridge development on page 48.

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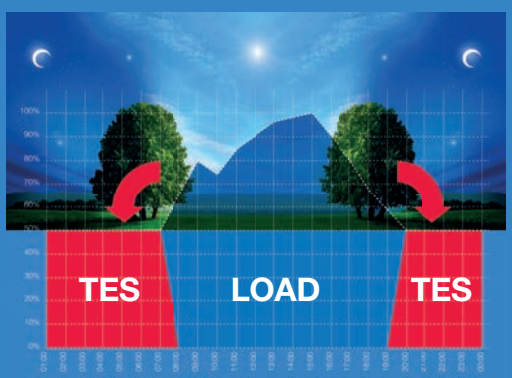

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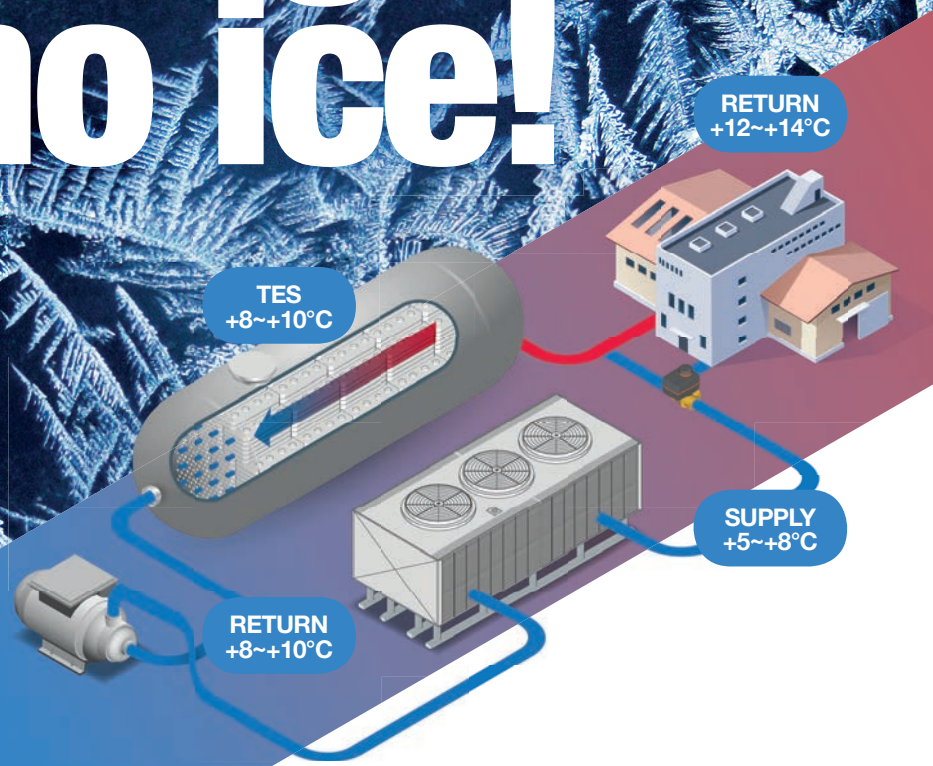

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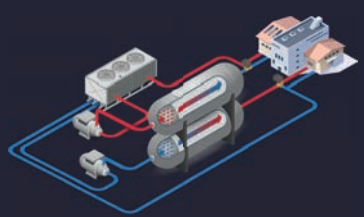
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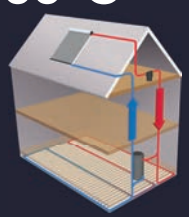
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MOTORWAY SERVICES

A desire for naturally ventilated homes on the North West Cambridge development was threatened by noise from the M11. Apex Acoustics' **Nick Conlan** explains how an attenuated system ensured a good night's sleep for all

Façade-mounted, attenuated ventilation controls overheating on a site with high noise levels

The North West Cambridge development is a £1bn project to supply the University of Cambridge with the homes and research accommodation it needs for future growth. Its first phase is the local centre, known as Eddington, which includes 700 homes for university and college staff, 325 rooms for postgraduate students, and 450 open-market homes, plus associated facilities such as a primary school, community hall, healthcare centre and retail units. This phase is now nearing completion, with parts of the residential buildings already occupied.

The development is a leading example of how residential schemes can use façade-mounted, attenuated ventilation to offer natural ventilation solutions to control overheating on a site exposed to high noise levels.

Within the first phase, four of the architects have adopted this approach into their façade designs, as an alternative to introducing mechanical ventilation options.

The site is exposed to constant traffic noise from the nearby M11

KEY-WORKER HOMES

The development known as Lot 3 (pictured above) consists of 323 one- and two-bedroom, key-worker apartments. Attenuated vents are located adjacent to the windows, behind the large perforated panels, that form part of the window surround. Behind the perforated metal panels are weather louvres, dampers, and then the attenuation. As with Lot 5, two levels of attenuation were specified, depending on external noise levels. Most spaces could use cross-flow ventilation with windows that open on quieter façades.

- **Architect:** Mecanoo
- **Contractor:** BAM

Site challenges

The North West Cambridge development is adjacent to the M11 motorway and, as a result, is exposed to traffic noise day and night.

A planning condition for the development required reasonable noise levels to be met within the residential buildings when they were ventilated at a rate to control overheating. If that could not be achieved with the windows open, an alternative method of ventilation would be required.

In addition to motorway traffic, the scheme had to consider noise generated within the development, which was to include new transport routes, an energy centre and commercial units.

The noise levels across the site were modelled using SoundPLAN software, which enables noise levels to be predicated on each façade based on future traffic data. It can predict the incident noise levels for each floor height, taking into account the shielding provided by the proposed first-phase buildings and the landscaping of the area next to the M11.

Once the external noise levels had been established for each room, the necessary noise reduction could be established.

The indoor noise levels required were 40dB LAeq,T during the day and 35 dB LAeq,T at night – whereas the predicted external noise levels were up to 67dB LAeq,T and 62dB LAeq,T »

» for the daytime and night-time respectively.

With the windows closed – and any trickle vents open – a reduction of 30dB is possible, so suitable internal levels can be achieved even at the façades with the highest predicted noise levels. The sound reduction provided when windows are opened, however, is considerably less.

Noise reduction from open windows

The sound reduction from an open window depends on several variables, such as the open area required, the type of window and how it's hinged, the direction of the noise source, and the room size and finish. Most noise assessments are based on a rule-of-thumb reduction of 10dB to 15dB for a partially open window.

For this development, the reductions were estimated using the open-area requirements for the ventilation and, typically, the predicted reductions were within the 10-15dB range.

To meet local authority requirements with open windows, external noise levels had to be below 55dB LAeq,T during the day, which was only predicted to occur at a small proportion of the site, furthest from the M11.

The majority of the first phase of the development fell within the 55dB LAeq,T to 67dB LAeq,T range, which meant the façades directly facing the M11 would require some form of alternative ventilation. The use of attenuated vents was proposed to enable a natural ventilation strategy to be maintained and achieve the 27dB indoor noise level required.

The attenuated vents at Swirles Court have a patterned, perforated metal finish

> "The scheme had to consider noise generated within the development, including new transport routes, an energy centre and commercial units"

The ventilation rates needed to control overheating were established using dynamic thermal modelling and assessed using CIBSE TM52 criteria.

To give the necessary ventilation rates, the size of the vents need to be significantly larger than standard trickle and through-wall ones. Vents of this size are more commonly used in the education and commercial office sectors, which – for air quality – require much greater ventilation rates throughout the year than a typical residential dwelling.

To demonstrate compliance with the required noise levels, the vents needed to be tested and meet specific acoustic requirements. These were specified as element normalised level differences (Dn,e), the same parameter used for trickle vents. **CJ**

■ **NICK CONLAN** is a lead author of the *Acoustic Ventilation and Overheating Guide* and acoustic consultant at Apex Acoustics

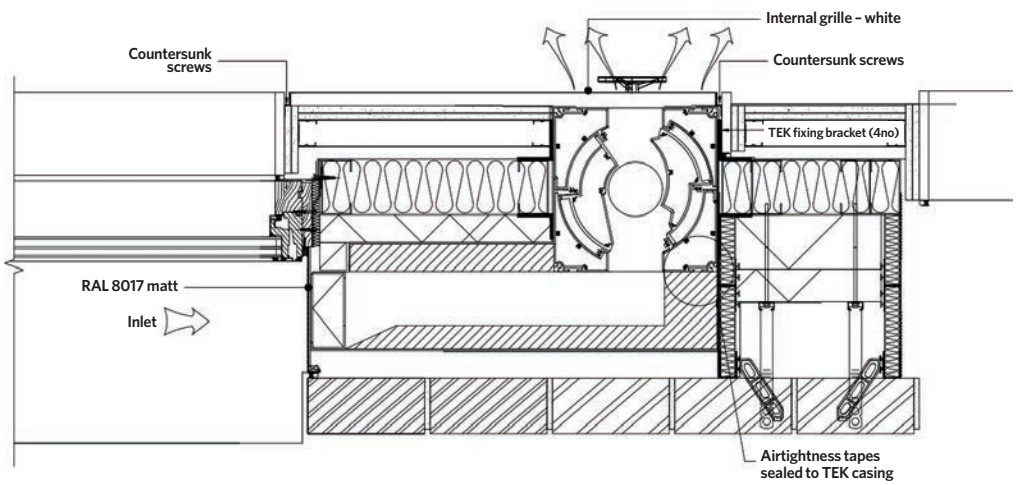
SWIRLES COURT

Swirles Court is a traditional student accommodation block, consisting of 325 en suite rooms and shared kitchen and dining facilities. The attenuated vents are located to the side of the windows and have a patterned, perforated metal finish. Behind the panel is a weather louvre, then the attenuation. The opening and closing of vents is via a simple manual damper, which can be operated as if it were a window, under the occupant's control. External solar shading is included on the south-facing façades, with provision for fitting to the other façades

The vents were sized to give two air changes per hour (20 L·s^{-1}) for the one-person bedrooms and two attenuation specifications were provided, depending on external noise levels.

The same ventilation strategy was included in all rooms – even when the noise levels were suitable for open windows – as they offered a safer, more secure option for night-time ventilation than opening windows.

■ **Architect:** RH Partnership
■ **Contractor:** Graham Construction



Attenuated ventilator unit (Source: TEK)

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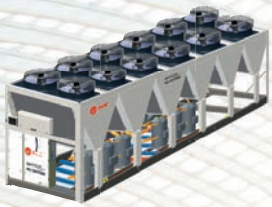

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Safety procedures will have to be strengthened to deal with the fact that many alternative gases are mildly flammable

HANDLE WITH CARE

The soaring price of refrigerant gas is leading to an outbreak of unsafe and illegal practices, writes **Ewen Rose**

As widely predicted, 2018 is proving to be a momentous year for the air conditioning and refrigeration sectors.

The next step in the phase-down of global warming refrigerant gases under the European F-Gas Regulation kicked in on 1 January and shifted the landscape dramatically. Some of the most widely used gases are rocketing in price since the quota system meant the amount of HFC gases allowed on to the market dropped by a whopping 37%.

As the step change approached, wholesalers set record price rises of up to 60% on refrigerants such as R404A and R507A, which have high global warming potential (GWP). Even some lower GWP alternatives went up by as much as 30%. R410A, for example, now costs 30% more, as do some R22 service blends.

The situation is so fast-moving that a number of European industry bodies have called for the industry to stop installing equipment that uses R404A and R507A immediately – all of which has major technical and cost implications for anyone operating and attempting to service plant.

AREA, EFCTC, Asercom and the European Partnership for Energy and the Environment (EPEE) have produced joint guidance recommending designers and specifiers switch to new equipment or installers retrofit existing systems with alternative refrigerant gases with lower GWP.

Focus on recovery and recycling

They are also urging the industry to amplify efforts to reclaim HFC gas and switch to alternative substances as quickly as possible. However, they also warn that safety procedures will have to be strengthened to deal with the fact that many alternative gases, such as the increasingly popular R32, are mildly flammable.

At the third meeting of the F-Gas Consultation Forum, which took place recently in Brussels, all EU member states agreed to continue their aggressive phase-down of higher GWP gases. They resisted lobbying by some countries to relax quotas in order to relieve the pressure on prices. Instead, the forum called for all members to focus on the recovery and recycling of gas that is already on the market and, therefore, permitted for use for a further 10 years after 'virgin' gas is banned – and to encourage its markets to accelerate the take-up of alternatives.

They were arguing from a position of strength because it appears that emissions of HFCs have started to fall for the first time, which suggests F-Gas legislation is working. However, there is growing nervousness about the industry's ability to work safely with flammable alternatives such as hydrocarbons, HFOs and R32, and the higher operating pressures of carbon dioxide.

Of more immediate concern is the growing evidence that the rising cost of gas is tempting people to try to subvert the market. 'In some »

» cases, the pricing is getting ridiculous,' says Graeme Fox, head of the UK's safe refrigerant handling register, Refcom. 'While it is legitimate to price gas in line with demand as certain types become scarcer, there is clearly also some manipulation of the market going on, leading to perverse behaviour.'

In particular, he is alarmed by the practice of using mildly flammable R32 as a replacement gas in air conditioning systems designed for R410A. 'R32 is one of the new A2L class refrigerants, which are not suitable for retrofit projects at all because they require specific safety measures. R32 has a higher compressor discharge temperature than R410A, so it will increase wear on the compressor and significantly shorten its operating life.

'However, that's not even the half of it: simply charging an existing system with R32 breaches the refrigerant safety standard EN378, renders the manufacturer's warranty invalid, and creates operating risks that potentially invalidate the user's insurance policy as well.'

The pressure on price is also leading to a rise in the amount of illegal disposable cylinders coming into the UK from countries such as Turkey. This kind of non-recyclable container has been banned in Europe for more than a decade, but is suddenly cropping up again on eBay.

Not only are the cylinders prohibited, there is very little way of telling if they actually contain the gas advertised on the label and Fox is worried that we may be seeing a return of the counterfeit refrigerant market that caused havoc seven years ago.

'Back in 2011, one Chinese gas supplier was selling what it claimed were bottles of R134A, which turned out to be methyl chloride. Putting the incorrect chemical into a system can be deadly – and it was.'

Policing

However, anyone breaching the F-Gas regulations today faces a tougher policing regime. The Environment Agency was recently given the power to impose on-the-spot fines of up to £200,000. In the past, many miscreants got away with it because of the cost and complexity of bringing legal action.

Ultimately, all of this means we are now looking at a very different refrigerant market and, as was highly visible at the recent Mostra Convegno exhibition in Milan, many manufacturers are switching to R32 for their new systems. Although it is an HFC, R32 has a significantly lower GWP than R410A – almost 75% lower – so will remain available for much longer, as it is the higher GWP gases that are being phased down first.

"R32 has a higher compressor discharge temperature than R410A, so it will increase wear on the compressor and significantly shorten its operating life"

A service technician recovers refrigerant from air conditioner system

Japanese company Daikin, which makes equipment and refrigerant gas, says R32 is suitable for split air conditioners and heat pumps.

Panasonic has announced a switch over to R32 for its residential and commercial AC equipment, including single and multi-split systems. 'Consolidating our portfolio to be compatible with R32 is an important step towards reducing the impact of air conditioning on our environment,' says Panasonic Heating and Cooling UK country manager Alfredos Armaos.

Colin Goode, product and specification manager at Fujitsu Air Conditioning, explains that there is no perfect solution. All of the 'new' refrigerants will either be flammable or toxic and they will not be as energy efficient as predecessors, but the industry has to be pragmatic.

Goode believes there will be a significant move away from VRF systems towards chilled water because designers are looking for a way to keep toxic and/or flammable refrigerant outside the building – with the water used as the medium for circulating warmth and coolth inside. 'Unfortunately, as soon as you go through a secondary medium you are losing efficiency. The plus side is you're not bringing something toxic inside,' he says.

He also thinks there has been 'profiteering' in the supply chain that is reflected in the massive price increases. However, the industry now has no choice.

'This sword of Damocles has been hanging over us for seven years,' says Goode. 'Lots of people have stuck their heads in their sand, but the sand has now run through. This year is the crunch and we have to reduce our imports by 30% compared with last year.

'This also has huge training implications because of the safety issues and consultants urgently need to bone up on the alternatives.'

So, 2018 has already been a big year for air conditioning and refrigeration, but it looks like we are just getting started. CJ

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COMMISSIONING POSSIBLE

Air conditioning offers benefits in terms of cooling and heating, but only if systems are commissioned correctly before they are put into use. Fujitsu's **Martyn Ives** explains

Although air conditioning commissioning varies depending on the type of equipment installed and the application in hand, the principle remains the same, with the same considerations applying throughout the duration of a project.

First, commissioning should not be left until the end of an installation; it needs to be considered throughout the system design process, as it is just as important as positioning the units correctly.

It is crucial to factor commissioning time into a project, as a system cannot be switched on until the process has been completed. Building owners may be piling on the pressure and demanding units are activated as soon as possible but, without suitable commissioning, the system could be inefficient, develop faults – or even not function at all.

Indeed, many common issues associated with commissioning are usually related to time constraints. If a project has been rushed or has overrun, there may have been mistakes made during the installation process, such as incorrect wiring or configuration settings. In addition to any mechanical and electronic issues, it is equally important that everyone involved in a project is shown how to correctly adjust controls.

Addressing the issues

'Addressing' the system, to ensure that indoor and outdoor units 'talk' to each other, can be another problematic area, especially in larger applications, where the process becomes more involved. The best time to address outdoor units, for example, is when wiring the system, as the covers will already be removed.

As air conditioning technology has advanced, VRF systems, in particular, have become simpler to commission. However, it is still important to check all units are connected and talking to the correct corresponding units in the system, otherwise there could be communication issues between external and internal units. After all, nobody wants operators thinking they are adjusting the settings for a wall-mounted unit in one room, when they are actually reprogramming a ducting unit in a different area of the building.

Many systems now offer 'auto-addressing' in addition to manual, but beware – this does not address in a logical way; this can lead to adjacent rooms being wide apart on any numbering collateral, adding »

"Systems should be in an evacuated condition prior to commissioning, having spent at least 12 hours held in a vacuum state before being signed off"

» an extra complication for service engineers to deal with.

Value engineering v design intent

Another issue to be wary of is value engineering undermining design intent. For example, stretching the capacity of a VRF system too far can result in it running below its intended capacity. While it is common to apply system diversity up to 120% for cooling – because not every space needs 100% capacity at all times of the day or year – anything higher should immediately start ringing alarm bells. In other words, a 30kW outdoor unit shouldn't be connected to 45kW of indoor equipment.

This 'over indexing' of VRF systems to take account of building diversity is fine for cooling. However, if the same system is also going to supply heating for the building, over indexing the system is not recommended because, on a Monday morning after an unoccupied weekend, on a designated heating day in the middle of winter, the building will need every kW of heating capacity possible. If the outdoor VRF units have been undersized or over indexed, it will take much longer to get the building up to the required temperature.

This type of scenario usually arises because budget constraints dictate that only one outdoor unit can be afforded. Should this be the case, calculations need to done to ensure that the amount of indoor units do not exceed the 120% capacity recommendations. Care should also be taken over ducted units and the duct runs between them, as incorrectly sizing these can affect capacity, as well as reliability.

Controls also need to be considered carefully, especially in terms of the area requiring heating and cooling. For example, there have been scenarios when a large open-plan area has a VRF system set to cooling on one side of the room, but heating on the other – therefore cancelling each other out.

It is crucial to factor air conditioning commissioning time into a project

Other considerations

Air conditioning systems also need to be suitably prepared before commissioning takes place. One important aspect is the condition of the refrigerant pipework, as it is essential there is no air inside it and, in turn, no moisture is present. To ensure this is the case, systems should be in an evacuated condition prior to commissioning, having spent at least 12 hours held in a vacuum state before being signed off.

Another crucial element is to power up the outdoor units 24 hours before commissioning takes place. Doing so energises the compressor, which then helps to remove any liquid from the system.

To aid with the commissioning process, system service software is available, which allows engineers to check that all address settings are correct, as well as view all the temperature and pressure readings from the condensers. Fujitsu has its own software, Service Tool, for commissioning VRF systems. Service software works by plugging a laptop into the system before checking all relevant components.

Furthermore, any system's installation must be compared to its design schematics, with visual checks made to ensure pipework and fittings are correct before building work renders them inaccessible. Pipework also needs to be supported correctly and well insulated, with any separation tubes and refrigerant branch boxes fitted at the angles advised in the installation manual.

So, while air conditioning offers cost-effective, as well as energy efficient, heating and cooling in the long term, this is only possible once a system has been suitably commissioned. By adhering to the standards outlined above (and ensuring regular servicing), equipment should operate correctly and to its full potential throughout its lifespan. CJ

MARTYN IVES is the technical training manager at Fujitsu

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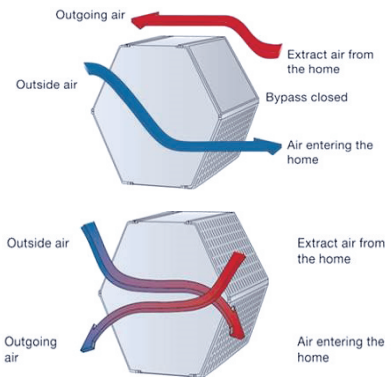

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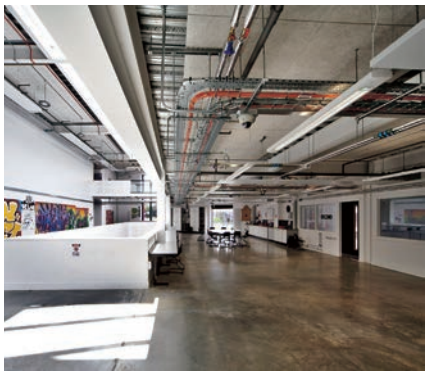

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- Recognise the different cooling solutions and how they work
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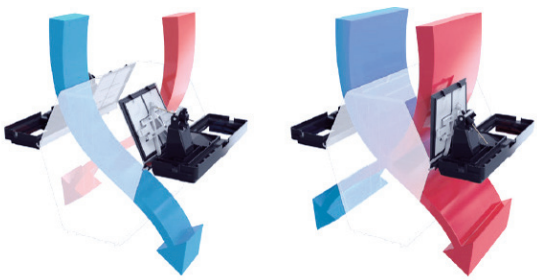

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Radiant sails for room conditioning

This module explores the impact of radiant heat transfer on occupant thermal comfort and considers the application of radiant sails for room conditioning

The challenge of maintaining comfortable and effective indoor environments is increasingly dominated by the need for cooling that also meets the demands of flexible working spaces. Ceiling-suspended radiant 'sails' can offer an energy-efficient and cost-effective alternative to traditional systems, and supply a source of heating. This CPD will consider the impact of radiant heat transfer on occupant thermal comfort and explore the application of these 'floating' ceiling elements that can be used effectively to deliver hydronic cooling and heating for built environments.

The influence of the radiant environment on occupants

The operative temperature, θ_c (°C) – a standard measure of human thermal comfort – is calculated[1] from $\theta_c = \frac{\theta_{ai}\sqrt{(10v)}+\theta_r}{1+\sqrt{(10v)}}$ where θ_{ai} is the air dry-bulb temperature (°C), θ_r is the mean radiant temperature (°C) and v is the mean air speed ($m \cdot s^{-1}$).

In cases where the air is outside the influence of significant motive forces (such as fans, diffusers and natural ventilation inlets), the air speed is taken as being of a similar magnitude to that of natural convection ($\approx 0.1 m \cdot s^{-1}$). So, the calculation for operative temperature is typically simplified to $\theta_c = 0.5 \cdot \theta_{ai} + 0.5 \cdot \theta_r$. Therefore, within limits, the balance of thermal comfort is determined by the average of the air dry-bulb temperature and the mean radiant temperature.

As discussed in some detail in Section 1.6 of CIBSE Guide A[1], there are several other factors that should be considered when assessing the overall thermal comfort of occupants. However, the practical impact that is explicitly related to radiant heat transfer is due to the asymmetry of the radiant surfaces and their temperature. As shown in Figure 1, the influence of surface temperatures on comfort has been shown to be highly dependent on their relative position to the occupant. So, for example, to meet a 'percentage of population dissatisfied' (PPD) figure of 5% would indicate that, for human comfort, the average ceiling temperature should be no cooler than around 14K less than the room air temperature, and should be no warmer than around 4K. (This is »

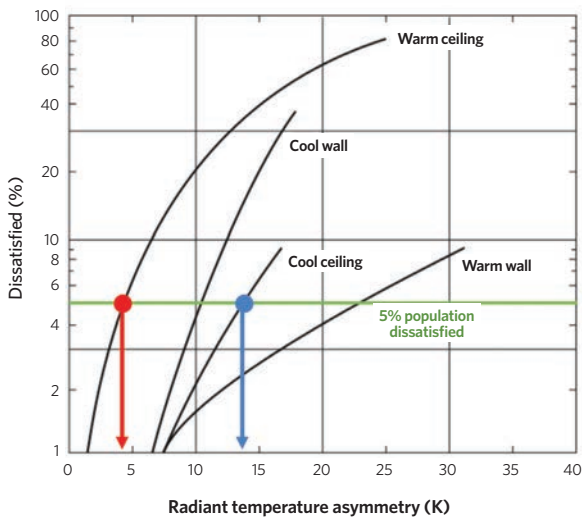

Figure 1: Percentage dissatisfied due to asymmetric radiation only, based on work by Ole Fanger (Source: CIBSE Guide A 2016 Fig 1.11)

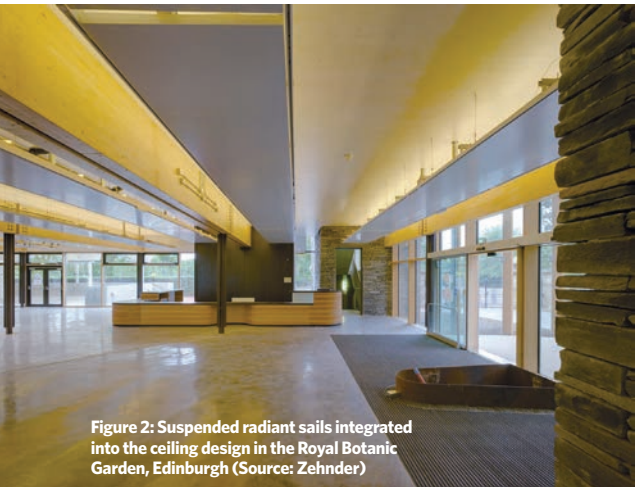

Figure 2: Suspended radiant sails integrated into the ceiling design in the Royal Botanic Garden, Edinburgh (Source: Zehnder)

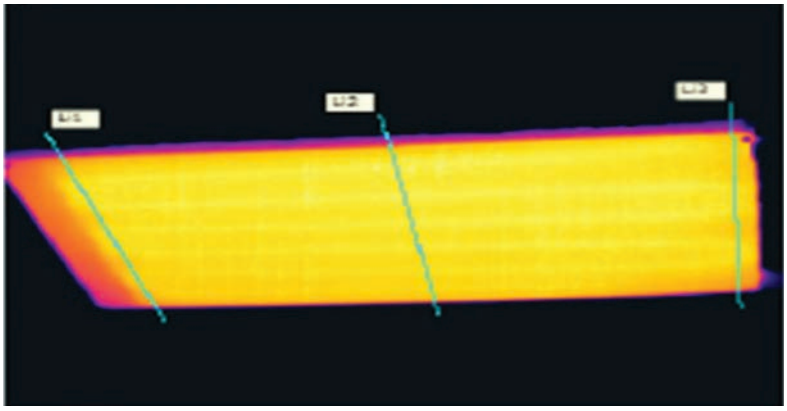

Figure 4: Thermographic image of a sail with enhanced coil-to-panel heat transfer, with a consistent surface temperature that can increase the effective output compared with more basic constructions (Source: Zehnder)

» approximately reflected in ISO7730[2] for category A and B buildings.)

The actual impact of radiation will be determined not only by the surface temperature, but also by the view (or shape) factor – that is, the amount that the surface impacts on the occupant. This can be geometrically complex to determine and, as occupants move around or are positioned differently within a space, will vary across the room. The mean radiant temperature, θ_r, is used to assess the average radiant temperature at any particular point, accounting for the temperatures, positions, radiant properties and areas of all the surrounding surfaces. It has been practically indirectly assessed through the use of a globe thermometer in a single position (experimentally, often suspended in the centre of a room) but – as confirmed by Alfano *et al*[3] – measuring it swiftly is challenging. The impact of all the non-uniform surface temperatures and shapes will integrate with other factors to give the sensation of comfort and wellbeing, so the impact of radiant heat exchange is likely to vary across the space – making it particularly difficult to determine a representative value. The CBE Comfort Tool at **http://comfort.cbe.berkeley.edu/** offers a simple device to predict the effect of asymmetric radiation on comfort – select the EN 15251 tab and the 'Local discomfort' button.

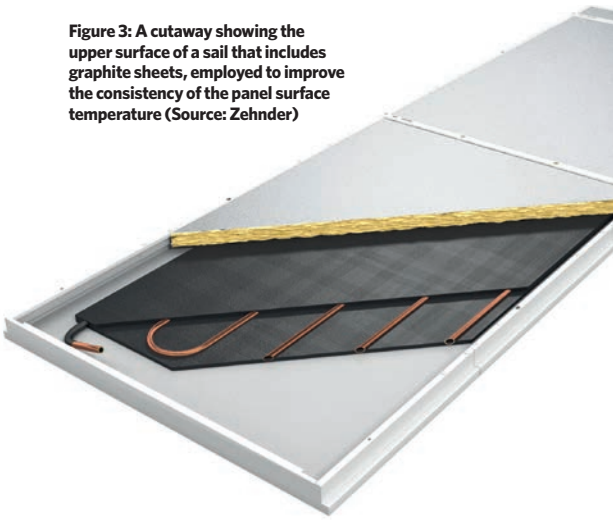

Figure 3: A cutaway showing the upper surface of a sail that includes graphite sheets, employed to improve the consistency of the panel surface temperature (Source: Zehnder)

Cooling and heating with radiant sails

Aside from the fixings, the radiant sail is designed so it has no significant physical (or thermal) connection to the structural soffit, and a space is maintained between the panel and the surface above it (as shown in the installation in Figure 2). Radiant sails may be used for heating or cooling (simply depending on the relative temperature of water flowing through the coils) and the performance of both modes is assessed by methods as described in BS EN 14037[4] and BS EN 14240.[5] The resulting thermal output is given in terms of $K{\cdot}\Delta\theta^n$, where K and n have been found by undertaking standard tests on the panel, and $\Delta\theta$ is the difference between the average sail temperature and the room. By virtue of using water to convey heating and cooling into the space, as opposed to using an all-air system, energy distribution costs and space requirements are reduced and – as demonstrated by Kosonen *et al*[6] – for properly sized and installed systems, the levels of comfort delivered by radiant and convective systems are practically the same. The sail will not be wholly radiative, as the surface will cool, or heat, adjacent air all around the sail. Cooled air will then convect downwards at a relatively low air velocity and, when heating, the warmed air will move upwards, as a result of convective forces.

When in cooling mode, the surfaces of a radiant sail must remain above the room air dew-point temperature to prevent surface condensation. This is often done by sensing the temperature on the pipe supplying the radiant panel and employing a mixing circuit to control the water temperature. Where the absolute moisture content in the room is high (and so the air dew-point temperature is also high) the cooling performance will be limited, as the sail must operate with warmer cooling water. If the room air moisture content is likely to be particularly high – possibly because of latent gains from people or processes – a radiant cooling system will typically be operated in conjunction with a dehumidifying ventilation system.

As the surface should not drop below the air dew-point temperature, an application in a location such as the UK would practically mean that the chilled water flow is likely to operate at temperatures between 14°C and 18°C. (For comparison, the dew-point temperature of air with 26°C dry-bulb temperature and 60% saturation is 18°C, as would be a typical indoor maximum design condition.)

An example steel commercial sail (600mm x 2400mm) has a K of 13.5 and an index n of 1.06 so with, say, an 8K difference in temperature between the sail and the room, the cooling potential (0.6m x 2.4m) x 13.5 x $8^{1.06}$ = 176W (or approximately $120W{\cdot}m^{-2}$). This output can be improved significantly with panels that incorporate enhanced heat transfer materials (such as that in Figure 3) to give a more even temperature across the whole sail surface, as shown in Figure 4.

With the cooling medium being at temperatures typically greater than 14°C, opportunities open up to use efficient heat pump/refrigeration systems or, potentially, passive or evaporative cooling.

The sails can also be used for heating, by passing relatively hot water through the coil. Despite some convection from the surfaces, the sails are a predominantly radiant heater with a large heat transfer surface. The impact of using a largely radiant heater can be examined by inspecting the CIBSE Simple Method[7], where the average total room heat loss Φ_t (W) is given by

$$\Phi_t = [F_{1cu}\Sigma(AU) + F_{2cu}C_V]\,(\theta_c - \theta_{ao})$$

where F_{1cu} and F_{2cu} are factors that are related to the type of heat source, $\Sigma(AU)$ is the sum of the products of the surface area and corresponding U value for each surface where there is a heat flow ($W{\cdot}K^{-1}$), C_V is the ventilation coefficient ($W{\cdot}K^{-1}$), θ_c is the mean operative temperature in the centre of the room (°C),and θ_{ao} is the outside air temperature (°C).

The factors F_{1cu} and F_{2cu} are obtained from

$$F_{1cu} = \frac{3(C_v + 6\Sigma A)}{\Sigma(AU) + 18\Sigma A + 1.5R[3C_v + \Sigma(AU)]}$$

and

$$F_{2cu} = \frac{\Sigma(AU + 18\Sigma A)}{\Sigma(AU) + 18\Sigma A + 1.5R[3C_v + \Sigma(AU)]}$$

where $\Sigma(A)$ is the total area through which heat flows (m^2), and R is the radiant fraction of the heat source. This will have high value for radiant heat sources (with a maximum value of 1 for a pure radiant source) and a low value for predominantly convective sources (practically zero for ventilation systems). As the value of R increases, both factors F_{1cu} and F_{2cu} will reduce, so the resulting average heat loss, Φ_t, will reduce. The increase in the radiant temperature of the air within a space will be reflected in reduced energy use, predominantly because of reduction in the temperature of ventilation air supply, and can be particularly beneficial in intermittently heated spaces where the volume of the space is large, as the bulk air volume requires less heating during times of discontinuous occupation.

Controlling radiant sails

The thermal inertia of the panels is small, so providing short response times. This means that they can be particularly useful where the load is likely to vary, but can make it challenging to monitor the space conditions reliably. In an attempt to interpret practically the operative temperature in a space, black bulb or radiant temperature sensors are used (such as that in Figure 5). Where standard air temperature sensors are used, with a predominantly radiant system, an attempt to simulate the radiant effect is made by resetting the set-point by 3K for heating and 2K for cooling.[8]

When using the sails with a single coil for heating and cooling, there are a number of ways to arrange the system. A two-pipe changeover system (for heating and cooling) is not typically recommended, as demand for heating and cooling may well be different across a building. Three-pipe and four-pipe arrangements allow concurrent heating and cooling – the four-pipe system is preferred, as it offers more useful return water temperatures and simpler control.

As well as controlling the required room temperature, a dew-point sensor must protect against moisture damage. This will influence the chilled water temperature being supplied to the zone to maintain the surface temperature above the room air dew-point temperature.

It is possible to put separate heating and cooling coils on the sail. As well as simplifying the control (by having two completely separate circuits), this allows – for example – for higher temperature heating systems that require a smaller coil area or cooling systems that include some specific water treatment.

Figure 5: A black bulb temperature sensor (Source: Zehnder)

Application of radiant sails

The sails can be combined with architectural lighting as part of an integrated scheme, and can be fabricated with perforations to affect the acoustic performance of the space, as shown in Figure 6.

Figure 6: A refurbishment of a 19th century school property included acoustically treated sails and lighting suspended between the panels. Basement-located heat pumps provide heating and cooling to the sails (Source: Zehnder)

Flexibility in the building space can be accommodated, as ceiling sails can be located appropriately to supply the required conditioning based on 'active' areas within a building, such as where more people are located. As the sails are suspended, they can provide a source of both hydronic heating and cooling without taking up floor area.

There are several areas in which the proper application of a radiant sail system may contribute to the accumulation of Breeam environmental points, for example through:

- System zoning
- Reduced noise levels when using perforated panels that reduce the reflection and increase the absorption of sound
- Potentially reduced size of cooling plant (this requires less than 5kg of refrigerant sealed within the unit, such as a medium-sized commercial heat pump)

Basic radiant panels are relatively simple pieces of equipment, with no moving parts. Some manufacturers include a microbial finish to prevent the growth of micro-organisms and, together with the simple easy-clean construction, this means that little maintenance is required. Radiant sails are manufactured from a combination of steel, aluminium or copper and, typically, are fully recyclable.

In appropriate applications, the operational energy consumption is likely to be reduced (compared with convective and slow-response systems) as a result of a combination of the more moderate temperatures of cooling and heating enabled by large heat transfer surfaces, the fast response of the system and the reduced air temperature – while still maintaining appropriate operative temperatures.

Turn to page 58 for references.

Module 126

May 2018

1. What mean air speed is assumed in order to simplify the formula for θ_c?

- ☐ A 0.01m·s^{-1}
- ☐ B 0.05m·s^{-1}
- ☐ C 0.10m·s^{-1}
- ☐ D 0.15m·s^{-1}
- ☐ E 0.20m·s^{-1}

2. What approximate percentage of people are likely to be dissatisfied if a cool ceiling has a surface temperature 10K cooler that the other room surfaces?

- ☐ A 1%
- ☐ B 2%
- ☐ C 3%
- ☐ D 4%
- ☐ E 5%

3. If a 2m² radiant sail is 5K cooler than the room and it has a K of 13.5 and an index n of 1.06, what is its likely approximate heating output?

- ☐ A 110W
- ☐ B 120W
- ☐ C 130W
- ☐ D 140W
- ☐ E 150W

4. The increased output from the radiant panel in Figure 3 is enabled through which one of these?

- ☐ A Increased number of tubes affixed to the rear
- ☐ B Increased room operative temperature
- ☐ C Lower cooling water temperatures
- ☐ D Materials to improve the consistency of the panel surface temperature
- ☐ E The surface coating of the panel has a higher radiant emissivity

5. Which of these is not noted as potentially providing Breeam points when using radiant sails?

- ☐ A Increased sound absorption
- ☐ B Opportunity for system zoning
- ☐ C Potential reduction in size of cooling plant
- ☐ D Recyclability of materials
- ☐ E Reduced reflection of sound

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References:

1 CIBSE Guide A, Chapter 1, CIBSE 2016.
2 BS EN ISO 7730, *Ergonomics of the thermal environment – Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria*, 2005.
3 Alfano, F R A *et al*, 'On the measurement of the mean radiant temperature and its influence on the indoor thermal environment assessment', *Building and Environment* 63 pp79-88, 2013.
4 BS EN 14037 *Free hanging heating and cooling surfaces for water with a temperature below 120°C*, BSI 2016.
5 BS EN 14240 *Ventilation for buildings – Chilled ceilings – Testing and rating*, BSI 2004.
6 Kosonen, R *et al*, 'Thermal comfort with radiant and convective cooling systems', *REHVA Journal*, June 2014.
7 CIBSE Guide A, Appendix 5.A2, CIBSE 2016.
8 Zehnder Radiant Cooling CIBSE-recognised CPD, 2018.

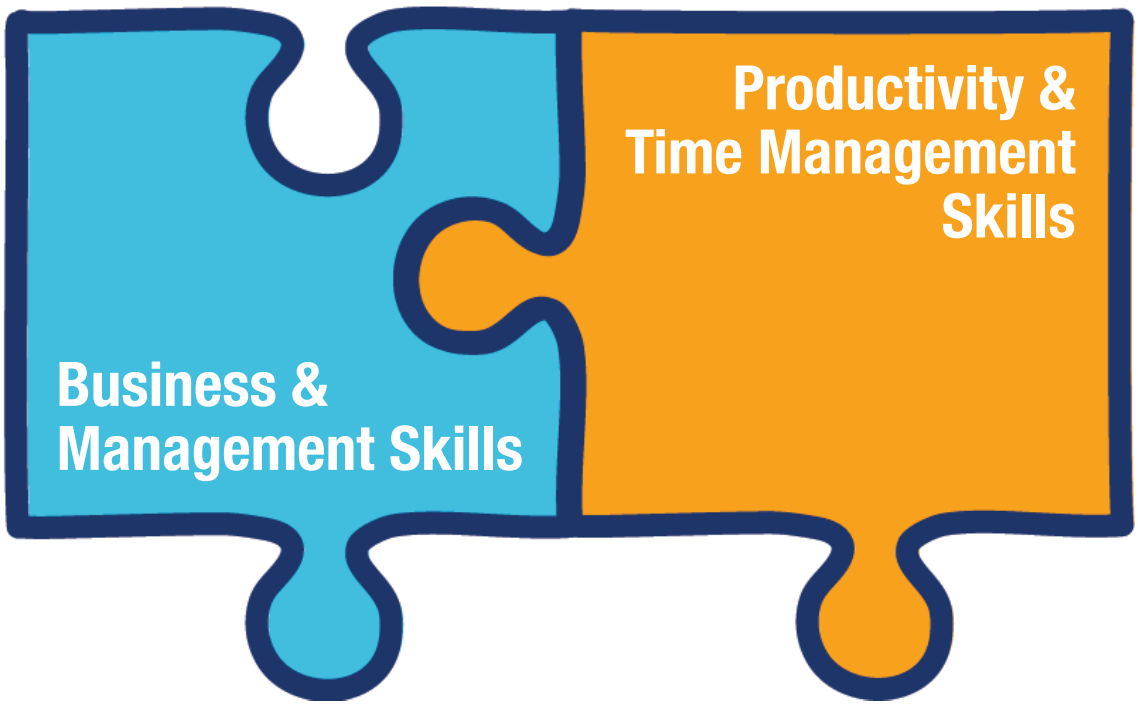
CIBSE

New Soft Skills Training Programmes Released

Supporting building services professionals to become outstanding employees

2 New Programmes

9 Online Learning Modules



Get 20% off* any soft skills modules purchased before Friday 18 May 2018 using promo code: MAY10

www.cibse.org/softskills

*Offer expires on 18 May 2018. This offer is valid on standard ticket rates but not in addition to any other discount offers.

PRODUCTS & SERVICES

Cooltherm forms exclusive partnership with Geoclima

After 25 years of working to bring the UK constant innovation in chiller and heat pump technologies, Cooltherm and Geoclima have made their partnership exclusive. Cooltherm places innovation, quality and service at the heart of its business, and Geoclima recognises that to get the very best from its products it needs to be supported and maintained by experts – so chose Cooltherm.

Since the early 90s, Geoclima has been designing and developing special chillers for applications in air conditioning and refrigeration systems, with particular attention to quality and environmental sustainability. During this time Cooltherm and Geoclima have won numerous prestigious awards for their projects and products.

This exclusivity partnership will further cement the product and design support for our clients in the UK, now with up to a five-year warranty available.

Visit www.cooltherm.co.uk

A farewell from – and a welcome to – the Hamworthy Heating sales team

Sales agent Mike Crouch (right) has retired after working with Hamworthy for almost 28 years – and service engineer Dave Ward has moved from the company's service team to its sales team to replace him.

In 1990, Crouch joined as area sales manager. He made the step towards independence in 2000, becoming sales agent for East Anglia. He retired at the end of March when Ward took over. Ward joined in 1998 as a service engineer and felt he was ready for a new challenge as sales manager.

Call 01202 662500, email sales@hamworthy-heating.com or visit www.hamworthy-heating.com

Webercem concrete repair system by Saint-Gobain Weber makes HQ shipshape again

The headquarters of Safestore, in Borehamwood, Hertfordshire, has received a smart exterior makeover with the help of the Saint-Gobain Weber webercem concrete repair system. The building substrate required general repairs to the façade, which was showing signs of wear and tear.

The multi-component system is compliant with BS EN 1504 for concrete patch repairs. It contains webercem HB40 for high build repair and levelling; the associated bonding slurry webercem bondcoat, and a high-performance coating of webercote smooth.

Call 08703 330 070 or visit www.netweber.co.uk @SGWeberUK

'We are ErP ready' as warm air, radiant and heating products now affected by European regulations

Warm air heaters are subject to Lot 21 of the directive and radiant heaters to Lot 20. Nortek's ErP-compliant range includes the Preeva EC heating and ventilation unit, which supplies combined heating and ventilation with optional cooling.

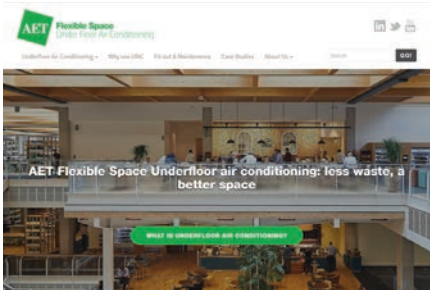
The units come with a range of heat outputs and cooling capacities. They are available as non-condensing heaters with thermal efficiencies of more than 91% or fully condensing heaters with thermal efficiencies of 102% (NCV).

Call 01384 489700 or visit www.nortekhvac.com

New website and 25th-year celebrations for AET Flexible Space

AET Flexible Space has recently launched a revamped website to coincide with its 25th year. The new website at **www.flexiblespace.com** has been designed to help visitors understand the concept of underfloor air conditioning. It also showcases the benefits of adopting a different way of thinking towards building services, and highlights the different types of underfloor systems available. The website is fully responsive on mobile devices and has been designed to inform and educate, with enhanced visual presentation tools.

Call 01342 310 400 or email aet@flexiblespace.com



A new captain takes the helm at Evinox energy

Evinox has announced Terry Mahoney as its new managing director. Mahoney joined Evinox in 2010 and, in his most recent role as operations director, has been pivotal to much of the company's recent success. This includes the delivery and ongoing support of key projects, such as Battersea Power Station, and the evolution of Evinox's manufacturing capability.

Mahoney said: 'I'm delighted and flattered to be appointed as managing director at Evinox. This is an exciting time for the business; with planning regulations and government policy continuing to support the deployment of district and communal heating, the market continues to thrive and evolve. Evinox has seen a strong growth in sales over the past 12 months, and, with product innovation and development at the forefront of the company strategy, this is only set to increase.'

Call 01372 722277 or visit www.evinoxenergy.co.uk

The right design for engineers

When Grundfos wanted to create an online hub for engineers, it knew it was best to start by speaking to a number of specialist engineers from different backgrounds. They all had one thing in common – their roles meant they needed to specify pumps.

The hub contains information that has been specifically designed to work with you, and the topics covered are varied. They range from building higher performance into small and large projects, to how to design water extraction in diverse conditions. There is also a wide choice of case studies from around the world – as well as the option to watch a video from different Grundfos product experts on a host of themes.

Today, the Grundfos for Engineers platform continues to evolve, and benefits from the company listening to what engineers need, to help support them. Perhaps this is why it has become popular with the thousands of engineers who visit the UK site.

Call 01525 850000 or email grundfos-uk@sales.grundfos.com

Intuitive Controller range

Committed to helping customers remain safety compliant, protect assets and manage energy efficiently, Resource Data Management has upgraded its Intuitive Controller range. Designed to increase flexibility, simplify set-up processes and reduce installation costs, the new controllers present optional built-in colour LCD, extended temperature range, dual Ethernet ports, four PWM outputs and increased processing power and memory. The flagship controller in the range, Intuitive TDB, is incredibly powerful, making it suitable for all HVACR applications requiring PLC control strategies.

Email hello@resourcedm.com or visit www.resourcedm.com

Titon achieves Passivhaus accreditation

Titon's HRV3 PH ECOaura MVHR unit has achieved Passivhaus accreditation. The unit, when used with Titon's new aura-t touchscreen or aurastat VT controller, supplies exceptional indoor air quality and energy efficient performance within a building.

Achieving Passivhaus accreditation shows Titon's ability to produce high-quality MVHR systems that can offer extra value within the home. Poor indoor air quality remains a pressing topic, and Titon says it has used its UK manufacturing prowess to produce a high-standard, compliant unit.

Visit www.titon.co.uk

The future of lighting control

Lighting control in commercial environments may be needed for many reasons, including building control regulations, environmental standards, or simply the desire to save energy and money. Luceco has collaborated with LiteIP to supply a flexible, intelligent wireless lighting system, which requires no complicated electrical installation. There is also no limit to the number of luminaires that can be controlled. Throughout the new Luceco Lighting catalogue, compatible products carry the LiteIP logo for ease of specification. LiteIP requires no special lighting controls design work.

Call 01952 238100, email uk_sales@luceco.com or visit www.luceco.com

Canadian consulting firm seeking investor or buyer

Are you interested in an exciting opportunity to leverage the Canadian marketplace to expand or diversify your business?

We are a well-established, successful, profitable Canadian consulting firm with a proven 10-year track record.

Our expertise includes market-leading technical knowledge, and business acumen to achieve growth targets, resulting in increased overall profitability.

We are seeking investors or buyers who are interested in helping to expand our company's business.

Email offers@shaw.ca

Leading security distributors turn to LG for heating and air conditioning

LG's Multi V VRF is the final addition to Oprema's new head office premises on Eastgate Business Park in Cardiff.

Oprema wanted the best heating and cooling for its new offices, server room and warehouse, to make it as comfortable as possible for its team and visitors, while being controlled easily.

Kinetic Workplace was responsible for the design and fit-out of the new premises. Design and project manager David Gilbert turned to air conditioning distributor M3R Climate for assistance when it came to specifying the right equipment to meet Oprema's demanding requirements.

M3R's Ryan Kontoh supplied a specification for LG's Multi V VRF system using LG's design software LATS HVAC, to offer optimum performance for the new premises. The indoor units included the Artcool wall mounts, 4-way ceiling cassettes and LG's ERV ventilation units, all controlled with the 5-inch touchscreen AC EZ.

Email uk.aircon@lge.com or visit partner.lge.com/uk

Welcome to the next generation of VRF

Mitsubishi Electric has launched the next generation of variable refrigerant flow (VRF) air conditioning with the new City Multi YNW. This supplies the market with a system that delivers ultra-quiet noise levels, an increased performance and a reduced footprint.

'The new City Multi YNW models deliver the lowest installation costs, the lowest running costs and the lowest CO_2 emissions currently available in a VRF system,' said Jordan Jeewood, product specialist for the company's City Multi range.

The YNW outdoor units include a unique new, four-sided heat exchanger, which maximises the space available for plant by reducing the area required for air conditioning modules. Improved compressor and fan design also help to reduce sound power, making the YNW one of the quietest VRF systems available.

Air source VRF systems are one of the most popular and widely used air conditioning systems in commercial buildings. The City Multi YNW also offers incremental capacity steps, giving increased flexibility in noise output control.

Visit www.nextgenerationvrf.co.uk

Mikrofill at Goodyers End primary school

Goodyers End primary is a community school that was established in 1996 after the linking of Goodyers End first and middle schools.

Under the umbrella of Warwickshire County Council, the decision was made to replace the existing LPHW heating plant at the school. The existing boilers and associated ancillaries were removed and replaced with new Mikrofill equipment by established Warwickshire term contractor Dodd Group. These included three Ethos 90kW stainless steel condensing boilers each with an integral shunt pump providing a total modulation of 30 > 1 (270 > 9kW). The new LPHW installation was complemented by the Mikrofill 400 pre-commissioned pressurisation package.

In addition, the upper school's HWS supply was enhanced by the installation of a new Extreme 500 litre loading cylinder. The Extreme is designed to operate at Δt of 30°C thereby optimising condensing boiler efficiency, as well as ensuring 100% of its stored volume attains 60°C.

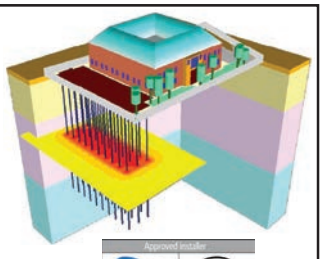
Call 03452 606020 or visit www.mikrofill.com

DIRECTORY Your guide to building services suppliers

Tel: 020 7880 6217 Email: callum.nagle@redactive.co.uk

Air Handling

Energy Efficiency



Air Conditioning

Heating & Hot Water Specialists

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The University of Manchester

Principal Electrical Engineer

Manchester – £50,618 - £60,410 per annum **Ref: PSS-011829**

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You will analyse and interpret the needs of the Directorate of Estates and Facilities and its customers in terms of electrical loads and capacity across the campus HV network.

You will manage a team of electrical engineers and inspectors in the development and monitoring of cost effective electrical Planned Preventative Maintenance and inspection schemes, ensuring that all work meets the set standard. In addition, you will conduct or commission an ongoing programme of electrical condition surveys to assist in the development of a long-term maintenance plan; design and implement policy that ensures electrical maintenance is carried out in a manner that meets legislative requirements, statutory/safety requirements and good practice.

You will assist in the development of strategies that will result in both energy consumption and energy cost reduction. You will manage and control any delegated budgets whilst assisting in the development and implementation of efficient, cost-effective working practices and quality service standards to ensure the provision of an effective maintenance service to the highest achievable standard, demonstrating value for money.

You will provide technical direction, support and advice to all construction project design teams to ensure good standards of electrical installations on all projects and be responsible for overseeing all HV and LV electrical infrastructure.

You will possess a degree, or equivalent, in an electrical engineering related discipline and/or substantial vocational experience and hold Chartered Engineer status and full membership of CIBSE.

You will have an established track record and experience in electrical engineering management together with experience of setting and monitoring standards, managing and controlling budgets/resources/funding and managing staff. You will be an approved authoriser on the Permit to Work/Access system.

Enquiries about the vacancy: Vacancy, shortlisting and interviews: Tony Small, Principal Mechanical and Energy Engineer at tony.small@manchester.ac.uk
General enquiries: hrservices@manchester.ac.uk or 0161 275 4499 or
Technical support: universityofmanchester@helpmeapply.co.uk or 0161 850 2004.

Please note that we are unable to respond to enquiries, accept CVs or applications from Recruitment Agencies.

For further information and to apply, please visit our website.

Closing date: 31 May 2018 at midnight.

As an equal opportunities employer, we welcome applications from all suitably qualified persons. As we are committed to the principles of the Race Equality Charter Mark and Athena SWAN, we would particularly welcome applications from women and the black and minority ethnic (BME) community, who are both currently under-represented at this grade. All appointments will be made on merit.

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Intermediate/Senior CAD/ Revit technician
North London, £30k - £40k + bens

I am working on behalf of a nationally renowned multidisciplinary Building Services consultancy who are looking to strengthen their growing CAD/Revit division due to a busy project pipeline. With at least 3 years' consultancy experience you will work on London's biggest projects across multiple sectors. Progression and an excellent package guaranteed, as well as a fantastic working environment. Ref: 4920

Senior Electrical Building Services Engineer
Kent, £45k - £55k + bens

An opportunity has arisen at a privately owned MEP design consultancy that specialise in innovative healthcare, education, and laboratory projects. The firm is well-established, highly successful, and has a large order book of projects running well into 2019. There will be an opportunity to progress to Director/Co-Owner of the business for someone with the experience and ambition to drive the company forward. Ref: 4927

Senior Electrical Building Services Engineer
London, £45k - £55k + bens

Exceptional opportunity to join a consultancy with a reputation for their dynamic and innovative approach and project delivery. Their work has been noted with an impressive list of industry awards, with some of the most highly regarded MEP engineers working in their London office. Their success is underpinned by the passion and appetite for building services and engineering, and it's imperative that the engineer who joins the team shares this thirst and enthusiasm to push the engineering envelope. Ref: 4829

Mechanical Engineer
Central London, £40 - £43p/h

This is an opportunity for a Lead Mechanical Engineer to join a front runner within the mission critical sector. The requirement is for a Lead Mechanical Engineer that has demonstrable UK consultancy experience and mission critical project exposure specifically data centres. Ref: 4918

Lead Mechanical Engineer
Cambridge, £45 - £50p/h

A multi-disciplinary consultancy has a need for a Lead Mechanical Engineer on a large Pharmaceutical site in Cambridge. Suitable engineers need to have experience using Hevacomp and Revit. Your time will be split between the office/site and provide design, review, and comment on contractors working drawings. Ref: 4930

Senior Mechanical Engineer
London/Wokingham, £45k – 55k + bens

With a number of recent interesting project wins and a pending company expansion, we have a great opportunity for an established senior engineer to join a fast paced, forward thinking consultancy that specialise in delivering high quality, innovative engineering solutions to the built environment. With an excellent Central London location and a dynamic team this company can offer a diverse and exciting opportunity to be part of a growing consultancy where reputation and service are paramount. Ref: 4924

Thinking of your future

www.b-a-r.com

EVENTS

HIGHLIGHTS

Iain Carlile, incoming SLL president, will give his presidential address on 24 May

Peter Boyce, *LR&T* editor, will speak at the SLL symposium on 16 May

NATIONAL EVENTS AND CONFERENCES

CIBSE AGM
8 May, London
CIBSE AGM, followed by incoming president Stephen Lisk's address. The AGM will be preceded by an Extraordinary General Meeting, held to consider proposed changes to the governing documents of the Institution.

Society of Light and Lighting: Light Bytes
10 May, Glasgow
7 June, London
Continuing the 2017-18 SLL Lighting Knowledge Series 'Light Bytes'. The day includes peer-reviewed, bitesize presentations, focusing on four key areas: Design, Build, Specify and Future.
www.cibse.org/sll

SLL Lighting Research & Technology Symposium
16 May, London
In celebration of the 50th volume of *Lighting Research & Technology* (*LR&T*) journal, the Society of Light and Lighting (SLL) is holding a celebratory *LR&T* symposium. Contributors to the 50th volume will speak at the event, which will be followed by a celebration of the inaugural International Day of Light.
www.cibse.org/sll

CIBSE TRAINING

For details, visit **www.cibse.org/training** or call **020 8772 3640**

Building drainage explained
9 May, London

Electrical distribution design
11 May, London

Electrical services explained
15-17 May, Manchester

Fire sprinkler systems: design
16 May, London

Low carbon buildings for local authorities
17 May, London

Lighting design: principles and applications
17 May, London

Fire safety in design, management and use of buildings
18 May, London

Air conditioning inspection for buildings
22 May, London

Heat networks code of practice
23-24 May, London

Building services explained
23-25 May, Bristol

Power systems harmonics
25 May, London

Mentoring skills workshops
1 June, London

Low carbon consultant design training
5-6 June, London

Heat networks code of practice
6-7 June, Manchester

CIBSE GROUPS, SOCIETIES AND REGIONS

For more information about these events, visit: **www.cibse.org/events**

Natural Ventilation Group webinar: Acoustics and natural/hybrid ventilation
8 May
Webinar on interdependency of acoustics and the natural/hybrid ventilation in non-domestic buildings.

ANZ: AGM
9 May, Sydney
CIBSE Australia and New Zealand region AGM.

West Midlands: The new CPR and the role of cables in building infrastructure
9 May, Birmingham
Presentation covering the latest Construction Products Regulation, and the use of cables and components in building management systems.

Scotland and SLL: Well Building Standard seminar
10 May, Glasgow
With speaker Helen Loomes, FSLL, speaking on the Well Building Standard.

South West: High-performance buildings symposium
10 May, Plymouth
With speakers from industry and academia.

Yorkshire: Mental health awareness – we need to talk…
10 May, Leeds
Joint event with Yorkshire branches of IStructE, CIAT, CIOB, with Rich Bell, from Community Links, leading the session.

SLL and North West: LG15: Transport Buildings – the key considerations
10 May, Manchester
Presentation by Keith Miller and Carolina Florian, giving an overview of the key considerations, recommendations and advice contained within LG15: *Transport Buildings*.

SoPHE: The secret life and turbulent future of water
16 May, Manchester
With speakers Moorthy Palanivelu and Jim Baker, of Culligan UK.

North East: Northumbria University Engineering Degree Show 2018
16 May, Newcastle
Event that showcases more than 50 final-year design projects from level 6 and 7 students, covering technical, renewable and sustainable design approaches associated with the architectural and building services engineering disciplines.

Yorkshire YEN: The performance gap – designing for performance
17 May, Sheffield
Presentation will cover the performance gap, the UK government's BIM strategy, and the intelligent use of data throughout a building life-cycle to enable performance-driven design.

West Midlands: LG14 controls guide
23 May, Birmingham
Presentation giving overview of key points in LG14 controls guide.

SLL AGM, awards and presidential address
24 May, London
Society of Light and Lighting (SLL) AGM, followed by Regional Lighting Award, SLL Lighting Award, the President's Award, honorary fellowships, Leon Gaster Award and Walsh Weston Award. Iain Carlile, incoming SLL president, will give his presidential address.

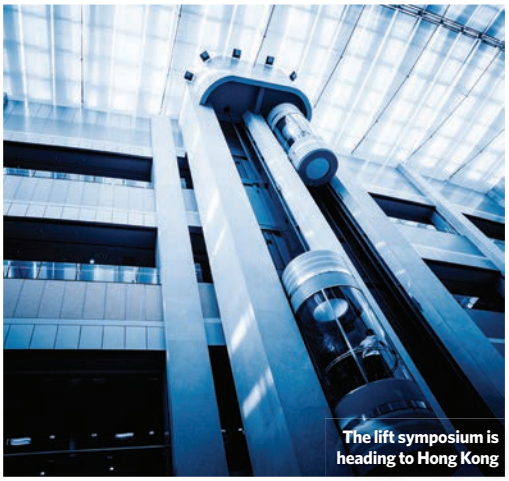
ANZ: Annual cocktail function and awards
21 June, Sydney
Evening reception, and ANZ Young Engineers Awards, hosted in the newly refurbished Westpac Long Gallery at the Australian Museum, Sydney.

8th symposium on lift and escalator technologies 15-16 May, Hong Kong

The Lift & Escalator Symposium brings together experts from the field of vertical transportation, with peer-reviewed papers from industry experts, academics and postgraduate students. It also features a behind-the-scenes tour of the machine room and control room of one of the world's steepest funicular railways.

There will also be a workshop on CIBSE Guide D *Transportation Systems in Buildings*, which offers information for those involved in the design, installation, commissioning, operation and maintenance of transportation systems in buildings. The workshop will include presentations from authors and reviewers of the guide.

The 9th Lift & Escalator Symposium will be held in Northampton, UK, on 19-20 September. For more information on either event, visit **liftsymposium.org**



The lift symposium is heading to Hong Kong

CIBSE

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The annual CIBSE Employer of the Year Award is open to any organisation that pro-actively champions young people in the building services sector.

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cibse.org/employer-award

Email completed entry forms by Wednesday 1st August 2018 to yea@cibse.org

www.cibse.org/yea

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Fast and accurate controls to drive high speed dampers or invertors. Full PID stand alone controls with BMS interface.

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Panel Mount Pressure or Velocity Transducers with remote alarms, analogue and digital interfaces. Traceable calibration certificates supplied as standard.

CAV AND VAV DAMPERS

Accurate air flow measurement with the unique CMR Venturi built into the airtight shut-off damper to control room pressure or constant volume.

Metal Damper

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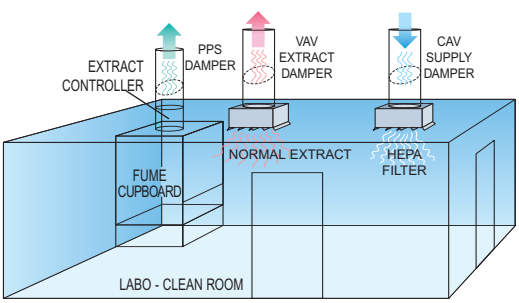
A complete turn-key system to control room pressure to +/-1Pa. Fume cupboard face velocity to 0.5m/s at high speed and provide constant air changes into the labo - clean room.



PPS EXTRACT DAMPER

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