

CIBSE JOURNAL



#Build2Perform

March 2018

www.cibsejournal.com

HEALTH AND
WELLBEING IN PRACTICE
WHY AIR QUALITY IS
A GLOBAL CONCERN
THE VALUE OF SKILLED
FACILITIES MANAGERS



OXFORD BAGS A DOUBLE

Meet the team behind the University of Oxford's success
at the 2018 CIBSE Building Performance Awards

20 Years of Multi Service Chilled Beam (MSCB) Solutions



Frenger supplied & installed the worlds largest Chilled Ceiling (175,000m²) at the Shell Building in 1962.

Nowadays Frenger Systems manufacture Chilled Beam Technology and supplied & installed the world's largest Multi Service Chilled Beam (MSCB) project in 2007 (4,500 MSCB units) at 55 Baker Street.

MSCB units can utilise either passive or active beam technologies. They provide visually stunning yet 100% functional building services which are **100% pre-fabricated off site in a controlled factory environment**, thus significantly reducing the site installation programme. All services are 100% factory tested and delivered **'Plug n Play'** to reduce on-site commissioning time.

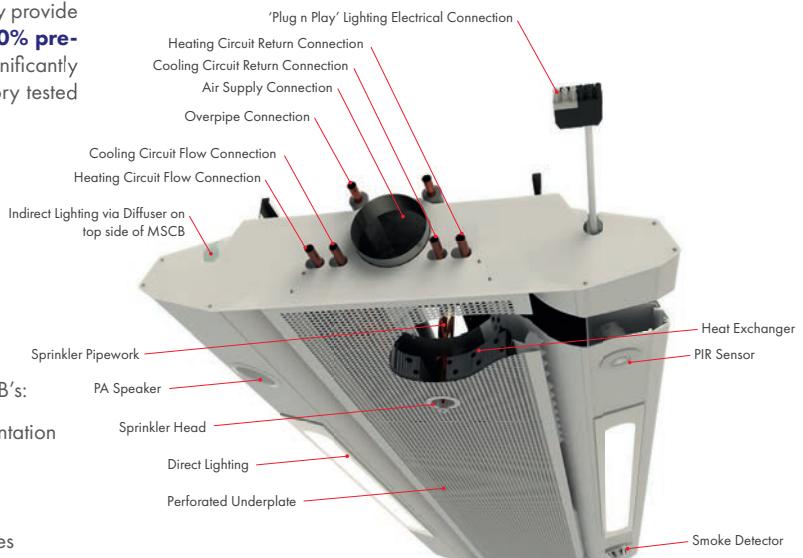
Key Benefits

- Ideal where floor-to slab height is minimal
- Low running costs - minimal maintenance requirements
- Delivers many services in a single unit - so reducing costs
- Optimum levels of occupancy thermal comfort
- Beam aesthetic can be customised to client requirements

Design Options

The following building services can be integrated within Frenger MSCB's:

- | | | |
|-------------------|--------------------|-------------------------------|
| • Cooling | • Heating | • Electrical Compartmentation |
| • Up-lighting | • Direct lighting | • Emergency Lighting |
| • Control valves | • Sprinklers | • Acoustic insulation |
| • Smoke detectors | • Lighting sensors | • Distribution Ductwork |
| • Fresh Air | • PA / VA Speakers | • Distribution water pipes |



There are several aspects of a "Chilled Beam System" that promotes a more energy efficient operation than other air based HVAC solutions.

Chilled water is distributed to the chilled beams above dew point, typically at 14-17°C to avoid the risk of condensation, whereas other HVAC solutions operate below dew point, typically at 6-12°C.

Elevated chilled water temperatures (i.e. above dew point) offer two principal benefits in terms of energy efficiency:

- By operating the chiller plant at elevated temperatures, its co-efficient performance (COP) is increased & energy consumption reduced. The efficiency of the compressor can be increased by using a dry cooling system (inlet water 14°C instead of 7°C) with a percentage increase in COP of typically 22%.
- Elevated temperatures enable a significant increase in the opportunity to avail free cooling from sources such as outdoor air or ground water heat sinks. That is an annual increase from 800 hours to 2000 hours for a 12 hour day & 2100 to 5200 hours for 24 hour operation.

Fan coil units and VAV systems rely on a fan assisted cooling distribution; that is each fan coil unit incorporates a fan. Active Chilled Beam systems utilise a centralised fan that delivers just enough air to meet respiratory requirements (or a little more in the case of some active chilled beam systems) with a consequent reduction in capital cost, electricity consumption and maintenance cost.

For further information on Multi Service Chilled Beams or to learn about our other product ranges please visit www.frenger.co.uk

FRENGER®
systems



Editorial
Editor: Alex Smith
Tel: 01223 378034
Email: asmith@cibsejournal.com
Deputy editor: Liza Young
Tel: 01223 378048
Email: lyoung@cibsejournal.com
Technical editor: Tim Dwyer
Designer: James Baldwin

CIBSE Journal is written and produced by CPL (Cambridge Publishers Ltd) Tel: +44 (0)1223 378000. www.cpl.co.uk
 1 Cambridge Technopark, Newmarket Road, Cambridge CB5 8PB.

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

The opinions expressed in editorial material do not necessarily represent the views of the Chartered Institution of Building Services Engineers (CIBSE). Unless specifically stated, goods or services mentioned in editorial or advertisements are not formally endorsed by CIBSE, which does not guarantee or endorse or accept any liability for any goods and/or services featured in this publication.

Engines (CIBSE). Unless specifically stated, goods or services mentioned in editorial or advertisements are not formally endorsed by CIBSE, which does not guarantee or endorse or accept any liability for any goods and/or services featured in this publication.

Advertisement sales

Consultant: Jim Folley
Tel: 020 7324 2786
jim.folley@redactive.co.uk
Senior sales executive: Paul Wade
Tel: 020 7880 6212
paul.wade@redactive.co.uk
Sales manager: James Rundle-Brown
Tel: 020 7880 7556
james.rundle-brown@redactive.co.uk
Advertising production: Jane Easterman
Tel: 020 7880 6248

Editorial advisory panel

George Adams, engineering director, Spie Matthew Hall
Patrick Conaghan, partner, Hoare Lea Consulting Engineers
Rowan Crowley, managing director, CIBSE Services
Chris Jones, Fläkt Woods
Philip King, director, Hilson Moran
Nick Mead, engineering consultant
Jonathan Page, building services consultant engineer, MLM
Geoffrey Palmer, director, Sweco
Dave Pitman, director, Arup
Christopher Pountney, senior engineer, Aecom
Paul Reeve, director, ECA
Andy Ford, director of research, School of Built Environment and Architecture, LSBU
Gethyn Williams, regional director, Amerlux
Hannah Williams, mechanical engineer, Atkins
Ant Wilson, director, Aecom

Learn from the best



CIBSE has crowned the University of Oxford as its 2018 Building Performance Champion. This means the building services industry has a new opportunity to learn from an exemplar organisation about the sorts of processes and innovations that need to be undertaken to make buildings work properly.

As well as the overall award, the university's estates services department also triumphed in the Facilities Management Team category. Its Carbon Reduction Programme, launched in 2011, has saved the college £1.3m in annual energy costs across the estate and an estimated 5,536 tonnes of carbon.

Among the most important aspects of the programme have been the training workshops for facilities managers (FMs) on energy management and building management systems (BMS). As carbon-reduction projects manager Lucinda Lay says, unless FMs are trained to use controls properly, the advantages of optimising a building will quickly be lost.

Lay believes that, through training, FMs gain the confidence to make their own decisions about building optimisation, which they go on to share with their peers. 'It is about empowering FMs to make decisions that ensure buildings work better for them, and sharing experiences so everyone buys into the vision,' she says.

Jo Harris, the CIBSE maintenance task group chair, also believes that upskilling facilities managers is essential to ensuring the smooth running of buildings (page 28). The move to specialist outsourcing has meant skills are no longer in-house, says Harris, but she sees the return of apprenticeships as an opportunity to introduce essential new technologies, such as BIM, 3D modelling and virtual reality.

Building performance used to be associated primarily with energy, but now is applied much more widely. The health and wellbeing agenda means the performance of a building is as much about air quality and adequate lighting as it is about energy efficiency.

In our section on health and wellbeing, Julie Godefroy – interim head of sustainability at CIBSE – discusses the institution's upcoming guidance on the topic, TM40. Godefroy says that to achieve healthy buildings, designers must collaborate across disciplines at an early stage in the design process. This is something Cundall understands, having gained the first Well Building Standard certification in Europe with its Carter Lane, London, office. On page 38, we look at its attempt to gain the highest level of Well certification at Colmore Row in Birmingham. Having experienced a 50% drop in staff absenteeism and 27% reduction in staff turnover following Well certification at Carter Lane, it is fully committed to the scheme.

ALEX SMITH, EDITOR asmith@cibsejournal.com

CONTRIBUTORS



Hywel Davies
 CIBSE's technical director discusses the world's increasingly pressing concern – air pollution



Mike Hefford
 The Remeha general manager ponders the cost to affordable energy of reducing NO_x emissions



Liza Young
 Our deputy editor goes back to college to meet the new Building Performance Champions



Tim Dwyer
 March's CPD looks at how the PCM-air heat exchanger could typically work in office applications

Panasonic

Panasonic – leading the way

Panasonic is committed to creating a better life and a better world thanks to its breakthrough innovations.

Our heating and cooling technology is constantly upgraded to find the most efficient solutions to save energy, costs and anticipate the needs of tomorrow. Our wide range offers super-efficient, quiet and beautifully designed solutions in both electric and gas-powered technologies for all your heating and cooling needs.

... VRF Systems

VRF Systems

Panasonic's VRF ranges considerably improves efficiency so even large buildings can benefit from a high level of comfort with less energy consumption.

- 8/10HP Mini ECOi
- VRF ECOi EX
- New ECO G GE3 series of gas-powered VRF (2-pipe and 3-pipe)

New 4/5/6HP single-fan Mini ECOi

- The Mini ECOi VRF is Panasonic's most compact, powerful, energy efficient and cost effective range yet
- A flexible and efficient solution for light commercial and residential use
- Compact units that integrate easily into building designs
- 50m piping without the need for additional refrigerant charge



ECO G



ECO i



NEW



Contact Panasonic or one of our distributors (see website) for more details

amp

DYSK
AIR CONDITIONING

EasyAir
CONDITIONING

in Heating & Cooling...

Celebrating two major milestones

Panasonic is celebrating two major milestones during 2018. Its 100th anniversary of the Panasonic brand and 60 years of technical expertise in the world of heating and cooling.



... Smart Connectivity

Connect to the future

Panasonic's VRF Smart Connectivity offers the ultimate in energy saving through the application of cutting-edge technology and Schneider Electric, an advanced global energy management specialist offering innovative control systems.

This collaboration has set the new standard for creating the next generation of smart buildings.

- Easy design and plug-and-play to reduce CapEx
- Dramatic reduction of OpEx with outstanding IAQ
- Ultimate customisation
- User-friendly



For building end users
COMFORT (IAQ)

For business partners
EASY INSTALLATION AND INTEGRATION

For building owners
CapEx

For building owners
OpEx



CONTENTS

News

9 News

More than 7,000 Carillion jobs saved; smart tech could cause surge in energy use; calls to strengthen energy policy; diversity benchmarks set

14 CIBSE news

Abu Dhabi Chapter's first year; Benevolent Fund anniversary; travel funding up for grabs; the role of the SFE

Voices

20 Feedback

LinkedIn IoT debate and our top Tweets from last month

21 A green Brexit

A fine balance must be struck between energy efficiency and minimum environmental impact, says Mike Hefford

22 The air we breathe

Air quality is now a pressing issue globally, says Hywel Davies

Features

16 Notes from Chicago

Tim Dwyer reports from the floor of the 2018 ASHRAE Winter Conference

18 Higher firsts

Alex Smith reports on the action from the 11th CIBSE Building Performance Awards

24 COVER FEATURE

Oxford aspires

Liza Young finds out why the University of Oxford was crowned Building Performance Champion at last month's CIBSE awards

28 The long game

Consultant Jo Harris talks to Liza Young about the value of skilled facilities managers to businesses

30 Learning on the job

The wisdom Wilson Weatherley Phipson applied to the Natural History Museum, after working on the University of Glasgow

21



28



Technical

SPECIAL FEATURES

Health and wellbeing/air conditioning/chilled beams

35 Fit to stand

CIBSE's upcoming health and wellbeing guide TM40

38 Well ahead

Cundall's aim for Platinum Well Building Standard certification

42 Book of evidence

Health and wellbeing can create a productive workplace

45 Comfort of chambers

Two cooling papers presented at the ASHRAE conference

49 Easing the pressure

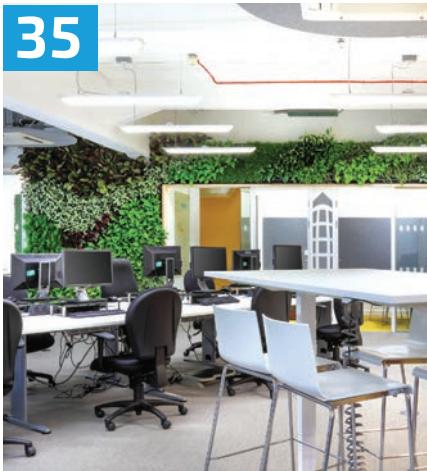
Making demand control ventilation work with chilled beams

50 Clothes to zero

Achieving comfort through evaporative cooling, renewables and a relaxed dress code

52 Silence is golden

Eliminating nuisance noise from MVHR systems

38**30****35**

■ CPD

55 Operating and enhancing PCM-cooled ventilation systems in offices

How the PCM-air heat exchanger could typically work in office applications and how future designs can be improved using CFD

■ Classified

59 Products

A round-up of systems and services for the industry

■ Jobs

64 Appointments

Jobs at jobs.cibsejournal.com

■ Events

66 Looking ahead

CIBSE Technical Symposium; Ecobuild; SLL Light Bites; CPD training; CIBSE groups, regions and societies

CIBSE JOURNAL

www.cibsejournal.com

The official magazine of the Chartered Institution of Building Services Engineers

SOCIAL MEDIA

- @CIBSEJournal
- CIBSE LinkedIn
- CIBSE Journal newsletter
- www.cibse.org

FOR CIBSE

Journal production manager: Nicola Hurley
Tel: 020 8772 3697, nhurley@cibse.org

CIBSE, 222 Balham High Road,
London SW12 9BS
Tel: +44(0)20 8675 5211
© CIBSE Services Ltd. ISSN 1759-846X

SUBSCRIPTION ENQUIRIES

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

The 2017 US annual subscription price is £100. Airfreight and mailing in the US by Air Business, C/O Worldnet Shipping NY Inc, C/O Air Business Ltd / 155-11146th Street, Jamaica, New York, NY11434. Periodical postage pending at Jamaica NY 11431. US Postmaster: Send address changes to *CIBSE Journal*, C/O Air Business Ltd / 155-11146th Street, Jamaica, New York, NY11434.

CREDITS

Cover image Dan Paton P09 iStock.com / Cscredon P10 iStock.com / Hakimhan P12 iStock.com / PeopleImages / SimplyCreativePhotography P14 iStock.com / Donald_gruenert P18 iStock.com / AndreyKrav P20 iStock.com / Jamesteohart P23 iStock.com / AH86 P24-27 Credit / Graham CopeKoga P28 iStock.com / Nostalgie P30 iStock.com / Thehague



ABC audited circulation:
18,331 January to December 2016
Printed by: Warners Midlands PLC



Cable.
It's in our DNA.

Trust in our experience

At BT Cables, we live, sleep and breath cable. For over 120 years we've been dedicated to designing and manufacturing cables that meet the needs of a global customer base. Today, our offer is even stronger, with a comprehensive range of cables and accessories for building and infrastructure management systems now available. Plus, we have recently launched a complete end-to-end connectivity solution for data centres through to commercial LAN installations. With world-class service, including expert technical support, available directly to all our customers, you'll be hard pressed to find a better partner. Call us today and we'll send you full details.

CCTV. Access Control. VOIP Telecommunications. Energy Management.
Fire Alarm Systems. Lighting Control. Temperature Control. Network Systems.

BT Cables Limited, Delaunays Road, Blackley, Manchester, M9 8FP

T: 0161 741 2345 www.btcables.com



UNIVERSITY OF OXFORD TOP OF THE CLASS AT CIBSE AWARDS



The University of Oxford Carbon Reduction Programme beat 14 other category winners to scoop the Building Performance Champion accolade at the 11th CIBSE Building Performance Awards, where three double winners were announced. The Oxford estates services team also scooped the Facilities Management Team of the Year Award.

BuroHappold Engineering was named Building Performance Consultancy (over 1,000 employees), and won the Energy Efficient Product or Innovation Award for its development of NewMass.

Elementa Consulting picked up the Project of the Year – International Award for the third year in a row, as well as the Building Performance Consultancy (up to 100 employees) Award. Read more on pages 18 and 24.

More than 7,000 Carillion jobs saved, but 1,000 lost

Firm's collapse left a £900m debt and £590m pension deficit

More than 7,000 former staff of the collapsed construction firm Carillion have been transferred to new employers, but around 1,000 former posts have been made redundant, according to the latest figures available as *CIBSE Journal* went to press.

Part of the rescue effort includes the creation of a government-owned facilities management (FM) company, Gov Facility Services, to take over the delivery of prison FM contracts on behalf of the Ministry of Justice. This covers 1,000 staff – including 100 contractors – who were previously employed by Carillion.

Serco has picked up 15 FM contracts for the NHS, with annual revenues of around £90m and an average of 14 years still to run. The Canadian FM firm BGIS was understood to be poised to take on more than 2,500 Carillion staff as part of a series of hospital, education, justice, transport and emergency services contracts.

Carillion's liquidation in January resulted in £900m of debt, a £590m

pension deficit, and hundreds of millions of pounds in unfinished public contracts. The company had a directly employed workforce of 18,000.

Unions have broadly welcomed the attempts to save jobs, but Gail Cartmail, assistant general secretary of Unite, warned of the dangers of workers 'being transferred to lesser contracts with reduced pay'. She also said there were 'serious issues' with outsourcing, especially in the public sector.

'Cut-price contracts, low wages, insecure working and boardroom behaviour more usually seen in a casino; these should have no place in our schools, hospitals and services,' she said.



Building efficiency falls despite MEES deadline

The energy efficiency of almost 20% of commercial buildings has deteriorated, according to new research from arbnco, despite the imminent launch of Minimum Energy Efficiency Standard (MEES) legislation on 1 April.

From that date, landlords will be banned from renting out a property if it has an Energy Performance Certificate (EPC) rating below band E. According to the property software firm arbnco, however, 17.7% of the 3,620 buildings on its database have lower ratings now than a year ago, and one in 10 has fallen below E.

Nearly 15% of its properties are now rated F or G, making them unlettable to new tenants or those looking to renew their leases. Figures for the whole UK market suggest as many as 20% of commercial buildings are likely to fall foul of the new regulations.

'MEES has been on the horizon for a long time, but the statistics from our re-simulation tell us that some commercial real estate investors and subsequent stakeholders are still not heeding the warning,' said arbnco director Simon West.

He added that, based on his firm's data sample, as much as £130bn of British commercial property could be unlettable under the MEES legislation, with landlords who seek to rent out substandard buildings facing fines of up to £150,000.

MPs and Lords agree to move out

Members of the Houses of Commons and Lords have agreed to temporarily vacate the Palace of Westminster, to allow its urgent refurbishment to be carried out in a single phase.

An 'Olympic-style' delivery authority and management board will now be established to manage the work.

The House of Lords stated there was 'a clear and pressing need to repair the services in the Palace of Westminster', and that 'a full and timely decant of the Palace is the best and most cost-effective delivery option'.

Tom Healey, director of the Restoration and Renewal Programme, said the decision to decant represented 'an important milestone in the vital process of safeguarding the future of this iconic Grade I-listed building'.

RHI reforms are vital, says BSRIA

The 'reformed and refocused' plans for the Renewable Heat Incentive (RHI) have been issued by the government after an industry-wide consultation.

According to a government statement, the revised scheme focuses on long-term decarbonisation by promoting the 'deployment of the right technologies for the right uses'.

It will also offer better value for money and protect consumers, while supporting supply chain

Smart tech could cause surge in energy use, inquiry warns

Consumers must better understand their energy footprint from being online

Growing dependence on connected devices and digital technologies could lead to an unsustainable rise in energy consumption, a cross-party parliamentary inquiry has said.

A group of MPs, drawing on research from think tank Policy Connect, wants the government to ensure energy efficiency keeps pace with the speed of digital growth and is embedded in the design of internet-enabled



systems. Its report, *Is staying online costing the earth?*, calls on the government to help the digital economy to grow further through energy-saving technology innovation.

Policy Connect said its research had identified a 'knowledge gap... for managing digital energy usage and taking advantage of new technology to cut carbon footprints'.

It added that there was a lack of technical expertise on digital trends and a shortage of data collection, monitoring and analysis. The think tank urged the government to help consumers understand their energy footprint from being online through initiatives such as better energy labelling systems.

The researchers claim ICT solutions have the potential to cut global greenhouse gas emissions by 15.3% by 2030. They want the public sector – with its influential spending power – to lead by example in taking forward an 'energy efficiency by design' approach to delivering digital services.

Building firms in line for digital boost

Digital technologies could be worth £89bn to construction firms in new business and cost savings over the next decade, according to research by the consultancy Accenture. The figure includes potential cuts to the cost of delivering the UK's long-term housebuilding targets and £6.1bn in new revenue streams.

Accenture said the use of offsite construction could be increased through wider use of virtual reality, while design costs could be cut by using 5D building information mapping, which visualises the impact of design alterations in real time. The research also envisages a growing role for artificial intelligence (AI) and machine learning, particularly in facilities maintenance and building operating efficiency.

'Most construction companies... recognise that digital technologies can drive transformation and growth, but many aren't yet realising this potential,' said Ben Salama, managing director of Accenture Digital. 'More than just transforming into digital businesses, construction companies must look at how to reinvent operating models, production and value chains.'

HVAC Fluids & Management Services Optimising efficiency & reliability

Call today and talk to the specialists

www.hydratech.co.uk

tel: 01792 572298

info@hydratech.co.uk



Energy policy must be strengthened, says Leti

Groups responses to London Plan and calls for more action

Current energy policy on carbon emissions in London buildings will not deliver net zero carbon for new buildings by 2030, the London Energy Transformation Initiative (Leti) has warned. It has released a report outlining recommendations for the Greater London Authority (GLA) to 'get London on the right trajectory'.

In its draft London Plan energy policy response, Leti recommends embedding a requirement to achieve operational zero carbon on all new buildings by 2030. This moves beyond the current definition of a 'design prediction' of partial 'zero carbon', to deliver actual operational and measured zero carbon, the report said.

Leti's response also calls for an absolute kWh metric, to allow the full range of stakeholders involved in the design, operation and delivery of buildings to understand – and fully contribute – to reducing energy consumption. It believes energy monitoring is fundamental to achieving operational zero emissions and

should be elevated into policy by adding 'Be Seen' to the energy hierarchy.

Leti also calls for whole-life embodied carbon to be explicitly included in policy.

The response adds that energy strategies should demonstrate future-proofing to 'Operational Zero Carbon' onsite by 2030. 'We support existing clauses in the draft, but believe leaving it until 2050 will only encourage further lock-in to fossil fuel and urban combustion pollution,' the report said.

A 'zero emissions by 2030' transition plan must also be given for all district heat/energy networks, it adds, alongside disclosing energy use and efficiency data to ensure networks help deliver operational zero emissions. The report also calls on the Mayor's Energy Advocates to be available to boroughs to assist in embedding sustainable design.

Leti is still working towards a zero emissions London by 2030, and is running three workstreams in 2018.

Visit www.leti.london for details on how to get involved in one of the workstreams, and to read Leti's guide to submitting a consultation response.

UK must get to grips with rising temperatures

With summer heatwaves predicted to become more common in the UK, the Environmental Audit Committee (EAC) is leading an inquiry into the resilience of building stock, and the economic and public health impacts of rising temperatures.

Currently, there are around 2,000 heat-related deaths per year in the UK. Rising temperatures and an ageing population, however, mean this figure will increase by two-thirds by the 2020s, according to the inquiry. The Met Office has also said the record high temperature of 38°C in 2003 will be the summer norm by 2040, as a result of climate change.

The committee revealed that an earlier inquiry had shown the UK 'lacks policies for adapting the built environment to rising temperatures, or standards to prevent overheating in new developments'. The government is due to publish its next National Adaptation Programme later this year.

Written evidence to the EAC inquiry should be submitted to www.parliament.uk by 14 March.

Group calls for end of global-warming gases

Building services sector bodies have urged the European air conditioning industry to stop installing certain types of equipment that use the most global-warming refrigerant gases.

The group believes the use of R404A and R507A should stop immediately to meet tighter quota restrictions on HFC gases that came into force at the start of this year as part of the EU's F-Gas Regulation.

AREA, EFCTC, Asercom, and the European Partnership for Energy and the Environment (EPEE) recommend designers and specifiers switch to new equipment, or installers retrofit existing systems with alternative refrigerant gases. They believe recycling and reclaiming HFC gas could reduce the damage being caused to the market by soaring costs as certain gases become scarcer.



HYDRATECH
Specialist Fluid Solutions

Engineering organisations set diversity benchmarks

Few black, Asian and minority ethnic people hold senior staff positions

Diversity and inclusion are to become key measurements of operating performance for 20 professional engineering institutions and 21 scientific bodies, in a collaborative exercise led by the Royal Academy of Engineering (RAE) and the Science Council.

The organisations, including CIBSE, carried out a joint benchmarking exercise and self-assessed their performance in eight areas. They found their diversity and inclusivity was poorest around education and training, accreditation and examinations, and in prizes, awards and grants.

Women are better represented on boards – and in the membership – of science bodies, but black, Asian and minority ethnic (BAME) people are better represented on the boards of engineering organisations. However, very few of the bodies have any BAME people in senior staff positions.



Women are better represented, with more than half of the bodies having 30% or more female board members and 50% female employees. However, women make up just 13% of the membership of engineering bodies, compared with 34% of the science ones, reflecting the fact that more women currently enter science professions than engineering.

The building services sector is looking to improve its diversity

'Tough year' ahead for construction

The construction industry will experience 'flat growth at best' in 2018, according to the Construction Products Association (CPA). Carillion's collapse – and a decline in public housing repair work – are expected to hit the sector, but there could be a 6.3% rise in infrastructure work.

Carillion accounted for £850m worth of projects and the CPA said it was hard to predict how long its liquidation would continue to hit the sector and the 25,000 to 30,000 firms in its supply chain. The public housing repair, maintenance and improvement sector has fallen by 20% since 2010, and output is expected to fall by a further 2% this year, according to the CPA.

It said the sector was suffering from a lack of finance for local authorities and concerns over the capacity to deliver the work. The sharpest decline will be in the commercial sector, particularly offices 'as a lack of clarity on the UK's post-Brexit deal has led to a sharp fall in contract awards'. Office construction is expected to fall by 15% in 2018 and 10% in 2019.

The CPA's economics director, Noble Francis, said '2018 is likely to be tough for the industry' and he urged government to help councils with funding 'to address issues on social housing towers above 18 metres since the Grenfell tragedy'.



... but more jobs to be created by 2022

More than 150,000 new jobs will be created in the UK construction sector over the next five years, according to the Construction Industry Training Board (CITB).

Its latest research predicts strong growth in most sectors, particularly in professional and managerial roles, fuelled by an annual growth rate of 1.3%, driven by infrastructure and housing work. By 2022, the CITB expects 2.77 million people to be working in construction – just below the industry's 2008 peak.

'Construction will continue to grow and create jobs,' said CITB policy director Steve Radley, but this would present a 'massive recruitment and training challenge, which is likely to get harder after Brexit'.

IN BRIEF

Government sets out £30bn works plan

The Crown Commercial Service will invite firms to tender for its £30bn public works programme in April.

For the first time, a giant framework has been prepared, which can be used by all public sector bodies – including central government departments and local authorities – to help procure the works.

An 'engagement event' has also been held in Manchester, to gather opinions and support from the industry for the huge programme of works. The framework is expected to be in place for up to 48 months, with the possibility of a three-year extension.

Seminal AC design book updated

Research engineer and lecturer Roger Legg has completed a revision of his book *Air conditioning system design*, published by Butterworth Heinemann.

This updated version of his 1991 work contains new chapters on unitary systems and chilled beams. It offers a technical foundation on building services engineering and covers large parts of the relevant academic syllabus.

Its theoretical coverage is backed up by working examples and the use of data from the latest editions of CIBSE and ASHRAE publications.

Legg taught the subject for more than 30 years at the Institute of Environmental Engineering at London South Bank University, having previously spent 10 years as a design engineer.

Kitchen ventilation guide gets makeover

The Building Engineering Services Association (BESA) has revised its guidance document for kitchen ventilation design.

The 2018 version of *Specification for kitchen ventilation systems* (DW/172), first published in 1999, was launched during the HVAC&R Show at London's ExCel. It reflects new legislation, as well as guidance on the latest cooking techniques and changes to catering equipment design. It also includes a chapter on 'demand controlled' kitchen ventilation.

“It takes 20 years to build a reputation and 5 minutes to ruin it. If you think about that, you'll do things differently.”

Warren Buffett

Why risk yours?

Minimise your **risk** when you appoint a contractor for any electrical or electrotechnical work across all aspects of design, installation, maintenance, testing, inspecting and monitoring.*

- ✓ Highest level of industry standard or certification achieved
- ✓ Businesses regularly assessed
- ✓ Quality of work underwritten
- ✓ Completion of work guaranteed
- ✓ Business financial standing confirmed
- ✓ Access to market leading technical support
- ✓ Health & Safety standards confirmed
- ✓ Market leading Risk Assessment & Method Statement software
- ✓ CHAS/SSIP supported

Find an ECA Member today

www.eca.co.uk/find-an-eca-member

✉ info@eca.co.uk ☎ 0207 313 4800

🐦 @ECAlive

Terms and conditions apply and are subject to change. All rights reserved.
Registered in England: Company Number 143669. Covering England, Wales & NI.



IN BRIEF

Lighting bursary aims to benefit the industry

Applications are now open for the Society of Light and Lighting's (SLL's) 2018 Jean Heap Bursary, with up to £4,000 of research funding available.

The bursary was launched in 2014 as a tribute to the commitment Jean Heap showed to lighting research and education throughout her career within the SLL. It is open to anyone with an interest in lighting, and the judging panel will be looking for a study or piece of research that has the potential to benefit the industry and SLL.

Applicants should outline their proposed project, including the specific topic to be researched, the methodology, the timescale and the aims and objectives of the research. Proposals should also include an outline of why the applicant needs further funding and how this will be used.

For more information and to apply, visit bit.ly/1qlI0SP. Applications need to be received by 30 March, and the winner will be announced at the SLL AGM on 24 May 2018.

Knowledge update

The Institution's Knowledge Portal gives members access to the full range of CIBSE-published guidance.

In 2017, 21 new CIBSE titles, as well as more than 100 other items – including symposium papers and case studies – were added to the portal, where they are available for immediate access by members. TM60 *Good practice in the design of homes*, new editions of Guide E *Fire safety engineering* and the *Lighting Handbook* are all scheduled to be published this year.

The most recent titles added to the portal are: Lighting Factfile 13: *Illuminance meters*; Lighting Factfile 12: *Thermoplastic lighting diffusers and fire safety*; Commissioning Code L: *Lighting*; KS21 *Competency & competency management systems for FMs*; *Guide to variable refrigerant flow (VRF) air conditioning*; and *Building for extreme environments: Cold climates*.

Visit www.cibse.org/knowledge

Anniversary is chance to boost Benevolent Fund

CIBSE members past and present have been getting help for 85 years

The CIBSE Benevolent Fund is celebrating its 85th year in 2018 – having been set up as the IHVE Benevolent Fund in 1933 – and plans to use this landmark occasion to raise its profile.

CIBSE has grown considerably over the past 20 years, but the number of clients to the fund has remained relatively constant. It appears not all members of the Institution are aware of the work the Benevolent Fund does.

Since it was formed, the fund has given

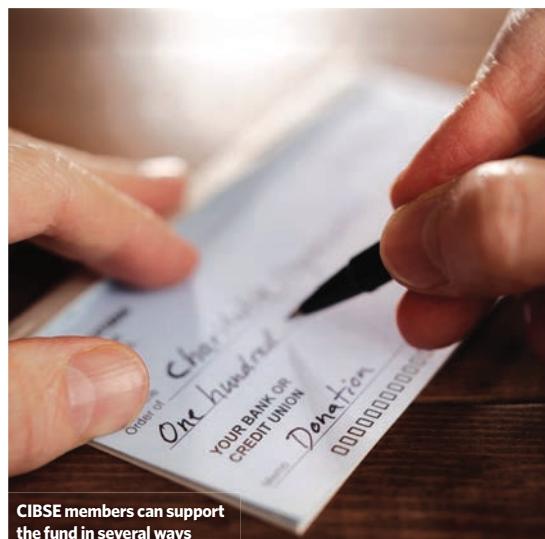
assistance to hundreds of people, their families and dependents. It can offer regular payments to supplement pensions, and assist with the purchase of special equipment, such as stair lifts or equipment to enable an individual to work from home. It can also help with major one-off bills, such as essential home repairs.

The fund can help current members of CIBSE and their immediate families, as well as former members and their dependents. If you know someone who needs help, please get in touch with your local almoner. There are almoners in 19 regions, and their email addresses are listed on the Benevolent Fund website. Alternatively, contact the fund administrator Stuart Brown at sbrown@cibse.org

The Benevolent Fund has reserves, but the dividends only produce about a third of its income. It relies heavily on donations from CIBSE members and the CIBSE regions for the rest. This income has been falling gradually over the past few years, so we would like to encourage members to help in the following ways:

- Voluntary contributions made when the annual subscriptions are paid
- Designate any interviewer fees you may receive to the fund
- Leave a legacy to the fund in your will
- Use Gift Aid to increase the value of your gift.

For more information, visit www.cibse.org/cibse-benevolent-fund. To contact the Benevolent Fund, email benfund@cibse.org



CIBSE members can support the fund in several ways

Travel funding up for grabs



Last year's winner
St John Townshend

The Ken Dale Travel Bursary 2018 is open for entries. It offers between £1,500 and £4,000 to CIBSE members, in the developmental stage of their career, who wish to spend three to four weeks abroad researching aspects of their field of work.

Last year's winner was St John Townshend, a graduate building services engineer at Hydrock Consultants, who travelled across Asia collating data for his research topic 'Air pollution in the built environment'.

After winning the bursary, Townshend said: 'I am thrilled to have the opportunity to research a topic of my choice, while immersing myself in a different part of the world. Winning

the bursary will enable me to fulfill my huge ambition to travel and will further strengthen my career.'

The Ken Dale Travel Bursary offers young building services engineers the opportunity to experience technical, economic, environmental, social and political conditions in another country, and to examine how these factors impact on the practice of building services engineering.

The application process involves an initial written application, followed by a presentation to a CIBSE panel, and applicants need to demonstrate the benefits of their proposed trip to CIBSE, their company, clients and their own development.

The closing date for entries is 13 April. For more information and to enter, visit www.cibse.org/awards



CIBSE student award opens

Entries are now open for the CIBSE Undergraduate Award, sponsored by Hays Building Services.

It is open to CIBSE student members in their final year of BSc, BEng and MEng courses, and is designed to encourage them to aim for excellence and develop their potential.

Entrants need to submit a 2,000-word synopsis of their final-year project, together with a completed application form. A judging panel, appointed by the CIBSE Board, will be looking for evidence of excellent understanding and knowledge in building services engineering, science and design, as well as originality and high-quality visual information.

The winner will receive £500 and a trophy, which will be presented at the President's Award dinner in October. Two runners-up will each receive £100.

Entries must be received by 20 July. For more information and to enter, visit www.cibse.org/awards

Online learning

CIBSE's online learning courses can now be purchased directly through the CIBSE website.

There are 13 engineering core modules, covering areas such as: cable sizing; lighting design; air conditioning systems; low- and high-voltage distribution; and heating system design.

Three digital engineering modules, which complement the Digital Engineering Series publications, are also available, with a further six modules to be released in 2018.

To help support building services professionals in their career – and in recognition of the importance of skills outside of technical capabilities – CIBSE is launching soft skills modules, covering: business and management; productivity and time management; self-management and personal development; and communication. These are scheduled for release this year.

For more details, and to purchase a course, visit www.cibse.org/onlinelearning

Positive response to Abu Dhabi Chapter's first year

Group's events have included visits to Masdar City and the Grand Mosque

Marhaba and greetings, from the CIBSE Abu Dhabi Chapter. The United Arab Emirates (UAE) group has just celebrated its first anniversary.

The chapter was formed in January 2017, to help the UAE committee deliver events and offer networking opportunities to more members in the region. It held its first event in April – a chilled beams seminar by Trox – which was received positively, with more than 30 people from Dubai and Abu Dhabi.

Since then, the group has held numerous events, including: 'Lighting with Henrik' by Henrik Clausen of Fagerhult; 'Solar thermal and heat pumps' by Ecoval; and 'Healthcare lighting' by Whitecroft.

More recently, it took part in the Young Engineers Network (YEN) Global Conference,

with visits to Masdar City, Cleveland Clinic hospital and the Grand Mosque.

The events not only offer valuable CPD and information on new and emerging technologies, but are also an excellent chance to meet other members and industry professionals in the region. A number of activities are planned for 2018, starting with a seminar on data centre technologies.

The Abu Dhabi Chapter is chaired by Dan Williams, of Black & White Engineering, who is supported by: Richard Ebrahim, membership secretary; Mohd AbuBaker, events officer; Ninos Kamber, technical officer; Chris Ackers, Society of Light and Lighting representative; and Robert Totton, general committee member. For more about events in the UAE, visit www.cibse.org/uae



Understanding the role of the Society of Façade Engineering

After the recent announcement of the Façade of the Year award winners, Saverio Pasetto FSFE, Society of Façade Engineering chair, explains the society's role

The Society of Façade Engineering (SFE) aims to promote excellence and best practice in façade engineering. It offers a forum where architects, structural engineers, building services engineers and façade engineers can talk and gather expertise.

Founded in 2004, as a joint initiative between RIBA and IStructE, the SFE is a division of CIBSE and has more than 1,000 international members across all grades. It has been supporting discussions and workshops on cladding fire safety in the wake of the Grenfell Tower disaster. This has included a response to the government's call for evidence via a committee led by SFE founder and former chair Chris Macey.

The society's technical meetings give members and non-members the chance to listen to eminent speakers on a variety of related disciplines and case studies, while the annual Façade of the Year award receives entries from all over the world. For more information about the Society of Façade Engineering, its activities and contacts, visit www.cibse.org/sfe



The city famous for its jazz and the blues hosted another huge engineering gathering at the 2018 ASHRAE Winter Conference.

Tim Dwyer tuned in

NOTES FROM



An unseasonably warm Chicago welcomed this year's ASHRAE Conference and the massive linked expo. There were a record 72,000 visitors, who paced the 48,000m² of exhibits and pored over the wares of 2,100 companies – a third of which were from outside the US.

ASHRAE CEO Jeff Littleton opened his plenary session address with an impressive catalogue of new and revised publications that were debuting at the meeting. These included: design guides for dedicated outdoor air systems (DOAS), cleanrooms, and air terminal units; the 5th edition of the *Green Guide*; the 9th edition of the *Pocket Guide* (ASHRAE's top-selling publication); the *'Design and Control of Central Chilled Water Plants'*; and the *'Principles of HVAC'*.

Littleton majored on the various science, technology, engineering and maths (STEM) activities in which ASHRAE continues to play a part. These include DiscoverE www.discovere.org, which offers resources akin to the UK-based www.stem.org.uk, and the annual USA Science and Engineering Festival, which attracts around 350,000 children each spring.

At his formal Monday lunch, ASHRAE President Bjarne W Olesen reported on his vision to extend ASHRAE's presence in three spheres – the global community, technological horizons, and value to members. He emphasised that ASHRAE is already a global community, and highlighted European Region XIV, which has been formed during his year in office to provide focus and serve the 2,000-plus members.

However, Olesen said that ASHRAE would maintain a raft of partnership agreements with European-based organisations, including CIBSE, the Italian Association of Air-Conditioning, Heating and Refrigeration (AiCARR) and the Federation of European Heating, Ventilation and Air-Conditioning Associations (REHVA).

He covered the work that was being done by ASHRAE with – and for – the United Nations Environment Programme (UNEP). This includes courses on refrigerants literacy for policy-makers, technicians and university students, plus a design and operation course on district cooling that heralds the development of a new ASHRAE standard.

Olesen also highlighted the jointly organised series of conferences aimed at developing economies, most recently held in Delhi in November 2017. In addition, he proudly announced that UNEP has recently given ASHRAE a Partnership Award, in recognition of its exceptional efforts to support the advancement of technologies that help protect the ozone layer.

The President said that work is continuing on the new ASHRAE Standard 90.2, which seeks to deliver residential building energy performance that is at least 50% more efficient than that defined by the 2006 International Energy Conservation Code.

The key to accomplishing this objective is an accurate, flexible performance-based tool that enables user creativity in meeting the performance objectives. This is possibly further evidence of the shift in ASHRAE from the fundamentally prescriptive standards to those that consider the holistic performance of building systems – an approach that has been well established in European standards.

Olesen also focused on the recently announced *Advanced Energy Design Guide for Zero Energy K-12 Schools – Achieving Zero Energy*. This is the first in a series of guides for achieving zero energy that are being developed with other US-based institutions, funded by the US government and tailored to the design and creation of zero energy schools.

The strategies employed by this guide include: setting measurable goals; hiring design teams committed to that goal; using simulation throughout the design and construction process; and being aware of how process decisions affect energy use. This advanced energy design guide has content that relates to each of the ASHRAE 'climate zones', so the material usefully can be applied worldwide.

The ASHRAE Conference was held in the Palmer House hotel in downtown Chicago, and attracted approximately 3,500 delegates from 61 countries. There were around 90 seminars, and technical and conference sessions across the four days, covering wide-ranging issues associated with HVAC&R. Turn to page 45 for summaries of two sessions that give some idea of the diverse topics that were considered. **CJ**

TIM DWYER is CIBSE Journal technical editor

VIESSMANN

Designed by our experts, for you
VITOCROSSAL 100

Easy to install, floorstanding gas condensing boiler
designed especially for compact plant rooms

Twin boiler up to 636 kW
Single unit 75 - 318 kW



6 Bar pressure



Lambda Pro
Combustion control



Width from 680 mm



Pre-wired &
pre-assembled



Stainless steel heat
exchanger





Two Passivhaus winners, three double winners and a university named overall champion (again) – **Alex Smith** reports from the 11th Building Performance Awards



HIGHER FIRSTS

A British university has been crowned Building Performance Champion at CIBSE's annual awards ceremony for the second year in a row.

The University of Oxford Carbon Reduction Programme beat 14 other category winners to scoop the overall prize at the 2018 Building Performance Awards, following on from the University of Bradford's success last year. The Oxford estates services team also scooped the Facilities Management Team of the Year accolade.

This year's ceremony, hosted by comedian Mark Watson at the Grosvenor House Hotel, was attended by more than 750 guests, and awards were presented to 12 companies representing the cream of the building services sector across the supply chain.

CIBSE President Peter Y Wong opened proceedings by reminding the audience that the awards were won for 'actual, measured performance outcomes, and not just promises of design intent or performance specifications'. He said that the awards increasingly stood for ethical, sustainable and environmentally sound business.

'The shortlisted entrants can rightly be proud that they have gone above and beyond the norm to create buildings that are truly fit for purpose – not just at present, but for years to come,' Wong said.

What overall winner the University of Oxford had achieved in tackling carbon emissions in its estate could be done across the higher education sector, said the judges.

'Winning the overall project award is just fantastic,' said Lucinda Lay, carbon-reduction projects manager at the University of Oxford. 'I feel incredibly proud to go up there and represent the team and those who contributed towards the programme.'

With more than 400 buildings to manage, Lay said the estates team had to be targeted in its approach. 'We look at the most intense buildings in terms of energy consumption and then look at the building services – how they're operating and how they can perform better. Hoare Lea has now optimised more than 30 of our buildings, which is fantastic.'

The University of Oxford was one of four double award winners on the night. In addition to being named Building Performance Consultancy (over 1,000 employees), BuroHappold Engineering won the Energy Efficient Product or Innovation Award for its development of NewMass. This is a low energy cooling system of finned tubes, filled with a phase change material, that fits within a ceiling space.

The judges were particularly impressed by BuroHappold's significant investment in research and training, and how it puts this in the public domain. They said: 'BuroHappold

Engineering has some different initiatives that grabbed our attention, and they provided some impressive performance data.

Andy Keelin, BuroHappold's cluster leader and project principal, said: 'The awards were a real shot in the arm. It's testament to a lot of the things we've tried to focus on. While it's fun designing buildings, it's even better to get them to work as the design intended.'

The engineering consultancy was also highly commended for the David Attenborough Building in the Project of the Year – Commercial/Industrial category.

Elementa Consulting made it a hat-trick of victories by winning the Project of the Year – International Award for the third year in a row. Its services design for the new 7,000m² laboratory at Pomona College, in California, resulted in an energy reduction of 67% compared with the existing building, and 75% compared with the benchmark.

"We look at the most intense buildings in terms of energy consumption and how they can perform better"



CIBSE Building Performance Awards winners

KEY DATES FOR 2019

- **Entries deadline:** Friday 14 September 2018
- **Shortlist announced:** Thursday 15 November 2018
- **Awards dinner:** Tuesday 12 February 2019

It also picked up the award for Building Performance Consultancy (up to 100 employees). Elementa Consulting has designed more than 80 net zero projects and the judges were impressed with its commitment to cross-industry collaboration in the form of the London Energy Transformation Initiative (Leti). The project was led by environmental design engineer Clara Bagenal-George, and some of its energy policy proposals have been published in the draft London Plan.

Simon Ebbatson, principal at Elementa Consulting, said: 'Leti has been really powerful for us, as it's about sharing our knowledge. The problem with building services is that it's not a community. We end up sparring with each other. One thing that Elementa and Integral Group look to do is raise the bar with the rest of the industry.'

BDP won the award for best Building Performance Consultancy (101-1,000 employees), and was the building services engineer on the Enterprise Centre, which won Project of the Year – Industrial/Commercial. The much-lauded Passivhaus building, designed by Architype for the University of East Anglia, has proven energy performance. It consumed 103kWh·m⁻²·year⁻¹ in the first



Building Performance Consultancy (101-1,000 employees) winners from BDP



CIBSE President Peter Y Wong

year, which is well below the 120kWh·m⁻²·year⁻¹ target for Passivhaus and the predicted 111kWh·m⁻²·year⁻¹. The judges were particularly impressed with the three-year soft landings process, which demonstrated the team's commitment to optimising the building's potential. Judging chair Hywel Davies said: 'The Enterprise is an outstanding building. Both its design and operational energy performance are at the highest levels.'

Another certified Passivhaus building, the University of Leicester's Centre for Medicine, won Project of the Year – Public Use for contractor Willmott Dixon (building services engineering was by Couch Perry Wilkes). The building's Display Energy Certificate A rating is partly attributed by Willmott Dixon to the soft landings approach taken on the project.

The awards took place on the 100th anniversary of women in the UK, over the age of 30, being given the vote. CIBSE continues to strive to attract people from all backgrounds to the building services industry, and give women an equal chance of success. The large number of women on the winners' stage is testament to the progress being made in creating a more diverse profession. Five years ago, there were only two women in the trophy holders' photograph. **CJ**

To read case studies on The Enterprise Centre and the Centre for Medicine, University of Leicester, visit www.cibsejournal.com/case-studies/

WINNERS AT A GLANCE

■ Building Performance Champion

Headline sponsor Baxi Heating
University of Oxford Carbon Reduction
Programme – University of Oxford

■ Building Performance Consultancy (up to 100 employees) Sponsored by ABB

Elementa Consulting
■ Building Performance Consultancy (101-1,000 employees) Sponsored by Smith's BDP

■ Building Performance Consultancy (over 1,000 employees)

Sponsored by FläktGroup
BuroHappold Engineering

■ Collaborative Working Partnership

Sponsored by Lochinvar
The New Energy and Industrial Technology Development Organization (NEDO) project – NPS North West

■ Learning and Development

Sponsored by CIBSE Patrons
Sustainability Matters – Landsec

■ Highly commended: Net Zero Buildings offsite construction tour/Redmoor Academy's Schoolhaus grand opening – Net Zero Buildings

■ Energy Management Initiative

Sponsored by Imtech
Beyond the six-Star Nabers barrier,
Melbourne, Australia – Energy Action

■ Facilities Management Team

Sponsored by Gratte Brothers
University of Oxford Carbon Reduction
Programme – University of Oxford

■ Energy Efficient Product or Innovation

NewMass – BuroHappold Engineering
■ Energy Saving Product or Innovation
Q-Floor – Q-Bot

■ Project of the Year – Commercial/Industrial

Sponsored by Viega
The Enterprise Centre – Architype / BDP

■ Highly commended: David Attenborough Building (Cambridge Conservation Initiative offices) – BuroHappold Engineering

■ Project of the Year – Leisure

Sponsored by Conex Bänninger
Oriam – Max Fordham

■ Project of the Year – Public Use

Centre for Medicine, University of Leicester – Willmott Dixon

■ Highly commended: Windmill Community Campus – Fife Council – Property Services

■ Project of the Year – Residential

Killynure Green, Carryduff – Choice Housing Ireland

■ Project of the Year – International

Sponsored by CMR
Pomona: Ultra-low energy lab eliminates
performance gap, California, USA –
Elementa Consulting



LinkedIn Group discussion on future-proofing buildings sparks comments on IoT

Pat Lehane

As CIBSE Ireland marks its 50th anniversary, and we look back at buildings designed in the 1960s, we understand why large areas of glazing, lightweight construction and insufficient ventilation led to overheating and downright poorly-performing buildings. But, in 50 years' time, will we think the same about the buildings being built now?

Paul Norton

With most items – including power – becoming wireless, and the fast-developing IoT, building flexibility in relation to services will become a thing of the past by virtue of technology, rather than, ultimately, the building design being treated more like a blank canvas.

Nick Skemp

IoT is a nice concept, but – first – building services engineers working with architects have the task of installing the pipes, ducts, terminal units, ceilings and suspended floors. It is these that define the possibilities for 'building flexibility in relation to services', since none of these can be changed by software... Wireless networks are great for controlling heating and



Join the conversation

We want to hear from you. Talk to us.

@CIBSEJournal

CIBSE LinkedIn

www.cibse.org

Subscribe to our newsletter

Receive our top stories about building services engineering. Sign up at cibsejournal.com

air conditioning in domestic properties, and for retrofit in small buildings, but they are not yet suitable to replace wired networking for the controls in larger or more complex buildings.

Top tweets from last month

Follow us on Twitter at twitter.com/cibsejournal and tell us if you think you should be added to our engineers' list. See what some of the biggest names in building services are saying at twitter.com/cibsejournal/engineers

@WorldGBC

We support @elementa_uk's #GettingToZero initiative. Read the #LETI response to the Draft London Plan energy policy here: ow.ly/5q2f3OirFYk

@asbp_uk

RT@Simonssturgis : Great news at the London Energy Transformation Initiative – 'whole life carbon' is being pushed for proper inclusion in the London Plan #LETI #WholeLifeCarbon

@JulieG_Sust

Great talk by Prof Holgate @unisouthampton as @asbp_uk conference. Brilliant catch phrase on observed declines in #fertility & possible link to indoor #airquality: 'our English castle really isn't as safe as you think, unless you want to think of it as a contraceptive'

@AECOM

In the year 2100, the sun's rays could play a major role in our energy needs with the help of devices designed to store an incredible amount of solar power, says global director of resilience @jsawislak. Read about the future of machines in [@PopMech. popularmechanics.com/technology/inf](http://PopMech.popularmechanics.com/technology/inf)

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

Please send all material for possible publication to:

editor@cibsejournal.com

or write to: Alex Smith, editor, CIBSE Journal, CPL, 1 Cambridge Technopark, Newmarket Road, Cambridge CB5 8PB, UK.

We reserve the right to edit all letters.

Mind the NO_x – at what cost?

Achieving high-performance heating requires a fine balance between energy efficiency and minimum environmental impact, says Remeha's Mike Hefford

As heating manufacturers, our goal is to help building services professionals achieve the most energy efficient delivery of comfort in a building, with minimum impact on the environment.

As heating regulations grow tighter, technology must become more sophisticated to meet the changing requirements. This can require a fine balancing act to ensure product compliance does not come at a cost to energy performance.

Take the move to reduce NO_x emissions from heating, for example. Almost all buildings emit pollution caused by combustion in their heating, cooling or electricity generation systems. Poor air quality has been linked to asthma, and lung and heart conditions – so encouraging a maximum level of NO_x emissions from heating is a welcome move.

The danger arises if positioning a product to achieve ultra-low emission levels comes at a cost to its performance.

Take the proposed Breeam 2018 *New Construction* manual, which will encourage new NO_x emission targets for combustion plant for heating and hot water. The BRE has broadened the newly named Pol 02-Air Quality credit to include benchmarks for particulate matter and volatile organic compounds (VOC) emissions that could have a negative impact on health and wellbeing, as well as for NO_x. In its Breeam 2018 draft, it also takes into consideration the sensitivity of the location of the development – for example, if it is in an air quality management area (AQMA).

The move coincides with the impending EU Ecodesign Directive, which will enforce mandatory NO_x emissions levels for space heating up to, and including, 400kW from 26 September, under the Energy-related Products Directive (ErP).

For some technologies, the proposed Breeam 2018 benchmarks – specifically for NO_x emissions – are far more challenging than those set out within the current Pol 02-Pollution credit, especially for new developments located in AQMAs.

A case in point is a gas boiler that, under ErP 2018, must comply with maximum NO_x emissions of 56 mg/kWh. When installed on a site in an AQMA, to supply heating and hot water it would need to achieve a NO_x level of less than, or equal to, 24 mg/kWh to gain the maximum number of credits (down to two from the previous three). If outside an AQMA, a NO_x level of less than, or equal to, 27 mg/kWh would be needed. This compares to the current Breeam 2014 criteria, for which a value of less than, or



"Applying modifications could adversely affect boiler performance"

equal to, 40 mg/kWh is required to gain the maximum credits.

While some Class 6 NO_x condensing boilers might struggle to meet the new thresholds, modifications are readily available to enable them to do so – but applying them could adversely affect boiler performance. Hence the balancing act.

For example, applying fan dilution to the flue system (see IGEM/UP 10 Edition 4) would help a condensing boiler achieve the proposed NO_x benchmark, and reduce carbon monoxide and carbon dioxide emissions. But it would also increase pluming at lower, street levels, bringing new nuisance issues around air quality. Additionally, there would be financial and energy repercussions caused by the need for modification. In other words, striving for lower NO_x emission levels beyond where the technology currently stands could have a detrimental effect on the ability to deliver high-performance heating and lifetime efficiency.

Combined heat and power (CHP) is another example. The UK has a binding commitment to reduce greenhouse gas emissions by 80% by 2050, compared with 1990 levels, with carbon budgets to achieve this. In its Clean Growth Strategy, the government has clearly identified heat networks as a central part of its emissions-reduction plans to offer low carbon heating in dense urban areas.

CHP is acknowledged as one of the most effective means of reducing emissions and generating high-grade heat for use in heat networks. However, as it currently stands, schemes using CHP as part of an energy-efficient services strategy may not achieve full credits under the proposed Pol 02-Air Quality credit. Again, applying modifications, such as a selective catalytic reduction system, will enable CHP to achieve the new thresholds, but at significant capital and running costs for the end user.

While Breeam is voluntary, it is increasingly influential in driving environmental performance practice, so some of the proposed NO_x thresholds could have far-reaching repercussions. Reducing the role of CHP to achieve the full credit, for example, would be counter to one of government's key aims to reduce regulated carbon emissions from heating.

As an industry, our focus must remain on achieving well-controlled, high-performance heating systems and optimising lifetime efficiency from our equipment. We need to mind the NO_x, but not at the expense of high-efficiency heating or affordable energy costs.

Breeam 2018 is due for publication on 7 March.

MIKE HEFFORD is general manager at Remeha CHP

The air we breathe

Air quality is a significant issue, and not just in the UK. Air pollution has serious impacts on health wherever it occurs and is now a pressing concern globally. Hywel Davies reports

The World Health Organization (WHO) recognised air pollution as a major public health concern in 2015, and the largest single environmental risk to health. It estimates that three million people worldwide die prematurely each year because of pollution.

WHO Air Quality Guidelines (AQGs) are used worldwide as a reference tool to help decision-makers to set standards and goals for air quality management. They include recommendations for four classical air pollutants particulate matter (PM), ozone (O_3), nitrogen dioxide (NO_2) and sulphur dioxide (SO_2). These guidelines underpin international guidance and are cited in CIBSE guidance such as TM40, on health and wellbeing, as well as underpinning EU air quality requirements.

Since 2006, the evidence of adverse health effects linked to exposure to these pollutants has grown. The WHO AQGs – for both outdoor and indoor air quality – offer guidance and recommendations for clean air to protect human health. With support from the EU, Germany, the Swiss government and the US Environmental Protection Agency (EPA), the WHO has started work to update the Global Air Quality Guidelines. It is expected to deliver up-to-date recommendations to improve protection worldwide from the adverse health effects of outdoor air pollution.

Regular readers will already be aware of the ongoing efforts of activist lawyers ClientEarth to hold the UK government to account over its air quality policies. The organisation has now won another court ruling against the current administration's approach to air quality. Mr Justice Garnham, in the High Court, ruled that its policy on air pollution and plans to address air quality are 'unlawful', and ordered changes.

He said the government's approach to pollution levels in 45 English local authority areas where air quality is below legal limits was 'not sufficient' and 'seriously flawed'. The judge instructed the government to ensure that these council areas take steps to 'achieve compliance as soon as possible, by the quickest route possible and by a means that makes the outcome likely'. Only 12 areas are currently likely to meet emissions standards by the end of this year.

Mr Justice Garnham endorsed the government's approach as 'sensible, rational and lawful' in five major cities – including Birmingham – even though air quality is not expected to meet EU limits until 2028. The judge granted ClientEarth the right to return to court without the need to apply for further judicial review



if it considers that government action continues to be insufficient.

This is ClientEarth's third successful action against the UK government. A ruling in April 2015 forced the Conservative-led coalition to prepare a new air quality plan, which was published in December 2015. The activist lawyers then returned to court in 2016, to argue that the new plan would still leave the UK in breach of EU air quality targets – and the government was ordered to do better. ClientEarth labelled the most recent plan a 'shabby rewrite' of previous plans, and returned to court to win the most current ruling.

So air pollution has become a pathfinder for environmental activism in the UK courts, as scientific evidence suggests that up to 40,000 people a year die from exposure to pollutants across the country. This focus on the quality of the air that we breathe will inevitably feed through into the work CIBSE members do, as clients and building users become more aware of the impact of air pollution on the operation of the buildings in which we live, work and teach – and in which we are cared for or are treated when ill.

The problem is not confined to the UK. On the day

"This focus on the quality of the air that we breathe will feed through into the work CIBSE members do, as clients become more aware of the impact of air pollution on the operation of buildings in which we live, work and teach"

of the High Court ruling, the American Council for an Energy Efficient Economy (ACEEE) and Physicians for Social Responsibility (PSR) published a major report highlighting the impact of air pollution from US power plants. Around 30,000 cases of asthma per year are linked to emissions from generating plants.

These organisations cite research by the American Lung Association that suggests as many as 40% of Americans have been exposed to unhealthy levels of air



pollution. The consequential health impacts tend to be greatest for the young, elderly, expectant mothers, and those with cardiovascular and respiratory conditions.

Improved air quality has the potential to reduce the incidence of asthma, heart attack, and respiratory illnesses and symptoms, and prevent premature deaths. These health benefits arise from improved ambient air quality that results, directly, from reducing electricity consumption. The ACEEE/PSR report describes the health benefits of greater energy efficiency in homes and businesses. Assuming a national 15% reduction in electricity consumption, it employs the Avoided Emissions and Generation Tool (AVERT) from the US Environmental Protection Agency (US EPA) to identify reductions in fine particulate matter (PM 2.5), nitrogen oxides (NO_x) and sulphur dioxide (SO₂), and where those reductions would occur.

AVERT predictions for more than 3,000 counties were then entered into the EPA's health-impacts screening and mapping model, to rank states and the 50 largest cities where emissions reductions could have the greatest positive impact on the health of those living nearby. It remains to be seen if this will be taken up at federal level.

In another case of a government being in the dock, a federal judge in California recently ruled that the US EPA must implement new energy efficiency standards for packaged boilers, uninterruptible power supplies and other products. The ruling addressed one lawsuit brought by California, New York and other US states, and another by environmental groups.

The quality of the air we breathe has become a significant issue. As engineers, we must be more aware of the impact of the systems we design, manufacture, install, and operate on air quality in the buildings we service – and more aware of the potential for litigation.

HVAC & BEMS Solutions for Companies of Any Size

Take Control of Asset Protection and Compliance and Energy Management in Your Business

Committed to helping build a better-connected world we develop and manufacture over 500 software and hardware solutions based on the principles of the Internet of Things



Since 2000 our solutions have been used by companies worldwide to control all aspects of their buildings and estate



Protecting assets and lowering install, maintenance and energy costs, we help our customers re-invest and grow



learn more about our HVAC solutions and read our IoT whitepaper at

www.resourcedm.com

hello@resourcedm.com
www.resourcedm.com

Resource Data Management



OXFORD ASPIRES

The University of Oxford not only tops the World University Rankings – it also heads its peers on building performance, after being named overall champion, as well as Facilities Management Team of the Year, at last month's CIBSE Building Performance Awards. **Liza Young** finds out why

As the oldest university in the English-speaking world, the University of Oxford has acquired a vast estate of buildings over the past nine centuries. Currently, it has more than 240 in its functional estate, some dating back to the 14th century.

With 650,000m² of floor space, the university understood that there were huge savings to be made from cutting energy use, so it started a carbon-reduction programme in 2011. This has been an unprecedented success. Over the past six years, it has saved an estimated 5,536 tonnes of carbon (tCO₂) and £1.3m in annual energy costs – a feat that was recognised last month, when the university's estates services team was crowned Facilities Management Team of the Year, and overall champion, at the CIBSE Building Performance Awards.

Carbon-reduction projects manager Lucinda Lay, who is a member of the environmental sustainability team in estates services, is pleased the work has been acknowledged by the building services sector. 'This award gives each and every person the recognition they deserve at an industry level. Having this shows that we are taking carbon-reduction seriously, and doing our best. The [satisfaction] we get is when we walk into a building and we are proud to be there because it has a correctly operating BMS system and is running efficiently,' Lay adds.

The university set an ambitious target to reduce direct carbon emissions – from buildings and vehicles (scope one) – and indirect emissions, from purchased electricity (scope two), by 33% by the end of 2020, against a 2005-06 baseline. More than 204 projects have been completed, including: installation of solar photovoltaic panels (PVs); LED

lighting; building management system (BMS) optimisation, and building system upgrades. The team's efforts have paid off because, in 2015-16, the university generated 54 times more onsite energy than in 2005-06 and, in 2016-17 – for the first time – its emissions were 5% lower than the 2005-06 baseline. CO₂ per square metre levels have also fallen, by 28% since 2006.

But the benefits aren't just in the numbers. The projects have helped to improve user experience, as well as empower building and facilities managers to take control of their sites.

Stephen Pearson, head of estates services' building services team at the University of Oxford, says: 'The biggest eye opener came from the seasonal commissioning and optimisation of major capital projects. It demonstrated how hard it is to achieve peak performance with zero and low carbon technologies when combined with conventional systems. It has also produced data that I expect will change the way we design services in the future.'

The university's environmental sustainability experts (above). From left: Ed Wigzell, travel officer; Alan Wood, energy manager; Tom Heel, deputy head of environmental sustainability; Jennie Jack, environmental sustainability projects manager; Harriet Waters, head of environmental sustainability; Omega Young, deputy energy manager; Lucinda Lay, carbon-reduction projects manager; Jane English, team administrator; and Adam Bows, sustainable transport manager

Tackling the sciences

The mathematical, physical and life sciences, and medical sciences divisions account for 76% of the university's carbon emissions, and were where the environmental sustainability team was able to make the most savings. One of the main reasons for this is the ventilation and conditioning requirements of the laboratories, as well as the energy-hungry equipment contained within them, says Lay.

A subsidy scheme was put in place to upgrade the university's 500 ultra-low-temperature freezers, while funding for more than 130 glass dryers was also provided.

The old uninsulated units, which were often left running, caused laboratory spaces to heat up, so additional cooling was required. The new, insulated glass dryers have 24-hour, seven-day timers, so can be programmed to switch off automatically. It is estimated that 370 tCO₂ can be saved simply by reducing the amount of time the dryers are on and increasing the efficiency of the units. As an added benefit, the cooling load in laboratories will also be reduced, says Lay.

Engagement materials, including 'Shut the sash' stickers – have been made available for all staff. These remind users to close the sashes on fume cupboards, to ensure less conditioned air is forced through the stack, reducing the amount of energy used by the fans.

The university is also in the process of converting chemical fume cupboards from constant air volume (CAV) to variable air volume (VAV) with energy recovery. In the chemistry research building, 300 fume

cupboards are already VAV and, using a £500,000 budget, the rest of the estate's units will be upgraded over the next two years.

Investment in renewable energy has led to more than 1,000 solar panels being installed on roofs. These have now saved £60,000 in annual energy costs and 226 tCO₂ in carbon emissions.

When installing PV panels on some of the science buildings, the team had to ensure the electrical fields created did not interfere with the electron microscope and other highly technical equipment in laboratories. 'We had to engage with the users and make sure everyone was on board,' says Lay. 'The primary focus of the university is research and education, and we have to support that.'

BMS optimisation

The biggest return on investment for the university was the optimisation of its building management system (BMS), which involved changing set points and time-clocks on sensors and controls.

Already, of the 1,546 tCO₂ per year savings that have been identified, 1,134 tCO₂ have been realised from 23 buildings since 2015. In many cases, this has led to further mechanical projects because the scheme identified where systems require maintenance or upgrades, says Lay.

Each building goes through a 12-month process, involving increased metering of its activity, analysis, and implementation of changes, before monitoring and validation to assess impact. 'We have made progress in identifying what those projects are, and how we could turn them into best practices,' says Lay. 'Every time we open the door, we find something new – there's always an opportunity around the corner.'

The Manor Road Building

Occupied by the social science library, plus four teaching and research departments, the building operates 24 hours a day. To optimise it, the team changed air handling time-clocks and removed unnecessary

Carbon-reduction projects manager Lucinda Lay



"The carbon reduction programme has produced data that will change the way we design services"

Energy and carbon

In 2005/06, the estate produced...



133
kg CO₂
per m²

by 2009/10, emissions peaked at...



143
kg CO₂
per m²

by 2015/16, emissions reduced to...



95
kg CO₂
per m²

More space supporting global research, but producing less carbon emissions for every m²



The University of Oxford has invested **£3.5m** in its carbon-reduction programme

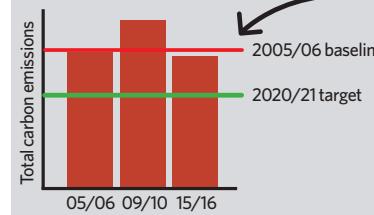
...it has allocated a further **£6m**



It has renewable energy including ground source heat pumps and solar PV

In 2015/16, it generated 54 times more onsite energy than in 2005/06

What about the total annual emissions?



Total emissions are lower than the baseline for the first time (-5%), but the university is still on a challenging journey to meet its 33% reduction target by 2020/21

A snapshot of the university's carbon reductions

- » dehumidification, which saved around £16,000 and 93 tCO₂ a year – the equivalent of the carbon emitted from 15 average households in one year.

George Newman, senior facilities manager at Manor Road Building, says: 'The changes were low impact and easy to implement, and the building is now able to perform optimally for the users – we have received no complaints.'

Department of Earth Sciences

Since January 2015, Hoare Lea has been working with the university to carry out detective work on existing systems. Since their intervention, the department has saved about £15,500 on its energy bill, and 84.5 tCO₂.

After interviewing students about when they were most likely to use the building, services were adjusted to operate from noon to 11pm, rather than from 9am to 5pm.

Department of Biochemistry

The university and Hoare Lea optimised the chillers, VAV units, and the atrium and bioinformatics ventilation systems, saving approximately £33,815 and 185 tCO₂ – or 5.8% – on its annual emissions. The main carbon-saving interventions included adjusting cooling and heating requirements – so, instead of running continuously, systems operated when the building was occupied. For a detailed case study, see 'University challenge', (CIBSE Journal, October 2016).

Bodleian Book Storage Facility

After reviewing the Swindon building and its internal environment, the Bodleian Libraries team, supported by estates services, optimised the BMS, while maintaining tight control of environmental conditions. Improvements at the 17-acre site, which holds 12 million books, included: changing the air in the facility less often; ensuring the humidifiers and pumps were used more efficiently; decreasing the

demand on the building's chillers; and limiting the speed of the fans. The BMS project has reduced annual carbon emissions by 410 tCO₂ – equivalent to making five million cups of tea – and saved around £77,000 a year in energy bills. Bacteria levels in the storage facility are monitored periodically to guarantee the safety of the books.

To help cut carbon emissions further, a ground-mounted 50kW PV system was installed outside the facility. When operating under optimum conditions, it supplies all of the building's electrical demand for free, without carbon emissions. The PV system generates 55,000 kWh of power a year, saving 27 tCO₂. On good days, the building even exports power to the national grid.

However, the benefits are not always in carbon reduction or financially driven, says Lay. 'Sometimes, you get a small return on investment. Our motivation is the enjoyment occupants get from a building – for example, if we help them fix a room that is overheating. It's a minor change, but it makes the occupants really happy and, next time, they will be much more willing to help us make further savings.'

Monitoring changes and making sure they stay in place is a full-time job in itself, adds Lay. 'Sometimes, we return to a building after six months and find it in manual mode – or discover its use has changed. It's a constant task, especially as there is a huge shortage of BMS experts.'

BMS user training now features as part of the environmental sustainability training programme, to ensure lessons learned are embedded and that optimisation of systems is maintained.

Behavioural change

To bridge the knowledge gap with building and facilities managers (FMs), the university has launched workshops on energy management and BMS training, and for sharing best-practice case studies that can be implemented elsewhere. 'It's about empowering FMs to make decisions that ensure buildings work better for them, and sharing experiences so everyone buys into the vision,' says Lay.

The university has also invested in new user-friendly monitoring and targeting software – SystemsLink – that gives building users access to their energy performance data and allows for direct billing. In October 2015, it also launched the Carbon Innovation Programme (CIP). This enables multidisciplinary teams of staff and students to propose

Lucinda Lay, Alan Wood and sustainability engineer Martin Taylor



CO₂
has been saved at
Manor Road Building
– equivalent to the
CO₂ emitted from 15
households in one year

Principal mechanical services engineer Ian Taylor and Lucinda Lay





"It's all about talking to occupants ... using language they can understand, explaining the risks and the benefits"

and develop ideas for reducing building energy use and associated carbon emissions across the university. One such proposal was the installation of a biomass boiler at Tubney House – a zoology department building that is off the gas grid and running off kerosene.

Another project launched by the university is Green Impact – an environmental accreditation scheme, run by the National Union of Students, which allows staff and students to improve the sustainable practices of their office, building or department. More than 3,000 actions – including the 'Shut the sash' stickers – have already been completed by more than 40 teams.

Lay says the carbon reduction programme, constructing new buildings to Passivhaus standard, the decarbonisation of the grid, and changes to the way the estate is being used, have all contributed to energy savings. The biggest lesson learned, she adds, has been stakeholder engagement.
'We are a services delivery team, so it's all about talking to occupants and getting them on board – and, when discussing a tricky engineering concept, using language that they can understand, explaining the risks and the benefits.'

Estates director at the Said Business School Mat Davies believes the work being done by the University of Oxford's environmental sustainability team is transformative. 'It sends a clear message that we are an organisation that understands our responsibilities, actively embracing every opportunity to reach our challenging targets for carbon reduction. The CIBSE award is deserved, and has been earned through great professional diligence and a genuine desire to reduce our environmental impact.'

Paul Goffin, director of estates services, adds: 'Our mission is to develop, maintain and manage the University estate in a safe, efficient and sustainable manner, ensuring the continued enhancement of our unique physical heritage and the provision of a world class research, teaching and learning environment. We put customers at the heart of what we do and this has been demonstrated through the carbon management programme. The University of Oxford is proud to be leading the way on building performance.' **CJ**

Lighting can collect data.



**Find
out how:**

zgservices.com

zgs zumtobel group services

THE LONG GAME

With the collapse of Carillion, attention has turned to the industry's outsourcing practices. **Liza Young** speaks to facilities management consultant Jo Harris about the value of skilled maintainers to businesses

Educating clients to ensure the outsourcing model is procured and implemented sustainably is an important lesson that should be learned from Carillion's collapse.

Jo Harris, CIBSE maintenance task group chair and controls and project engineer at Eli Lilly, says the insolvent firm's demise should provide the impetus to address the bad practices that exist within facilities management (FM).

A member of the CIBSE FM Group, Harris started her career as a maintenance apprentice, and – for the past 14 years – has been an FM consultant and industry advocate for improving the construction and operation of buildings. In our interview, she acknowledges that FMs must upskill in order to outsource less, and show clients how they add value to businesses.

The dangers of outsourcing

Part of the issue with Carillion was that it was bidding for contracts at below market-level prices. Many clients suffer from poor service if suppliers can't deliver at those prices, or are charged for lots of extras, says Harris.

'Hopefully, this collapse will highlight the need for procurement teams to carry out due diligence on companies tendering for contracts, and interrogate their prices and the supply chain,' says Harris, who adds that procurement teams must be wary of accepting under-price bids. 'If you get four bids and one is implausibly low, do not take it, because – if the service company isn't making a profit on your contract – they will cut the services they provide until they do, or start charging extras.'

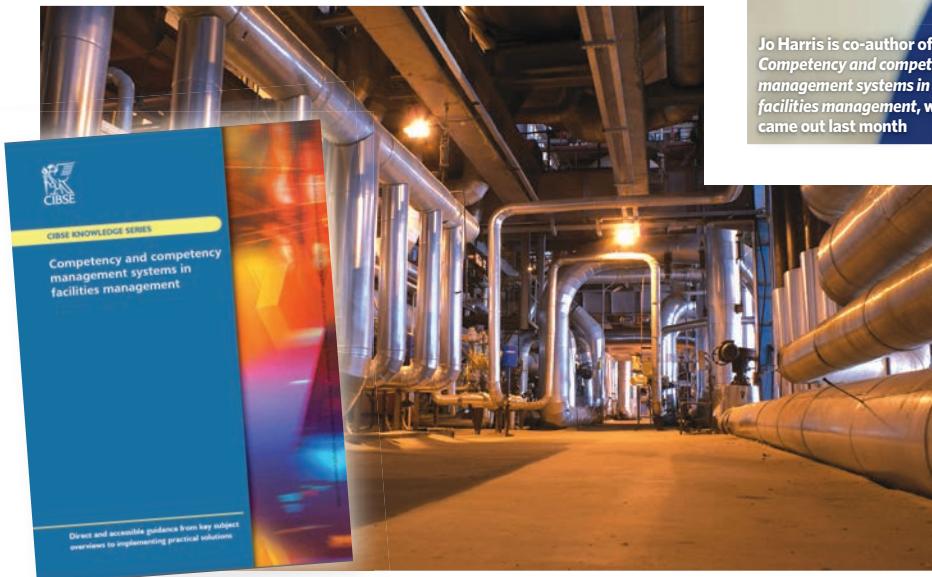
'It's about benchmarking, setting the service level agreements (SLAs) that you can afford, and putting in place KPIs [key performance indicators] that are realistic and drive the behaviours you want. If you get FM right, you can add value, and support the business – but, if you go cheap, buyer beware.'

FM is a service industry and you get what you pay for, adds Harris – but she doesn't

believe Carillion's situation will reduce the industry's appetite for outsourcing, because FM is non-core for many businesses. 'Outsourcing it makes sense for organisations that think "a building will do", because they're not interested in running buildings and knowing how to add value to them. They're interested in getting their product out there.'

Having an in-house FM team is important for businesses that make money from their assets – such as train lines, factories, data centres and hotels – but Harris concedes that even FM companies outsource, calling in specialists for technical jobs.

'They have to outsource jobs they cannot do, because we have multiskilled our staff to a point where they are jacks of all trades but masters of none – so even something as simple as welding a bin store is outsourced,' she says. 'We've also become a disposable society; we don't strip down things such as pumps any more – we just throw them away and buy new.'



Jo Harris is co-author of **KS21 Competency and competency management systems in facilities management**, which came out last month

"The biggest challenge facing FMs is managing existing estates and legacy plant within ever-decreasing budgets, while ensuring compliance with the skill sets they have"



Harris says manufacturers have a lot to answer for, because products have become so complicated that maintainers don't have the systems to interrogate and fix them. 'Domestic boilers are becoming throw-away items because manufacturers have created this magic box full of technology that we can't do anything with,' she says.

The biggest challenge facing FMs, however, is managing existing estates and legacy plant within ever-decreasing budgets, while ensuring compliance with the skill sets they have. 'FMs are struggling to fill engineering positions, so we have to outsource, and end up paying others, while spending less on plant. Having someone in-house who can do the work is cheaper, but we lack the skills,' Harris says.

FMs are like first aiders, she adds, while the 'doctors' are the specialists flown in when they can't fix things themselves. 'There are not enough doctors in-house, because we don't have the skill set.'

Skills shortage

Harris believes many FM engineers have lost the skills to maintain buildings. 'In my experience, they are being used only to fire fight and to manage specialists, who are brought in to do all the repairing or replacing of assets when needed.'

With help from the government's Apprenticeship Levy, recruitment has taken a huge leap from a couple of years ago. 'People see there is a financial benefit to having an apprentice, so – as long as we get those schemes operating effectively, and the governance of them right – we should have the engineers we need in five to 10 years' time,' says Harris.

With technologies such as BIM, 3D modelling, and virtual reality, it is not as arduous to attract youngsters into the industry. 'Kids in school today will do jobs that haven't even been invented yet,' says Harris, who believes future skills will focus on programming computers to do tasks. 'We might not need maintainers any more – just programmers.'

Think like a maintainer

Only if you take yourself out of designer mode, and put yourself in operator mode, will you create a building that works after handover, claims Harris. BIM – with its clash detection and understanding of how buildings operate – could help do that, 'but a computer won't tell you that you didn't put in cleaners' cupboards,' says Harris. 'Only if you've operated a building will you know that you need cleaners' cupboards – otherwise, where will the mops be kept? In the office?'

Designers need to consider their decisions from the other end of the telescope, says Harris, who cites countless schools that have reverted to back-up gas boilers after finding their new biomass systems too complex to run and maintain. 'The default position for occupiers is to go back to the technology they know,' says Harris. 'If, during the construction of those schools, the designers had thought about the caretaker managing the building, would they have put in biomass boilers? In my kids' school, the caretaker was previously a pub landlord – a handy chap, but not an engineering technician.'

Having separate project and maintenance teams that fail to talk to each other is often the root of problems. In many projects, the FM never talks to the architect or any constructors, says Harris, who believes outcomes can be improved with two-way communication between the right parties, engaged early. 'You need somebody who knows how the building is going to be used to write the procurement. It's important to have users' input before too many decisions have been made.'

The BIM information, and the calculations and decisions taken during design, must also be put to good use. 'If we educate maintainers and operators to use that information, we can keep our buildings running as efficiently as the design,' Harris says. 'Instead of all the tweaking we do when somebody is cold, we could go back to the design and find the root cause, rather than just addressing the symptoms.'

Facilities management is about making the most of your resources, especially in legacy buildings, 95% of which will still be here in 2050. These are the buildings that need attention, says Harris, and engaging FMs in design and commissioning is the best way to make them operate efficiently. **CJ**

LEARNING ON THE JOB

A youthful Wilson Weatherley Phipson was taken to task by some members of the Institution of Civil Engineers for his work on the University of Glasgow, but he graduated to greater things at the Natural History Museum, says **Neil Sturrock**

Wilson Weatherley Phipson was, undoubtedly, the most prolific building services engineer of the mid to late 19th century. His systems for the Liverpool Royal Infirmary and the Royal Albert Hall have been featured in previous *CIBSE Journal* articles (September 2015 and April 2017), but here we consider two of his better-known buildings – the University of Glasgow and the Natural History Museum in London.

University of Glasgow, Gilmore Hill 1870

The architect for the new university building, when it relocated in 1870, was George Gilbert Scott, who had recently completed the Grand Midland Hotel at St Pancras Station.

Scott wrote to the university's Building Committee requesting guidance on an engineer to oversee the heating and ventilation for the building, and Phipson was appointed. At this time, the university was governed by its tenured professors and Phipson's contract defines his client as a group of 25 of them, all listed on the contract.

The Building Committee included some of the most famous scientists of the time and they insisted that a number of criteria had to be met – for example, related to air supply and extract rates, and control of temperature.

Phipson's system

The solution Phipson adopted involved a central air supply chamber and an extensive network of underground tunnels. The main



air supply chamber was in the basement under the central tower, itself the means by which air was 'drawn from some place where the air is always pure' – another one of the Building Committee's requirements.

Phipson had calculated that the maximum air-supply rate through the system should be no less than 30,000 cubic feet per minute (cfm) ($14\text{m}^3/\text{s}$) and he specified a screw fan – rather than the more conventional rotary one – which needed to be 7ft 6in (2.30m) in diameter. After being transmitted from the central supply chamber, the air was heated locally in hot air chambers, by independent Cornish boilers that heated gravity-fed pipe coils in each chamber. Each boiler

Architect's sketch showing
boiler chimneys at the
University of Glasgow
Gilmore Hill site





Natural History Museum

"The building committee's requirement that each space have the 'means of mixing' hot and cold air to provide individual temperature control was not met – although this may have been because of cost cutting"

flue was enclosed in a concentric shaft to enable their heat to aid the movement of vitiated air out of the building.

The air supply to each 'classroom' was to be at high level and the extract at low level. However, the committee's requirement that each space have the 'means of mixing' hot and cold air to provide individual temperature control was not met – although this may have been because of cost cutting. It is also apparent from later experiments carried out by the university's professor of civil engineering and mechanics, James Thomson, that the addition of outlet points above the gas lamps prevented the warm air from descending to low level in any quantity. He also states that the air inlets were only halfway up the wall.

The university must have been satisfied with Phipson's system, because it engaged him for £255 per year to supervise its operation. This amount was to cover the wages of an engineer and stokers, plus a minimum of two visits each year by Phipson. When Phipson delivered a paper to the Institution of Civil Engineers (ICE), however, and implied that the system operated in a satisfactory manner, he was taken to task by Thomson and several others. The problem seems to have been that the system, as installed, did not allow for simultaneous thermal comfort in spaces that had differing occupancy rates and heat gains. For example, three classrooms – stacked one above the other – at the east end of the south-facing façade were fed from the same supply duct, the mixing of hot and

MORE INFORMATION

Much of the information in this article is taken from an e-book by Brian Roberts, *Wilson Weatherley Phipson: Victorian Engineer Extraordinary 1838-91*, which is available to download from the Heritage Group website, www.hevac-heritage.org

cold air having taken place in the basement.

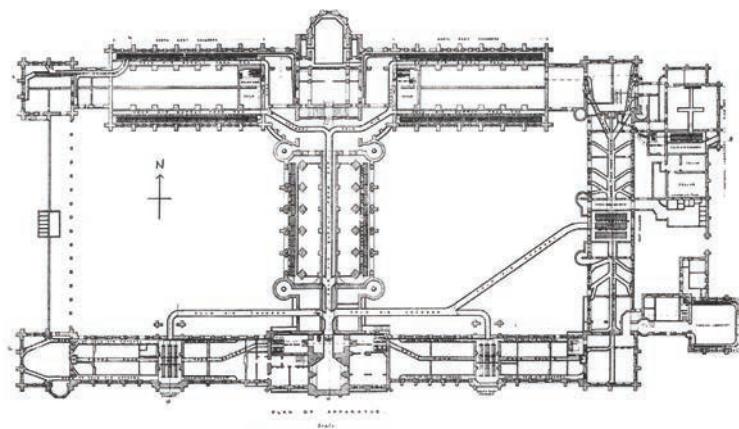
In his defence, Phipson was only 28 years old – and relatively inexperienced – when he designed the system for this very large and complex building, and he had only been appointed after much of the architectural design had been decided upon.

The Natural History Museum, Kensington 1880

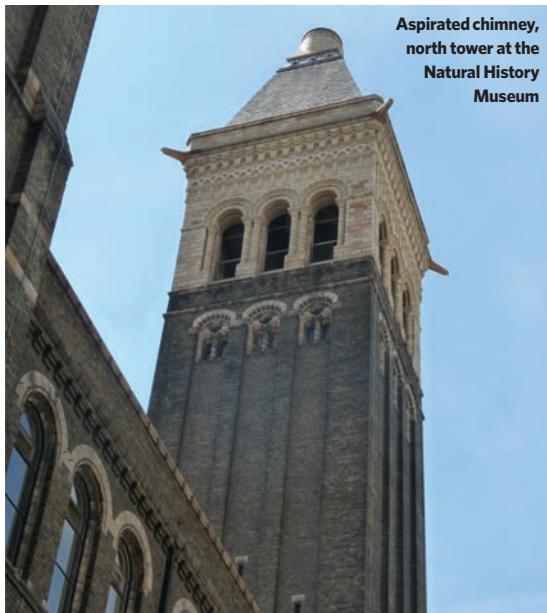
The site occupied by the Natural History Museum had been used in 1862 for an International Exhibition and it was originally suggested that the ever-expanding Natural History Collection at the British Museum should overflow into these Exhibition Buildings. However, it was eventually decided that a new Natural History Museum should be built there and Francis Fowke, who had designed the Exhibition buildings, produced a design.

When Fowke died in 1865, the task was passed to Alfred Waterhouse, who was asked to complete Fowke's design but prepared his own in 1868.

Waterhouse asked both Phipson and the oldest heating and ventilation engineers in the country, Hadens, to design systems for the »



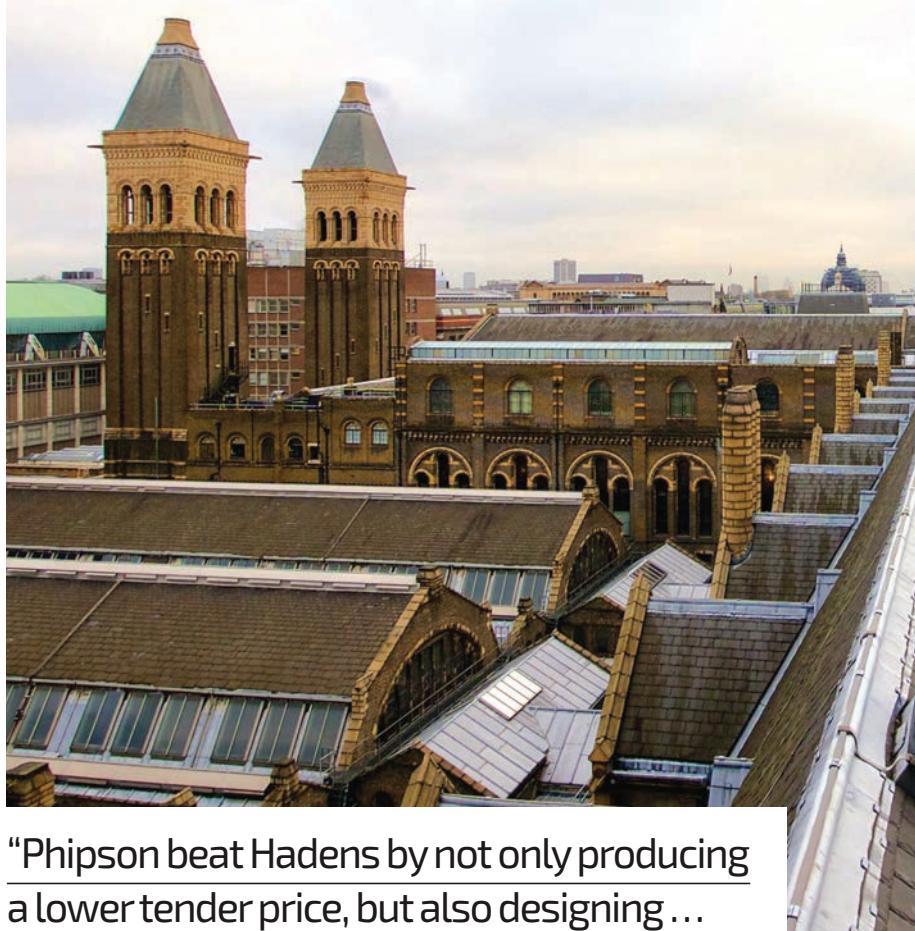
Plan of underground supply ducts at the University of Glasgow



» museum (which they would then supervise the installation and operation of) in one of the earliest known examples of competitive tendering. Surprisingly, Phipson beat Hadens by not only producing a lower tender price, but also designing, in Waterhouse's view, a better system using steam boilers – rather than hot water boilers – as the primary heat source. Phipson also gave an estimate of the ventilation rate his system would provide, which Hadens did not do.

Phipson had clearly learned from the mistakes he made at Glasgow University and made sure he allowed for local temperature control. The system he designed was effectively a 'dual-duct' type, with a series of parallel ducts – one carrying heated air and one carrying untreated outside air. The hot and cold ducts ran one above the other at basement level, with air supplied directly from outside to the 'cold' channel. For the upper, warm-air duct, air was passed through a number of steam coil 'stations'. There were also steam coils under the main staircase at the north end of the Central Hall (Index Gallery) and near to the main entrance.

A detailed description of the building and its system was provided by Professor Jeffrey Cook and Dr Tanis Hinchcliffe in the 1990s,¹ while further details of the control mechanisms are included in Cook's paper in the *ASHRAE Journal*.² They had concluded that the fresh-air supply was all from the north side of the basement; however, a recently discovered Phipson drawing – unearthed by Professor Vidar Lerum³ in the uncatalogued section of the RIBA Collection – indicates that air could also be taken from the south end. The ducts shown on this drawing suggest air could be drawn in at the sides of the ramp leading up to the



"Phipson beat Hadens by not only producing a lower tender price, but also designing ... a better system using steam boilers – rather than hot water boilers – as the primary heat source"

main entrance – and possibly even from grilles in the retaining wall at Cromwell Road.

Essentially, most rooms and all the large spaces got a (warmed) ducted air supply through grilles at low level, from vertical risers built into the walls. The air-supply rate and temperature were controlled by means of dampers on the side walls of the supply tunnels. A limited number of perimeter rooms had fresh air supplied through grilles behind steam radiators.



Typical elaborate floor grille

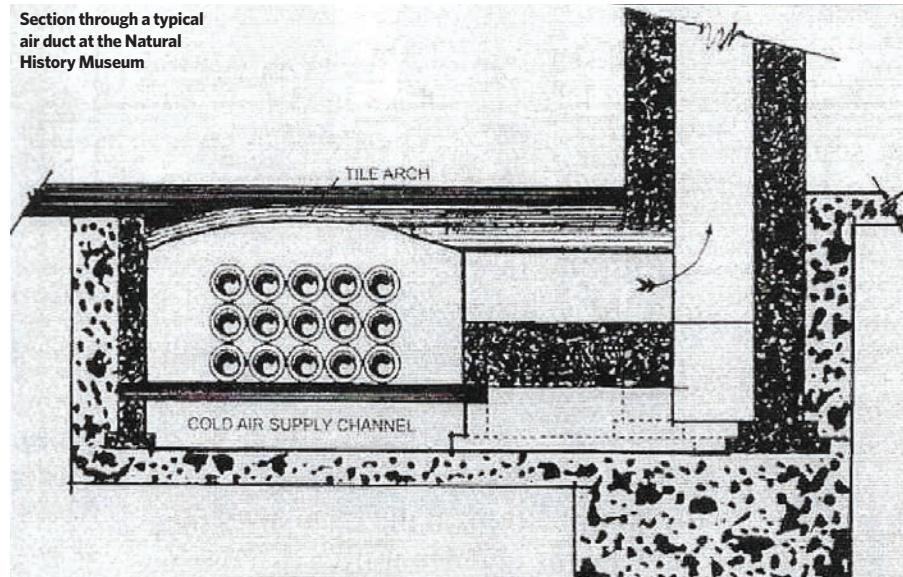
The building's six main towers were all essential elements in the natural ventilation extract system. Waterhouse was asked to reduce the height of the two main south towers that encompass the main entrance, but argued that this would reduce their effectiveness as storage towers for large water cisterns for emergency firefighting. He was supported in this argument by the London Fire Brigade.

The two (north) towers, at the rear of the building, carried the boiler flues up through their centre and these were surrounded by brick ducts for vitiated air from the galleries. The ducts terminate at the level of the exhaust openings on all four sides of each tower. Five



of the six extract towers can be seen in the image above, taken by Lerum from the west tower. It is reproduced by kind permission of Routledge from *Sustainable Design – Learning From Nineteenth-Century Innovations* by Vidar Lerum, Routledge, Abingdon 2016 (Figure 11.4, p113).

The two towers on the left are the ‘aspirated chimneys’. Together with the towers on the near right at the main entrance, they frame the central Index Gallery – the



large space immediately behind the main entrance. Exhaust air from this main space passed through disguised openings halfway up the north wall and into the aspirated north towers. Originally, however, it seems likely that exhaust air would have passed into the two rooftop conservatories – to the east and west of this gallery – through the balustrades that now have brick walls behind them.

The Natural History Museum had no fans and relied on natural ventilation for all seasons. Phipson estimated that the system would provide three air changes per hour. This puts into perspective the suggestion that naturally ventilating the new Bloomberg London building was a monumental challenge and that ‘people need to be near an external wall, a roof or an atrium to benefit from fresh air’.⁴ [CJ](#)

References:

- 1 ‘Designing the well-tempered institution of 1873’, Jeffrey Cook & Tanis Hinchcliffe, *Architectural Research Quarterly*, Vol 1, winter 1995, 70-78
- 2 ‘Designing ventilation with heating’, Jeffrey Cook, *ASHRAE Journal*, April 1998, 44-48
- 3 *Sustainable Building Design – Learning from Nineteenth-Century Innovations*, Vidar Lerum, Routledge, Abingdon, 2016
- 4 ‘Business in Bloom’, *CIBSE Journal*, December 2017, 28-33

■ NEIL STURROCK is chair of CIBSE Heritage Group

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



CMR CONTROLS Ltd

CMR are the inventors and manufacturers of both the P-Sensor and the Velogrid. The Velogrids are made to measure to fit any ductsize up to 3m x 3m and the P-Sensor has a keyboard to easily enter : duct height - width - density - magnification factor and the scaling in m/s - m3/s - m3/h - l/s. It can even work out the Air Change rate. And the BMS gets three linear volume signal outputs of 0..10V 4..20mA and an addressable Modbus rtu bus.

22 Repton Court Repton Close Tel +44 (0) 1268 287222
Basildon Essex SS13 1LN GB Fax +44 (0) 1268 287099
www.cmr-controls.com sales@cmr-controls.com





Emax 2 and ABB Ability™ Electrical Distribution Control System

Microgrids and the power of data
make energy digital

Transforming the flow of energy into analysable, manageable data – this is the function of Ekip Smart-Vision, the cloud computing platform that re-writes the rules for the energy management of low-voltage electrical systems. The internet of things is integrated into the devices, services and processes, allowing for better informed decision-making and easier supervision, even remotely. A simple, ready-to-use system that makes it possible to enhance radically, in combination with the new functions of Emax 2, the efficiency of latest-generation systems – microgrids – in terms of control, connectivity and ease of use.

Tel. +44 (0) 333 999 9900 | new.abb.com/uk/power-distribution-solutions

Are you starting to understand what the future will be like?

ABB

This month: Wellbeing guide; Well Building Standard, cooling papers; evaporative cooling; reducing HVAC noise

FIT TO STAND

CIBSE's upcoming revision of its Health and Wellbeing guidance TM40 includes the latest research linking building factors to comfort and wellbeing.

CIBSE's Julie Godefroy explains how it will help ensure buildings aren't harming their occupants

Life expectancy continues to rise, which is good news – but ageing populations are putting healthcare systems under increasing pressure. In addition, there has been a rise in non-communicable diseases, including those related to lifestyle. In many locations – especially urban ones – air pollution is linked to premature deaths and a range of physical and mental health issues. Health inequalities are significant, even in rich countries. In the UK, for example, there is a difference of nine years in life expectancy and of 18 years in 'healthy life' expectancy between the richest and poorest.

These factors are driving authorities towards preventive approaches, and the built environment has a significant role to play – from the indoor spaces where we spend most of our time, to the surrounding outdoor areas and the way we plan our neighbourhoods, towns and cities. Indeed,



many health improvements in the past two centuries have been related to measures such as water sanitation, the creation of parks in cities, and the construction of well-ventilated and daylit homes.

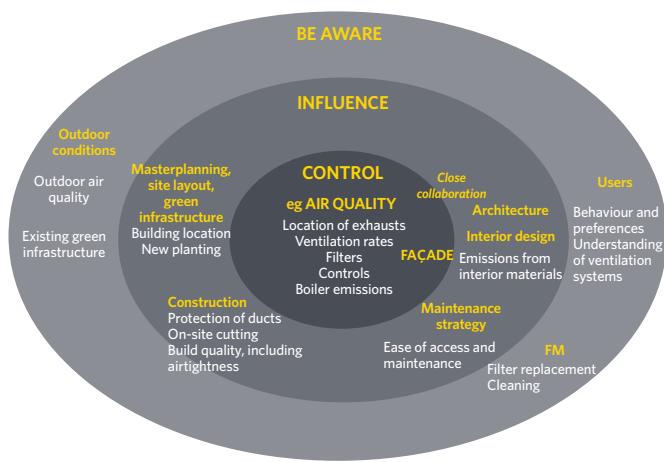
Advances in knowledge and solutions

There have been significant advances in knowledge and technical solutions in the past decade. These include an increased understanding of the non-visual effects of light on our metabolism, growing evidence of overheating risks, and widespread deployment of LEDs, wireless technologies and consumer devices, allowing building occupants to monitor their environment and activities. All of these have prompted CIBSE to revise Technical Memorandum 40, first published in 2006.

Approach

The scope of 'health and wellbeing' is extremely broad, ranging from acute health impacts through comfort and performance, to fulfilment, joy and happiness. The revised TM40 is mostly focused on the middle ground and providing best-practice advice on the design, construction and operation of buildings to support health, comfort and wellbeing. Health and safety issues are highlighted, but mostly with reference to other sources, where they are covered extensively.

The environmental parameters covered in 2006 – namely, air, humidity, thermal comfort, light, acoustics, electromagnetic fields, and water – are in the new version. There is a broader range of contexts, including new-build, non-domestic environments, homes, refurbishments, and some considerations of external spaces and site



Spheres of influence by building services engineers on health and wellbeing

Why

Current knowledge on **effects on health, comfort, and cognitive performance**

What

Defining **performance criteria** for health and comfort in buildings, based on guidance from health authorities – such as the WHO – regulations, and best practice

How**Guidance:**

- Site assessment
- Design, controls and monitoring
- Construction, handover and commissioning
- Operation and maintenance

Emerging themes

Limits of knowledge, areas of debate, innovation, research and development

"It is crucial for designers to collaborate between disciplines and understand the limits of their responsibility"

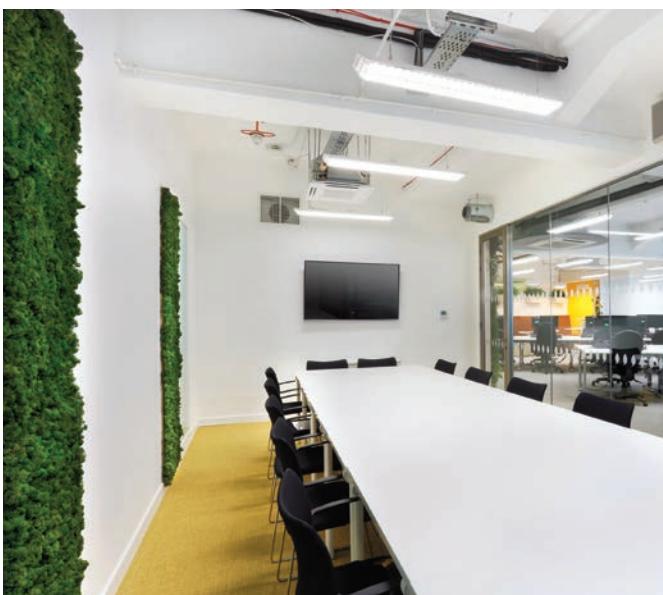
desired outcome is expressed in terms of maximum recommended pollutant levels rather than ventilation rates, as is commonly done. Rates will not necessarily guarantee a suitable outcome, especially if outdoor air is polluted.

How: For each parameter, guidance is given on design, construction and operation. Fundamental rules are to apply source control – to limit the potential hazard in the first instance – and to follow the precautionary principle to avoid unintended consequences, which can manifest themselves in the long term, or on people with individual sensitivities. It is recommended to offer a certain level of user control and choice over environment, to take account of sensitivities and preferences, and increase the likelihood of high comfort and satisfaction levels.

An overview of monitoring approaches is given, to allow building performance assessments, the gathering of lessons learned, and better communication with clients and occupants. The guidance highlights the many overlaps between each issue and with the environmental agenda, both in design, and in operation and maintenance procedures. Occasions where a compromise may be needed, based on project priorities, are also highlighted – for example, between the level of user control and potential energy savings.

Looking ahead: Finally, each chapter includes a section on emerging themes. This looks at areas under debate, current research and development, and the areas in which professionals should be aware of the current limits of knowledge. These are opportunities for innovation and collaboration with academia. One is the non-visual effects of light, where there is no consensus yet on metrics and solutions. For a live debate, look out for the CIBSE/SLL seminar at Ecobuild. **CJ**

- More details can be found from Build2Perform, and publication is expected in 2018. To contribute to case studies, contact JGodefroy@cibse.org
- Thanks to all contributors and to steering group members Ann-Marie Aguilar, IWBI; Sani Dimitroulopoulou, Public Health England; Alan Fogarty, Cundall; Keith Miller, GIA; Marcella Ucci, UCL; Sara Kassam and Anastasia Mylona, CIBSE.
- **JULIE GODEFROY** is interim head of sustainability at CIBSE



Refurbishment at the UK Green Building Council's London headquarters

Be sure. **testo**

The new testo 440 combines variety and highest ease of use.

Intuitive air velocity & IAQ

The new testo 440 combines variety and highest ease of use.

- User-optimised menus: All measurements under control
- Wireless probes: For all applications, without any cable mess
- Clearly arranged display: Set-up, measured values and results at a glance

www.testo.co.uk



Aegean – fan coil

A new range of fan coils for heating and cooling commercial applications



For a wide range of applications, with the ability to rapidly heat and cool large areas efficiently

- Incorporating the latest EC motor technology, for full BMS integration
- Variable speed control as standard
- Free 5-year parts and labour guarantee
- Suitable for traditional and renewable heat sources
- Independently certified by BSRIA
- Designed and made in the UK



01245 324900 | sales@smithsep.co.uk
SmithsEP.co.uk | @SmithsEP_UK | #ThinkSmiths

WELL AHEAD

Cundall's London office was the first in Europe to gain the Well Building Standard. For its Birmingham office, it is attempting to go one better and gain Platinum certification – the highest level. **Alex Smith** speaks to Cundall and architect Studio Ben Allen to see what this means in practice

Cundall was the first company in Europe to have an office achieve Well Building Standard certification, its 1,400m² head office in Carter Lane, London, gaining gold certification in 2016. Now the multidisciplinary engineer and project architect Studio Ben Allen are aiming to go one step further and gain Platinum – the highest level of Well – for the refurbishment of its Birmingham office at 15 Colmore Row.

The Well Building Standard is a scheme established by the International Well Building Institute (IWBI). It measures, certifies and monitors features of the built environment that will affect health and wellbeing, namely air, water, nourishment, light, fitness, comfort and mind. (See panel 'Well meaning'.)

To assess whether Well has improved the health and wellbeing of staff at Carter Lane, Cundall has been carrying out occupant surveys and recording staff turnover and absenteeism. In the two years since it gained certification, there has been a 50% reduction in absenteeism and a 27% reduction in staff turnover. This, says Cundall, equates to an annual saving of £200,000 for the firm.

The results, which are backed up by positive post-occupancy surveys, have reinforced Cundall's commitment to Well, and it is now aiming for certification in more buildings, with its 1,100m² Birmingham office – 15 Colmore Row – next in line.

15 Colmore Row

Refurbishing Cundall's Midlands base to the Well standard was not straightforward. The company's 90-strong staff occupy two floors in the building – the fourth and fifth – but the

former had only been refurbished three years before, and had won a British Council for Offices (BCO) award.

'There was no desire to undo the great work done by Peter Grant, the architect for the fourth floor,' says Cundall acoustics partner Andrew Parkin. 'So new areas and fittings were carefully inserted, leaving key elements of the existing office intact.'

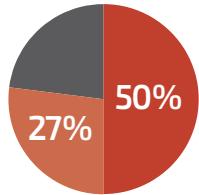
The fifth floor, however, had only recently been rented by Cundall, after it decided to expand its Birmingham office, so the project team had *carte blanche* over the refurbishment.

Cundall wanted an open staircase to connect the floors and unify the office. As a result, the fourth floor also had to meet the Well standard because, without certification, there was a danger the indoor environment on the fifth floor could be compromised by air flowing from the non-certified level below.

According to Parkin, the quality of the previous fit-out meant the fourth floor 'ticked a lot of boxes' in the Well Building Standard – for example, with its low-energy lighting, which featured task-based lighting, daylight dimming and absence detection, and had a capital



Carter Lane office



In the two years since it gained certification, there has been a 50% reduction in absenteeism and a 27% reduction in staff turnover

PROJECT TEAM

Client, MEP engineer, including sustainability: Cundall
Architect: Studio Ben Allen
Quantity surveyor: Rider Levett Bucknall
Staircase manufacturer: Meer End Staircases & Joinery
Contractor: Paragon Interiors



The space encourages social integration



Private pods are at the extremities of the office

cost of £8/m² compared with the benchmark of £12/m².

What concerned Parkin was Well's limits on volatile organic compounds (VOCs). Three years earlier, materials had not been specified with this in mind, but – when Cundall tested the fourth floor – it found the VOCs were within the limits. 'Anything that did have VOCs had already off-gassed [dissipated any toxins] – it wasn't the issue we feared it would be,' says Parkin.

All the new materials specified, including furniture, paints, glues, textiles and flooring, were virtually VOC-free, and shelving and breakout furniture was made locally.

An active office

One of the driving forces behind Colmore Row, said Ben Allen, was the active office, with fitness being one of the seven categories targeted by Well. 'The staircase became the central feature, and embodied the idea of people moving around the office,' he says.

To encourage movement around the offices, the design team positioned some of the most interesting breakout and social spaces –

"We tried to move away from the front-of-house space as being a 'wow' space, with the rest of the office ordinary"

such as private pods and a horseshoe amphitheatre – at the extremities of the office. 'We tried to move away from the front-of-house space as being a "wow" space, with the rest of the office being quite ordinary,' says Allen.

To encourage social integration, a single, expanded kitchen and eating space for 50 people was created, to serve both floors; this doubles up as a town hall space for large meetings. Inclusion of natural materials in the indoor environment is a precondition of attaining Well certification, and is an attempt by IWBI to nurture what it calls 'the innate human-nature connection'. As a result, the kitchen has solid-timber units and a herb garden.

Biophilia

The spectacular, helical central timber staircase – designed and engineered by Cundall and Studio Ben Allen – is intended to give a sense of nature. Light passing through its filigree framework creates intricate patterns, that change throughout the day and give a connection to nature.

However, Allen believes that biomimicry should not be overdone. 'I'm a bit sceptical about pictures of trees on walls. After a year, when the tree hasn't changed, it just becomes more stuff on the wall,' he says. 'Nature is the key thing. With the plant reacting to the sun, you have a great natural display next to your space.'

To meet the biophilia requirements in Well, there is extensive planting at Colmore Row, contained in planted zones, including trellis shelving. There is also a centrepiece 'planted chandelier' – or plantelier – positioned over the lightwell. Allen says there are more English plant species at the Birmingham office, because they relate to the external environment.

Lighting and services

As the fifth floor included a category A and B fit-out, Cundall had more scope to try different service designs, particularly when it came to acoustics and lighting.

Half of the fifth-floor ceiling is similar to the fourth-floor one, and has task lighting hanging from square horizontal rafts. The other half, however, is more unusual. To attenuate noise, a high, 1m x 1m grey acoustic lattice hangs at 45 degrees to the desks, on which lighting that can be controlled by two people is mounted. 'The desk lights have been really popular,' says Allen. 'They give people a sense of empowerment.'

Cundall had to alter the services to meet the preconditions for certification. A primary air supply had to be improved, so F7 bag-type





air filters were installed on the landlord's air handling unit so that sufficient amounts of PM10s and PM2.5s could be removed to meet the levels required by the standard. Cundall is hopeful that the next version of Well will also consider NO_x in its overall assessment of air quality.

Existing fan coil units in open-plan spaces were too noisy to meet Well and had to be relocated to meeting rooms that didn't have the same requirements.

Cardboard ductwork is used as the primary air distribution on the fifth floor. This has the benefit of being light and easy to clean, says Parkin, but it had to be 'top hung' on wires – rather than supported from underneath on a galvanised steel frame – because, otherwise, it would have twisted under its own weight.

WELL MEANING

There are three levels of Well certification: Silver, Gold and Platinum. Well is composed of 102 features, across the seven areas of air, water, nourishment, light, comfort, fitness and mind. These might be physical activity spaces for 'fitness', sound masking for 'comfort', and stress and addiction treatment for 'mind'.

There are two types of feature: preconditions and optimisations. Preconditions must be met for buildings to gain Silver certification or above. Examples include VOC reduction and moisture reduction for air, and circadian lighting design and solar-glare control for lighting.

Gold and Platinum certification have tougher requirements, known as optimisations. These include standards for displacement ventilation, antimicrobial surfaces and daylight modelling. Gold projects must meet 40% of the optimisation requirements and Platinum must achieve 80%.

Different preconditions and optimisations have to be met depending on whether the project is shell and core, a tenant improvement or new construction. The detailed requirements for each feature are described in the Well Building Standard (bit.ly/2C9f3mE). The microbe and mould-control precondition, for example, requires 'the use of ultraviolet germicidal irradiation devices to manage mould and bacteria on cooling coils, as well as inspections for signs of mould outside of the air handling system'.

A key concept of Well is the need for projects to be recommissioned and recertified three years after the initial certification. Well scores may rise or fall as a result.

'It looks much neater top-hung, as you can't see the wires,' says Parkin. Where ductwork passes into a social space, it has been photoprinted with tree bark. 'It's a branch duct, literally,' says Parkin.

Soundscaping

Sound masking counts towards Gold or Platinum certification, and is designed to create background noise so private conversations can't be overheard in open workspaces. 'Open-plan offices get a bad press, either because background noise is too low – meaning a lack of privacy – or because inadequate acoustic finishes result in a cacophony.'

Speakers have been embedded on acoustic rafts in the town hall area to provide soundscaping, and Parkin has been experimenting with different recordings. 'There's no music or speech, as you would be inclined to listen out for it. It's natural sounds we're looking for.' Parkin says birdsong has potential, especially from native species. 'Australian birds feel a bit too raucous,' he says.

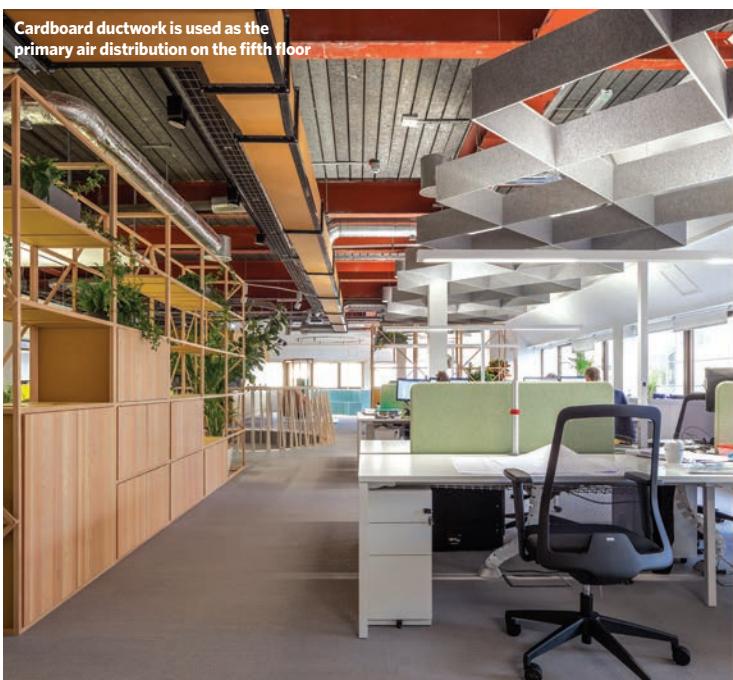
Parkin is also tempted to try traffic noise fed in from the office's city centre location. 'It would give you a connection to the external environment when you are in a sealed office, cocooned from the outside world,' he says.

Evidence of performance

Verification for each feature is spelled out in Well. For example, evidence of sound masking is by a letter of use, while compliance with the sound masking limits are tested on site; the open workspaces limit is 45-48 dBA and, for enclosed offices, it is 40-42 dBA. Measuring the wellbeing and productivity of staff as a result of compliance with Well is more difficult, says Allen. 'We're trying to employ data and some is really useful, such as VOC content and absenteeism. But it's frustrating if somebody sells you an ergonomic chair, for example, because there isn't a great deal of research on their benefits.'

Allen says having a close relationship with the client allows you to receive continuous feedback, while Cundall surveys its employees about how they feel the office changes have affected their productivity. The firm is also planning to undertake cognitive testing to observe the impact of CO₂ levels on performance.

Cundall is prepared to experiment with innovations, and put the latest research around health and wellbeing into practice. 'There's a big element in our office fit-outs of being our own guinea pigs. We like to try new things,' says Parkin, who believes it makes commercial sense too. 'Clients are more inclined to use solutions themselves if they can see them in action.' **CJ**



INDUSTRY FIRST, FRONT DISCHARGE, 6HP HEAT RECOVERY VRF SOLUTIONS

MULTI V™ S

HEAT RECOVERY - 15.5kW COOLING / 18kW HEATING



Multi V S™ Heat Recovery from LG boasts superior energy efficiencies (EER - 3.90 / COP 4.39. Capable of achieving an **ESEER value of 8.05** and a heat recovery potential **COP of 9.57**, in nominal operating conditions). Providing heating and cooling simultaneously with the option to connect to the LG Hydro Kit for the *production of domestic hot water*.

Technological developments including '**Dual Sensing Control**', 'Smart Load Control' and LG's own designed and manufactured 5th generation compressor equipped with High Sided Shell and a new Polyetheretherketone (PEEK) bearing. Ideal for small / medium sized spaces Multi V S™ Heat Recovery is compact and lightweight with considerable flexibility.

 **Business Solutions**

www.lg.com/uk/business

Please note: This product contains Fluorinated Greenhouse Gases R410A.

Book of evidence

The third edition of *Creating the productive workplace: Places to work creatively* provides evidence of the benefits of health and wellbeing, as well as many case studies, says the book's editor Derek Clements-Croome

We are increasingly seeing the importance of health and wellbeing in everyday living. There is growing evidence of its influence on productivity and creativity, with absenteeism and presenteeism (over-working) costing the nation around £100bn per year. Musculoskeletal issues and mental stress – as well as respiratory problems – are among the many ailments people can suffer as a result of poor health and wellbeing.

We live through our senses; what we see, hear, touch, taste and smell affects our human system – physiologically and psychologically. At a basic level, we need fresh air to live and to nourish our blood. The air has to be clean and not too hot or cold. We also need light to see, and to sense space in different ways. An acceptable aural climate is another consideration.

There are other factors – such as aesthetics, greenery, social ambience and the culture of a workplace – that subtly influence humans' response to their environment. All of these help determine the look and feel of a space, whether it's calm and tranquil, for example, or buzzy and energetic.

The third edition of *Creating the Productive Workplace: Places to Work Creatively* describes more human-centric ways of designing the built environment and comprises 28 chapters, with 55 international contributors from practice and academia.

The book is in four parts: Health, wellbeing and productivity landscape; research evidence; experiential evidence from surveys and building case studies; and future horizons.

Chapters 1 to 4 conclude that comfort alone is not enough to guarantee health and wellbeing. A number of personal factors – which depend on the physical and mental health of an individual – and external factors, which depend on the physical and social environment besides the work-related systems of management, influence productivity.

In Chapter 7, Peter Barrett demonstrates why different work tasks require different environmental settings, to allow optimum levels of alertness. At very low levels of alertness (sluggish) or very high levels (nervousness), the capacity for performing work is low. There is an optimum level that allows the individual to concentrate on work

while being aware of – but not distracted by – stimuli from the physical and social environments.

Kevin Reader makes the case for the workplace as a tool for investment in Chapter 18, and proposes a Flourish model that recognises physical, economic and emotional factors. This work is being developed further, into a design tool. Evidence on the economic benefits of making health and wellbeing a primary design issue shows that, for every £1 spent on wellbeing, you get about £5 to 10 back – which makes it a sound investment. Individuals feel better, companies get higher productivity and, indirectly, NHS costs reduce because there are fewer absenteeism illnesses.

Several chapters discuss and demonstrate various indicators, such as the Well Building Standard. There is a growing need to have a health and wellbeing consultant involved at the early design stage and in the post-occupancy evaluation phase of projects.

Chapter 21 considers the need for a wellness integrator. This is a transdisciplinary area, in which silo thinking limits the understanding of how people react in the built environment. The authors of this chapter are architects, engineers, planners, psychologists, physicists and ergonomists in research and practice.

In the words of Despina Katsikakis, in Chapter 27, 'the working environment can either stimulate and sustain people's engagement and energy or dampen and drain it'. For it to be a positive experience that adds value, she says, it must meet a series of basic human needs: to renew physical energy, to feel valued, to focus and be creative, and to connect with others in a range of ways. Katsikakis adds that people

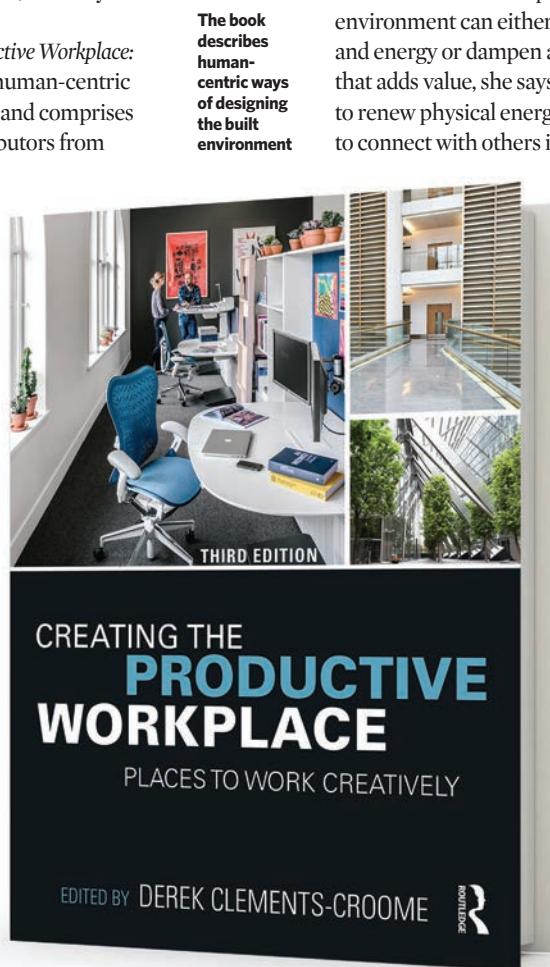
perform at their best 'when they move, spend time outside getting daylight, and alternate between different physical, emotional, mental and spiritual states'.

We have to realise that wellbeing affects our physical, mental (cognitive function) and social states – and, again in the words of Katsikakis: 'We need to bring more humanity into the workplace and provide environments with a new purpose – environments that delight, stimulate, energise and connect us with each other.'

It is not enough for buildings to be functional and economically resource efficient – they must also be for humanity. They offer an opportunity to construct a kinder world, and health, wellbeing and happiness must be integral to our planning, design and management thinking.

The book has been endorsed by the International Well Building Institute and the British Council of Offices.

DEREK CLEMENTS-CROOME is professor emeritus in architectural engineering at the School of the Built Environment, University of Reading, and visiting professor at Queen Mary University, London





"Our pitch is a bit hit and miss,
luckily the showers aren't."

When you need hot water and need it fast, Andrews always does the job. As the UK's leading supplier of commercial water heaters, we're top of the league for quality, reliability and customer service. Our products are built to perform, and keep on performing in the most demanding environments, time and time again.

Call our sales team on **0345 070 1055** or visit andrewswaterheaters.co.uk

Andrews. Built to perform.



Your trusted HVAC partner.

Delivering total integrated solutions
through industry leading brands.



We are ready.
visit www.nortek-erp.com
for more information.



01384 489700 www.nortekhvac.com/europe

www.reznor.eu



TRANE®

LOW GWP REFRIGERANT READY 300 KW - 14,000 KW

ALWAYS EVOLVING



SINTESIS™
AIR COOLED CHILLER RTAF



XSTREAM™
EXCELLENT
WATER COOLED CHILLER GVWF

CONTACT US FOR A COPY OF TRANE'S INDUSTRY UPDATE ON NEXT-GENERATION REFRIGERANTS

HVAC Equipment | Climate Rental | Energy Management | Service | Maintenance | Spare Parts



TRANE®

a brand of



Ingersoll Rand.

The tripling in size of an emergency department at Nanaimo Regional General Hospital, in Vancouver Island, Canada, offered designers the opportunity to improve the safety of the environment and cut operational energy usage.

David Clark, principal at Stantec Consulting, told a CIBSE-supported seminar how the designers had incorporated a thermal labyrinth to provide cooling and heating for the £22m (CAD\$37m) 10,000m² facility. The project included a new psychiatric emergency services and psychiatric intensive care unit, plus the existing emergency department.

Nanaimo, in British Columbia, has a temperate climate – classified as cool-

THE PROJECT OBJECTIVES

- LEED Gold certification
- Energy efficiency
- Redundancy and backup systems
- Patient and occupant comfort
- Infection reduction
- Ease of operation and maintenance

The thermal labyrinth is located in the basement of the new emergency department building (inset below). Water-filled containers increase the accessible thermal mass, but seismic requirements reduced the efficacy of these repurposed food-storage vessels, as they were intended to be perpendicular to the airstream, with air passing through holes in the 'dimples'

Among hundreds of seminars at the winter ASHRAE Conference in Chicago, two focusing on cooling caught the attention of CIBSE technical editor Tim Dwyer

COMFORT OF CHAMBERS

A new emergency department at a Canadian hospital enabled designers to use a basement void to install a thermal labyrinth and find their way to healthy energy savings

summer Mediterranean – with design conditions in winter (1%) of -7°C db and summer (July 2.5%) of 26°C db, 18°C wb. The internal design conditions for the project were winter 21°C, 30-35% RH minimum and, summer, 24°C, 50-60% RH maximum. The primary requirement was to deliver a building that met high levels of patient and occupant comfort and experience.

The idea was to bring nature into the building wherever possible. The courtyard-based plan incorporated visual access to green spaces and the surface finishes made extensive use of natural materials. The

»



Interior of the new emergency department at Nanaimo hospital

» useful daylight was carefully optimised, and it works in conjunction with bespoke lighting controls and automated exterior solar shading.

In terms of thermal comfort, the design used the full basement void as a thermal labyrinth, to pre-cool or pre-heat supply air. It did this by storing the heat of the day, or the cool of the night, and taking advantage of the diurnal range. Displacement ventilation, which requires moderate supply temperatures, was a good match for the labyrinth system and – through CFD modelling – was shown to be suitable to meet the air-distribution requirements.

This was used in conjunction with high-level radiant heating and cooling employing a 6-way valve to allow seasonal changeover. Particular care was taken to prevent condensation on the cooling radiant panels by ensuring that the chilled water temperature was always greater than the air dewpoint temperature, controlled using feedback from sensors on the panel supply pipe.

The annualised saving from the thermal labyrinth is £2,700 (CA\$4,780) – close to the prediction in the pre-construction modelling exercise.

The building energy performance index (BEBI) is 524kWh·m⁻²·y⁻¹, delivering annual savings – compared with the reference building – of 939GJ gas and 1,071,892kWh electricity, and a 39kW demand reduction. The total annual savings were £34,000 (CAD\$59,815).

In addition to the savings in energy, the C-Difficile infections have been reduced by half, hospital staff sick time is less than half that of the previous year, and annual overtime costs have been reduced by £292,000 (CAD\$500,000) compared with the previous year, with an overall improvement of the staff time loss-to-injuries rate.

A key achievement has been that the patient rating of perceived care has been reported as very good by 90% of patients and families. **CJ**

"The idea was to bring nature into the building and the surface finishes made use of natural materials"



A scale drawing of Nanaimo Regional General Hospital in Canada

BALANCE BEAM

CFD can be used to gauge flow predictions for chilled beams, says **Abdullah Karimi** in Chicago

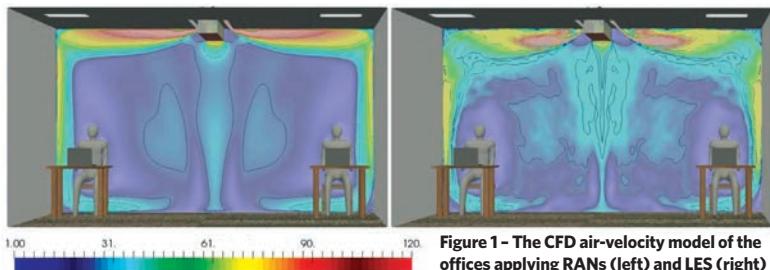


Figure 1 – The CFD air-velocity model of the offices applying RANs (left) and LES (right)

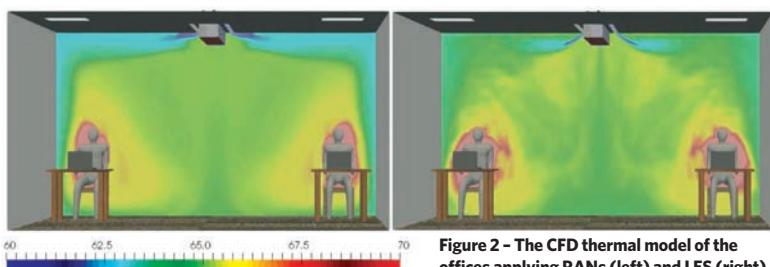


Figure 2 – The CFD thermal model of the offices applying RANs (left) and LES (right)

T

he North American market for active chilled beams for cooling and heating applications was highlighted in a conference paper by Abdullah Karimi, of Southland Industries, Dulles, Virginia.

He noted that chilled beams performance was determined by several parameters, including placement, primary supply airflow, mixed-air throw angle, and the effective rate of induced air.

These combine to make the design optimisation of active chilled beams particularly challenging when employing conventional one-dimensional calculations, and performing experimental tests for many design variables is cost-prohibitive.

Karimi introduced the application of computational fluid dynamics (CFD) as a cost-effective and accurate design-optimisation tool. He specifically employed large eddy simulation (LES), which – with proper flow-resolving computational grids – can give a more accurate prediction of the flow distribution.

He provided the output of high-fidelity LES that had been carried out for an active chilled beam design for a typical office space application, which takes account of buoyancy and typical heat loads for manikins, laptops, lights and so on. These were compared with the output of more traditional CFD that employs the two-equation Reynolds-averaged Navier-Stokes (RANS) approach, and was validated against published experimental data.

When compared with experimental data, the induction ratio (IR) was accurately predicted by LES, and RANS predicted it within 8%. The LES model captured the detailed flow structures and jet width relatively better, and – in support of the application of active chilled beams – results also confirmed appropriate draught-free cooling of the office space. The jet separation and reattachment near the ceiling was predicted by LES, while the RANS model showed wider jet width with no separation. In addition, the core of the mixed air jet was thinner in the LES results than in the RANS results.

The full paper is available at bit.ly/2ElVfd9

■ The technical sessions from the meeting were recorded and are available (at cost) through <http://ashrae.org/Chicago>

NEW MODULAR SCROLL CHILLERS

DELIVERING TOMORROW'S EFFICIENCY STANDARDS TODAY

Hitachi's new generation of compact, modular chillers is a no-compromise solution delivering industry-leading efficiency and world-class performance.

The new range of air cooled cooling only and heat pump chillers utilises Hitachi's DC inverter scroll technology to deliver infinite capacity control across all cooling loads and ambient temperature conditions. Up to 32 modules can operate as a single chiller providing up to 4000kW_s of cooling and - being modular – additional modules can be added to future-proof any chiller installation.

Starting at under 2sqm, it's the smallest footprint chiller across the widest capacity range on the market; Hitachi's RCMA and RHMA chillers are delivering 2021 comfort cooling efficiency standards today.

To find out more call Hitachi on **020 3901 0912** or visit hitachi-hvac.com

HITACHI
Air conditioning solutions

Johnson Controls
HITACHI
Air conditioning solutions



Ever wished chilled beams could be more flexible?



Chilled beams don't have to be long, straight, inflexible lengths. Parasol and Paragon. All the benefits of a chilled beam, all the flexibility of any other modular system. Visit www.swegon.co.uk.



parasol@swegon.co.uk



paragon@swegon.co.uk

Swegon

EFFAST

Support under pressure

That's **Polypipe Effast**



When it comes to our plastic pressure systems, you not only get a wide choice of materials, but quality valves designed to maintain optimum flow rates. What's more you'll have the dedicated support of our sales and technical teams at every stage of your project. It's what you'd expect from a leading UK manufacturer with more than 40 years in the trade.

For more information visit:
www.polypipe.com/Effast

 **Polypipe**

Frenger has patented technology that maintains the Coanda effect at supply static pressures as low as 15Pa



EASING THE PRESSURE

Normally, demand control ventilation cannot work with chilled beams without controls and actuators – but Frenger's **Michael Ainley** says it is possible at lower pressures without extra components

Demand control ventilation (DCV) systems offer two benefits. The modulation of ventilation air volumes can result in a significant reduction in fan energy consumption. It can also prevent overcooling of the space where the primary air's cooling effect is greater than the internal cooling load.

Normally, active chilled beams (ACB) systems can only benefit from DCV if they have costly controls fitted to every ACB to prevent draughts that would occur when air volumes are reduced. However, developments in ACBs now allow DCV without additional controls and actuators.

ACBs use outdoor air and chilled water from central plant, have no internal fan or moving parts, and are almost maintenance-free. Outdoor air is delivered from a centralised air handling unit (AHU) to meet the ventilation requirements of the internal space, and to generate induction of room air over the active chilled beam units' cooling coils (and heating coils if applicable). The mixed outdoor air (primary air) and induced reconditioned room air (secondary air) is then delivered into the space from the active chilled beam. A well-designed ACB will discharge the conditioned air horizontally, using the Coanda effect. This ensures low air velocities and high thermal comfort within the occupied

zone, to meet comfort requirements for most categories of office applications.

As ACBs are designed to provide cooling and heating at relatively low outdoor air requirements, the ventilation rates are normally set to meet standard requirements, such as BS EN 15251: 2007. ACBs work above dew point (with no latent cooling), so the design ventilation air volumes must also be able to control any latent loads by being suitably dehumidified at the AHU.

Historically, most ACB systems have been designed to function based on constant air volume (CAV), set by the project-specific design ventilation rates required. At lower-than-design air volumes, the use of traditional ACBs has been restricted. If supply air volume is reduced, the discharge air from the chilled beam may lose adhesion (typically to the adjacent ceiling), because the Coanda effect is not maintained. This could result in a vertical, rather than horizontal, discharge of conditioned air, so causing a draught for the occupants.

Some ACB designs have prevented vertical air discharge at lower-than-design air supply volumes/pressures by incorporating integral controls and actuators to each ACB. This changes the discharge characteristic to ensure horizontal discharge when the ventilation air requirement is reduced. However, this inflates the cost of ACBs, makes installation more complex, and increases maintenance.

Frenger has developed ACBs that maintain the Coanda effect at lower supply static pressures so that the supply air path remains horizontal. The static nozzle pressure can be as low as 15Pa and maintain induction of the recirculated room air. This will effectively allow a volume flow turndown of up to 38%, compared to about 22% with traditional ACBs, while maintaining the Coanda effect. The noise levels are unchanged compared to older CAV models.

These require no integral moving parts, actuators or controls, and can be used in CAV or DCV systems. A batch of ACBs can be factory-set to require the same system pressure regardless of a unit's supply air volume requirements. This can reduce the need for individual volume control dampers (VCDs), subject to the ductwork layout enabling similar upstream pressures. For example, if the ductwork system feeds two units that are split equally, then only one VCD is needed in place of the traditional two.

Factory-setting the resistance in the ACB allows units to be connected in series more easily, as each beam can be pre-set to account for the lower pressure caused by resistance in the upstream beams. For example, four beams in each VCD control zone could be installed based on two beams being connected in series, with the ductwork splitting equally between each pair. This would result in the system having only one VCD per four beams – 25% fewer actuators than traditional chilled beams.

If all of the ACBs on a project are set to operate at the same static pressure, regardless of the individual ACB ventilation airflow rates, it enables DCV with just one VCD in the ductwork serving a complete zone of active chilled beam units, as opposed to one VCD per active chilled beam unit. The savings using these novel ACBs will depend on how often the units are working at reduced air volumes. **CJ**

■ **MICHAELAINLEY** is managing director at Frenger Systems

CLOTHES TO ZERO

In many climates, comfort cooling with zero carbon emissions can be achieved through a combination of evaporative cooling, renewables and a more relaxed dress code in the summer, says **John Hammond**

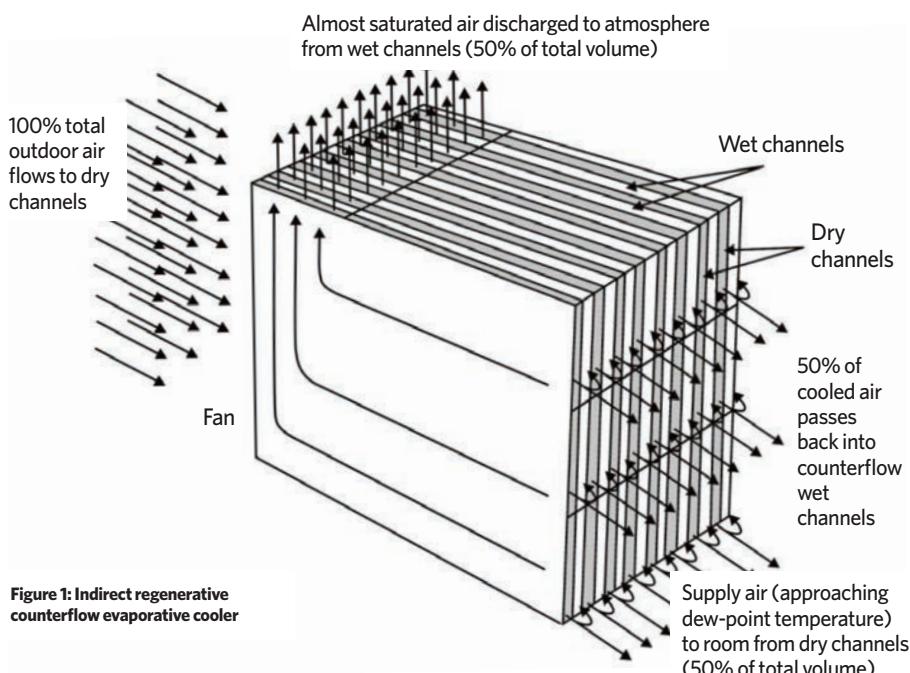


Figure 1: Indirect regenerative counterflow evaporative cooler

Journal, June 2017) – is potentially able to drop the air's dry-bulb temperature 80–90% of the way towards the air's wet-bulb temperature; this is known as the wet-bulb effectiveness. Typically, with conventional, high-level air distribution, the summer supply air needs further cooling using mechanical refrigeration. However, an indirect, regenerative, counterflow dew-point evaporative unit – originally developed in 1976 by Valeriy Maisotsenko, and shown in Figure 1 – cools the supply air about 35% to 50% more than indirect, crossflow units, and close to the outdoor dew-point temperature, instead of the wet-bulb temperature. It has a wet-bulb effectiveness of about 120%.

As shown in Figure 2, the regenerative evaporative cooler initially cools a total volume of outdoor air flow towards the air's wet-bulb temperature. It then returns about 50% of the cooler air – with its lower dry-bulb and wet-bulb temperature – back along a wet, counterflow path. This returned air is saturated by water sprays and wetted surfaces, so reducing its dry-bulb (and wet-bulb) temperature further.

Across the heat exchanger plate, this further cools the incoming total air volume to a lower dry-bulb and wet-bulb temperature. This air leaving the unit (used to supply the room) ultimately nears its dew-point temperature. The remainder of the air, having been saturated in the wetted channel, is rejected to atmosphere. The unit will reach operational steady state within a few seconds of starting.

Where buildings are designed to reduce unwanted overheating – and where the outdoor air dew-point design temperature is less than about 20°C – the regenerative evaporative cooler (with no additional mechanical cooling) can meet comfort conditions in many temperate global locations, including west-coast USA, the UK and most European locations, using a conventional, high-level air supply. The system uses slightly less energy than conventional refrigerant cooling; however, a well-designed, low-level air supply system can save even more energy.

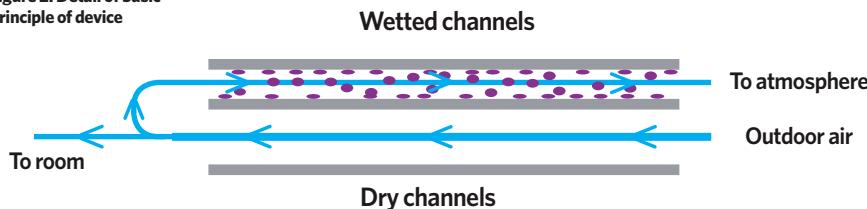
At outdoor dew-point temperatures approaching 20°C or above, further refrigeration can still be avoided if a low-level, displacement, air-distribution system is used to supply the air to the space. This can be applied in offices and homes in areas such as New York (peak 0.4% external conditions $\theta_{ao} = 32^\circ\text{C}$, $DP=19.1^\circ\text{C}$) with about a 6K supply to

here is a proven system that, with appropriate integration – and a shift in office-wear norms – could allow comfort cooling with practically zero operational carbon impact.

Mechanical cooling could be replaced in comfort cooling applications worldwide with 120% wet-bulb effective, indirect regenerative evaporative coolers, using 100% healthier outdoor air, recycled water and solar power

The system is based around the technology of an indirect regenerative counterflow evaporative cooler. The more basic, indirect crossflow evaporative cooler – as shown in ‘Making the case for evaporative’ (CIBSE

Figure 2: Detail of basic principle of device



room temperature rise (2K in the floor-level mixing air zone and 4K ankle-to-ceiling rise) – particularly when adaptive comfort is considered (see CPD, on page 55).

Displacement systems can also be very effectively applied in locations with lower outdoor air dew-point temperatures (below 20°C), such as London (peak 0.4% external conditions $\theta_{ao}=28.2^{\circ}\text{C}$, DP=12.6°C). For spaces such as a computer and switching rooms, high room temperature rises, in the order of 10K, can be used. A proportional integral derivative (PID) controller can maintain a constant room temperature by modulating the fan speed, enabling the regenerative evaporative coolers to replace refrigerant-based units in applications where acceptable conditions can be maintained with sensible cooling.

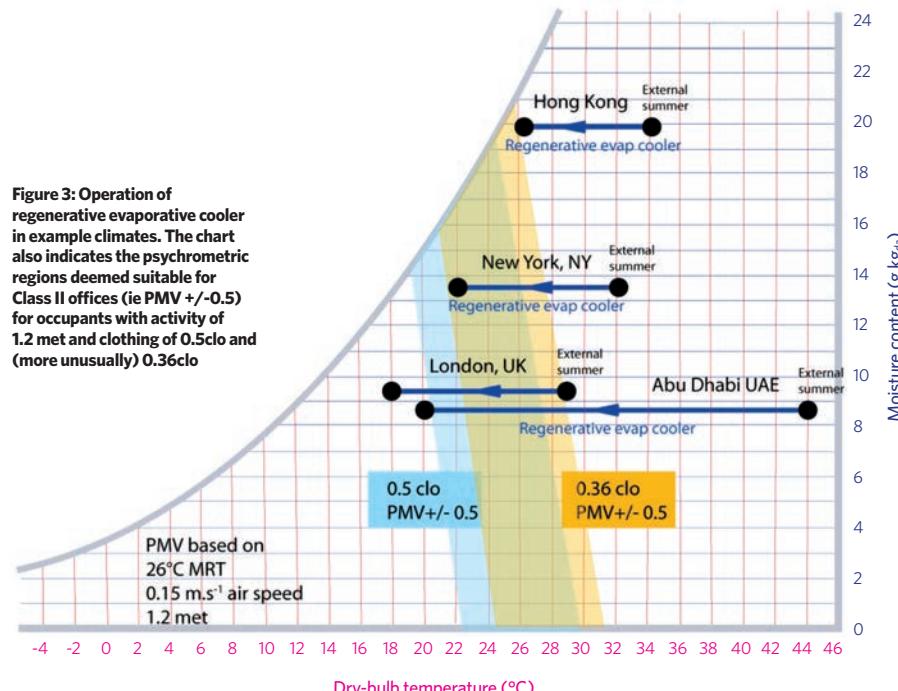
Increased room temperature gradients (as discussed in the Cheong 2005 investigation¹) have been found acceptable in tropical climates and, together with adaptive comfort principles, offer opportunities to apply regenerative evaporative coolers in many warmer and humid climes. As reported by Yau², the standard predicted mean vote (PMV) comfort model – as described in BS EN ISO 7730 and CIBSE Guide A – is not suitable for a hot and humid climate.

So, in sub-tropical and tropical areas, the adaptive comfort model is more important as a method to establish the appropriate internal conditions that are likely to satisfy the thermal comfort requirements of occupants. Effectively, this increases the acceptable temperatures by several degrees beyond the PMV comfort model.

One manufacturer has a range of regenerative, indirect counterflow evaporative coolers, the smallest being an 800 L·s⁻¹ unit requiring 1.4 kW power. This can give 7.5kW cooling in London summer conditions when supplying a room with a design temperature of 26°C. The weatherproofed unit is 2m wide, 2.5m long and 1.5m high, and the operating potential for the same unit in some example climates is shown in Figure 3.

Potential applications for such a unit could be broadened if occupants were encouraged to shift office clothing norms. If people wore lighter-weight clothes in hot conditions, the comfort temperature could be increased by 1.4K. For example, wearing shorts/skirt and a short-sleeved shirt/blouse is 0.36 clo – rather than long trousers and a long-sleeved shirt of 0.61 clo – so the comfort temperature would increase by about 1.4K. Introducing a low-level air velocity of about 0.8m·s⁻¹ could allow a further increase of about 2.6K in comfort temperature. The PMV-related comfort regions have been shown in Figure 3, based on

Figure 3: Operation of regenerative evaporative cooler in example climates. The chart also indicates the psychrometric regions deemed suitable for Class II offices (ie PMV +/- 0.5) for occupants with activity of 1.2 met and clothing of 0.5clo and (more unusually) 0.36clo



information generated by the CBE Thermal Comfort Tool that is available at bit.ly/2GsNjrc

Just changing the clothing allows for a higher room temperature (of +1.4K) and extends the use of regenerative evaporative coolers as the sole provider of cooling in applications such as New York.

Based on data from bit.ly/2sFxmXH, the 1.4kW unit (providing 7.5kW cooling in London) could be powered by a 14m² solar PV array – so cutting the demand on the electrical supply network and reducing the operational environmental impact.

More environmentally benign

Recycled, collected or even wholesome water can be used to provide the cooling, which is then evaporated into the atmosphere with no atmospheric degradation. A regenerative evaporative cooling system uses less water per square metre conditioned area than that evaporated by cooling towers in water-cooled air conditioning systems.

Comparing the coefficient of performance of evaporative coolers with that of standardised refrigeration units is not comparing similar devices or environments. It is better to compare the total seasonal energy use of devices operating in the same area under similar conditions. [C1](#)

■ JOHN HAMMOND MCIBSE

References:

- Cheong KKWD et al, Thermal comfort study on vertical air temperature gradient with displacement ventilation system in the tropics, *Indoor Air*, 2005.
- Yau YH et al, A review on predicted mean vote and adaptive thermal comfort models, *BSER&T*, Vol 35(1) 23–35, CIBSE 2014.

"If people wore lighter-weight clothing in hot conditions, the comfort temperature could be increased by 1.4K"

SILENCE IS GOLDEN

Nuisance MVHR noise is not a 'necessary evil', and can be eliminated. Zehnder Group's **Rupert Kazlauciunas** shares his six steps to quieter systems

One of the biggest reservations for tenants and homeowners about mechanical ventilation with heat recovery (MVHR) units is noise. Because these systems run 24 hours a day, if the noise they produce is even slightly more than noticeable, it becomes a problem. This causes issues for landlords, contractors and manufacturers, who may have to carry out costly investigations and servicing to rectify the issue.

Excessive noise is also an issue on a regulatory level – Building Regulations state that continuously running systems, such as MVHR units, should not exceed:

- The upper limit of 30dB (A) weighted sound power level in bedrooms and living rooms
- The upper limit of 35dB (A) weighted sound power level in kitchens and bathrooms.

One of the most common causes of noisy MVHR systems is taking shortcuts at the design stage to bring down costs and speed up production. Such measures are a false economy, because faulty units and noisy performance will lead to complaints and costly servicing work.

Here are six steps you can take to achieve quieter and more efficient MVHR.

Design out the noise

By addressing key considerations during the design process – and looking at where noise may occur – this issue can be eliminated from MVHR systems from the outset, avoiding costly correctional measures later on.

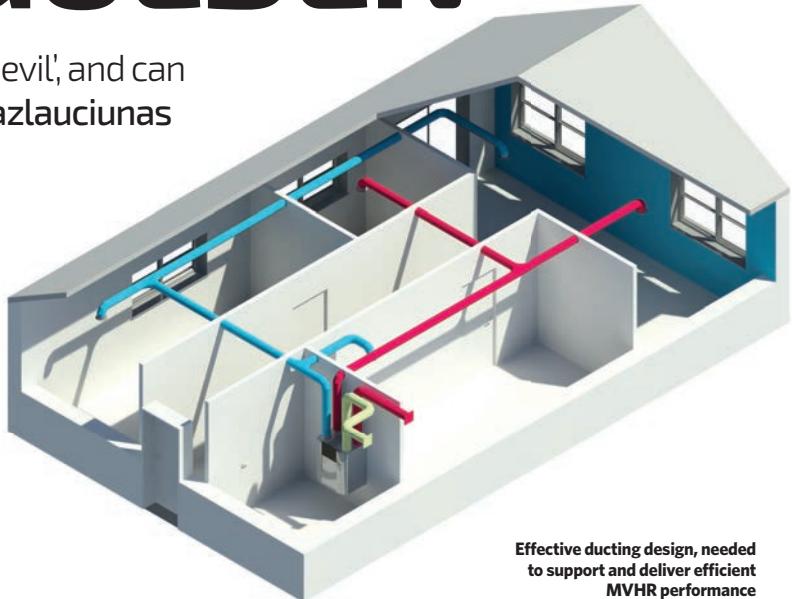
If mass flow isn't taken into account, the unit's motor speed may have to be increased and grille terminations throttled down, which can result in excessive noise.

Ensuring ductwork is the right size, limiting the amount of bends in it, and using Coanda-effect grilles can all help to reduce system pressure.

Radial ducting handles mass airflow via a manifold, which reduces system pressure, ensuring all room rates can be met without having to increase the speed of the unit. In comparison, traditional or branched ducting often leads to an under or oversupply of airflow, which affects the pressure in the system, causing excess noise.

Designing in attenuators

These components – which can ensure noise is reduced at the source and in individual rooms – are particularly effective where larger MVHR units are specified, for bigger properties, or for buildings where cross-talk between rooms could be an



Effective ducting design, needed to support and deliver efficient MVHR performance

issue. Attenuators should be sized and calculated for each installation, to reduce noise levels correctly and not impact on airflow performance. Integrated attenuators within airflow manifolds can also save space.

Select the right unit and location

If a unit is too big, the bigger motors will produce more noise – and if the unit is too small, it will have to work harder and faster to be effective, resulting in breakout noise. Units should be located away from noise-sensitive areas, such as bedrooms, and grilles should be located away from beds, where even low noise levels can disturb sleep.

Competent installation

Good design can be easily undone on site. At the installation stage, it is essential that ductwork is supported and sealed properly, that none of it is crushed, and that excessive lengths of flexible ductwork are not used. Otherwise, there may be leakage, which requires the unit to be turned up – or which increases pressure in the system – causing noise.

Quality commissioning

Commissioning the unit correctly, by following procedures and conducting the right checks, will also help eliminate nuisance noise. At this stage, it is vital to balance the supply and extract air, and to set trickle and boost speeds to help minimise operating noise. It is also essential to check the correct dampers are fitted in each room, and to fine-tune each grille to meet airflow rates, rather than having to turn up the unit.



Ductwork should be supported and sealed properly

Maintenance and filter care

Blocked filters will cause a unit to run at higher speeds, raising noise levels. To prevent this, the filters should be cleaned or replaced every six months, or in accordance with the manufacturer's recommendations and the handover document. **CJ**

RUPERT KAZLAUCIUNAS is technical product manager, MVHR, at Zehnder Group UK

STEPPING STONE TO SUCCESS



Years of experience but no formal academic qualifications?

Through our alternative route you can still become a CIBSE member and gain professional registration with the Engineering Council.

STANDARD ROUTE

Follow this route if you hold exemplifying qualifications*

Application + Engineering Practice Report

Professional Review Interview

Assessment + Approval by CIBSE Members Panel

IEng ACIBSE / CEng MCIBSE

“Once the stepping stones had been laid out, what seemed like a giant leap became a few simple steps. I would recommend that anyone considering the process speaks to the membership department... they'll find all the help and encouragement there.

Wally Gilder, FCIBSE, Chairman ILEVE

“Don't be afraid of the Technical Report. I just started writing and everything fell into place.

David Holmes MCIBSE CEng, Thorn Lighting

ALTERNATIVE ROUTE

Follow this route if you do not hold relevant qualifications or you do not meet the academic standards. You can still obtain CEng/IEng once your MCIBSE/ACIBSE has been approved

Application + Engineering Practice Report

Competence Review Interview

Assessment + Approval by CIBSE Members Panel

ACIBSE / MCIBSE

Complete Technical Report

Interview

IEng ACIBSE / CEng MCIBSE

Simply apply for Associate (ACIBSE) or Member (MCIBSE) first. Once successfully elected, you can then proceed through the Technical Report route to gain IEng or CEng.

* Please visit www.cibse.org/membership to check if you have the exemplifying qualifications.

Interested in applying?

Get in touch by emailing membership@cibse.org or call +44 (0) 208 772 3650

www.cibse.org/membership





Monodraught®

engineering delivered. naturally

 Cool-phase®

Natural Cooling
(Active PCM)

 Windcatcher®

Natural Ventilation

 HTM®

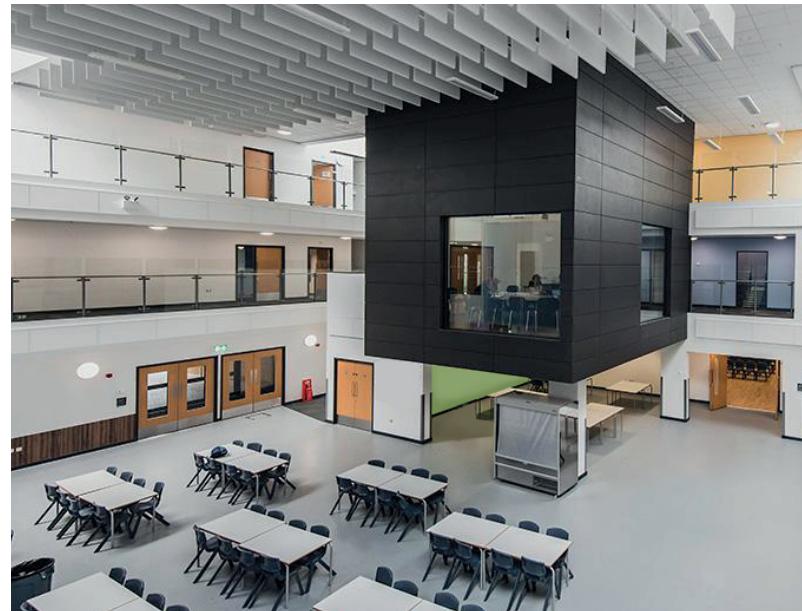
Hybrid Ventilation (NVHR)

 MVHR

Mechanical Ventilation
Heat Recovery

 Sunpipe®

Natural Lighting



Specialists in Design to Installation

www.monodraught.com • info@monodraught.com • Tel: 01494 897700



Continuing professional development (CPD) is the regular maintenance, improvement and broadening of your knowledge and skills, to maintain professional competence. It is a requirement of CIBSE and other professional bodies.

This Journal CPD programme can be used to meet your CPD requirements. Study the module and answer the questions on the final page. Each successfully completed module is equivalent to 1.5 hours of CPD.

Modules are also available at www.cibsejournal.com/cpd

Operating and enhancing PCM-cooled ventilation systems in office applications

This module looks how the PCM-air heat exchanger could typically work in office applications and how future designs can be improved using computational fluid dynamics

Phase-change material (PCM)-air heat exchangers include a thermal battery consisting of encapsulated PCM panels in the ventilation path as a means of storing, and subsequently releasing, heat. The thermal battery employs latent heat to store energy that, typically, is charged (and solidified) during the night and discharged for cooling during the day, by passing air across the heat exchanger.

This module develops the July 2016 CPD by exploring an example of how the PCM-air heat exchanger could typically operate in an office application, and examines how computational fluid dynamics (CFD) can be used to improve the future designs of PCM-air heat exchangers.

When applying ventilation systems to an office environment, it is normally appropriate to consider adaptive thermal comfort methodology. This links the acceptable indoor comfort temperature with the running average outdoor temperature, so that, during summer conditions, occupants are likely to be comfortable at higher internal temperatures and, conversely, comfortable at lower temperatures in winter – as illustrated for free-running buildings in Figure 1 from CIBSE TM52.¹

As reported in TM52, the relationship is a complex one because it involves all the interactions between climate, building, services and occupants and the resulting indoor environment – and the occupants are likely to take a week to adjust fully to a change in the outdoor temperature.

However, this has been codified in CIBSE Guide A to provide ranges of external temperature-related operative temperatures that are likely to give comfort in applications such as offices. CIBSE recommends that designers should aim to remain within the Category II limits for ‘free-running’ operation: $(0.33\theta_{rm} + 15.8) \leq \theta_c \leq (0.33\theta_{rm} + 21.8)$ where θ_c is the operative (comfort) temperature ($^{\circ}\text{C}$) and θ_{rm} is the running mean of the daily mean outdoor air

temperature ($^{\circ}\text{C}$). (See CPD article, *CIBSE Journal*, July 2017 for more details.) As indicated in TM52, the division between mechanically and naturally ventilated (free-running) buildings is blurring because of the increasing use of mixed-mode or hybrid buildings, and it is suggested that ➤

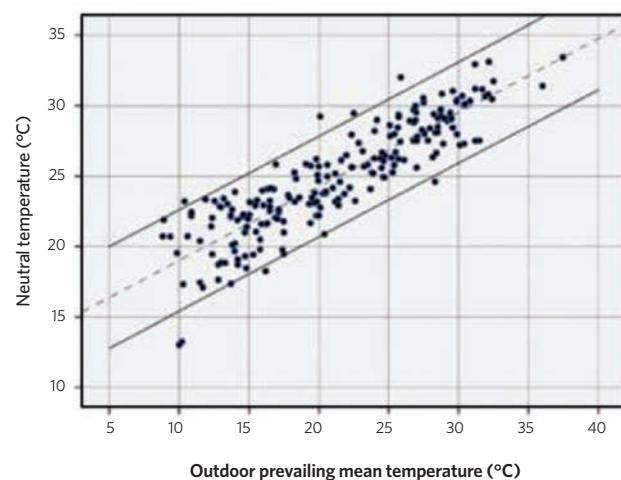


Figure 1: The neutral temperatures for buildings in free-running mode against the prevailing mean outdoor air temperature. Band includes 95% of the 58,000 reported neutral temperatures (Source: CIBSE TM52: Figure 4)

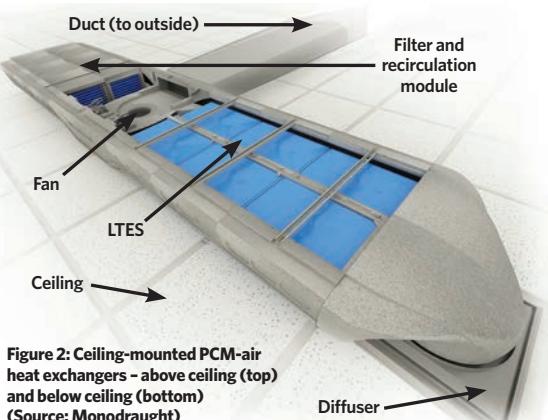


Figure 2: Ceiling-mounted PCM-air heat exchangers – above ceiling (top) and below ceiling (bottom)
(Source: Monodraught)



- » people respond in a similar way to all kinds of buildings, irrespective of their ventilation system.

Figure 2 shows one of the few PCM-air heat exchangers that are currently available in the marketplace. The equipment is essentially a demand-controlled ventilation and cooling system, controlled by the feedback of temperature, relative humidity and CO₂ levels inside the conditioned space. There are several panels of encapsulated PCM fixed in the unit, to supply cool air when it is needed, that integrate to provide the low-temperature energy store (LTES).

As an example, an application of a system – as shown schematically in Figure 3 – was installed to supply an open-plan office. The temperatures were monitored, and example summer day data are shown in Figure 4, with the system being operated under the operating modes listed below (it was assumed that the occupied spaces will have mean radiant temperatures similar to the air temperature and, with relatively low air velocities, the operative temperature can be represented by air temperature).

Night purge (midnight to 01:00) – The fan runs at the maximum speed setting for one hour, with the aim of flushing the room air. Temperatures all decrease during this period.

Summer night charge (01:00 to 07:00) – The LTES outlet temperature [C] reduces, indicating that the PCM is being ‘charged’ as the cool external intake air passes through.

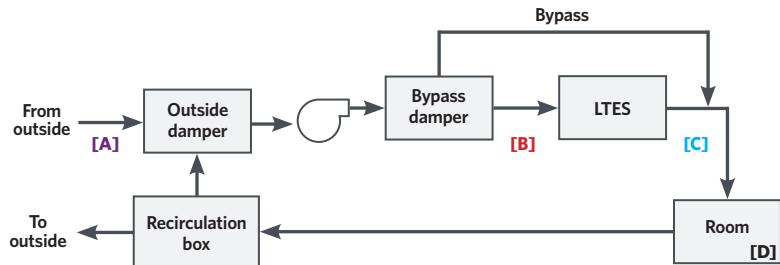


Figure 3: Schematic of ventilation system with integrated PCM in a low-temperature energy store (LTES). The temperature measuring points [A] to [D] are referred to in the text

System switched off (07:00 to 08:00) – The period before the occupancy. In this case, the room temperature [D] rises during this period, which effectively offsets some of the work done to cool the space during the night. At 07:00, the room was within the thermal comfort range and there was no overcooling.

Summer day mode (08:00 to 18:00) – The internal temperature [D] is above the room set-point temperature of 23°C at 08:00, so the cooling mode is initiated. The outside air temperature [B] is below the room set-point temperature, so air bypasses the LTES until about 10:40, when the room temperature reaches the set point. During this period the LTES temperature readings are misleading, as there is no airflow through the PCM. At 10:40, the bypass is closed and air passing through the LTES is cooled by the melting PCM. Room temperature is maintained below the adaptive thermal comfort upper limit for this particular day.

System switched off (18:00 to midnight) – At 18:00, the conditioned period in the space ends, the system switches off, and all temperatures converge to the same value. The system remains off until midnight, when the process starts again.

Figure 5 shows the room temperature (red dots) in the open-plan office for one summer season. The system largely maintains temperatures within the limits of Class II thermal comfort, except during one week in July (upper limit) and in May (lower limit). The exceedance in May was because of low night temperatures, and during the night charging period the 18°C night cooling limit was reached swiftly. When the system was turned off at 07:00, the increase in temperature was not enough to reach the lower limit of thermal comfort at the commencement of the conditioned period. This behaviour of the control system is representative of the potential trade-off between sufficiently charging the LTES and cooling the space during the night, in preparation for optimum performance on a hot day, but causing the space to be too cool for thermal comfort if the morning (and day) turns out to be unusually cold for a summer period. This is a known issue, and it is highlighted in TM52 that the calculated lower limit of thermal comfort can be inappropriate on cold mornings during summer periods, so this is not considered a failure of the system. A recent study³ indicated that this system could offer acceptable thermal

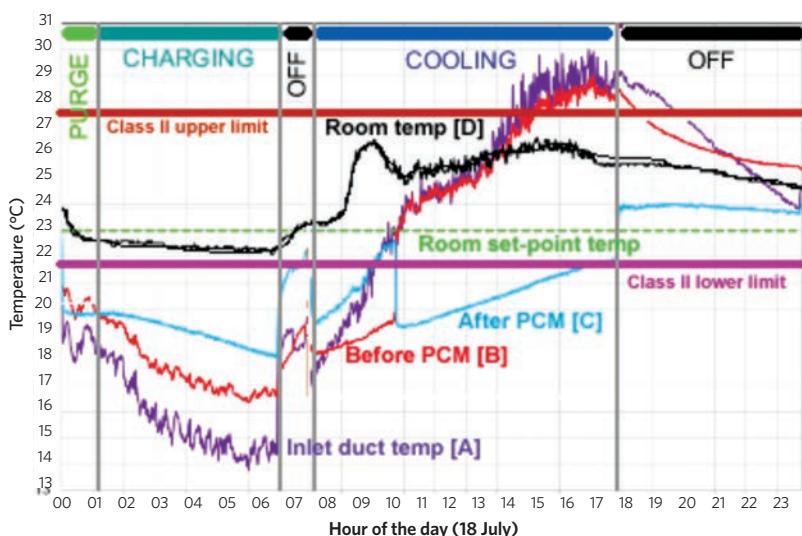


Figure 4: Measured summer temperatures for an open-plan office operation of a PCM-air heat exchanger unit for an example July day



Figure 5: Summer room temperatures using system

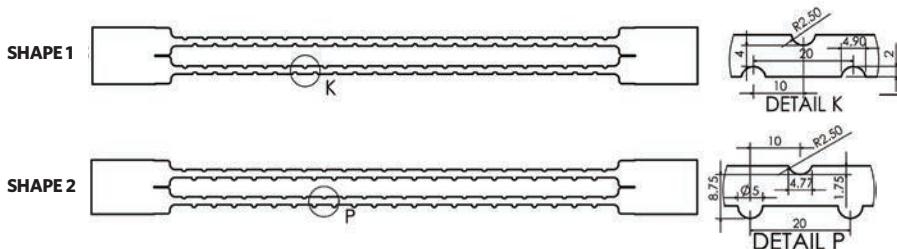


Figure 6: Examples of the different heat exchanger profiles under examination

comfort throughout the day for a seated occupant level (0.7m from the floor) in the moderate weather summer conditions of south and west England, in accordance with the CIBSE adaptive thermal comfort criteria.

Santos³ has indicated that changes in the control strategy can improve the performance of the system, but this will be limited by the cooling capacity of the PCM. Another option is to increase the heat transfer rate at the surface of the PCM by optimising the properties of the heat exchanger. Improvements in the heat transfer between air and panel will increase the equipment's overall performance and deliver a faster thermal response, shorter charging period and reduced energy consumption. Santos⁴ analysed different surface designs, using CFD simulation, and compared their performance with the existing panel, but with different spacing between ridges, and ridge height and radius, as illustrated in Figure 6.

Simulations analysed the heat transfer between panel and air. This heat transfer is predominantly by

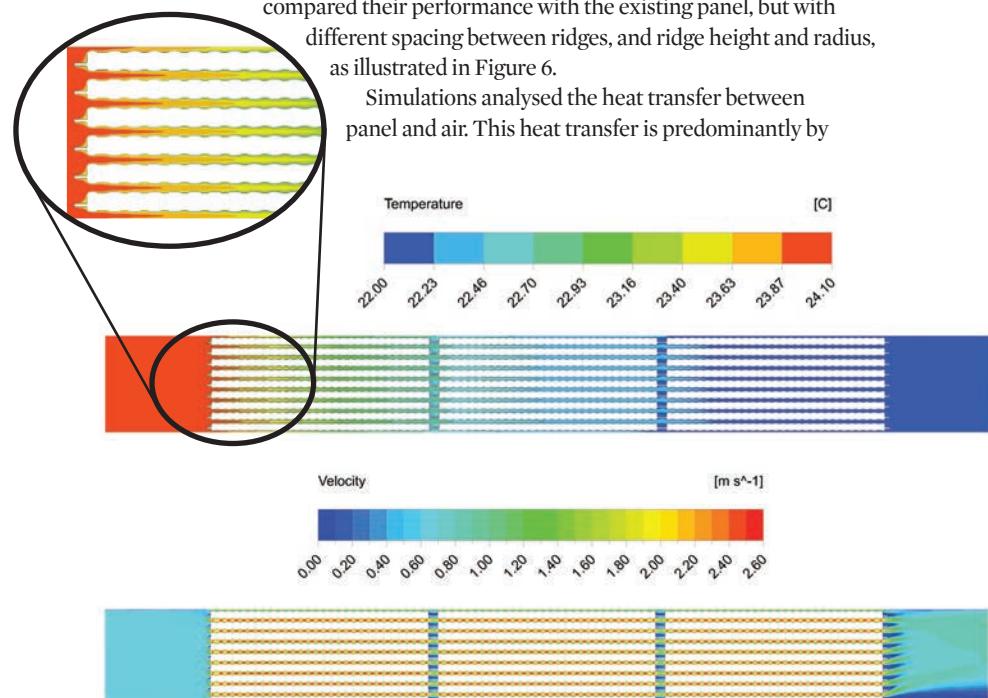


Figure 7: Temperature and velocity distribution of one design with an airflow rate of 260 litres per second

conduction and convection, since it involves heat transfer because of a moving fluid. As PCM-air heat exchangers used for cooling deal with small temperature differences, radiation is neglected.

An example of the CFD output is shown in Figure 7, from a Shape 1 LTES design, comprising three stacks of PCM, each consisting of seven panels. The analysis identified a shape where a highest practicable heat transfer is achieved for most airflows – approximately double the heat transfer when compared with the existing panel.

The introduction of ridges, fins, dimples, grooves and/or bulges increases the heat transfer, but can also increase the pressure drop of the air flowing through the unit – so increasing fan energy cost and noise. To indicate if improvements in heat transfer are more advantageous than unwanted additional pressure loss, a heat effectiveness ratio of Nu to the cube root of pressure drop was applied to the developed shape. It gave an average effectiveness approaching 1.0, indicating that improved heat transfer had been achieved without excessive pressure loss. Other shapes that were tested had lower heat effectiveness.

© Tim Dwyer, 2018.

■ The content of this article is based on work published by Thiago Santos and Professor Maria Kolokotroni, both from Brunel University, London.

■ Turn to page 58 for references.

WHY APPLY CFD TOOLS TO ESTABLISH HEAT TRANSFER RATES?

To analyse the efficiency of the heat transfer from the panels of PCM, the Nusselt number, Nu , is required. Nu is a dimensionless term and provides the ratio between convective and conductive heat transfer. When $Nu = 1$, the heat transfer is purely by conduction, and higher values indicate an increasingly dominant convective heat transfer and increased effectiveness. To estimate the heat transfer coefficient required for the Nusselt number, three parameters are required. In this case, the inlet temperature was assumed as 26°C, as is common return air from PCM-air heat exchangers during the cooling period. The second – the panel surface temperature – was assumed to have a uniform temperature of 20°C. The third is the outlet temperature. This is a challenge to estimate appropriately. However, CFD software can be applied to overcome this by breaking down the geometry into very small volumes ('a mesh') and repeatedly applying algebraic equations to each connecting node iteratively, to describe the conservation of mass, momentum and energy exchanges between adjacent volumes, so that all of the calculations converge to provide a contiguous and consistent representation of all the exchanges.

» Module 123

March 2018

1. Which CIBSE TM specifically considers the avoidance of overheating in buildings?

- A TM50
- B TM52
- C TM54
- D TM56
- E TM58

2. In the illustration of observed neutral temperatures, what is the maximum neutral temperature that falls within the 95% band for a prevailing mean temperature of 25°C?

- A 22.5°C
- B 24.5°C
- C 28.5°C
- D 30.5°C
- E 32.5°C

3. In the example application of a system, at what time did the bypass close so that the supply air was cooled by the LTES?

- A 8:40am
- B 9:40am
- C 10:40am
- D 11:40am
- E 12:40am

4. Which of the following was not specifically listed as a benefit of improving the heat transfer between air and panel?

- A Faster thermal response
- B Increase in the equipment's overall performance
- C Reduced air-side pressure drop
- D Reduced energy consumption
- E Shorter charging period

5. The Nu number is given by which ratio?

- A Conductive to radiative heat transfer
- B Convective to conductive heat transfer
- C Convective to radiative heat transfer
- D Radiative to conductive heat transfer
- E Radiative to convective heat transfer

Name (please print)

Job title

Organisation

Address

.....
.....
.....

Postcode

Email

Are you a member of CIBSE? If so, please state your membership number:

The CIBSE Journal CPD Programme

If you do NOT want to receive information about Monodraught, the sponsor of this CPD module, please tick here:

By entering your details above, you agree that CIBSE may contact you with information about CPD and other training or professional development programmes, and about membership of CIBSE, if you are not a member.

Go to www.cibsejournal.com/cpd to complete this questionnaire online. You will receive notification by email of successful completion, which can be used to validate your CPD records. Alternatively, fill in this page and post it to: N Hurley, CIBSE, 222 Balham High Road, London, SW12 9BS

References:

- 1 CIBSE TM52 *The Limits of Thermal Comfort - Avoiding Overheating in European Buildings*, CIBSE 2013.
- 2 CIBSE Guide A *Environmental criteria for design*, Section 1, CIBSE 2015.
- 3 Santos, T et al, *Analysis of operational performance of a mechanical ventilation cooling system with latent thermal energy storage*, Energy and Buildings 159, 529–541 (2018).
- 4 Santos, T et al, *A study of panel ridges effect on heat transfer and pressure drop in a ventilation duct*, 38th AIVC – 6th TightVent and 4th venticool Conference, Nottingham, UK (2017).



PRODUCTS & SERVICES

Fire Design Solutions appoints new national sales manager



Specialist fire engineering and smoke ventilation contractor Fire Design Solutions (FDS) has welcomed John Harris to the role of sales manager, as part of the company's growth strategy.

Harris's career has spanned more than 30 years within the fire protection and security sector, and he brings extensive experience, including national sales roles with leading industry specialists. John's introduction to the industry was with Thorn Security and Tyco International, where he spent more than 20 years in a number of different senior roles, including head of sales.

Commenting on his decision to join FDS, Harris said: 'Fire Design Solutions is a company with an excellent reputation in the industry and with a real focus on providing the highest levels of service to clients.'

Harris will oversee a growing sales team and take responsibility for business development as FDS expands and strengthens its position nationally over the next five years.

■ Visit www.firedesignsolutions.com



Ellis doubles up for Belgian energy order

Centaur cable saddles, designed and manufactured by cable cleat manufacturer Ellis, have been installed to secure two separate high voltage cables in a power tunnel in the West Flemish region of Belgium.

The Stevin project, which, when complete, will feed the Belgian interior with wind, solar and other forms of renewable energy generated in this coastal region, is being undertaken by the country's electricity transmission system operator Elia.

■ Call 01944 758395 or visit www.ellispatents.co.uk

New Condair RO for better humidity control

Condair is launching the Condair RO-A reverse osmosis water filter, specifically designed for use with humidification systems. The Condair RO-A removes 95% of dissolved solids from a humidifier's supply water to reduce maintenance, improve energy consumption and benefit ongoing running costs.

When operating on regular mains water, a steam humidifier will frequently need to drain hot water and replace it with fresh water, to dilute mineral levels in the boiling chamber.

■ Call 01903 850200 or visit www.condair.co.uk



Ultra-low NO_x CHP by Adveco

As national concern over atmospheric NO_x concentrations continue to grow, the selection of low-emission CHP appliances has never been more important.

The Adveco Totem range of 10-25kW m-CHP remains one of the greenest CHP solutions available in the UK, with CO and NO_x emissions below 10mg/Nm³ - 20 times lower than the 240mg/kWh limit defined by the coming 2018 EcoDesign directive.

■ Visit <https://adveco.co/chp/>



Panasonic wins environmental project of the year

The Greystones Marina Village, which features Panasonic's Aquarea heat pumps, has won the ACR News Environmental Project of the Year award. Judges recognised the sustainability and high efficiency of the Panasonic Aquarea air-to-water H Generation heat pumps that were installed in the development's 358 dwellings.

A resident commented: 'We have found at least a 50% decrease in our overall fuel bills since moving, and found the system to be efficient, reliable and eco-friendly.'

■ Visit www.aircon.panasonic.eu



Condair at Data Centre World 2018

Condair is appearing at the forthcoming Data Centre World exhibition on stand D1060, at the Excel Centre in London from 21 to 22 March. The company will be displaying the latest in adiabatic and steam humidifier technology, which offers in-duct evaporative cooling and humidification to data centres.

Condair has extensive experience in working with data centre designers and air handling unit manufacturers who need to incorporate evaporative coolers or humidifiers into their systems.

■ Call 01903 850200 or visit www.condair.co.uk

▼ Big cats perfect for tranquil space at new Louvre Abu Dhabi

Dunham-Bush has supplied United Arab Emirates-based Intercool central air conditioning with 247 of its Panther and 207 Puma fan coil units to provide heating and cooling at the new Louvre Abu Dhabi museum.

The climatic conditions experienced demand that only the highest quality materials be used in the museum's construction. The comfort levels of its visitors were a major design consideration.

Dunham-Bush fan coil units combine the latest design and manufacturing technology.

■ Call 023 9247 7700
or email info@dunham-bush.co.uk



▼ Grundfos 'centers' on customers

The Grundfos Product Center (GPC) is an online selection support hub that gives anyone, who has a requirement to design or replace a pump or pump systems, straightforward access to a wide range of information.

By simply inputting basic head and flow parameters, the GPC will not only offer a choice of pump options, classed in various ways, including by efficiency, but will also give access to a range of supplementary information. In addition, it has a range of useful support tools, such as a pipe friction loss calculator, NPSH calculator, cable calculator, as well as a template for sizing a pumping station.

GPC is a work-in-progress that is under constant development, and its use is continually monitored.

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



▼ Award win is recognition for content-based approach

Mitsubishi Electric's innovative blog site The Hub has received industry recognition after winning the Online Initiative of the Year category at the prestigious ACR News Awards.

The website publishes regular comment and articles on issues affecting anyone involved in energy use in the built environment.

'We've designed The Hub to provide informative and interesting content that will help everyone understand why it is so important for all of us to tackle energy use within our buildings,' said

Russell Jones, content and communications manager for the company and editor-in-chief of the website.

'Not only does it aim to help inform the debate about energy use, we also want our customers to be able to use it to help educate their customers about the issues that affect us all.'

The blog site contains informative, topical and entertaining articles from both independent editors and Mitsubishi Electric's own experts.

■ Visit <http://thehub.mitsubishielectric.co.uk>



▼ White is the new grey

In response to popular demand, the standard colour finish for the best-selling Dunham-Bush series ASM, CM, UH, Ocelot and Finvector ranges of fan convectors will now be white (RAL 9010 semi-matt).

This finish will replace the current grey (BS 10 103), which will still be available as one of the company's preferred colours. Grilles, back plates and similar accessories will continue to be supplied in black (BS 00 E 53) finish.

■ Call 023 9247 7700 or email info@dunham-bush.co.uk



▼ SPC radiant panels are in the 'zone'

British manufacturer SPC is now offering a zone control kit as an option on radiant panel orders.

Teaming up with Belimo, SPC has put together a high quality zone control kit that comprises a Belimo rotary actuator, Belimo zone valve plus a dual sensing digital thermostat and black bulb temperature sensor.

The kit is easy to set up, cost-effective and can be used for panels on both heating and cooling applications.

■ Call 0116 249 0044
or visit www.spc-hvac.co.uk



▲ Fujitsu introduces larger simultaneous multi

Fujitsu has added 19kW and 22kW outdoor units to its range of Simultaneous Multi Twin, Triple and Quad systems for light commercial air conditioning applications. The two new 400V three-phase models, the AOYG72LRLA and AOYG90LRLA, can be connected to two, three or four indoor units. This allows the Simultaneous Multi systems to be used in a wider scope of applications, from large, open-plan offices to retail stores and car showrooms.

■ Visit <http://www.fujitsu-general.com/uk/>



▲ Rinnai to headline sponsor CIBSE tech symposium in London

Rinnai is to be the headline sponsor of the CIBSE Technical Symposium, held on 12-13 April at London South Bank University.

Rinnai managing director Tony Gittings (pictured) said: 'We are a manufacturer of water heating technologies, products and systems for commercial sites and we have been a main sponsor of the CIBSE Technical Symposium for several years now. We believe it is the best event of its kind.'

■ Visit www.rinnaiuk.com



▼ New CIBSE-accredited seminar explores heat interface unit test standard from BESA

Evinox Energy has launched a new CIBSE-accredited CPD seminar, following the introduction of the first UK test standard for heat interface units (HIUs) from British Engineering Services Association (BESA).

This new standard is seen as an important step towards improving the overall performance of British district heating schemes. Its key objective is to enable the performance of different HIUs to be evaluated within the context of typical UK operating conditions, thereby enabling heat network developers to consider the performance of specific HIUs against design requirements.

Until now, it has been a common misconception that heat interface units are 'one size fits all'; results from the BESA tests show that this isn't the case for today's modern systems - the network design and HIU specification must be closely matched to ensure optimum performance, and the HIU must deliver the widest delta T and lowest return temperatures possible in all operational modes.

The Evinox seminar explores all aspects of the test regime and discusses how, for the first time, designers and specifiers will be able to see the impact of a specific HIU on their network. Entitled 'Understanding the BESA test standard for HIUs (VWARTS and all)', the seminar is accredited by CIBSE and offers credits towards consulting engineers' continuing professional development (CPD).

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



▼ Rinnai hot water – instant, continuous, limitless and sensibly economic for every type of commercial site



Installers, specifiers and end users have the most practical and cost-effective solution for domestic and commercial hot water heating and delivery needs – thanks to Rinnai's comprehensive range of energy efficient A-rated, electronically controlled continuous flow gas-fired units and systems.

Rinnai's Infinity 16i, weighing just 18kg and measuring less than 675mm x 139mm, has a delivery capacity of 15.2 litres per minute, at a temperature rise of 25°C.

■ Visit www.rinnaiuk.com

◀ Kingspan Industrial Insulation acquires the assets of GRM

Kingspan Industrial Insulation has agreed with SIG Distribution an asset purchase acquisition (APA) of GRM Insulation Solutions, based in Manchester. This APA will combine the assets of the two pipe insulation manufacturers, giving the market improved customer service for the UK, Ireland and central Europe.

Kingspan Industrial Insulation products are used across building services, process and petrochemical applications and refrigeration services. Kingspan has also announced the introduction of the Continuous Process Line 3.

■ Call 01544 388 601, fax 01544 388 888 or email info@kingspaninsulation.co.uk



▲ Modern building services essential to hospitality sector

Stokvis Energy Systems is experienced in meeting specifiers' needs for hotel and leisure projects, along with projects in schools, hospitals, offices, apartment blocks and retail centres.

Underpinning the heating offer are the new generation Stokvis R40 and R600 Evolution boilers, which build on the well-established reputation and technology of earlier generation boilers from Stokvis, but deliver even higher performance and greater reliability.

■ Call 020 8783 3050
or visit www.stokvisboilers.com



▲ Luceco lights print innovation specialists

Luceco and Advanced Interior Solutions (AIS) have recently completed an LED lighting installation at Vinyl Graphics, with LuxBay, a cost-effective LED luminaire ideal for high ceiling mounting positions in industrial and warehouse environments.

Reading-based Vinyl Graphics (VGL) is a family-run screen and digital print company with a reputation for quality and innovation. During the 1980s, VGL introduced the UK's first computer-aided sign-cutting machine, and has remained at the forefront of digital print technology ever since.

VGL's production facilities were poorly lit following the initial base build installation inherited when it took over the building. Given the high-quality graphic works produced, there were issues with precision technical equipment not working correctly under the original lighting levels. With the expertise of Luceco and Advanced Interior Solutions, a full lighting design was produced, and luminaires were installed to ensure correct lux levels were reached.

Offering more than 50,000 hours of operational life, LuxBay boasts 105 Llm/cW, is environmentally friendly and requires no maintenance over its lifetime. Mounting positions include surface, trunking or suspended, and there are options of integrated presence and daylight sensors for use with fixed output or DALI dimmable control gear.

Mark Hill, of AIS, said: 'With the installation of high-performance LED luminaires, the client has reported that cameras on the machines can decipher colours more efficiently and production rates have greatly increased.'

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



▲ Swegon introduces latest addition to Gold air handling unit

The latest addition to the Swegon Gold air handling unit is the RX/HC – a fully integrated reverse cycle heat pump, developed to complement energy recovery from the unique thermal wheel and provide tempered fresh air to the ventilation system.

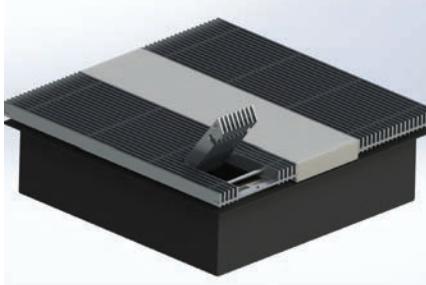
The unit can be supplied with airflows up to 6.5 m³/s and provide up to 110kW of cooling or up to 40kW of heating.

Developed in Sweden, the range has been fully tested to operate at temperatures down to minus 20°C and can be selected with three different defrost options to suit the local conditions.

The overall efficient package, with a small footprint, is an answer to space-saving versus traditional AHU and condensing unit solutions and reduces the size of the refrigeration system and gases, vital in futureproofing against reduced availability of refrigerant gases.

The package requires no other boiler, chiller or associated pipework, pumps and valves.

■ Visit www.swegon.co.uk



▲ Super slimline Fantile launched by AET Flexible Space

Underfloor air conditioning systems provider AET Flexible Space has released the latest version of its recessed fan air terminal, or Fantile. The new super slimline TU350 Fantile is similar to the existing TUS Fantile, with an equivalent unit height of just 150mm, but the new model has superior performance, achieving higher airflow capacity with reduced noise levels. The Fantile units feature integrated controllers so users can adjust fan speed and temperature to suit their own comfort.

■ Call 01342 310 400
or email aet@flexiblespace.com

▼ ErP: We are ready

Nortek's ErP-compliant range includes the RTU series of packaged direct expansion air source heat pumps and air conditioning units, equipped with EC plug fan technology and free-cooling as standard.

Reznor's range of packaged rooftop units are available in cooling and heat pump modes, with optional energy recovery functions.

Tandem scroll, multiscroll technology, combined with electronic expansion valves, are also available as futureproof options that are likely to be compliant with ErP in 2021.

■ Call 01384 489700
or visit www.nortekhvac.com



› Hamworthy launches compact condensing water heater

Commercial boiler manufacturer and hot water solutions specialist Hamworthy Heating has launched a series of compact direct-fired condensing water heaters for smaller applications. The Dorchester DR-CC extends Hamworthy's hot water range for every building.

It comes in nine models with a storage capacity ranging from 160 to 380 litres, available as gas or LPG-fired versions. An efficiency of 106-109% with modulating burner makes it run more economically.

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



↳ Vent-Axia provides Cambridge sustainable development with energy efficient ventilation

British manufacturer Vent-Axia has supplied specialist company D R Ventilation with units for an exemplar of sustainable development in Cambridge. The Virido development offers future living with a collection of 208 unique apartments. Brimming with eco design, the homes are triple-glazed and clad in brick and dark timber with Vent-Axia's Lo-Carbon Sentinel Kinetic BH and Lo-Carbon Sentinel Kinetic Plus mechanical ventilation with heat recovery units, offering energy efficient and effective ventilation to these sustainable homes.

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

▼ Weber spray concrete defends Nothe Fort at Weymouth Harbour

High performance spray repair concrete by Saint-Gobain Weber has been used to fortify a sea wall that acts as coastal defence to Nothe Fort at Weymouth Harbour. Webercem spray DS and RS were used.

Webercem spray RS ready-to-use, dry-sprayed concrete is able to achieve rapid repairs to structures within tidal zones, dock walls, jetties and sea walls. It achieves a permanent repair where time constraints demand the earliest possible strength gain. It can be applied up to 100mm thickness.

■ Call 08703 330 070, visit www.netweber.co.uk or follow @SGWeberUK on Twitter



› DIRECTORY Your guide to building services suppliers

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

Air Handling



Manufacturer of high quality bespoke AHU's.
Specialists in refurbishment and site assembly projects.
Rapid delivery service available.

Aircraft Air Handling Ltd

Unit 20, Moorfield Ind Est,
Cotes Heath, Stafford, ST21 6QY

Tel: 01782 791545 Fax: 01782 791283

Email: info@aircraftairhandling.com Web: www.aircraftairhandling.com

Energy Efficiency



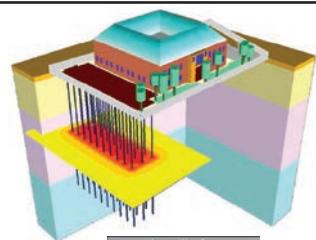
Ground Source Heat Pump Installations

Meeting Renewables Targets

Tel: 02392 450889

Fax: 02392 471319

www.groenholland.co.uk



Certificate Number MCS 1201
Heat Pumps

Air Conditioning



For total solutions in air-conditioning

E: info@clivet-uk.co.uk

W: www.clivet.com

T: 01489 572238

W: www.versatemp.co.uk

Heating & Hot Water Specialists



PRACTICAL, EFFICIENT & SUSTAINABLE
BUILDING SERVICES SOLUTIONS

- BESPOKE SYSTEM DESIGN
- COMBINED HEAT & POWER
- HEATING & HOT WATER
- PACKAGED PLANT SOLUTIONS
- MAINTENANCE & SERVICE PLANS

T: 01252 551 540
W: <https://adveco.co/>
E: enquiries@adveco.co/



To advertise here,
contact Callum Nagle
on 020 7880 6217
or email:
callum.nagle@redactive.co.uk



Due to significant growth we are currently looking to recruit for the following positions:

Dublin Office:

- Associate/ Senior Mechanical Engineer. CEng or en route to CEng.
- Intermediate Electrical Engineer
- Sustainability and Environmental Engineer

Antrim Office:

- Intermediate Mechanical Engineer
- Sustainability and Environmental Engineer

If you feel you have the skills and experience required for any of these positions, please send your application with CV to Alexandra Samson, asamson@delapandwaller.com

CIBSE JOURNAL



Are you looking for experienced staff?

Just send us the job description and we will do the rest



With over **20,000** CIBSE members receiving the **magazine**, **15,000** receiving the **e-newsletter** and over **7,500** unique visitors to the **jobsite**, many companies are successfully filling vacancies with highly qualified candidates using **CIBSE Journal Jobs**.

Our experienced recruitment team will help you all the way giving you the best chance to find **your perfect candidate**.

Contact the recruitment team at cibsejobs@redactive.co.uk or call on 020 7880 7633

b-a-r beeby anderson recruitment

Senior Mechanical Design Engineer

£36 - £38p/h, Surrey

Following successful project wins, the need for a Senior Mechanical Engineer has presented itself. You will be part of project team predominantly working on residential, commercial, and educational projects. There is the opportunity to lead projects and successful engineers will be rewarded with a longer term contract. Ref: 4805

Senior Electrical Building Services Engineer

£45k - £55k + bens, London

Outstanding position with a global award-winning building services consultancy who are looking to secure an inspiring and driven engineer. Their work has been noted with an impressive list of industry awards, their success is underpinned by their passion and appetite for building services and engineering, and it is imperative that the engineer who joins the team shares this thirst and innovative approach to push the engineering envelope. Ref: 4829

Associate - Building Services/ Energy from Waste

£54k - £73k + bens, London

With energy being a major focus in the current economic / environmental climate, a major global engineering consultancy are growing their energy division and seek an experienced, well connected Mechanical or Electrical Associate level engineer who has experience with incinerator EfW projects. With a long term target of guiding the UK towards a more circular economy this is an exciting position for a forward thinking individual who can take a lead role within this innovative MEP team. Ref: 4832

Int/Senior Electrical Engineer to £45k + bens, Hertfordshire

Outstanding opportunity within a consultancy established in the 60's and known for delivering projects on many prestigious historical buildings, pharmaceutical, and laboratory facilities. The role will suit a driven and ambitious engineer as progression will be rapid working alongside some of the best engineers in the industry. Paid overtime and excellent benefits offered. Ref: 4823

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

Revit Technician

£35p/h, London

A Revit Technician is required for a dynamic independent M&E Environmental consultancy working on project values of £50m. You will be assisting the Revit team working on large High-Rise Commercial / Residential projects. The role will involve developing 3D BIM using REVIT MEP and implementing 3D coordination. 6 month contract with an immediate start. Ref: 4821

Intermediate Electrical Building Services Engineer

£30k - £40k + bens, London

This is a fantastic opportunity for an engineer to join an international award-winning building services consultancy. Due to planned growth of the London office and a healthy and diverse portfolio of current and future projects they are looking to add a driven and dynamic Electrical Engineer to work across several different project sectors including hotels, laboratories, commercial, and high-end residential projects. Ref: 4819

Thinking of your future

www.b-a-r.com



conrad consulting
technical recruitment specialists

Trusted recruitment advisors bringing
candidates and organisations together
to build outstanding careers

Electrical Associate - Newcastle
£47k to £52k plus benefits

Award winning multi-disciplinary consultancy are looking to recruit an Electrical Associate. Being a CEng engineer you will have a proven track record in successful project delivery in the North East within several sectors that include commercial, healthcare, education, retail and critical systems. Candidates should have the ability to lead a multi-discipline team on large projects. An excellent package is available for the right candidate.

Senior Electrical & Mechanical Design Engineers - London

£50k to £60k plus benefits

An award winning multi-disciplinary consultancy is now looking for both senior electrical & senior mechanical candidates to grow their MEP design team. Being degree qualified and a member of a professional body, you should hold a minimum of 7 years' design experience in building services. Current projects are within residential, education and commercial sectors.

Senior Mechanical Design Engineer - Rochester

£45k to £50k plus benefits

A 20-strong building services consultancy is seeking a senior mechanical design engineer. Working within the residential, commercial and leisure sectors alongside other disciplines, to create a full range of sustainable solutions for their illustrious client base. Ideally CEng or working towards.

Senior Mechanical Design Engineer - Colchester

£40k to £45k plus benefits

Well-established contractor is keen to add to their team in Colchester. At senior level you will have the chance to work on projects from start to finish on a range of local schemes. Candidates should be strong communicators and possess a good work ethic. An excellent benefits package is on offer for the right candidate. The contractor will also look at intermediate engineers looking to make the step up.

Principal Mechanical Design Engineer - Oxford

£45k to £50k plus benefits

Our client, a medium sized MEP consultancy, is now looking for a technically strong Principal Mechanical Design Engineer. The consultancy can offer projects covering a wide range of sectors that include education, leisure, commercial, community and healthcare from conception to completion. Candidates should be confident in attending design/client meetings and possess strong leadership skills in a team environment.

Associate (Mechanical bias) - Birmingham

£50k to £60k

A nationally recognised property consultancy is keen to recruit an Associate to head up their building services design team. Working with their prestigious client base on projects from start to finish, you will be capable of leading a delivery team. Ideal candidates will have strong commercial acumen and be keen to sharpen business development skills.

Associate Mechanical Design Engineer - London

£50k to £70k plus benefits

Mechanical Associate required for a strong MEP design team in Central London. The ideal candidate will have a proven track record in successful project delivery and a solid understanding of mechanical design for building services. You should possess good working knowledge of RIBA stages and be confident communicating with internal and external stakeholders. Project experience - iconic sports stadia and high profile residential developments.

Intermediate Electrical Design Engineer - Newmarket

£28k to £32k plus benefits

Forward-thinking building services design consultancy is looking to add an intermediate electrical design engineer to their growing team. The ideal candidate will possess 4-5 years' electrical building services design experience and be fluent with AutoCAD and, ideally, Revit MEP. Candidates should be capable of running some of their own projects and be able to lead design and client meetings.

We are looking for engineers from Graduate to Director throughout the UK - please do contact us for further information

Find all jobs at conradconsulting.co.uk

For more information contact Martin Bell on 01728 726120

London 0203 1595 387
Suffolk 01728 726 120
Leeds 0113 457 0079

Edinburgh 0131 240 1260
Manchester 0161 209 3246
Birmingham 0121 698 2085

EVENTS

NATIONAL EVENTS AND CONFERENCES

Ecobuild 2018

6-8 March, London
Visit CIBSE on stand C174 at this free-to-attend conference and exhibition that showcases the latest products and technologies, while delivering a conference and seminar programme. The CIBSE Green Infrastructure Design Challenge 2018 winners will be announced on 6 March at 5.30pm.
www.ecobuild.co.uk

Society of Light and Lighting: Light Bites

26 April, Newcastle
Continuing the 2017-18 SLL Lighting Knowledge Series 'Light Bites'. The day includes peer-reviewed, bitesize presentations focusing on four key areas: design, build, specify and future. Speakers include Lee Thomas and Nick Van Tromp, from Fagerhult; Steve Shackleton, from Zumtobel Group; Helen Loomes, from Trilux; and Roger Sexton, from Xicato. The series will continue through to June 2018.
www.cibse.org/sll

CIBSE TRAINING

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

Energy efficiency building regulations: Part L

6 March, Manchester

Electrical services explained

7 March, Manchester

Heat networks code of practice

7-8 March, London

HIGHLIGHT



Tamsin Tweddell will speak at the Scotland conference on 20 March

Design of heating and chilled water pipe systems

21 March, London

Heat networks code of practice

27-28 March, Edinburgh

CIBSE GROUPS, SOCIETIES AND REGIONS

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

West Midlands: Lighting, energy and the environment

7 March, Birmingham

Presentation looking at how to achieve a balance between quality of lit environment and environmental impact of the installation and operating life.

Southern: What is a KNX building control system?

8 March, Brighton

Presentation by Martin Hawley, from Ivory Egg, on how KNX offers a completely unique approach to building control.

Ready Steady Light

13 March, Sidcup

The Society of Light and Lighting annual event, in partnership with Rose Bruford College, challenges teams to design and set up temporary lighting installations.

Scotland: Scotland Conference

20 March, Glasgow

One-day conference exploring opportunities for the growth of the sector in the region.

www.cibse.org/scotlandconference

West Midlands: BSRIA guide BG 6 – Why? What? How?

21 March, Birmingham

Discussion on BSRIA guide BG 6.

HCNE: Low-voltage switchboards type tested assemblies classifications

21 March, London

Address by CIBSE President Peter Y Wong, followed by low-voltage switchboards type tested assemblies classifications.

SoPHE: Gas-fired water heater sizing and selection

21 March, Manchester

A talk by Trevor Taylor and Steve Addis, of Lochinvar.

Daylight Group: Well and daylight, CBDM and health

21 March, London

With speakers Dr Cosmin Ticleanu, principal consultant, BRE, and Andrew Bissell, director, Light4, Cundall.

M and NW: Annual Luncheon

23 March, Liverpool

Hosted in the iconic main stand at Anfield, with guest Brian Moore, former Rugby Union England International.

North West: AGM

23 April, Manchester

The evening AGM will take place at BDP's office in Manchester.

CIBSE Technical Symposium 2018 – Stretching the envelope

12-13 April, London South Bank University

The 2018 symposium will enable the sharing and dissemination of knowledge and skills that 'stretch the envelope' by applying forward-looking techniques, applications and technologies to create and maintain healthy and productive environments.

- A diverse range of presentations will encompass the breadth of building services and includes:
- Tony Day, of IERC, Cork, on how business and research centres can successfully join together in mutually profitable projects to realistically advance technology and operation
 - Rebecca Ward, of Cambridge University, will discuss the passive and active benefits of planting flora and illustrate the potential of a simulation model for quantification of the impact of the plants on energy demand and air quality
 - Bobo Ng, of Northumbria University, will tackle practical retrofitting and refurbishment measures to reduce the environmental impact of 1960s office buildings, providing insight into the feasible future retrofit strategies
 - Jack Harvie-Clark, of Apex Acoustics, will consider new quantitative guidance that properly accounts for acoustic aspects when designing ventilation systems in the mitigation of overheating
 - Adrien Cooper, of Whittington Hospital NHS Trust, will share practical lessons from working in hospitals over the last 18 years as to how water-acquired infections, such as MRSA, can be practically eliminated by appropriately engineering and managing systems.
- For more information and to book, visit www.cibse.org/technical-symposium



This year's symposium will be held in London



Technical Symposium 2018



Technical Symposium 2018

12-13 April 2018, London South Bank University

Stretching the Envelope

Techniques, applications and technologies
for healthy and productive environments.

Tickets on sale now

Available from as little as £90 + VAT.

www.cibse.org/symposium

+44 (0)20 8772 3643
Symposium@cibse.org

@CIBSE

#CIBSEsymposium

CMR

in complete control

CMR Controls manufactures low air pressure and air volume measurement sensors and control systems for standard air conditioning, clean rooms, sterile laboratories, containment facilities, and fume cupboard extract systems.

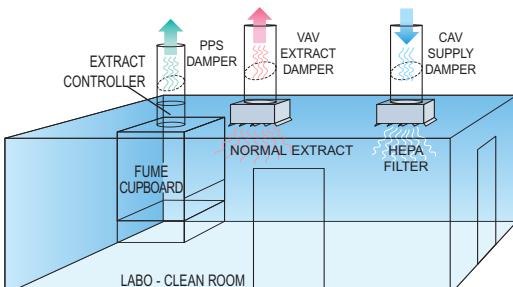


DPM PRESSURE SENSOR

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

AIR MANAGEMENT SYSTEM

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.



PRECISION COMPONENTS FOR VENTILATION AND PROCESS CONTROL

CMR CONTROLS

A Division of C. M. RICHTER (EUROPE) LTD

22 Repton Court, Repton Close,
Basildon, Essex SS13 1LN. GB
Website: <http://www.cmr.co.uk>

Tel: +44 (0)1268 287222
Fax: +44 (0)1268 287099
E-mail: sales@cmr.co.uk



DPC CONTROLLER

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



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



PPS EXTRACT DAMPER

Poly-propylene control and shut off valve incorporating the CMR Venturi Nozzle. This is essential when dealing with corrosive extract air especially from fume cupboard systems.

PPS Damper

