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Fighting on all fronts

Like every current conference in the UK, last month's CIBSE ASHRAE Technical Symposium was held online. Delegates may have had to forego the pleasure of catching up with friends and colleagues, but they were still able to gain valuable insight into the latest industry research from more than 60 technical papers presented by the authors in pre-recorded videos.

There were five key speakers, and presentations on Covid-19 by Dr Shaun Fitzgerald and Dr Clive Beggs. With the sharp uptick in Covid cases in Europe, the advice from scientists on keeping buildings virus-free becomes even more important. Fitzgerald is the co-author of CIBSE's *Covid-19 Ventilation Guidance*, which recommends ventilating buildings with outdoor air as much as possible. He accepted that the guidance would have to evolve over the winter, as systems would not be able to heat buildings adequately without some recirculation of existing air.

Beggs examined the possibility of installing UV lamps, either in ducts or high up in the ceiling, to irradiate aerosolised particles. He said both techniques were promising but added that more trials are needed to gauge how effective they would be in real-world situations (page 20).

After the government encouraged workers to return to work in early August, many companies have been looking to make their offices Covid-secure. Hoare Lea advises clients on their buildings, so it used its King's Cross headquarters to look at how it could make its HVAC systems safe. The consultancy calculated that it could switch to full outside air and avoid recirculation if it modified controls to prevent heating and cooling coils from being overwhelmed (see page 34).

Carbon Intelligence found a range of issues in monitored buildings that increased the risk of transmission. These include recirculation dampers being open when building operators think they have closed; thermal wheels running when they should not be; and AHUs not operating for longer hours because of a lack of understanding of the guidelines. During lockdown, it also identified poorly performing buildings that were consuming almost as much energy as when they had 100% occupancy. How Carbon Intelligence optimised systems during lockdown is outlined on page 30.

Of course, workplaces are likely to be a long way from full occupation following the government's latest recommendation to work from home. Attention has now turned to universities – large clusters of more than 100 positive Covid-19 cases in Scotland is a forewarning to the rest of the UK. Now is the time for colleges to check services in their halls of residence and ensure freshers aren't tempted to socialise in study bedrooms where ventilation rates are set for just a single occupant (page 7).

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Hywel Davies
The Building Safety Bill sets out competence requirements that will be supported by new standards

Liza Young
The façade industry is having to rethink the use of materials after new regulations on combustibility

Julie Godefroy
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APPRENTICE OF THE YEAR SHORTLIST ANNOUNCED

Nine apprentice engineers have been shortlisted for CIBSE's inaugural Apprentice of the Year competition. The winner will be announced on 8 October during an online Young Engineers Awards ceremony, which will also host the CIBSE ASHRAE Graduate and Employer of the Year competitions (www.cibse.org/yea). The award allows the CIBSE community to recognise the contribution made by apprentice engineers and those in the early years of their careers. The winner will receive £500, while those in second and third place will receive £300 and £200 respectively.

See the shortlists on page 23, and for a Q&A with Apprentice of the Year chair of judges Vince Arnold turn to page 73.

Student study bedrooms pose high risk of spreading Covid-19

Students gathering in study rooms in halls of residence at risk as ventilation rates are only designed for single occupancy

Student bedrooms with limited ventilation risk spreading Covid-19 among students as they return to universities for the first time in six months, a senior buildings services engineer has warned.

Max Fordham principal engineer Ali Shaw said study bedrooms within student residences are typically ventilated at lower rates because they are normally occupied by only one person.

'Those rooms are not designed for groups,' he added. 'I can see why gatherings would make them a high risk. In normal circumstances, social gatherings would be OK for short periods, but these aren't normal circumstances. Students should be made aware.'

At Glasgow University, at least 172 students have tested positive for Covid-19 in two halls of residence. A spokesperson for the university said the positive cases were largely caused by social activity at the start of fresher's week. Shaw said students should be encouraged to open windows if possible. If there is flexibility in the ventilation system, he also recommended increasing the flowrate during the daytime, but potentially turning it off at night because of noise.

ChapmanBDSP board director Jerry Lehane said avoiding transmission through infected materials and surfaces was also key: 'A non-touch environment where there are shared facilities is really important. Measures to consider include making doors openable, and changing to non-touch flushing and tap mechanisms.

Arup's aim is net zero within 20 years

Engineering consultancy Arup is aiming to be carbon neutral by 2030. It has pledged to reduce direct greenhouse gas emissions, buy offsets, and apply a carbon levy of $40 per tonne to flights taken by its employees.

Arup said it would reduce its 'scope 1, 2 and 3 greenhouse gas emissions' by 30% over the next five years, from a 2018 baseline. It also pledged to buy 'Gold Standard' offsets. Proceeds from the carbon levy will be used to set up an Arup Carbon Fund to support other carbon-cutting initiatives, including support for local community projects.

'While the world grapples with the Covid-19 pandemic, it is crucial that we do not take our eye off the ball when it comes to reducing emissions and managing the approaching risks because of climate change,' said Jo da Silva, global sustainable development leader at Arup.

'The greatest difference we can make is through the advice and solutions we offer our clients and communities – from helping city leaders take practical steps to meet the Paris Agreement, to working with property developers to understand how digital technology can reduce their resource consumption.'

Indoor air quality deteriorates when working from home

An analysis of home offices over 12 months has found that air quality deteriorated during the Covid-19 lockdown.

The study, by UCL Institute for Environmental Design and Engineering, was sponsored by CIBSE, and monitored IAQ and window operation data in eight London flats between 2019 and 2020.

Its aim was to find out whether the IAQ in flats deteriorated during Covid-19 lockdown, and whether the patterns of window operation by occupants had changed to offset increased occupancy levels.

The research found higher levels of CO_2, and particulate matter (PM10 and PM2.5) compared with the pre-lockdown period. It also found that, despite the higher occupied hours, occupants have generally relied less on natural ventilation.

Clean air good for health and wealth

The UK economy would benefit by as much as £1.6bn if World Health Organization (WHO) targets for air quality are met, according to a new report.

According to the research, which was commissioned by CBI Economics and funded by the Clean Air Fund, 17,000 premature deaths could also be prevented and more than three million lost working days regained. It also found that people would benefit from an additional £900m in increased earnings as a result of being able to spend more time in work, while the financial burden on the NHS would be reduced.

Breathing life into the UK economy calculated the likely benefit to four major cities, with London receiving a £500m economic boost from meeting the WHO levels.

IN BRIEF

M&E firms feeling more optimistic

The worst fears of specialist M&E contractors about the impact of the coronavirus crisis have not been realised, according to a new survey. Firms are now far more optimistic about work prospects and most remain upbeat despite the furlough scheme ending this month.

The Building Engineering Business survey shows that 67% of contractors expect their turnover to increase or remain the same in the third quarter of this year compared with quarter two, when there was a sharp drop in turnover because of the pandemic. Between the first and second quarters, almost two-thirds (60%) reported the sharpest drop since the survey began four years ago, but the fall was not as large as businesses had predicted.

Compact reactors could fill nuclear gap

A new generation of more compact nuclear reactors could be built on the site of the cancelled Wylfa development, according to manufacturer Rolls-Royce.

Plans to build a £20bn large-scale reactor at the North Wales site were abandoned last month when the main developer, Hitachi, pulled out. However, Rolls-Royce – with its consortium partners BAM Nuttall and Laing O'Rourke – said this could open up an opportunity to bring forward smaller reactors at the Anglesey site and at Trawsfynydd. These can operate for 60 years, providing about 440MW of electricity – enough to power a city the size of Leeds. The government believes 16 compact reactors could be delivered by 2050.

Sustainable buildings can support wellbeing

Sustainable buildings can help tackle the climate emergency and boost people's health and wellbeing, according to the World Green Building Council (WGBC).

This was a key message from the launch of the organisation's 'Sustainable buildings for everyone, everywhere' strategy.

The strategy is designed to address the fact that, by 2050, the global population will increase to 9.8 billion and the world's building stock will double. This could have devastating environmental, social and economic impacts, according to the WGBC.

MANCHESTER OFFICE TARGETS OPERATIONAL NET-ZERO CARBON

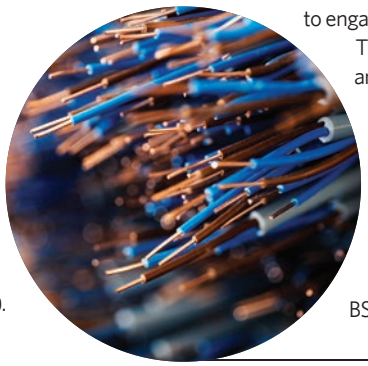
Federated Hermes and MEPC have become Design for Performance (DfP) pioneers with 4 Angel Square at Manchester's mixed-use redevelopment Noma, and 11 and 12 Wellington Place, Leeds. Angel Square is targeting operational net-zero carbon, in line with the UK Green Buildings Council definition. It is a LETI Pioneer Project, so will seek to achieve the KPIs in LETI's Climate Emergency Design guide. Wellington Place, with is targeting Breeam Outstanding. Read more on the DfP initiative on page 40.

Industry urged to have its say on changes to Wiring Regulations

Draft for public comment released for proposed Amendment 2 to BS 7671:2018

Proposed changes to the 18th edition of the Wiring Regulations are now open for public comment, with the release of a consultation for the electrotechnical industry on a potential second amendment to BS 7671:2018. Led by the Institution of Engineering and Technology (IET) and BSI, the draft for public comment (DPC) outlines the proposed changes to the regulations to be introduced in March 2022.

John O'Neill, NICEIC and ELECSA's director of technical excellence, said: 'The DPC gives everyone within the electrotechnical industry an opportunity to put forward their views, and I urge all to engage and comment.'



The proposed changes, which cover safety improvement and international and European standards alignment, follow discussions at committee level with electrotechnical industry stakeholders.

Gary Parker, technical manager of the Electrical Contractors' Association, also encouraged its membership to engage with the consultation. He said: 'It's vital that the regulations keep up to speed with new industry technology and methodologies. However, this must be balanced with a practical engineering approach.'

The DPC will be open for comment until 11 December. It is available via the BSI Standards development portal at **standardsdevelopment.bsigroup.com**

CEO: value firms that have apprentices

The CEO of a major specialist contractor has urged clients to demonstrate their commitment to skills by positively discriminating in favour of subcontractors that invest in apprentices.

TClarke's Mark Lawrence said commitment to training should be recognised when packages of subcontract work are awarded.

'It would have been easy for us to say that, this year, we will not take on any apprentices,' Lawrence said. 'But we did not. We showed our willingness to invest in our future, in the futures of 180 apprentices, and in our industry's future.

'I have a direct and frank question for our marketplace: does commitment like this carry weight with you? Either our marketplace actively recognises the value of skills and the creation of a talent pool or it does not. Now is the time.'

Lawrence believes that if the commitment made by firms like his goes unrewarded, then quality will continue to fall across the sector.

'Contract by contract, project by project, the construction world and the UK supply chain will fight on price and keep on grinding downwards,' he said. 'The result will be that, for all the billions of pounds invested by the nation in the coming months and years to build homes and infrastructure, there will be little return in terms of skills and quality jobs for the future.'

Grenfell designer 'was not concentrating' in fire seminar

Cladding contractor relied on architects, fire consultants and local building control officers to make sure designs were compliant

A key designer involved in the Grenfell Tower refurbishment told the inquiry into the disaster that he could not remember anything about a presentation he attended on façade fires.

Daniel Anketell-Jones, who worked for the cladding contractor Harley Façades, said he was present at the conference session in October 2014, but – because he was focused on structural design – he had probably ignored it, despite having worked on the tower project for several months by then. The presentation covered topics such as flame spread, safety regulations and examples of cladding fires.

'I think I might have been there and not concentrating, because it wasn't what I was trained in and not part of my remit,' Anketell-Jones told the inquiry.

It also emerged that Harley did not have a fully trained technical manager working on the Grenfell refurbishment who could assess the suitability of the products used. Instead, according to Anketell-Jones, the cladding contractor relied on architects at Studio E, fire consultants Exova, and local building control officers to make sure the designs and materials were compliant. He said emails, documents and design drawings relating to the refurbishment were almost certainly permanently lost after being wiped from his laptop when he left the firm in March 2016.

Meanwhile, it has emerged that as many as 186,000 privately owned flats in high-rise developments may be clad with unsafe, combustible materials and that 1.5 million could be unmortgageable because they cannot provide the necessary safety certificates.

A group of MPs has called for additional government funding to address the fact that around 700,000 people are living in flats with 'dangerous cladding' and millions more must wait years to get the EWS1 (external wall safety) form to show the property is safe to be sold or let. '[These flat owners] are trapped and have nowhere to go,' said Clive Betts MP, chair of the parliamentary housing committee.

Cladder says manufacturer misled him

The owner of the contractor that installed the cladding on Grenfell Tower has accused the manufacturer of misleading his company. Ray Bailey, director of Harley Façades, also said the use of Class O materials was causing widespread confusion in the industry because, although they are designed to reduce the surface spread of a fire, they can still contain flammable elements.

'I think any form of combustible insulation or cladding should be banned immediately,' he told the Grenfell public inquiry; adding that the current legislation was too complicated. He claimed he did not realise the material could burn and that Harley was not 'ultimately responsible' for ensuring the installation complied with the Building Regulations.

Bailey added that his firm was convinced by the cladding manufacturer Celotex, which is owned by Saint Gobain, that the combustible foam it supplied did comply. He said a salesperson from the company assured him that the 'new super-duper insulation products' were safe.

The inquiry has established that the Celotex RS5000 insulation and Kingspan Kooltherm K15 insulation fitted should not have been used on the Grenfell Tower refurbishment. These were rated as Class O, but not of 'limited combustibility'. The styrofoam and Kingspan TP10 rigid insulation, which is usually used to insulate roofs, was used in panels around windows and was also not compliant.

However, Bailey told the inquiry that nobody in the industry would have done anything differently from his company and 'nobody would have thought for one minute that anything we were doing was unsafe'. However, if he 'could go back in time, armed with what I know now… none of it would be on the wall.'

IN BRIEF

Industry loses 'champion' Lord O'Neill

Martin O'Neill, long-term president of the Specialist Engineering Contractors' (SEC) Group, has died aged 75. Lord O'Neill of Clackmannan became president of SEC Group in 2005, having served as an MP for more than 25 years. In 2002, he instigated an inquiry into the abuse of retention payments in the construction industry and set about trying to abolish them. In 2009, he launched a report that concluded the major barrier to progress in developing a more sustainable industry was the lack of collaboration between project participants.

'The construction industry has lost a parliamentary champion,' said SEC Group CEO Rudi Klein. 'Martin fully aligned himself with the challenges faced by SMEs. He was not afraid to speak his mind and hold ministers and civil servants to account for their inaction.'

Efficiency offsets refrigeration demand

Use of refrigeration technology in Germany has risen by 16% since 2009, but the energy it consumes has only gone up by 6% thanks to improvements in energy efficiency, says a new report.

Energy demand for refrigeration technology in Germany, published by the country's mechanical engineering industry association, VDMA, showed that the number of units in use had grown from 125 million to 144 million, and energy demand rose to 87TWh.

There were particular increases in the use of heat pumps during the period studied, which led to greater electricity consumption, but this was offset by efficiency gains.

Guidance fills gap to standards update

The Building Engineering Services Association, the ductwork trade body ADCAS and the Association of Specialist Fire Protection have produced guidance to help the industry deliver safe solutions in compliance with the Construction Products Regulation (CPR) while awaiting updated standards.

Fire test standards and the CPR in relation to fire resisting ventilation and smoke-control ductwork explains the relevant standards and the current status of the EN standards.

IN BRIEF

Europe aiming to cut emissions by 55%

The European Commission has revealed plans to achieve a 55% cut in greenhouse gas emissions by 2030, as part of a new 'Green Deal' programme designed to reach 'climate neutrality' by 2050.

'Our impact assessment clearly shows that our economy and industry can manage this,' said EC President Ursula von der Leyen, who pointed out that EU countries had already reduced emissions by 25% since 1990 while growing the economy by more than 60%.

She said Europe now had better technology, more expertise and the necessary financial firepower thanks to the €1.8tn EU budget and recovery fund, agreed in July for the years 2021 to 2027.

Net zero could cost less than 1% of GDP

A new report says the transition to net zero by 2050 will cost less than 1% of global GDP if the world scales up energy efficiency and speeds up adoption of renewable energy generation sufficiently.

In *Making mission possible: delivering a net zero economy*, the Energy Transitions Commission (ETC) proposes that all electricity generation built from next year should be zero carbon, and calls on policymakers not to rely on offsetting or carbon removal.

The ETC says investment is needed to ensure clean power generation capacity is built five to six times faster than at present. It also wants annual hydrogen use to increase to between 7,000Mt and 10,000Mt, but says its production would have to be decarbonised.

UK trailing in race to net zero

Consultancy Atkins calculates that country is only achieving 43% of required build rate to reach 2050 carbon goals

Low carbon technologies will have to be scaled up rapidly to achieve the government's 2050 net zero target, according to a white paper published by engineering consultancy Atkins.

The *Race to net-zero* white paper found that 48 natural gas units, 66 biomass facilities, six nuclear power stations and 6,520 offshore wind turbines would have to be added to the UK's energy system – and 20GW of onshore wind, 80GW of solar and 15-30GW of energy storage would be needed – to meet the 2050 target.

An additional 20GW of onshore wind and 80GW of solar are needed to meet the 2050 net zero target

It predicts that, by 2050, the UK's power system will have to comprise nuclear (11%); wind and solar (58%); combined cycle gas turbines with carbon capture storage (22%); and bioenergy with carbon capture storage (6%). Currently, the UK is only achieving 43% of the required build rate to reach these goals, based on Atkins' calculations.

'Market intervention in the UK offshore wind industry saw the cost of construction and electricity come down, resulting in the UK now being a global leader in deploying renewables,' said David Cole, market director for power-generation assets, nuclear and power at Atkins.

'Similar intervention is now required across nuclear, new technologies and other energy sources so that the UK energy industry can construct the above number of facilities in enough time.' He said the country would have to replace almost all of its current generating capacity and 'build as much again'.

Low carbon heat challenge for taskforce

A group comprising business leaders, local authorities and scientists has been set up by the Green Finance Institute to create 'financial products' that can attract investment in decarbonising heating systems and advise government on policy changes.

The Zero Carbon Heating Taskforce will review barriers to investment in low carbon heating solutions in a bid to speed up progress on reducing the almost two-fifths of UK annual energy consumption – and one-fifth of greenhouse gas emissions – attributed to residential heating and hot water. Currently, the government's target is to convert 12% of UK homes to renewable heat by the end of 2020, but it is expected to miss this goal.

The taskforce includes representatives from British Gas owner Centrica, E.ON, Engie and Octopus Energy. Officials from Defra, the Scottish and Welsh administrations, the Greater London Authority and the Greater Manchester Combined Authority will also take part, as will a number of financial firms.

'Decarbonising the way we heat our buildings is one of the largest policy and investment gaps to meeting the UK's domestic carbon budgets', said the Institute's chief executive Dr Rhian-Mari Thomas.

IN BRIEF

Take the initiatives for member application

CIBSE Membership has introduced new initiatives to support members through the whole process of member application.

Virtual membership application workshops: run by professional CIBSE interviewers through four online, 'bite-sized' lunchtime sessions. Join us on 20 October for the next series.

Membership webinars (two-part series): discover your best route into membership and how to start writing your Engineering Practice Report.

One-to-one advice in our virtual membership surgeries or our application phone surgeries: to book your place email **membership@cibse.org**

Visit **cibse.org/briefings** for more information. We are here to help you achieve professional membership with CIBSE.

We are CIBSE volunteering blog

The **#WeAreCIBSE** campaign aims to celebrate the individuals and groups who make up our Institution and keep it running.

As part of this campaign, CIBSE has launched a new blog series, focusing on members who go above and beyond to give back to the building services community through their work with CIBSE.

The first blog of the series features Alan Lawrence CEng MCIBSE, member of the CIBSE's Inclusivity and Diversity Panel.

Read the blog at **cibseblog.co.uk**

A career as a district heating engineer

The Young Energy Performance Group have launched a 'Career in Building Services' blog series with a view to encouraging more people into the career.

In the latest post, Tom Burton, a heat network engineer at Fairheat, discusses what his job involves, why he chose the role and what typical challenges might be.

He refers to the performance gap between design and operation and says a large part of his role is helping clients manage the commissioning process, ensuring that heat networks operate as intended and deliver reliable and affordable heat to residents.

Read the blog at **cibseblog.co.uk**

Young engineers 'at heart' of shortlisted companies

Businesses had to demonstrate how they invest in the career progression of young engineers

Six forward-looking companies have been shortlisted for the Employer of the Year awards, which – together with the Graduate and Apprentice of the Year accolades – form the Young Engineers Awards.

The employer award highlights the achievements of firms in supporting and encouraging young people entering the industry. It has three categories, with one overall winner.

Aecom was last year's overall Employer of the Year; the firm's Robert Mitchell and Tracy D'Souza (right) received the accolade

The shortlist is:

Small (under 50 employees)
- InTandem Systems
- S I Sealy & Associates

Medium (51-300 employees)
- Troup Bywaters + Anders
- Elementa Consulting

Large (over 300 employees)
- Hoare Lea
- Cundall

Kevin Mitchell, Employer of the Year judge, said: 'The companies in this year's shortlist have put young engineers at the heart of their business.

'By committing to nurture, mentor and encourage the new talent entering the industry, they are helping to ensure a skilled and motivated engineering community for the future.'

Winners will be unveiled on 8 October at the online Young Engineers Awards event, delivered in partnership with CIBSE Patrons, and sponsored by Kingspan Industrial Insulation, Baxi and Ideal Commercial Boilers and Swegon Air Management.

- For details, visit **cibse.org/yea**
- See page 23 for more on the awards

Quartet of new TMs offers insight into building performance

Four new publications on building performance have been published following a CIBSE-supported study by University College London. The new Technical Memoranda, TM61-64, provide detailed insights into operational building performance, occupant surveys, modelling for energy use, and indoor air quality. As well as building services engineers, they will be of value to anyone who influences design, construction, and facilities management outcomes of buildings.

TM61 focuses on operational building performance, particularly the collection of data to help address the performance gap – data that can be fed back to design teams to diagnose issues with current design, but also to ensure lessons are learned for future design.

TM62 looks at occupant surveys of non-domestic buildings. This is an area of growing interest because of increased concerns about physical and emotional wellbeing, and runs in parallel with building performance evaluation and post-occupancy evaluation. Occupant surveys are now established assessment methods to complement technical and quantitative forms of performance analysis.

TM63: ***Operational performance: modelling for evaluation of energy in use*** aims to provide a methodological framework to undertake measurement and verification of building energy performance in use.

TM64: ***Operational performance: indoor air quality — emissions sources and mitigation measures*** looks to give the information necessary to identify indoor emissions sources and measures to mitigate these to maintain good indoor air quality.

All four publications are available on the CIBSE Knowledge Portal, **cibse.org/knowledge**

Talented trio envisage the future to carry off awards

Winners of CIBSE ANZ Young Engineer Awards win AU$1,000 following video presentations in virtual ceremony

Three young professionals have been recognised for their achievements at the CIBSE Australia and New Zealand Young Engineers Awards 2020.

Shruti Govinda Rajan, a sustainability consultant graduate at ADP Consulting, won the Graduate of the Year award; Prateek Alkesh, a mechanical engineer at Aecom, won the Jack Pirie Award – Young Engineer of the Year; and Bipin Tom Thomas, who has a graduate diploma in building services engineering from Weltec, won the Mark Griffin, Student of the Year Award. All three winners receive a AU$1,000 cash prize.

Entrants to the awards had to submit a short written statement on why they would make a good ambassador for the building services profession. They also had to submit a short video addressing the question of what changes need to occur in planning the built environment today to achieve a desirable, high-performing, sustainable built environment a decade on.

Maria Atkinson, 2020 judge, said: 'What has emerged in the past five years is this ability of the next generation to challenge business as usual. They can articulate the changes that are possible and we need to recognise that it's time to hand over to them, to allow for a different way of doing things, rather than pressing forward with incremental change and being bound by the constraints of business as usual.'

The awards, sponsored by Northrop, Aurecon and Aecom, were announced as part of the ANZ virtual seminar events on 8 September. Winning video submissions can be viewed at **bit.ly/CJOct20ANZawards**

Prateek Alkesh won the Jack Pirie Award

Bipin Tom Thomas won the Mark Griffin, Student of the Year Award

Shruti Govinda Rajan won the Graduate of the Year Award

Building Simulation Group Awards

The CIBSE Building Simulation Awards 2020 and CIBSE Building Simulation Young Modeller 2020 are open for entries, with prizes of £1,000 and £500 respectively up for grabs.

The awards, offered by the CIBSE Building Simulation Group (BSG), aim to encourage innovation in building simulation techniques. Entries should provide information about a project that has a simulation or modelling aspect, and give details of why simulation and modelling were important.

All entries will be reviewed by a panel of experts, who will select six entrants to present their papers at an online event as part of Build2Perform Live in November, when the winner will be announced.

Young Modeller 2020 is a new award that recognises the outstanding contribution of young engineers, apprentices and sustainability consultants working with building simulation. Nominees in academia, industry or the public sector who are within three years of completion of their highest degree, as well as undergraduates, apprentices or those graduating in 2020-21 are welcome to apply. They must submit samples of their work, their CV and a referee's testimonial.

The deadline for entries for both awards is 23 October. For full details and to enter visit **bit.ly/CJOct20BSG**

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A question of competence

The draft Building Safety Bill sets out new requirements for professional competence. Hywel Davies considers proposals in the draft framework, and explains how new British Standards will support the changes

In July, the government published its long-awaited draft Building Safety Bill – a result of the terrible events at Grenfell Tower in June 2017 – which is currently under scrutiny by the Commons' Housing, Communities and Local Government Select Committee.

The 140-page bill, with 119 sections and eight schedules, demonstrates the scale, complexity and detail of the legislative change needed to address the many industry failings identified by the Independent Review of Building Regulations and Fire Safety.

Central to the proposed regime is the new Building Safety Regulator, to implement and enforce a more stringent system for higher-risk buildings and oversee the safety and performance of all buildings.

We must be quite clear about this: there will be a new regulator to oversee the regulations for *all* buildings, of any kind, and to be responsible for *all* enforcement action against those who put people's safety at risk by non-compliance.

There will be powers to imprison serious offenders, to drive better attitudes to compliance. In addition to this new regime for all buildings, the much more stringent requirements will apply to higher-risk buildings.

The draft bill proposes classification of certain buildings 'of a prescribed description' as higher risk. This description will be in secondary legislation. While it is expected, initially, to apply to buildings more than 18m in height, or six storeys, with more than one residence, there is a clearly structured mechanism for future broadening or supplementing of this 'prescribed description' in Part 1 of the draft bill.

The draft bill underlines the need for further change in industry culture and competence. One general function of the new regulator is to 'facilitate improvement in the competence of industry and of building inspectors', with a new industry competence committee. Section 6 requires the regulator to give appropriate 'assistance and encouragement' to those in the industry or members of a profession to improve their competence.

The new committee will be responsible for monitoring industry competence and advising the regulator and the industry on competence. It will 'facilitate persons in the industry to improve industry competence' and advise the public on how to identify competence.

"The 140-page bill demonstrates the scale, complexity and detail of the legislative change needed to address the many industry failings"

Statutory roles set out for design, construction and operation of higher-risk buildings may be filled by individuals or organisations. The regulator may prescribe competence requirements for the designer or the contractor, and impose duties on those appointing them to ensure they really are competent. There will be an Approved Document to support these requirements. Clients will be required to signify that they have assessed and are content with the competence of the principal designer and contractor.

To support these new requirements, the British Standards Institution (BSI) is developing new standards on industry competence. An overarching framework for competence will define the overall requirements for competence frameworks in the built environment sector. It is particularly aimed at the competence of those involved with higher-risk buildings, as defined within the legislation – which, as noted above, is likely to expand over time.

While it does not set specific requirements for any given profession, it does specify core characteristics to be included. So it is very relevant to CIBSE, the Engineering Council, or any other relevant body looking to develop or achieve recognition for a relevant competence framework.

It establishes ground rules for bodies responsible for assessment of competence of individuals against any sector-specific competence scheme. The document is out for comment until 20 October; for further details see the CIBSE website.

Part 5 of the draft bill amends the Architects Act to make continuing professional development a statutory requirement. This is because 'architect' is already a regulated profession and protected title. There must be no doubt that other professions must follow suit, at the very least those wishing to work on higher-risk buildings.

We must prepare for mandatory CPD, and members should be aware of the significant range of CPD materials CIBSE delivers online already. They will be invaluable in preparing for the changes that the draft Building Safety Bill is bringing.

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

Industry bids farewell to WSP co-founder John Frederick Sale

John Sale, who died on 17 August, aged 92, at his home in Burgh Heath, Surrey, was one of the founding partners of global management and engineering consultancy firm WSP.

He co-founded consulting engineering practice Williams Sale Partnership (WSP) in 1969, having joined former colleague Geoffrey Williams' and Chris Cole's renamed Engineering Design Associates practice. After a successful period of expansion, WSP was floated on the London Stock Exchange in 1987 and, subsequently, grew rapidly through a series of major acquisitions that added structural and civil engineering capability to its skills portfolio.

John retired in 1990 to spend more time with his family, while WSP continued to expand globally, being involved in a number of prestige projects, including: the Shard in London, UK; One57 in New York, USA; and the Petronas Towers in Kuala Lumpur, Malaysia. In 2014, WSP was acquired by Canadian engineering consulting firm Genivar and is now WSP Global Inc – one of the world's largest professional services firms.

Born on 23 May 1928, in London, most of John's childhood was spent in Morden, Surrey. He left school at 14 to work with his father at GEC as an office boy and eventually trained as a draughtsman. After National Service in the RAF, during which he was involved in the Berlin Airlift in 1949, he returned to work at GEC, and went to night school for five years to qualify as an electrical engineer. During his time at GEC, he was involved in the design of light fittings, and became recognised as a talented lighting designer and draftsman.

In 1959, John went to work in Aden, Yemen, spending two years as a design engineer, working on upgrading RAF bases. After returning, he joined consulting engineering practice Zisman Boyer Partnership in 1962, where he met Geoffrey Williams, with whom he would later establish WSP.

According to his family, John loved music and played in a band as lead guitarist. He also had a keen passion for fly fishing and travelled the world to pursue his hobby. He had strong morals, and valued loyalty to family, friends and work colleagues – he believed strongly that you should 'treat everyone as you would like to be treated yourself'.

In recognition of his achievements in the industry, John became a Citizen and Lightmonger of London in 1986, and was made a Freeman of the Worshipful Company of Lightmongers in 1990.

John is survived by his wife of 64 years, Margaret Sale, their children, Andrew, Peter, Jacqueline and Stephen, and seven grandchildren.

The air that we breathe

Media coverage of airborne virus transmission in buildings shows the importance of promoting our air-quality message, says Swegon's **Josh Emerson**

A *BBC News* report recently advised returning workers to avoid entering 'stuffy' offices, as they were highly likely to spread the Covid-19 virus. It also said the best defence was to open all the windows.

CIBSE technical director Hywel Davies bravely tried to explain the difference between 'fresh' and 'outside' air to the watching public, but this is often too subtle a distinction for a mainstream audience. The indoor environment quality (IEQ) argument remains elusive.

Healthy eating and drinking campaigns get wall-to-wall media coverage, but very little is said about what we breathe – despite our air intake being many times greater than the amount of food and drink we consume. The average adult, when resting, inhales and exhales about seven or eight litres of air per minute. That's around 11,000 litres of air being processed by our lungs every day. In comparison, most humans eat between three and five pounds of food a day, and are advised to drink about three litres of fluids.

Scientific reasons

It is not surprising most people are unaware of what is entering their lungs, because they can't see it. Now, however, millions of people are wearing face masks. So, could the education sector be the best place to start building greater awareness of indoor air quality?

Several studies highlighted air quality inside classrooms before the pandemic and these are now being scrutinised to help assess the risk of Covid-19 transmission. For most schools, however, a shortage of funding means opening a window is their only tactic. Apart from the fact there is no guarantee an open window will provide the required air changes, how can that be a sustainable, longer-term solution?

Mechanical ventilation has a role, but persuading hard-pressed school management teams to allocate limited resources is a huge challenge. The issue would have serious weight, however, if Ofsted required air quality readings as a way of assessing safeguarding performance. Air quality has a direct impact on pupils' health and wellbeing. The issue's current visibility is a chance to increase the number of schools having their IEQ monitored, to increase pressure on local and central government to fund better solutions.

If an airborne pandemic does not concentrate collective minds on IEQ and its impact on child health, surely nothing will.

www.swegon.co.uk

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Red-tape sticking points

More environmental rigour is needed to support the government's rhetoric on deregulating planning while ensuring standards, says **Julie Godefroy**

Government wants to make the biggest changes to the English planning system since 1947. The aim is clear: 'tear it down and start again'. The emphasis in the white paper *Planning for the future* is on building new homes. Land will be placed into one of three zones: growth, renewal or protected. For substantial developments in growth zones, there will be streamlined approval, subject to local design codes framed by policies contained in the National Design Guide, Manual for Streets and the National Model Design Code. Developments in renewal zones will be subject to limited checks, while development in protected zones – such as the Green Belt – will be subject to more stringent controls.

The white paper states that 'we are cutting red tape but not standards' to 'improve outcomes on design and sustainability'. Beyond the rhetoric, how could the proposals make planning work better for climate change and sustainability?

In April 2020, CIBSE set out eight priority recommendations on planning.[1]

"A low carbon retrofit strategy could use the shift to home working to create jobs across the UK"

1. Encourage and reward schemes that offer environmental and health benefits

- The white paper includes a headline-grabbing 'all new streets to be tree-lined' and a requirement for biodiversity net gain in the upcoming Environment Bill. Local plans would be subject to a 'sustainable development test'. Beyond that, more detail is needed on climate change and sustainability requirements.
- It wants to make environmental impact assessments less time-consuming and process-driven, and more meaningful – this is welcome. It is, however, unclear how this will happen.

2. Encourage climate leadership

- Government previously proposed stopping local authorities from setting carbon-performance requirements beyond national standards. CIBSE disagrees: local leadership can cut carbon earlier and ease the transition to net zero. The paper is tantalising, but ambiguous: government will 'review the roadmap to the Future Homes Standard to ensure... the shortest possible timeline' and 'clarify the role [local authorities] can play in setting energy-efficiency standards'.
- The paper proposes a 'fast-track for beauty'. CIBSE believes incentives should, instead, reward exemplar sustainability schemes to reflect their reduced long-term burden on carbon emissions, healthcare and transport.

3. Local authority resources

The white paper announces 'a comprehensive resources and skills strategy' and a strengthening of planning enforcement. New resources must cover climate mitigation and adaptation, including retrofit and heritage conservation. Outcomes should be evaluated to feed back into policies.

4. Adaptation to climate change

The paper indicates that high flood-risk areas should not be designated for growth – but building on a low-risk area could increase risk elsewhere. To be effective, zoning and blue-green infrastructure must be planned at a wider scale.

5. Retrofit of heritage buildings

The paper says many buildings will need to be adapted 'to respond to new challenges, such as mitigating and adapting to climate change', including 'more historical buildings (to) have the right energy efficiency measures to support our zero carbon objectives'. This is encouraging. A low carbon retrofit and regeneration strategy could use opportunities from the shift to home working to create jobs across the country and relieve housing pressure in the South East.

6. Permitted development rights (PDRs)

PDRs are known to lead to the creation of homes of poor standards. This must be addressed beyond the new regulation for 'adequate daylight provision'.

7. Transition to electric

Features such as charging points could be addressed through design codes. However, the real opportunities are through location and mix of uses that reduce the need for transport. It is unclear how this will be taken into account.

8. Energy infrastructure

It is not clear how sites will be allocated for low carbon energy infrastructure, such as renewable energy schemes.

Much will depend on the detail, 'to be consulted on this autumn'. Key areas include how the new system will address planning for blue-green and low carbon infrastructure, and how carbon and sustainability objectives are embedded in policies and design codes. Policies should encourage and reward climate leadership and low carbon retrofit and regeneration strategies.

- Contact **JGodefroy@cibse.org** to contribute to CIBSE's responses to the white paper.

DR JULIE GODEFROY is technical manager at CIBSE

References:

1 Information management according to BS EN ISO 19650, UK BIM Alliance **bit.ly/CJOctJG**

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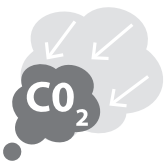

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THINKING OUTSIDE THE BOX

Covid-19 may have moved the 10th CIBSE Technical Symposium from auditorium to desktop, but the expertise and knowledge shared by more than 70 speakers, made it an enriching experience for those who tuned in. **Alex Smith, Liza Young** and **Phil Lattimore** report

The 10th CIBSE ASHRAE Technical Symposium was to have taken place in Glasgow this year, until the emergence of Covid-19 put everyday lives on hold and forced working populations to be physically distanced from their colleagues and friends.

With more than 64 academic papers and posters accepted, however, the event chair, Tim Dwyer, was never in doubt that the two-day event would take place in some form.

'As in the oft-quoted assertion by the great American scientist Benjamin Franklin, "from adversity comes opportunity",' Dwyer said. 'The symposium team grasped this opportunity, building on the experiences of earlier symposia to create an online event that provided depth of knowledge and the opportunity to learn, share and communicate with others.'

The first virtual symposium took place last month, with every paper author taking time to record a 15-20 minute presentation of their research or application. In addition, there were five live keynote speakers and seven, four-minute long, Ted-style presentations. Each session was followed by a live audience Q&A.

The second morning of the symposium was given over to presentations on Covid-19 by director of the Royal Institution Dr Shaun Fitzgerald and professor of medical engineering at the University of Bradford, Dr Clive Beggs.

Fitzgerald, who is a co-author of the *CIBSE Covid-19 Ventilation Guide*, reminded the audience that there were three main routes of transmission of the virus: via aerosols that can remain airborne for long periods; larger-particle droplets that may fall on a surface near a susceptible person; and materials or objects that are likely to carry infection.

CIBSE guidance has been in part to avoid recirculation of air in buildings and maintain high ventilation rates to dilute the virus. While it was relatively easy to do this in warm weather, Fitzgerald warned that the heating season would be another matter. 'We are concerned about the cooling months, and volumes to supply more ventilation will incur energy penalties,' he said.

Some degree of recirculation may be needed if it allows the building to bring in more fresh air, said Fitzgerald, who told the audience that the CIBSE guidance would be updated to take account of the changing seasons.

Beggs explained how ultraviolet germicidal irradiation (UVGI) offered a potential method of eliminating Covid-19 in indoor space. He explained how the SARS CoV-2 was particularly susceptible to damage from UV light.

There were two potential methods of disinfecting the

air, said Beggs: through in-duct and upper-room UVGI. He explained that putting UV lamps in the return air duct would protect the air handling unit (AHU), as well as the supply air and exhaust. However, Beggs explained that high air velocities in AHUs meant the irradiation time would be less than one second. He also said that particles passing close to the lamp were irradiated a lot more than those that were further away.

Beggs believes that upper-air UVGI has more potential, but explained that good mixing was essential to ensure that larger particles did not drop into the breathing zone before being irradiated. **CJ**

Taming the energy tiger


Andy Pearson

The opening keynote was given by Andy Pearson, group managing director at Star Refrigeration. In his address, *Taming the energy tiger: how can I make a difference?*, he suggested how tough, global energy-reduction targets could be met.

Pearson advocated following three principles: switch to electricity; eliminate its carbon content; and remember the 'negawatt' – the unit of electricity not used.

Pearson reminded us that academics had long been warning of the folly of burning fossil fuels when he gave a memorable rendition of an 1860s humorous song called *What shall we do for coal*, by Professor William Rankin of Glasgow University. 'In warmth and wealth while we rejoice,' sang Pearson. 'Nor heed the risk we run, geology with warning voice, says, "coal will soon be done".'

Pearson argued for the wide adoption of heat pumps and heat recovery, and said that gathering live data is key to checking whether real performance matches the design intention.

Net zero in practice


Stuart MacPherson

In his keynote presentation, *Net zero in practice*, CIBSE President Stuart MacPherson explained that net-zero buildings must be highly efficient and have onsite renewable generation, and any gap in emissions mitigation by onsite generation should be offset off site.

'Many forms of offsetting have been criticised for a lack of transparency and clear evidence that they are truly adding to carbon mitigation. And there are doubts over the actual effectiveness of some measures,' he said.

Some form of benchmark was needed, MacPherson added, so that a proposed building 'on paper' meets an energy efficiency and carbon emissions standard.

He said operational performance should be monitored as part of a statutory process, and reported for most buildings. Feedback loops were needed to enable actual building performance to be taken into account.

MacPherson said the challenge is to bring current groundwork – for example, LETI's approach on net-zero operational carbon – into a framework that is robust but flexible enough to encourage innovation.

> "Pearson reminded us that academics had long warned of the folly of fossil fuels with an 1860s song *What shall we do for coal*"

Understanding the dynamics


Lynne Jack

CIBSE past-president Lynne Jack said Heriot-Watt University had used her keynote to share her work on a series of numerical models, to understand the dynamic flow characteristics and overall performance of water and waste-water systems in properties.

In her keynote presentation, *Designing implications for flow attenuation in property-scale water and wastewater services*, Jack said many technologies and strategies can influence water flow. 'We also need to ensure changes in rainfall patterns because of the impacts of climate change are recognised,' she added.

When water sources are diverted inside a property for reuse – or when low-flow appliances are implemented, for example – there is a resulting decrease in the hydraulic loading of the system, said Jack, and the reduction in flow depth can lead to unintended consequences, whereby pipe systems are more prone to deposition and blockage.

The formulation of an overall system framework and a means »

THE WINNING PAPERS


John Mardaljevic


Paige Tien

The awards for the best papers at the Technical Symposium went to Loughborough University's John Mardaljevic and University of Nottingham PhD student Paige Tien.

Mardaljevic's paper, *Aperture-based daylight modelling (ABDM): a new approach for daylight and sunlight planning*, won the prize for most effective delivery of material

It described a new modelling schema to evaluate building apertures based on numerical measures of their 'connectedness' to the sun, the sky and the view of the external environment.

The paper describes the concept of the 'view lumen' – the illumination effect received at the building aperture from a visible external entity (such as the ground, sky or obstruction), which is made self-luminous for this purpose.

Tien's paper, *Energy management and optimisation of HVAC systems using a deep-learning approach*, was voted most significant contribution to the art and science of building services engineering. It described how a deep-learning-based framework can be integrated with building energy management systems to predict occupancy activity for HVAC systems.

The framework uses a deep-learning algorithm and an artificial intelligence-powered camera to predict typical activities in buildings, such as walking, standing, sitting and napping.

» of analysing dynamic flow conditions are required to understand how systems and networks perform and how water efficiency can be integrated within a property without introducing unintended consequences, Jack said.

Lighthouse moment


Charles (Chuck) Gulledge

In his keynote presentation on the *ASHRAE Digital Lighthouse and Industry 4.0*, ASHRAE President Charles (Chuck) Gulledge looked at the production process in engineering and construction.

'We can differentiate ourselves from the competition, identify ourselves as the innovators, improve our profit margin, attract and retain a digital-savvy workforce, and deliver value. Our evolution to digital maturity can deliver this "harvest" and more.'

Gulledge identified current construction industry issues, including chronic waste and the cost of rework, which is associated with poor data and communication.

He pointed to the lack of productivity growth – 1% over the past two decades – and the sector's poor record in digitisation and use of data.

'Over many decades, we have perfected the "dance of the silos" – risk and liability keep us from optimising the whole,' Gulledge said, pointing to firms working to protect individual interests rather than widening the scope of what can be achieved.

He said lean collaboration would lead to the sharing of risk and reward, and that digital technology would connect knowledge, to enable numerous iterations and testing with dynamic digital models.

America's carbon challenge


Ben Skelton

Ben Skelton, president of Cyclone Energy Group, delivered a keynote presentation discussing *Net-zero buildings from a US perspective*.

He began by referring to Cyclone's Walgreens zero-energy retail-store project in Chicago, which opened in November 2013. Since 2012, however – with the economy growing – the interest for such buildings had dwindled, said Skelton.

He highlighted some notable developments in zero-energy buildings, focusing on McDonald's recent opening of its latest global flagship store outside of Walt Disney World in Orlando, Florida. The building was designed to be zero energy, featuring a variety of sustainable energy and ventilation solutions.

Skelton said the New Buildings Institute has created a voluntary database that tracks new buildings across the United States of America that are seeking to be zero energy or have been verified as zero energy. The database currently has 549 buildings registered, 134 of which have been verified as zero energy.

Skelton highlighted ASHRAE design guidelines to encourage zero-energy building design, and AIA Architecture 2030 Challenge initiatives. He also outlined policy drivers for zero energy, with California leading the way with its energy efficiency building codes.

■ Access the online Technical Symposium content from £50 for members, until 8 December, at **bit.ly/CJOct20access**

THE DEBATE: REAL OUTCOMES v THEORETICAL CALCULATIONS


Debate host: Laura Luckhurst

The symposium young engineer debate was hosted by Cundall graduate mechanical engineer Laura Luckhurst (left), who is the current CIBSE ASHRAE Graduate of the Year.

The debate was on whether designing for building performance needed to focus on real outcomes rather than theoretical calculations.

The session featured three prominent CIBSE YEN engineers: Munis Hameed, Ramboll Middle East and YEN in the Middle East; Erato Vasileiou, Overbury and CIBSE YEN London chair; and Anastasija Taranenko, WSP and CIBSE YEN New Zealand Region chair

Vasileiou says theoretical calculations are still needed to create a benchmark. 'It's not that we don't need theoretical values – the [process] needs to change.' She said that the design intention was not being achieved in reality and there needed to be more feedback. 'There is more information we could gather at the end of the design process in the onsite and commissioning phases,' she added.

Taranenko said the issue was that, once a building is constructed, engineers move onto the next project. 'How many of us take a break and analyse building performance?' she asked. 'We don't include this in our scope of works.'

Accreditation schemes, such as Greenstar, would 'push designers to look at building performance', she added.

The panel agreed that regulations would help. 'Regulations are one of the most effective methods of making designers follow rules,' said Taranenko.

When Luckhurst asked whether engineers should focus on live data, rather than calculus, Hameed said there was already plenty of usable data. 'We can't go back to the same argument of not having enough data,' he said.

Taranenko said it was hard to predict how the building would be used. Sometimes the performance gap is because of how occupants use the building, she said. 'It was important to adjust the design to fulfil the purpose of the building, rather than just focus on accuracy,' she added.

The panel agreed there is a danger of tweaking calculations just to get the design to meet requirements in Part L or Breeam. Munis said that using software to meet clients' performance requirements must not be at the expense of buildability.

'You have to appreciate your input as designers. It has to be practically possible on site and achievable by the contractor,' he said.

MEET THE ENGINEER APPRENTICES

Alan Sugar's show may have been cancelled this Autumn because of Covid-19, but CIBSE's first Apprentice of the Year competition is taking place as part of the virtual Young Engineer Awards. We introduce the nine finalists, plus the candidates for Graduate of the Year

Nine apprentice engineers have been shortlisted for CIBSE's inaugural Apprentice of the Year competition.

The winner will be announced on 8 October during a special online version of the Young Engineers Awards, which will also host the CIBSE ASHRAE Graduate of the Year and Employer of the Year competitions.

Launched in 2020 to coincide with the 25th anniversary of the Young Engineers Awards, the Apprentice of the Year award allows the CIBSE community to recognise the contribution made by apprentice engineers and those in the early years of their careers.

The apprentices had to submit a short video presentation on the topic 'Why the role of a building services engineer is a good career', and the nine shortlisted entrants impressed the judges with their passion, pride, drive and commitment to the sector.

Vince Arnold, chair of the judges for the Apprentice of the Year, says he has been 'encouraged' by the quality of the candidates. 'Apprentices – and graduates, of course – are the future of our industry,' he says. 'They bring enthusiasm for sustainable design and building performance across the full range of construction and maintenance.' (See page 73 for a Q&A with Vince Arnold.)

The winner of the award will receive £500, while those in second and third place will get £300 and £200 respectively. A compilation video of the shortlisted Apprentice of the Year videos will be available after the event.

Eight newly graduated engineers have been shortlisted for the CIBSE ASHRAE Graduate of the Year award, while the Employer of the Year has six firms in the final (see CIBSE News on page 12 for the shortlist). The chair of the judges for Employer of the Year is Kevin Mitchell, who won the first Graduate of the Year Award in 1995.

Graduate finalists will be challenged to show off their presentation skills on a given topic in front of a panel of industry judges at the online final. This year's winner will enjoy a fully paid trip to an ASHRAE Winter Meeting in 2021.

Ewen Rose, Graduate of the Year judge, said: 'We are delighted that the award is able to celebrate its 25th anniversary with this wonderfully impressive line-up of finalists. This award has matured into one of the most sought after professional accolades for young engineers. Everyone who attends the final online on 8 October should be hugely reassured about our profession's future when they see the range and depth of talent on show.'

The Young Engineers Awards, will take place on 8 October between 3.30pm and 5pm. They will be delivered in partnership with CIBSE Patrons, and sponsored by Kingspan Industrial Insulation, Baxi and Ideal Commercial Boilers and Swegon Air Management. The awards are also supported by the Manly Trust. To register to attend the awards online on 8 October, visit **www.cibse.org/yea** CJ

Young Apprentice of the Year shortlist

1 Adam Daulby, Aecom
Adam Daulby joined Aecom in January 2019 as an apprentice mechanical engineer and is studying at London South Bank University. He has excelled in his role working on key projects such as South Bank Place, Wood Wharf and Fleet Street Estates. He has a keen interest in building information modelling and has helped to develop Aecom's technical library.

2 George Field, ChapmanBDSP
George Field is a 20-year-old apprentice mechanical engineer. He started at ChapmanBDSP after finishing his A levels and is now working while studying at university. For the past six months, Field has been extremely fortunate to have learned his profession on site at Battersea Power Station, one of Europe's largest regeneration projects.

3 Bradley Heppell, Mace
Bradley Heppell works in Mace MEP as an MEP apprentice engineer, a role in which he won Apprentice of the Year 2019. Bradley says he has a strong passion for engineering, particularly around mechanical,

»

electrical and public health systems. Understanding how these services make a building come to life is particularly rewarding, he says.

4 Benjamin Horton, Couch Perry Wilkes
Benjamin Horton has been gaining design experience as an engineering apprentice at CPW for two years. He attends Derby College on day release, and is working towards an HND qualification. He says he thoroughly enjoys his job and his objective is to progress as high as he can in his field.

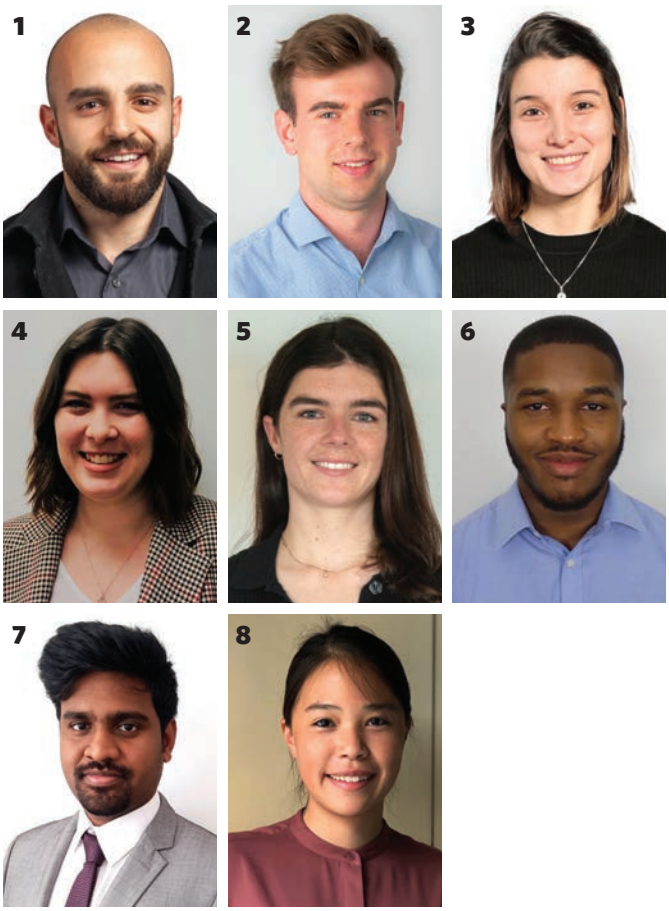
5 Louise Johnston, Schneider Electric
Louise Johnston joined Schneider Electric in 2019, fresh from A levels (which included a Technical Level in engineering). Since joining the company, she has been able to work on many sites as a building services engineer, including the The National Gallery in London.

6 Alexandro Justin, Waterman Group
As an apprentice mechanical engineer with Waterman Group, Justin's growing skillset and experience have resulted in him contributing to all of the Nottingham office's recent major projects. He recently completed his end-point assessment with CIBSE and will soon start the third year of the Level 6 building services design engineer apprenticeship at Coventry University.

7 Iqra Pervez, WSP
Iqra Pervez has been a part of WSP since 2015 and is now starting the fourth year of her undergraduate degree programme at Coventry University. Pervez works primarily on large- and small-scale electrical projects, and uses programmes such as CAD, Revit, DiaLux, ReLux, and MagiCAD to carry out her assigned tasks.

8 George Suddery, Hoare Lea
George Suddery is currently working at Hoare Lea in Cambridge, within the electrical team, while studying at London South Bank University (LSBU), where he has just started his second year. He enjoys playing for his weekend football team, and is captain of the office football team.

9 Megan Whitbread, Troup Bywaters + Anders
Whitbread is an apprentice building services engineer at Troup Bywaters + Anders in London. She started her apprenticeship in 2015, completing her BTEC Level 3, and is now on track to complete the final year of her degree apprenticeship at LSBU with first-class honours.



Graduate of the Year shortlist

1 Joey Aoun, Foster + Partners
Joey Aoun joined Foster+Partners in 2018, as an environmental design assistant, and has worked on large-scale infrastructure projects. He has a Master's in architecture, a postgraduate diploma in green building technology, and an MSc in urban energy (Newcastle University). His academic work was awarded IBPSA-USA's Project StaSIO 2019, and the highest-marked postgraduate dissertation prize at Newcastle University. A registered architect in Lebanon, Aoun is an incorporated engineer through CIBSE, and a RIBA Affiliate member, pursuing chartership. He is a Stem ambassador, a contributor to the LETI 2020 Retrofit Workstream and winner of this year's Ken Dale Travel Bursary.

2 Tom Burton, FairHeat
Tom Burton spent four years at the University of Cambridge, studying for a Master's in chemical engineering, during which he developed his interest in reducing energy use, CO_2 emissions and water use. His role as a graduate engineer involves working on the design of new heat-network systems and developing the skills to deliver cost- and energy-saving measures to clients. He also spends time on site, carrying out commissioning reviews and acceptance testing. At FairHeat, Burton is gaining experience in a wide range of areas from high-level design questions to the detail involved with installation and testing.

3 Laura Cattaneo, Foster + Partners
Laura Cattaneo graduated with a MEng in mechanical engineering from Imperial College London, achieving first-class honours and reaching the Dean's list in her final year. Since joining Foster + Partners in September 2019, she has worked on a variety of projects centred on sustainable design systems and energy optimisation, working with architects, engineers and designers on a daily basis in an integrated design approach. Her work focuses mainly on mechanical HVAC systems and

thermal and energy modelling, which links seamlessly with informing architectural design on sustainability and occupant comfort.

4 Jennifer Cox, Aecom
Jennifer Cox is a graduate electrical engineer working within the buildings and places team in Aecom St Albans. She graduated from Heriot-Watt University with a MEng in architectural Eengineering in 2018. Shortly afterwards, she joined Aecom as a graduate engineer in their Edinburgh office, working on mechanical and electrical design. In August 2019, she transferred to the St Albans office and has continued to work as an electrical engineer. Cox is a graduate member of CIBSE and has applied for ACIBSE membership. She is the general secretary of the London CIBSE YEN Committee and a Stem ambassador.

5 Rochelle Kirby, WSP
In 2018, Rochelle Kirby graduated from the University of Auckland with a Bachelor's degree in mechanical engineering (honours). This year, she was named a finalist for the New Zealand Green Building Council Future Thinker of the Year Award. She has been recognised with the WSP Undergraduate Scholarship, the Rotary Youth Leadership Award, and the Hine Kahukura Trust Scholarship. She was also selected by Engineering New Zealand and the Association of Korean Woman Scientists and Engineers to be one of two representatives from New Zealand at the International Young Woman Scientist Conference in Korea. As the leader of the Auckland Pathways Committee, Kirby organises events that promote personal and professional growth for the young professionals at WSP.

6 Khali Mboob, Buro Happold
A graduate mechanical engineer, born and raised in London, Mboob had a passion for maths, art and buildings while at school, and studied architecture and environmental engineering at the University of West England. There, he discovered a passion for building services and was given an opportunity to intern at Buro Happold as a mechanical engineer. He changed his degree to focus on building services, as he wanted to know more about the engineering and operation of buildings. Mboob achieved a first-class honours in building services engineering.

7 Joshua Vasudevan, Mitsubishi Electric R&D Centre
Having completed his BEng in civil engineering, Vasudevan started a low-energy building services Master's degree at Loughborough University. He graduated in 2019 with distinction and won the Aecom prize for the highest-performing building services student. His Master's research was based on machine learning using thermal imaging cameras to predict thermal comfort in building. He won the ASHRAE paper competition at ASHRAE's Orlando conference. He started as a research intern at Mitsubishi Electric R&D Centre working on monitoring and controlling IEQ. He has earned a fully funded PhD from Mitsubishi. He mentors Loughborough University students and participates in CIBSE and YEN.

8 Michelle Wang, Hoare Lea
After attaining a BSc in architecture and an MA in environment, politics and globalisation, Wang joined Hoare Lea as a graduate sustainability consultant in 2018. She has helped her team explore alternative ways of representing data and concepts around sustainability, energy and wellbeing. Her interest in human-centric design has also seen her contribute to Hoare Lea's workplace POE study, on which she presented at the CIBSE ASHRAE Technical Symposium. Michelle is the youngest member of industry think tank The Edge, and contributed to the #ConstructionIsOpen campaign to support EU27 nationals post-Brexit.

TALL ORDER

Following the ban on the use of combustible materials in some building façades, two industry bodies have come together to produce guidance on these legislative changes. **Liza Young** looks at the wider implications of the new regulations

In June 2017, after the devastating fire at Grenfell Tower, construction industry practices and competency were called into question, and wholesale change was inevitable.

The following year, in November 2018, the UK government announced changes to the Building Regulations in England, implementing a ban on the use of combustible materials in the external walls of certain high-rise buildings in England.

In response, the Society of Façade Engineering (SFE) and the Centre for Window and Cladding Technology (CWCT) have come together to develop technical guidance offering a practical and pragmatic explanation of the new regulations. The principal challenge, says the guide's main author, David Metcalfe, was taking the wording of the legislation and applying it to modern, complicated façades.

Although the amended Regulation 7 bans the use of combustible materials in external walls more than 18m high in residential buildings, it acknowledges the vital role that some combustible materials play in the performance of modern façades – especially when it comes to meeting other regulated requirements, such as thermal performance and weathertightness. Subsequently, it introduces some exceptions. However, the SFE and CWCT say these exemptions do not fully recognise the complexity of modern building envelopes, and leave some ambiguity and uncertainty over materials that may or may not be used, and the circumstances in which they may be used.

In developing the guidance, the CWCT and SFE faced numerous challenges, including interpreting definitions and terminology, as well as reconciling the – sometimes conflicting –requirements of the wider regulatory framework that buildings must meet.

New legislation

The amended Regulation 7(2) bans the use of materials that do not meet the specified reaction to fire requirements in any part of the external wall of so-called 'relevant buildings', to ensure they are safe from fire.

A relevant building is one with an occupied storey at least 18 metres above ground level, and which contains one or more dwellings, an institution – such as a hospital – or a room for residential purposes, such as student accommodation. Put simply, all components need to be constructed from materials that achieve European reaction to fire classification A2-s1, d0, except those that do not pose a significant contribution to fire risk, or for which there are no suitable alternatives, as referred to in the exceptions.

'This is significant because, in recent years, some combustible materials have been used to improve thermal performance and airtightness, or reduce defects as a result of water leakage, and so on. The amended regulation seeks to dramatically reduce their use,' says Metcalfe, who is director of CWCT, a board member of the SFE, and chair of the SFE Fire Committee.

To add to the challenge, other requirements related to buildings' thermal performance and environmental impact must also be taken into account, says Saverio Pasetto, head of

"A single material could have a different function depending on how, and where, it is used in the building"

COMPETENCY IS KEY

The Society of Façade Engineering is in the process of altering the way it scrutinises its members, and aims to establish a framework enabling it to recognise chartered status.

David Metcalfe says: 'The SFE recognises that it is increasingly important that individuals are able to demonstrate their competencies, and our long-term ambition is to work towards chartered status to recognise those highly qualified and experienced individuals.'

Saverio Pasetto says that some members have already obtained CIBSE chartership by applying as façade engineers through the SFE. 'The discipline has been recognised as an important aspect [of building services engineering] and we are working on a framework that will enable the SFE to deliver chartership status in the future.'

David Metcalfe, director of CWCT, a board member of SFE and chair of its fire committee

façades at Skanska, and chair of the CWCT and SFE.

Coming to terms

One of the biggest challenges the team faced was understanding and applying definitions and terminology. 'The regulations use very simple terms that don't necessarily translate consistently when dealing with complicated façades,' says Metcalfe.

Translating the terminology into a language consistent with that used in the industry was, therefore, the first step. Then, there was the challenge of understanding the scope of the regulation. 'It's not just about the material; it's how those materials are used,' says Metcalfe. 'A single material could have a different function depending on how, and where, it is used in the building.'

A membrane-type material could have several applications, for example. It could be used as a seal around a window frame, sealing one element to another, or it can be used as an extensive membrane, covering the whole wall for means of vapour control. 'This distinction is important, because the requirements are different depending on whether you consider it a seal or a membrane,' says Metcalfe.

At all costs

Before the amended regulation, system testing allowed the use of combustible insulation, and this was favoured because of its excellent thermal performance – which, in turn, meant less of it needed to be used.

'The non-combustible alternative isn't quite so thermally efficient, so you need more of it,' says Metcalfe.

'Consequently,' adds Pasetto, 'this will make the wall thicker and will result in cost implications for both the developer and the client.'

In London, where the price of land is significant, a developer may naturally choose to build higher, if possible. 'Building higher causes more risk because it introduces rescue challenges, for example, which is one of the reasons there is limitation on certain materials in relation to the height of the building,' says Pasetto.

A thicker envelope may result in a reduced internal floor area, which has financial implications – and, in a high-rise building with multiple floors, the impact of this may be significant, he adds.

In addition, because the building envelope is thicker, Pasetto says other components – such as frames and brackets – inevitably become deeper and heavier, which, potentially, increases the environmental impact of the building.

The industry will have to step up to this challenge, say Metcalfe and Pasetto, and come up with materials that perform well in limiting »

» the spread of fire, as well as in regard to their thermal properties.

Chance to change

This highlights the fact that the industry has to change. 'Potentially, buildings – or build cost – will become more expensive, but we can't carry on doing what we've always done,' says Metcalfe. 'These changes – which are very important and the right thing to do – will have knock-on effects. The industry has to come to terms with those and work out how it can accommodate the changes, physically and financially.'

Such challenges present a good opportunity for the industry to innovate, says Pasetto. 'This may lead to new technologies, and new and safer materials, products and components. The industry has to react to this in a positive, constructive and collaborative manner.'

Already, he says, steps have been taken to start this process, with organisations within the industry carrying out tests to build a body of evidence to show that certain materials could be safe.

One material that has been undergoing such tests is laminated glass, which is now banned on 'specified attachments' to external walls, meaning it can no longer be used for balcony balustrades. Laminated glass is a safety glass and has, for many years, been used for its impact performance, containment and post-failure behaviour. However, it is also combustible when classified in accordance with the European standard.

'This has introduced significant problems,' says Metcalfe. 'In blocks of flats, the balcony is the only external space you have, so it's very important.

'The industry has responded to this challenge by carrying out testing to try to demonstrate that these materials, in this application, don't contribute to fire spread, and this work is continuing.'

"The industry will have to step up to this challenge, and come up with materials that perform well in limiting the spread of fire, as well as in regard to their thermal properties"

The SFE and CWCT have supported these tests by providing technical backup and consultation. The bodies have also met and collaborated with the Ministry of Housing, Communities and Local Government, acting as conduits for the transfer of knowledge in the sector.

'We take the information, process it and spread the word to the rest of the industry, and that dissemination of knowledge is a key role that CWCT and SFE play,' says Metcalfe, adding that the visibility of the façade industry was a major hurdle that had to be overcome.

THE GUIDE

The guidance on the changes to the Building Regulations in relation to the inclusion of combustible materials in external walls, focuses on the combustibility of materials.

It has been formed through consultation and collaboration between industry professionals, including façade engineers, fire engineers, architects, building control professionals, surveyors and manufacturers.

In addition to setting out the context of the regulations in an introduction, the guidance explains the definitions and terminology, as well as the materials and exemptions under the legislation.

- **It is available to download, free of charge, from www.cwct.co.uk**
- **To find out more, and for more on the SFE, visit www.cibse.org/SFE**

Pasetto adds: 'We attended various conferences, meetings and workshops to contribute and to be as visible and present as possible; increasing our visibility presented a real challenge.

'We will continue to contribute to various discussions, and the more we do, the more visible we will become and the more we will be able to contribute.'

Fluid industry

By far the biggest challenge of all is that this is an almost constantly changing environment, says Metcalfe.

The initial ban came into force in late November 2018 and, in January 2020, the government published a consultation that looked at proposals such as removing laminated glass on balconies from the ban, as well as the 'trigger height' for the regulations.

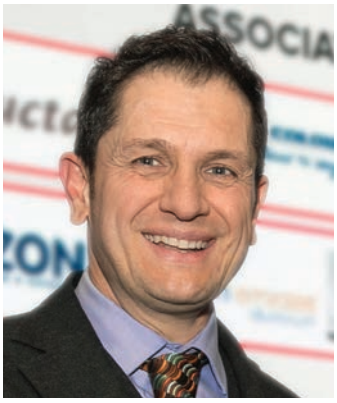
'The industry is designing buildings and façades in the knowledge that things may be different in six months' or a year's time when it comes to construction. The ever changing regulations and guidance are another challenge we have to deal with,' says Metcalfe.

For this reason, the SFE and CWCT intend the guidance to be a live document. 'It's not going to be something we publish and forget about; it is something we will be coming back to, either when regulations change or when we have more information – for example, from testing,' says Metcalfe.

Most importantly, he adds, this is just the beginning. 'There is a lot we still need to do to better understand the fire safety of façade systems. It's not just about combustible materials; it's about fire stopping and cavity barriers, and how things work as a system. Considering a material in isolation doesn't tell you how it's going to perform once it's used in combination with other materials, for example.

'We will continue to engage with relevant parties to try to achieve this. Collaboration is really important; Dame Judith Hackitt and the government want the industry to be more proactive and to work together to try to overcome some of the challenges we're facing.

'We are responding – and will continue to respond – to those challenges.' CJ



Saverio Pasetto, head of façades at Skanska and chair of the CWCT and SFE

- The SFE and CWCT would like to thank CIBSE for its input and help with the guidance.
- The guidance is now available to download for free at **www.cwct.co.uk**

SAFETY IN NUMBERS

Data monitoring can help identify poorly ventilated office spaces at risk from Covid-19, as well as highlight poorly performing HVAC systems during lockdowns, says Carbon Intelligence's **Khasha Mohammadian**

The Covid-19 crisis has put enormous pressure on businesses to reduce costs, while ensuring the health and safety of their staff. We've seen smart building technologies help facilities teams manage assets remotely, improve visibility, and allow greater control over building performance when it matters most.

In March, social distancing and lockdown measures came into force to curb the spread of the virus. With many buildings largely empty, facilities managers were presented with the challenge of reducing energy consumption to the minimum.

At Carbon Intelligence, we capture energy data from more than 40,000 buildings and provide many of our clients with data-driven insights, actions and optimisation services. Our services cover areas such as improving energy performance and comfort in buildings, as part of our mission to enable a zero-carbon economy.

Shortly after lockdown, we carried out a macro-scale analysis on 300 buildings with high-quality, half-hourly electricity data. Many may think an empty building should result in close to no energy consumption, but we found that, even in the best-performing buildings, energy consumption was only around half of pre-lockdown levels. The worst 10% of buildings only reduced energy consumption by 3% in the first week after lockdown.

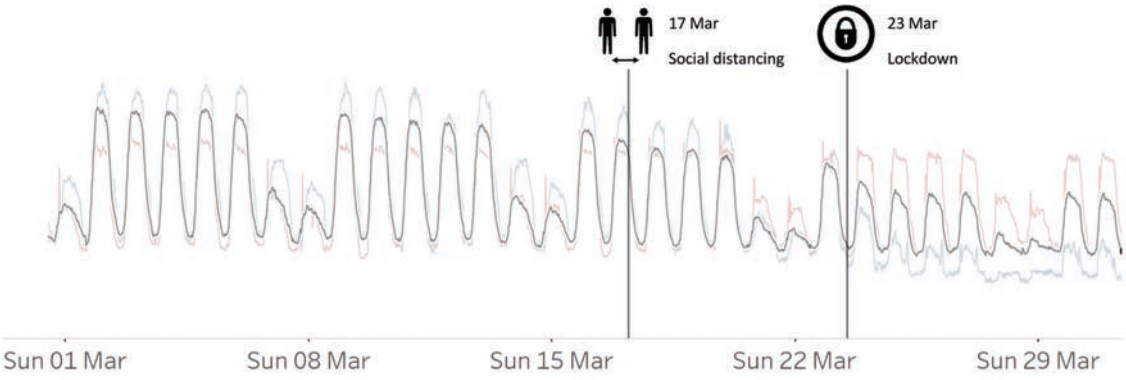
As lockdown continued, we saw more buildings gradually reduce their energy spend, but those with the three key ingredients of visibility, control and proactive management continued to outperform the rest, and responded to changes the fastest. We recommended optimisation measures that our clients could implement quickly during the low-occupancy period (see panel, 'Top tips during lockdown and low-occupancy periods').

Data – the missing piece of the puzzle

Empty buildings and a livestream of data have given our engineers the opportunity to reveal many hard-to-find issues and unlock huge, long-term environmental and financial gains. Some examples include faulty or miscalibrated sensors, passing valves and control issues, which cause a false demand whether or not buildings are fully occupied – but these issues are a lot easier to identify in empty buildings.

Above all these issues sat one key finding from our analysis; buildings, in general, are not designed to respond to very low loads and there will always be some unavoidable baseload.

Net zero is a hot topic at the moment, and we know – from UK Green Building Council and LETI guidance – that a standard office will need to achieve an energy-use intensity of 70kWh$_e$·m^{-2} of net lettable area per year to be aligned with a net-zero future. Lockdown has shown us that even an empty building is a long way from achieving this intensity. Our analysis on a sample of air conditioned



The average building has reduced energy use by **16%** following the lockdown

Worst-performing buildings have reduced energy use by **3%** following the lockdown

Best-performing buildings have reduced energy use by **54%** following the lockdown

Figure 1: Changes in electricity profiles before and after lockdown for average, best- and worst-performing buildings

UK offices during lockdown shows that, if a reduction trend similar to the one seen during lockdown were to be seen over the course of a year, an energy intensity of 160kWh$_e$·m^{-2} of net lettable area per year could be expected.

The Covid period has illustrated the scale of the challenge ahead for the industry, but data-driven design and actions will make that journey a lot easier.

Returning to the workplace

We all want to see a safe and successful reoccupation of commercial real estate. Building managers and engineering teams are working hard to create this safe environment by following best-practice guidance from organisations such as CIBSE and REHVA.

In an era of Covid health and safety in the workplace is a complex subject. Our engineers have discovered a huge awareness gap between guidelines and operating regimes in buildings that have been modified to be compliant with guidelines. We have seen a range of issues, such as: recirculation dampers being open when building operators think they have closed them; thermal wheels running when they should not be; and air handling units (AHUs) not operating for longer hours because of a lack of understanding of the new guidelines.

Moreover, as best-practice guidelines are continually updated (based on evolving knowledge of Covid-19 transmission risk) and building management teams juggle competing priorities with limited time, ventilation strategies may end up delivering sub-optimal air quality for building occupants. Building fit-outs, locations of ventilation supplies and extracts, and ventilation balancing also have big impacts on overall air circulation and creating small areas of stagnant air.

To add further certainty to how our clients are reoccupying their buildings, and give them another level of visibility and control, we have created a new data service to shed light on how different areas are performing in real time, using CO_2, temperature and humidity as metrics to measure the 'freshness' of the air. The aim is to enable building managers to optimise ventilation strategies, and make occupants feel informed and able to make decisions.

Data from sensors give us insights that have previously been inaccessible, including how many people can be using different areas, and for how long, while receiving healthy air quality. We have been trialling this approach in our own office and meeting rooms, and have seen some very interesting results, as shown in Figure 2. »

TOP TIPS DURING LOCKDOWN AND LOW-OCCUPANCY PERIODS

Some optimisation quick wins we recommended to our clients during the low-occupancy period included:

- **Changing time schedules**
- **Changing settings on empty floors that were being controlled to comfort conditions, which, in turn, brought on HVAC systems as a whole**
- **Relaxing temperature set points and deadbands while protecting the fabric**
- **Avoiding hours with Distribution Use of System Charges (DuOS) red bands when carrying out plant exercising and flushing, to prevent unnecessarily high electricity costs and relax pressure on the grid**
- **Making the most of passive night-time cooling and avoiding running chillers if possible**
- **Taking action to reduce unused small-power loads being left on or automatically switched on, such as computers, TVs and vending machines**
- **Engaging with tenants. This has been an important part of this process, and the data we provided really helped building managers get their tenants' buy-in to make changes to their demises.**

> "Even an empty office building is a long way from the energy-use intensity needed to be aligned with a net-zero future"

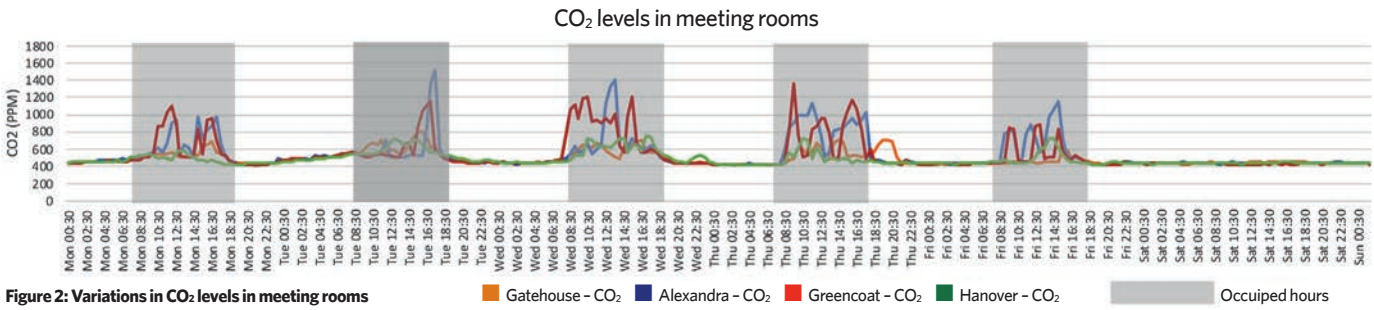


Figure 2: Variations in CO_2 levels in meeting rooms

Figure 3: Indoor air quality monitor in meeting rooms

» The rooms with the highest CO_2 levels (Alexandra and Greencoat) are the smallest rooms in the office, with no windows or dedicated fresh air supply. Data has helped us conclude that only a single user at a time can use these rooms and, even then, with the doors open. The data also allows us to understand how many people can use other spaces simultaneously, for what length of time, and under what conditions. We are continually monitoring this data and displaying it live to empower users to make decisions, act, and feel comfortable using the space.

We have found that leaving meeting room doors and windows open, as well as leaving a short time in between meetings to 'flush out' the rooms with fresh air, has the biggest impact in ensuring that air quality is optimised through sufficient air changes.

As temperatures cool and the ability to open windows becomes limited, we will be able to use this data further to make informed decisions about how we use our office space – for example, by reducing the capacity of some meeting rooms.

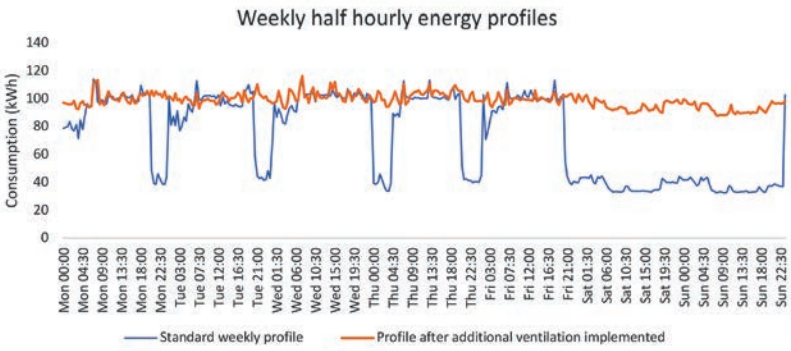


Figure 4: Electricity load profiles for a typical London office before and after implementation of increased ventilation

Covid safety, comfort and energy – is there a conflict?

There is no doubt that running ventilation for longer increases energy bills, especially where heat recovery is not available or not permitted. The extent of this additional energy demand can be very high. In a number of buildings, we have seen energy use increase by as much as 80% compared with pre-Covid levels, because of the additional hours of ventilation, heating and cooling, especially if AHUs do not have speed control.

In conclusion building managers and engineers are telling us there are three factors to be aware of when reoccupying buildings.

One is to mitigate extra costs that arise from increased ventilation levels and associated increased heating and cooling of air.

Another is to communicate that your building is a safe place to work – this ensures confidence for the returning building occupants. And the third factor is to use data and systems for visibility and control of the building, so that ongoing assurance of the safety of the workspaces is possible.

All three are possible, but will often require additional or new sensors and processes. CJ

KHASHA MOHAMMADIAN is senior energy performance consultant at Carbon Intelligence

Before Hoare Lea started offering advice to clients about making their offices Covid-secure it looked at how its own air handling units could be modified to make its King's Cross headquarters safe and comfortable. Hoare Lea's **Steve Wisby** explains

DISTANCE AND DILUTION

After the recent rise in Covid-19 cases in the UK, the government has recommended office workers who can work effectively from home should do so over the winter and only those that are unable to work from home should go to the office. The work undertaken to our office means that we can welcome back staff into a COVID secure environment if they need to come in.

Foremost in our minds when making our office Covid-secure was creating a calm, reassuring space that was productive. We wanted the office experience to be as close to that of the pre-Covid workplace, while being as safe as possible.

The first step was a survey to discover how people felt about returning and how they were working at home. This information was invaluable, leading us to conclude that any return to work should be on a phased basis, with only those struggling to work from home – because of IT issues, home conditions, and so on – invited back in our first phase.

The distance dilemma

Most modern offices, including our London one, use straight workstations, where employees sit about 1.8m apart, opposite each other, face to face. The government guidance emphasises 2m social distancing or 1m with risk mitigation where 2m is not viable. Not wanting to install a vast array of Perspex screens, we have used a staggered, diagonal, active workstation arrangement to comply with the 2m social distancing guidance (see Figure 1).

This, obviously, places capacity limitations on the reoccupation permitted. The government's mantra is 'follow the science', so I was curious to read the supporting documentation behind the 2m guidance. The evidence is in a paper prepared by the Environmental and Modelling Group and published by SAGE in June 2020.

This paper does indeed detail 'face to face' safe distances of 2m where prolonged periods are necessary. However, it also details that the risk of 1m side to side or back to back carries the same risk as 2m face to face. This is not mentioned within the government's guidance. If adopted within the guidance, the resulting planning bubble around an office employee would, I believe, be along the lines of Figure 2.

It is no surprise that following government guidance leads to office occupancies of around 30-45% without further intervention measures. If the government's guidance was to fully adopt the 'scientific evidence', occupancies could increase – perhaps, up to 50%. Also, if the government was bold enough to lower the face-to-face distance to 1.8m, office planning occupancy levels may well rise above 75%. A dilemma, indeed, if we are to see numbers return to their office workplace.

Dilution

There is clear scientific evidence that dilution of indoor air with the introduction of outside air plays a crucial role in minimising the risk of airborne viral transmission.

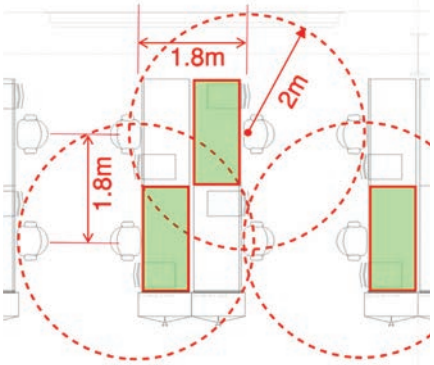


Figure 1: Staggered workstations

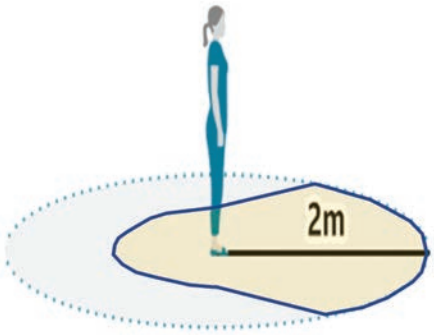


Figure 2: Individual bubble with 1m safe distances side to side and back to back

Hoare Lea's socially distanced desks are arranged to suit the air distribution

"If the government's guidance was to fully adopt the 'scientific evidence', office planning occupancies could increase up to 50%"

Like most modern workplaces, our London office's façades and roof do not have any opening windows or vents, relying upon a mechanical air supply system to condition the space and introduce outside air for ventilation. The office is environmentally conditioned using two dedicated air handling units (AHUs) that serve underfloor variable air volume (VAV) boxes to independently controlled zones over two floors.

Installed in 2012, the AHUs use a recirculation air cross-connection between supply and exhaust to recover energy from the office while maintaining a design minimum outside air supply of $1.32L{\cdot}s^{-1}{\cdot}m^{-2}$ during times of very high or very low external enthalpy. They include mixing dampers to regulate and provide free cooling/heating at times when the outside air permits.

Air is supplied into the space, via underfloor plenums, through floor grilles. Each grille can vary in volume between $15L{\cdot}s^{-1}$ and $40L{\cdot}s^{-1}$. Given the injection of air at floor level, the desks are arranged to suit the air distribution and ensure comfort. It was all tested before Cat A design.

The characteristic performance of the diffusers means that, at $15L{\cdot}s^{-1}$, the air injected into the space acts in a manner similar to that of a displacement air supply system. At $40L{\cdot}s^{-1}$, the air is thrown vertically and mixes with the surrounding air, providing comfort conditions up to 2m height, with temperature then rising with height above 2m.

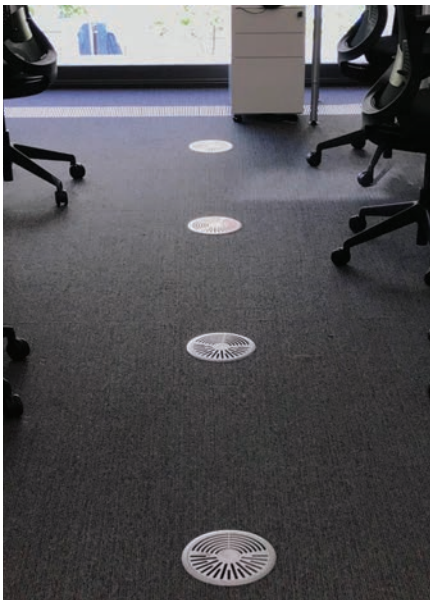
To prove the system in operation, we installed vertical arrays of temperature sensors located at the desk spines. A time slice of the space, taken at midday during high solar gain, can be seen in Figure 3, demonstrating the conditions achieved within the occupied zone.

As a firm, we have been monitoring industry reoccupation guidance closely and have our own Covid-19 technical support team. It offers advice to our clients who are looking to 're-energise, reoccupy and rethink' their premises.

Our office is conditioned by two zonal AHUs that use recirculation to minimise peak coil loads. Following CIBSE and REHVA guidance, recirculation needs to be isolated and the ventilation run 24/7. This creates challenges in how the supply air volume could be supplied within the capacity limits of the heating and cooling coils.

The AHUs are owned, operated and maintained by our landlord. One of the fundamentals of any Covid-19 reoccupancy plan is to understand fully how ventilation air is supplied into your office and how much is delivered. Cooperation and liaison with the landlord is a must. Knowing our systems well, we knew that supplying an increased amount of outside air into the space was not an issue; it was more about how the supply air was to be maintained at around 19°C without the heating and cooling coils being overwhelmed.

The solution involved a series of control interventions that respond to outside air conditions, and whether the office was in occupation or not. The images on page 36 show the successful implementation of the controls modifications. As the AHUs operated on the demands of static pressure to satisfy »



Air supplied through floor grilles varies between $15L{\cdot}s^{-1}$ and $40L{\cdot}s^{-1}$

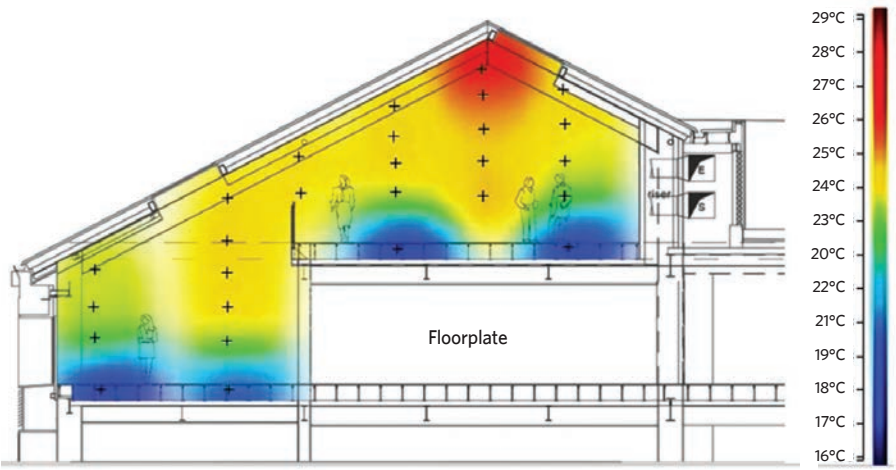


Figure 3: Internal temperatures during occupation in August

» the zonal VAV boxes, speed control of the fans had to be implemented to allow the coils to temper the air to the desired temperature, recognising that the desired supply duct pressure may drop at very high or very low ambient air conditions.

During unoccupied periods, the controls interventions permitted a greater period of time when neither the heating nor cooling coil were energised, while also lowering the fan speed to lessen the amount of outside air being provided. The observed flowrates at night are above the normal minimum outside air supply design flowrate and around 20 times that recommended within the REHVA guidance of $0.15 L \cdot s^{-1} \cdot m^{-2}$ during unoccupied periods. Stable fan speed operations limit the minimum supplied volume.

As the AHUs operate under a variable air volume control, the units have outside air intake velocity measurements to ensure the desired minimum design outside air flowrate is maintained. This is reassuring to have, as it provides a means to monitor flowrates.

Hoare Lea's HQ employs sensors, including for air quality

All the above is logical in principle, but how do you prove, in practice, that the office space is ventilated to a high level to reassure employees that the environment they occupy for long periods of time is of good quality? The answer lay with the installation of air-quality monitoring within the space. CO_2 monitoring is known to be a very good indicator of how well indoor air is diluted with outside air. Since 2016, we have used our office as a 'Living Lab' to demonstrate and test bed new technology, to continually evaluate the post-occupancy performance of our spaces. As part of this, we have multiple sensors around the office, including for air quality.

The air-quality sensors' data are collected constantly and reported via our in-house app, which displays trend logs of the conditions. At the time of commissioning the new AHU control interventions, the app showed a climb in CO_2 when the supply air was interrupted to the space. The sensitivity and response to ventilation being cut is very quick and is a cost-effective way of reassuring employees of the ventilation rates within the space.

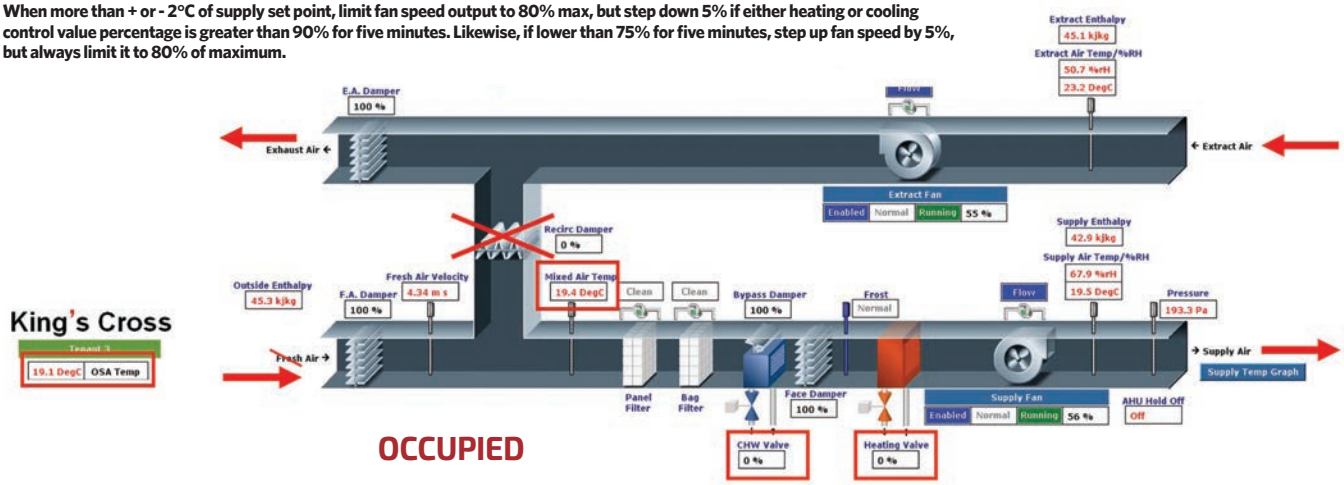
Reopening offices to employees following government guidance is not as easy as one would think. The airborne transmission route of Covid-19 is by far the greatest challenge to understand and to minimise, especially with the ever growing prevalence of those who are asymptomatic.

As a result, the ventilation of indoor spaces has never been so important to understand, control and monitor. CJ

STEVE WISBY is a partner at Hoare Lea

Control modifications when office is occupied

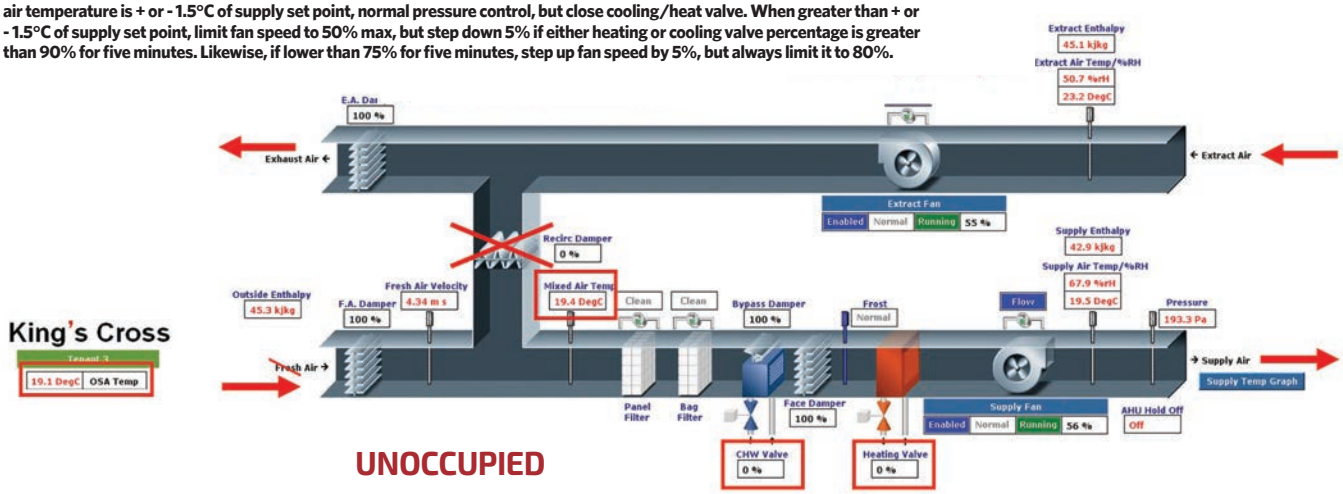
When outside air and mixed air temperature is within + or - 2°C of supply air set point, fan speed should be normal pressure control. When more than + or - 2°C of supply set point, limit fan speed output to 80% max, but step down 5% if either heating or cooling control value percentage is greater than 90% for five minutes. Likewise, if lower than 75% for five minutes, step up fan speed by 5%, but always limit it to 80% of maximum.



OCCUPIED

Control modifications when office is unoccupied

Space temperature set points to be overridden to 26°C cooling set point and 20°C heating set point. When outside air and mixed air temperature is + or - 1.5°C of supply set point, normal pressure control, but close cooling/heat valve. When greater than + or - 1.5°C of supply set point, limit fan speed to 50% max, but step down 5% if either heating or cooling valve percentage is greater than 90% for five minutes. Likewise, if lower than 75% for five minutes, step up fan speed by 5%, but always limit it to 80%.



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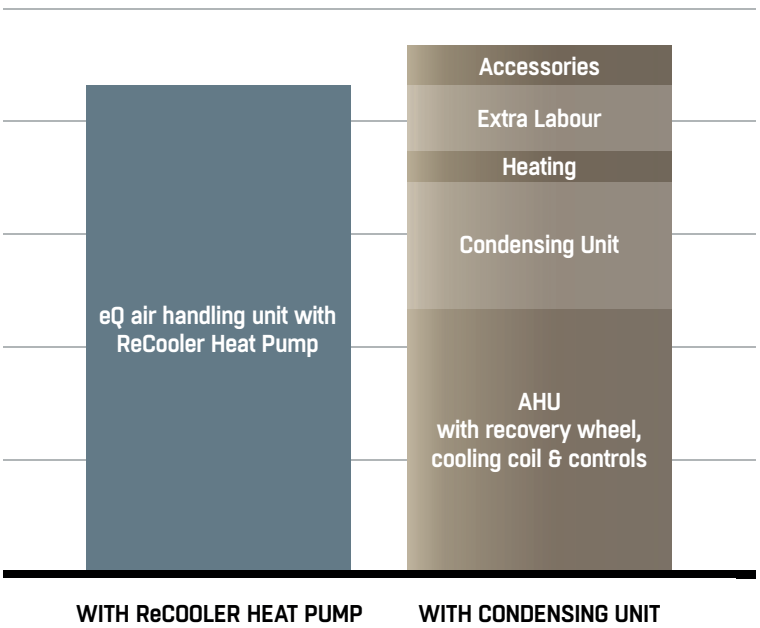

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PERFORMANCE PIONEERS

Eleven office developments will trial the UK version of Australia's Nabers rating scheme, which grades buildings by actual performance. **Andy Pearson** speaks to consultants on the Design for Performance initiative about outcome-based designs

It is a sobering fact that a typical new office base building in London could be using up to six times more energy on a like-for-like basis than the best new prime office building equivalents in Melbourne, Australia, the antipodean city with a similar, though slightly warmer, climate. Even the best new offices in London could be using three times more energy than their Melbourne equivalent.

One of the reasons for this striking differential is that the focus in the UK is on design and *predicted* energy performance of the base building (and in the worst-case scenarios, only compliance) – whereas, in Australia, the focus in on the *measured actual* energy performance of the base building.

By contrast, in Australia – in addition to achieving compliance – it is mandated that the operational energy efficiency of large commercial office buildings is measured and rated using the Nabers scheme.

(Of course, not all buildings in the UK ignore operational performance as the widespread use of *TM54: Evaluating Operational Energy Performance of Buildings at the Design Stage* testifies.)

The Better Buildings Partnership's (BBP's) Design for Performance (DfP) initiative is an industry-backed project instigated to tackle the performance gap in the UK. Based on the established Nabers methodology, it sets out to deliver measurable performance outcomes to ensure UK office developments deliver on their design intent.

To date, the BBP has undertaken a feasibility study followed by a series of pilot projects. More recently, it announced that 11 pioneering office developments will be trialling a DfP approach to office design.

Consultant Arup is working on two of these pioneer projects: Derwent London's 9-35 Baker Street development and Stanhope's 2 Ruskin Square, Croydon.

'There is an expectation from both clients that the ratings we achieve for these buildings will be important by the time schemes hit the market,' says Stephen Hill, a sustainability consultant and associate at Arup.

He believes that the DfP approach fits into the sustainability strategy Arup now uses on the majority of its projects. This involves using advanced energy modelling to establish operational performance targets.

'DfP is helping us engage with our clients to have more meaningful conversations about what those [operational] targets should be and what project teams should be doing to make sure those targets are achieved,' Hill says.

Arup is in the fortunate position of being able to draw on the experience of engineers working in its Australian offices with experience of delivering Nabers. 'We are providing a lot of input to our clients based on our Australian experience of things such as contractor relationships, how contractors can contribute to the DfP process, and how contractual relationships with tenants can work,' Hill explains.

He adds that advanced energy modelling will need to be part of the design process for MEP design firms if they are to deliver DfP projects.

'The model needs to be sufficiently mature at RIBA Stage 2 to inform the broad decisions around massing and façades, and then it needs to evolve through Stages 3 and 4 to the point where you have a pretty detailed model capable of capturing the efficiency of individual pieces of equipment in the building,' Hill says.

Ruskin Square, in Croydon (left), and St James' Market Phase 2, in central London (right)

Consultant Watkins Payne (WP) is working on another of the BBP's pioneer projects: Phase 2 of the St James' Market development in London's West End for the joint venture between The Crown Estate and Oxford Properties.

Andrew Thrower, a partner at WP, agrees that a lot of work is needed to model HVAC systems to the level of detail that will allow engineers to have a meaningful discussion with the client.

'At RIBA Stage 2, we need to be able to look at different HVAC systems to show the client what the impact is on DfP,' he says. 'For example, the model might show can achieve a 5-star energy rating with a fan coil system, but a 5.5-star rating with a mixed-mode solution – the option the client goes for is a decision that will influence the building design.'

"One of the challenges of undertaking detailed modelling early in design development is that tenants may not be onboard and, so, occupancy details are unknown"

Tenants' energy use does not come under the base building remit, but Thrower says it cannot be ignored. 'Tenants' small power and lighting doesn't come into the Nabers rating, but the more light and power tenants use, the more landlord cooling will be required – and that does impact the building's Nabers rating, along with the way tenants control their on-floor HVAC equipment,' he says.

In addition to modelling expected occupancy, Thrower says it is important to model using what he terms 'off-axis' scenarios: 'What if the occupancy is higher than the figure we've decided to use; or small-power loads are higher or lower than we've anticipated? What is the implication of the building being occupied for longer hours?'

WP tests these different scenarios to arrive at a performance band. 'For example, if the base building has a rating of 5, but the tenants have a particular working pattern or partial occupancy hours, it may bring the rating down to 4.5,' says Thrower. 'Of course, we'll also be looking for opportunities to push up the rating and achieve 5.5.'

One of the challenges of undertaking detailed modelling early in design development is that tenants may not be onboard and, so, occupancy details are unknown. In such cases, Thrower says the model can be run using Nabers default figures – or, in the case of an informed client, data from their existing buildings. 'Nabers has some default figures for office occupancy and small-power usage, which are less than the normal design criteria because most buildings operate at part load for the majority of the time,' he explains.

A key aspect of DfP is ensuring HVAC systems operate efficiently in part-load operation. 'You have to think, I don't want two large heat pumps; I should have four smaller ones, because that will be a more efficient arrangement when the system is operating at part load, which it will be for most of the time,' Thrower says.

He adds that another impact of DfP will be in value engineering a scheme. Under DfP, buildings are given an »

PIONEER PROJECTS

1 Broadgate, London
Developer: British Land
MEP: Hilson Moran

2 Ruskin Square, Croydon
Developer: Schroders
MEP: Arup

4 Angel Square
Developer: Federated Hermes/ MEPC
MEP: Buro Happold

11 and 12 Wellington Place
Developer: Federated Hermes/ MEPC
MEP: Arup

19-35 Baker Street
Developer: Derwent London
MEP: Arup

21 Moorfields
Developer: Landsec
MEP: Cundall

International Quarter London – The Turing Building
Developer: Lendlease
MEP: NDY

New City Court
Developer: Great Portland Estates
MEP: Chapman BDS

Ralli Quays
Developer: L&G Real Assets
MEP: Hannon Associates

South Molton Triangle
Developer: Grosvenor Britain & Ireland
MEP: Hoare Lea

St James Market Phase 2
Developer: The Crown Estate
MEP: WPP

Statesman House
Developer: Royal London Asset Management
MEP: Buro Happold

Timber Square
Developer: Timber Square
MEP: Hoare Lea

For more information on the pioneer projects, visit the Better Buildings Partnership website at bit.ly/CJOct20BBPDfP1

19-35 Baker Street is designed by Hopkins Architects with Arup as MEP engineer

» energy performance rating to two decimal points. This figure is then rounded down to the nearest half a star. 'At design stage, to maximise the Nabers rating, we will try to find the most efficient and effective plant for the HVAC systems, but the contractor might say, "I can save £100,000 using an alternative",' Thrower explains.

'If the scheme is at 4.82 stars (a 4.5 star rating) the contractor might put in different plant that brings the total down to 4.67. OK, that is still a 4.5 rating, but you've reduced your headroom should something else change – and if that drops the rating to 4.49, then the building's rating will reduce to 4 stars.'

The impact of the DfP initiative on the energy efficiency of new buildings will take several years to hit the market. To get a DfP rating, a building has to have been occupied for 12 months at a minimum of 75% capacity, which means the building services consultant will be involved with a project from design, through construction, commissioning and, finally, operation, to input metered data into the model to reappraise it in light of the building's actual performance.

'There will be ongoing involvement to update the model through construction to completion, and then to use the model as a comparison with actual metered data once the building starts to be occupied, so you can track your trajectory to your intended Nabers rating,' says Thrower. 'You might set your goal at 5 stars at the outset, but you will not find out if you've achieved that until about six or seven years after that for a large project'.

Thrower says DfP is not just applicable to new-build office schemes; it will affect existing buildings, too: 'If you have an existing building, and you can get the metered data, you can give that building an energy rating,' he says. 'However, that rating might only be, say, 3.5, because the building was never designed to optimise energy in use'.

As a consequence, the performance of existing offices will have to be improved. 'A refurbishment will need to be undertaken using a DfP approach, because – when an office returns to the market – it will have to compete with newer stock that will have been designed to optimise its in-use energy performance' says Thrower. 'DfP will have a big impact on office refurbishments.' **CJ**

- CIBSE has published new Technical Memoranda, TM61-64, which aim to provide insights into operational building performance, occupant surveys, modelling for energy use, and indoor air quality. *TM63: Operational performance: modelling for evaluation of energy in use* is particularly relevant in the context of DfP as it aims to provide a methodological framework to undertake measurement and verification of building energy performance in use.
- For more on the Better Buildings Partnership's DfP initiative, see 'Learning from Nabers: Designing for performance in the UK', *CIBSE Journal*, at **bit.ly/CJOct20DfP**

CIBSE JOURNAL

HOTEL AND LEISURE SPECIAL

STAGING A COMEBACK

Max Fordham's low carbon retrofit of Croydon's iconic Fairfield Halls theatre

Modern revival

Fairfield Halls theatre in Croydon is a prime example of 1960s public architecture, so when Max Fordham was asked to devise a services strategy during a major refurbishment, it had to stay faithful to the original while maintaining 21st-century comfort and efficiency. Andy Pearson reports

After a £42m refurbishment by MICA Architects, Croydon's Fairfield Halls performance venue has been returned to its original 1960s design intent.

The foyer has been decluttered and the two main auditoria, the Phoenix Concert Hall and the Ashcroft Theatre, have been brought up to date. An underused gallery space to the south has also been converted into two multipurpose creative spaces to expand the types of events the Halls can host.

Trying to bring a 1960s public building up to current comfort standards has been quite a challenge. From a building services perspective, this means delivering the modern levels of comfort and ventilation expected of a 21st century venue, but with the same ducts, risers and plantrooms that served the original scheme.

'One of the really tricky things with working on existing buildings is the constraints they impose on the MEP,' says Edmund Chan, principal engineer at Max Fordham, the project's MEP, lighting and acoustic engineers.

The giant 1,600-seat Concert Hall (1,800 seats including the choir stalls) is at the heart of the building. Its rows of reconditioned, deep-red, material-covered seats are set against panels of Japanese oak that line the auditorium's lower walls.

Rising up from the joinery is the hall's supporting concrete frame, complete with double-skinned brick infill panels, its form clearly visible in the white of the upper walls. At the junction of these two finishes is a dark-coloured band, which contains two rows of jet nozzles for supply air ventilation. Perimeter ventilation supply was a legacy of the original system that Chan has had to adapt to work for the hall's new ventilation scheme.

At this point, it should be mentioned that the outstanding acoustics of the original Concert Hall meant that it had a reputation as one of the best venues for orchestral music in Europe. So good was its reputation, that it was used by the BBC to record classical music performances, mostly without the audience present.

In the original 1960s installation, ductwork transported tempered fresh air from the Concert Hall's plantroom, located above the stage, and through the auditorium ceiling void, from where it dropped down the walls through voids between the brick infill panels to supply air to perimeter grilles.

The architect's philosophy of being true to the original means that alterations to the walls, ceiling or wood panelling were not an option, so Max Fordham had to use

MEP engineers had to work within the constraints of the original building's scheme

The 1960s performance venue is a striking part of the Croydon landscape

COVID-SECURE THEATRES

Many of Max Fordham's clients are asking how building design and operation can help mitigate the transmission of coronavirus. 'The key area on which we can have an impact is the ventilation – reducing the concentration of aerosol through good ventilation in terms of volume, distribution and filtration of air,' says Mark Palmer, senior partner at Max Fordham.

Good ventilation design is about delivering adequate volumes of fresh air to all occupied parts of the auditorium through good design and system controls, says Palmer. 'Displacement ventilation, with air supplied under each seat, is the best way to get good-quality air to every person, because they are sitting in the freshest air in the room, with potentially contaminated air extracted at high level,' he adds.

During the pandemic, theatre operators should also adjust ventilation controls to increase ventilation rates, prevent recirculation of contaminated air, and extend the run-on period.

'In the past, some theatres have not taken air quality seriously enough, but if the public is to return, theatres need to be able to show that they have taken appropriate measures and that things are being done right,' Palmer says.

One positive he hopes will come about as a result of coronavirus is an increased awareness of the importance of good ventilation, which, Palmer says, 'will be no bad thing for general health and wellbeing'.

the existing duct routes to the hall's perimeter to ventilate the refurbished venue. 'For a newly constructed concert hall, you would build in low-velocity supply grilles under the audience seating, but our only option was to supply air into the hall through from the side walls. We had to carefully design the system so that ventilation, audience comfort and noise criteria are all achieved,' explains Chan.

The original system was designed to push 100% conditioned air in from side-wall nozzles, with stale air extracted from grilles set into the auditorium ceiling, with no form of heat recovery or recirculation. 'Air turnover was massive, but using perimeter grilles meant air would never reach the audience seats in the centre of the hall,' says Chan.

The Concert Hall's acoustics are among the best in Europe for orchestral music

Max Fordham's ventilation system for the hall uses three air handling units (AHUs), each with heating and cooling coils, a heat-recovery wheel and an air-recirculation capability. 'You do the hall's temperature control through air recirculation as much as possible, and then you introduce fresh air based on CO_2 levels,' says Chan.

The three-AHU solution adds operational flexibility. One AHU serves the stage area, one the stalls and one the balcony; individual units can be turned off – for example, if the balcony is not in use. 'We've segregated the systems so you have stage vent separated from stalls vent, separated from balcony vent, so you can turn the fresh air down accordingly,' Chan says.

The system is designed to supply fresh air at a rate if $8L{\cdot}s^{-1}$ per person. 'We're limited by the number of nozzles in the auditorium; if we'd wanted to supply more fresh air, we'd have put in more nozzles, but there was nowhere to put them,' Chan says.

To deliver fresh air to where it is needed, and to limit the air velocity through the jet nozzles, Max Fordham used extensive computational fluid dynamics modelling. »

» The jet nozzles are angled between five and 15 degrees from horizontal, depending on their location in the auditorium to ensure good air movement across the audience seating. Noise is minimised using attenuators, lined plenums and by controlling regenerated noise.

'The ventilation system has pre-sets, calibrated to suit different situations,' says Chan. For example, during recording sessions, the facilities team can select a mode that achieves the lowest noise levels and provides sufficient fresh air for an orchestra without an audience.

Where new finishes have been applied to the hall, these have been selected to match the acoustic performance to the original finish they replaced. The one significant addition to the hall is what Chan terms 'acoustic banners'. These are rolls of sound-absorbing material hidden in banner boxes at high level on the walls. For the majority of events, the banners will remain furled, but they can be unfurled to adapt the reverberation time of the hall – for speech-based events, for example.

Max Fordham tested the hall's acoustics as part of the commissioning process. 'Acoustic testing was done during the night to minimise the influence from other noise sources,' says Chan. The acousticians have also used the Covid-19 lockdown as an opportunity to make additional measurements to validate the Concert Hall acoustics and quantify the effect of the acoustic banners.

Ventilating the Ashcroft Theatre

The ventilation system for the 800-seat Ashcroft Theatre is very similar to that of the Concert Hall, with fresh air delivered via wall-mounted jet nozzles and extracted through ceiling grilles; Chan describes it as 'Concert Hall lite'.

Two AHUs serve the theatre; one supplies fresh air to the stage and the front of the auditorium, and the other the rear. 'As with the Concert Hall, we have front and rear AHUs, which can be turned on or off individually depending on occupation levels,' Chan explains. These AHUs have heating coils, heat-reclaim wheels and a recirculation facility, with the ability to add cooling in the future.

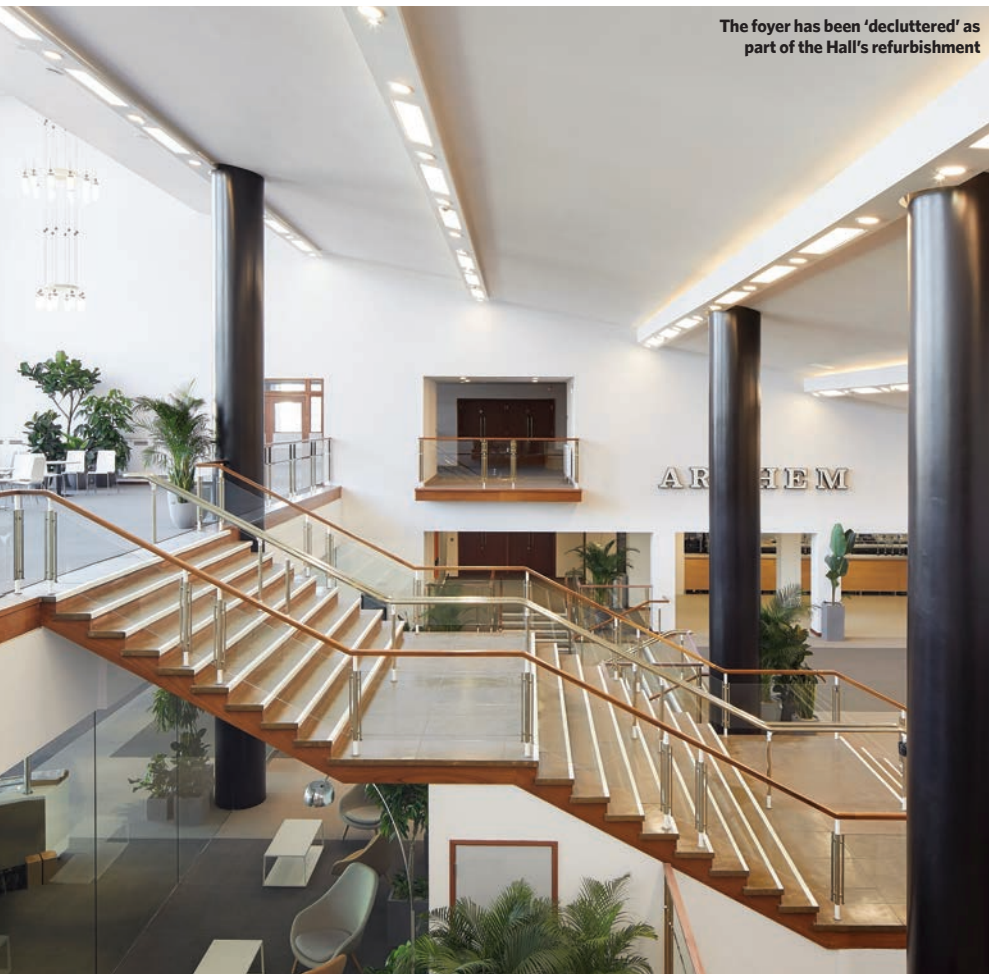
The AHUs are located in a plantroom above the stage. Ducts transport the tempered air from the units and through the ceiling void above the auditorium, to supply branches that drop down in the walls of the auditorium to feed the jet nozzles.

Routing the ductwork through the ceiling void was much more of a challenge for the theatre. Unlike the Concert Hall, which is supported on a concrete frame, the roof of the theatre is supported by a series of dense steel trusses, which Chan describes as the bane of his life.

He says the original ventilation system must have been designed alongside the steelwork very accurately to ensure the ducts could be threaded through the forest of angled steel.

'I'd be lying if I said everything went in as we'd designed it, without hitting a single beam,' Chan says, laughing. 'Some of the voids and risers could only be accessed from scaffolding; when we started to open them up, we discovered things such as downstand beams that were not on historic drawings.

As with the Concert Hall, the challenge



The foyer has been 'decluttered' as part of the Hall's refurbishment

The venue is currently closed because of the pandemic

AHUs for the 800-seat Ashcroft Theatre are located above the stage

"Rolls of sound-absorbing material hidden in banner boxes at high level on the walls can be unfurled to adapt the reverberation time of the Concert Hall"

with the theatre was to provide modern levels of comfort and ventilation within the constraints imposed by the existing structure while keeping noise to a minimum. 'We managed to drive the ventilation rates up by pushing more air to the rear of the auditorium,' says Chan.'Space constraints meant we had to build attenuators into the wall voids, which was a less efficient solution than having one big attenuator upstream.'

Ready to return

The lighting control system for the theatre is also similar to the one used for the Concert Hall. All of the original fittings have been refurbished or rebuilt and fitted with LEDs (see panel, 'Making light work of Fairfield Halls'). All the fittings are tuneable, dimmable and linked to the house-lights system.

The revamped and revitalised Fairfield Halls opened in September 2019 to critical acclaim. Seasonal commissioning of the building services was part of the contractor's remit. The systems' operation was optimised for winter conditions.

However, when it came to commissioning for spring and summer, the country was in Covid-19 lockdown and all performances had been suspended, so commissioning was put on hold until the venue reopens.

Hopefully, it will not be long before audiences can return to appreciate the iconic architecture, comfortable environment and outstanding acoustics. **CJ**

MAKING LIGHT WORK OF FAIRFIELD HALLS

Our overarching ambition in relighting Fairfield Halls, says Chan, was to restore the original character of the venue while using the latest technologies to minimise energy costs and bring a higher level of flexibility and control.

This meant creating bespoke lighting fixtures, sometimes by refurbishing and adapting what was already on site and sometimes by designing new lights based on old photographs and archive evidence of the original installation.

Fortunately for Max Fordham, bespoke lighting manufacturer and renovation specialist Dernier & Hamlyn was based locally.

Perhaps the most challenging of all the lighting projects was the restoration of the eight Concert Hall chandeliers, to bring them up to current electrical standards and enable them to accommodate LED lamps.

The chandeliers' size meant they had to be dismantled carefully on site so they could be transported to Dernier & Hamlyn's workshop. Here, they were stripped back to their original metal finish before being given a new powder-coated finish in a period colour. Replacement glass shades had to be handmade to fit. To complete the restoration, hundreds of crystal elements were sourced and fitted to the conical cowls above the shades; these had been in the original fittings, but had disappeared over time.

Some of the lighting was too far gone to be repaired. Originally, Dernier & Hamlyn was asked to renovate 139 recessed lights. When these were removed, however, it became evident that they were beyond reasonable repair, so Dernier & Hamlyn recreated the original fittings, which it adapted to incorporate LED lamps.

Dernier & Hamlyn also manufactured 44 semi-recessed downlights for the Concert Hall's house lights to replicate the original fittings, using black-and-white photographs from the 1960s for reference.

Similarly, for Fairfield Hall's foyer, three two-tier chandeliers, each 5.4m long, had to be recreated using black-and-white photography from the venue's early days as inspiration. Each chandelier has 20 conical, opal glass shades, supported on 24 metal rods and balls finished in shades of silver and cream. Above each chandelier is a metal ceiling plate that houses control gear for the dimming system.

Max Fordham used ETC ArcSystem lamps in the Concert Hall and theatre, with tone-adjusting dimming for a warm ambience and fittings controlled by a wireless DMX system. Low-energy decorative fittings by Lucifero and Lightnet were chosen to add interest to the circulation spaces.

The two-tier chandeliers in the Hall's foyer are each 5.4m long

Unwanted guests

Bipolar ionisation can improve air quality and remove odours from hotel rooms, says Spire Building Services' Adam Taylor, who highlights research in Spain on its use to reduce the risk of Covid-19

When people book stays in hotels, they expect high levels of cleanliness. Now, discerning customers are also demanding high indoor air quality (IAQ). One way hotels have been improving IAQ and removing odours is by installing bipolar ionisation systems, which have now also been tested for their effectiveness in eliminating Covid-19.

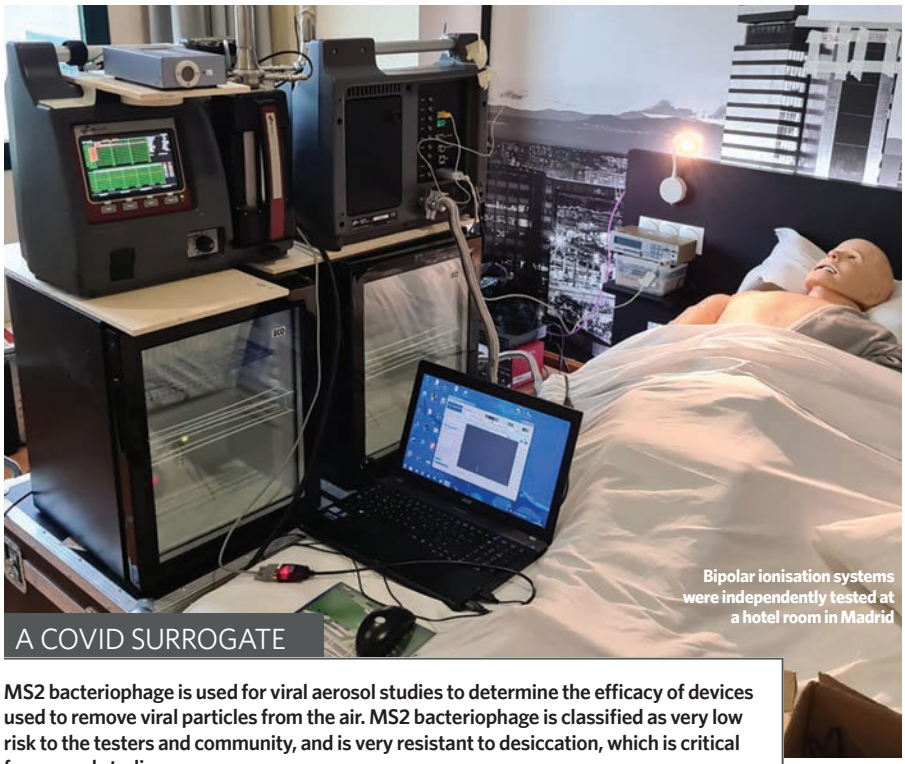
Bipolar ionisation systems are placed inside the HVAC system to give an electrical charge to the air passing through them. The charge creates a plasma (an energised gas) containing positive and negative ions, which are then distributed throughout the space.

Where these charged molecules encounter particles in the space, they give over their charge. When particles in the room have opposing charges, they are attracted to each other, causing the particles to clump together, or 'agglomerate'. This agglomeration process turns particles in the air from being <5μg – and, therefore, classified as aerosols – to >5μg, at which size they fall out of the breathing zone faster or get removed by low-grade filters.

Bipolar ions also break down the surface proteins of the virus, rendering it inactive. This is particularly helpful for deactivating virus trapped in filters.[1] The ions also react with volatile organic compounds (VOCs) and odours, breaking them down into more stable compounds.

Hotel rooms are challenging spaces in which to deliver good air quality, with plenty of moisture created by guests using baths and showers. Frequent cleaning can also leave high levels of VOCs in the rooms. Washed and changed bedding releases a large amount of lint into the air, which – as well as being a respiratory irritant – clogs HVAC filters and decreases coil efficiency.

Because of the low air-change rate, a room recently vacated by a person infectious with Covid-19 could, potentially, contain a high level of viral particles in the air and fomite depositions on surfaces, presenting a risk to the housekeeping team. Hotels are currently leaving extended amounts of time between guests checking out and the housekeeping team heading in to clean and make up the room. Settling times for infectious droplet nuclei <5μg are likely to exceed the time that a room is left vacant between guests, so these, potentially, pose a risk to staff and guests long after an infectious person has left the hotel.



Bipolar ionisation systems were independently tested at a hotel room in Madrid

A COVID SURROGATE

MS2 bacteriophage is used for viral aerosol studies to determine the efficacy of devices used to remove viral particles from the air. MS2 bacteriophage is classified as very low risk to the testers and community, and is very resistant to desiccation, which is critical for aerosol studies.

Viruses cannot replicate outside of a host, so one way of testing for their presence is by choosing a virus that infects enteric bacteria.

In May 2020, in a hotel room in Madrid, bipolar ionisation systems were independently tested by INTA, the Spanish National Institute for Aerospace Technology, and Spanish Plasma Air distributor Tayra. A Plasma Air PA600 device was fitted to the outlet of a fan coil serving the room. A SARS-CoV2 surrogate, MS2 bacteriophage (see panel above), was aerosolised into the room air via a nebuliser. Air samples via a solid bio sampler and surface swabs were taken for analysis at the laboratories of INTA. After just 10 minutes, the concentration of bacteriophage in the air captured by the solid bio sampler showed a log two (99%) reduction compared with the control. Swab samples taken from surfaces around the room showed an ~80% reduction in bacteriophage counts on surfaces.

In September 2020, testing conducted in cooperation with Nagasaki University in Japan[2] demonstrated that, in a small, three-litre test chamber, aerosolised SARS-CoV2 concentration was reduced by 91.3% when exposed to Bipolar ions.

Many hotels had installed Bipolar Ionisation systems pre-Covid to enhance general IAQ. Chains such as Ritz Carlton, Marriott and Four Seasons have recently adopted the technology to give customers confidence to book a room. CJ

ADAM TAYLOR is managing director at Spire Building Services

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1 Hyun J et al. Application of corona discharge-generated air ions for filtration of aerosolised virus and inactivation of filtered virus, May 2017, *Journal of Aerosol Science*, **bit.ly/CJOct20AT**

2 Sharp Plasmacluster technology reduces airborne coronavirus, September 2020, *Industry Analysts Inc*, **bit.ly/CJOct20AT3**

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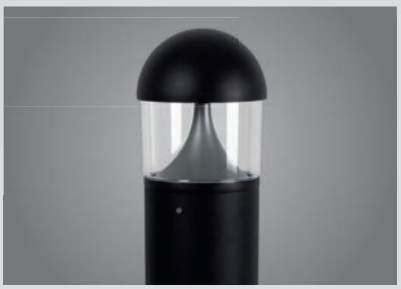

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Advancing towards 'smart' lighting control for the built environment

This module explores the latest wireless lighting-control system technology and what it offers for building applications

Where once individual lighting-control systems could, potentially, appear unwieldy and complex, a developing generation of 'smart' wireless solutions can ease implementation and open up opportunities to enhance building users' experience. This CPD article will consider how the latest wireless lighting-control systems are bringing the industry up to speed in the increasingly digital world.

As the demand on building lighting systems to perform effectively and cost-efficiently has become more intense, so has the need for control solutions that allow building operators and end users to readily maximise the potential of their systems. Alongside this, the digitalisation of buildings, and the associated industries, continues to move forward. The recent explosion in remote working, learning and social networking has accelerated buildings towards a digital age, where flexible operation is becoming increasingly important as occupants expect improved agility in the control of their spaces. Progressively, technology is catching up with user demands.

In recent times, the attention of the wider lighting community has shifted – or, more correctly, broadened. While there is still a focus on energy efficiency, system longevity and ease of installation, the advent of LED lighting has, in many cases, already made this more achievable. Alongside this, however, there is a rising demand for, and increasing focus on, control, flexibility and connectivity.

The aspirations to better meet the needs of occupants are not new – they were evaluated by Bordass and Leaman[1] more than 20 years ago, as shown in Figure 1. But there are now increased opportunities to fulfil these desires because, in the intervening years, the capabilities of the enabling technologies have developed.

The end goal, and the overall objective, remains to: enhance occupant health, wellbeing and productivity; minimise environmental impact; minimise operational and total life costs; and collect and intelligently process system performance data. As explained in CIBSE TM40: 'The lighting design should also incorporate a level of user control in order to increase satisfaction and comfort, and to respond to different visual performance needs and glare control if tasks vary.'

As discussed in *CIBSE Journal* CPD module 147 (June 2019), the visual environment can significantly impact the health and comfort of building occupants. As staff are by far the largest cost in offices – typically 85% to 90% in the UK and US (as reported in TM40) – a small improvement in staff productivity can result in large improvements in profit margins. However, CIBSE Society of Light and Lighting (SLL) LG14[2] notes that a well-informed and interested user group is necessary to ensure that the control system performs at its best, with less chance of compromise to its operation in subsequent months or years. User expectations can often be influenced by poor communication during the design process, and the lighting-control designer should seek to engage with the user group as early as possible to establish an understanding of their needs. Unrealistic expectations on the part of the user can develop so that the system is left unused or bypassed, resulting in issues such as a lack of flexibility (in terms of comfort control) or a reduction in efficiency (in terms of energy control).

Until relatively recently, the multiplicity of wired network standards meant that connecting even medium-sized lighting »

installations to control systems could be an expensive and time-consuming task. Traditionally, luminaires have been linked through wired networks that are connected to each fitting to achieve overall control. While the benefits of such networks – often controlled using the digital addressable lighting interface (DALI) protocol – can be considerable, they can also lead to significant additional cabling requirements, with the attendant cost implications. Extensive cabled networks can also be challenging to amend when luminaires fail or need to be updated. This position has recently changed with the advent of the standard DALI wireless protocol (see 'DALI' panel). Lighting networks that use wireless DALI connections enjoy the same benefits as a typical DALI system, but without the set-up and maintenance of large-scale wired solutions. In a wireless system, integrated wireless nodes are housed within the luminaire and communicate with each other, eradicating the need for a physically connected network with its associated cabling requirements.

Inevitably, safety and security are priority concerns with all building systems, and lighting control is no exception. As highlighted in CIBSE's recent cyber security publication, *CIBSE DE6.1: Cyber security in building services design*, when considering the security of such systems, a traditional wired system with tamper-evident protection is generally preferable to the use of wireless connectivity. Wireless is inherently less secure; a malicious – or simply inadvertent – interruption, or interception, of network traffic can take place in the vicinity of a system, and standard encryption protocols may be insufficient to prevent such an attack. The majority of the recently developed wireless lighting-control systems occupy a frequency outside of the spectrum occupied by Wi-Fi or Bluetooth systems (typically 868MHz). This makes them less susceptible to disruption, allowing the wireless network to operate in a more secure and reliable way, which is a particular requirement if there are multiple remote sites. It is prudent to assess the risks and evaluate opportunities, as deemed necessary for the particular application, for enhanced security, system redundancy and provision for fallback in case of failure.

With the extra cabling needs removed, networks can be scaled up with minimum disruption, while additional spaces or even separate buildings can be brought under the control of the same system. For designers and consultants, this means that lighting installations are not rigidly fixed at the time of commissioning. Instead, they can be adjusted as the occupancy and usage patterns of individual spaces or entire buildings develop.

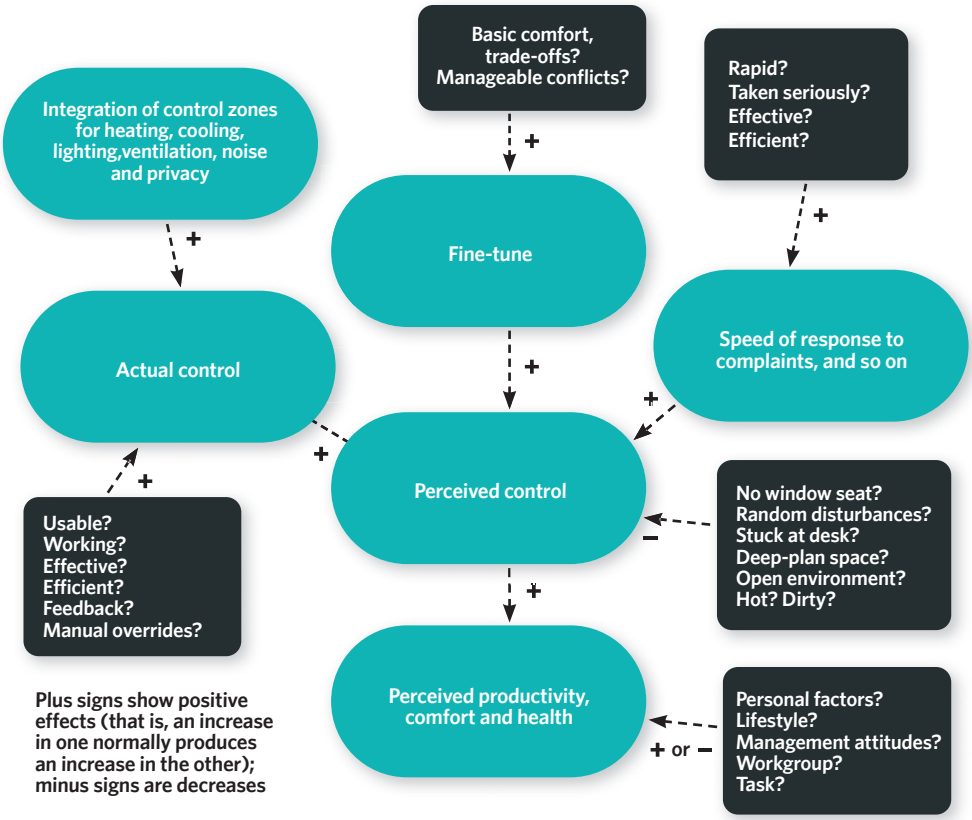

Figure 1: Control strategies: three routes for better occupant satisfaction (as illustrated in the recently updated CIBSE TM40[3])

The simplified scalability of the wireless system makes it practical for operators to control entire estates, and even manage multiple sites. In conjunction with building management software, this allows luminaires to be assessed for repair or maintenance without the need to be on site to check for fittings that are in need of repair.

The lighting-control system allows building operators to make system-wide assessments of, and changes to, the lighting function. Luminaires can be managed on an individual or group basis, depending on the requirements. This enables the simple, but functionally important, parameters for each fixture to be amended quickly and easily. The nodes can be readily addressed with an app or online portal, and entire systems can be monitored, controlled and managed remotely, with nodes passing the commands between each other.

Sensors can be applied to groups or to individual fittings, with the settings for these sensors altered and adjusted depending on the needs of the facility. This also allows maximum outputs to be set for luminaires and illumination for spaces to be reset with reference to outdoor conditions, or time of day, so as to keep lighting levels and energy costs under control. A room can be programmed to have several different 'scenes', each equipped with different lighting levels and

DALI

Digital addressable lighting interface (DALI) systems protocol can be used to broadcast – typically to groups of luminaires in zones – to activate and maintain on/off, scene setting and dimming control. DALI-addressable systems, which are able to communicate with individual devices and luminaires, provide additional functionality, such as lamp-status feedback, lamp colour temperature shift, and automatic test and monitoring of emergency lighting. Each field device and luminaire has an individual address for control and identification purposes. The recently updated DALI standard IEC 62386-104:2019 specifies the use of DALI with wireless instead of a wired bus system. (The underlying transport protocol differs from the conventional wired DALI bus system that is described in part 101 of the standard.)

Figure 2: Integrating PIR data to infer building occupancy – red = denser occupation (Source: Enlighted[4])

colour temperatures that can be selected manually using wired or wireless wall plates, or via apps. The SLL LG14 highlights the opportunities afforded by 'scene setting' that allows the user to recall different lighting scenes, which may also incorporate a manual dimming override and automated/manual operation of associated window blinds. These employ components including integrated passive infrared (PIR) sensors and sensors for daylight harvesting systems, with each node communicating with the managing control system.

Live reports of the status of luminaires, sensors and emergency systems can keep building operators informed of potential interventions and changes that may be required in the lighting system. The building management software can highlight which fittings are in need of repair, so they can be dealt with to minimise consequent problems. This can be particularly useful, for example, in retail environments and spaces that rely on the 'visitor experience', helping to understand which luminaires may be approaching the need for maintenance so that they can be attended to effectively at the most convenient – and least disruptive – time.

'Intelligent' environmental monitoring and control – informed from the output of PIR sensors that are connected to, or integrated into, luminaires – can provide the information to create real-time, detailed occupancy maps. In the building illustrated in Figure 2, the areas highlighted in red have more PIR sensors activated than those areas in green, indicating that these zones are more occupied. This is crucial data for those in retail or warehouse environments, but this can be easily applied to a wide variety of applications. So, for example, the system can mesh its data with that from the building management system, the conference-room scheduling system, ambient daylight and the weather, to manage light levels. It can also pair room occupancy with HVAC data, so the building knows which rooms to heat and cool.[2]

Another advantage of the more recent lighting-control systems is that they often support scheduled emergency lighting self-testing. This can reduce ongoing interventions and costs – for example, the current market price for monthly mandatory emergency lighting tests is £200 (for up to 30 lights) when conducted manually. Manual tests also require recording and logging of all results, to be presented to the relevant authority upon request. Traditional self-test systems do support automatic testing, which already reduces the costs of manual tests and automatically logs the data. However, these legacy networks typically conduct such tests at random times. The nature of such tests – replicating a loss of mains power to assess the reliability of the emergency lighting – meant that their random occurrence could disrupt day-to-day activities. Wireless communication built into emergency lighting luminaires can also simplify adaptation of installations to new fire-safety requirements and reorganised building layouts.

The integration of wireless devices into the lighting systems can provide key advantages over traditional DALI systems and deliver enhanced lighting control, data collection and building management, scalability, and more effective emergency lighting. Such 'smart' lighting is not exclusive to new construction – there is good opportunity for the new generation of lighting to be applied to the existing building stock. The replacement of an existing system with a wireless network requires the installation of new luminaires with an integral 'smart' node. The small wireless DALI nodes ensure that the new fitting is physically no more difficult to install than an existing luminaire.

As building operators work to recover from the effects of the current global health and economic crises, the attraction of working from home has never been greater. As part of the required catalogue of adaptations – many of which can be seen in the CIBSE guidance at **www.cibse.org/coronavirus-covid-19/emerging-from-lockdown** – the decision-makers will be seeking ways to make their buildings a more appealing place to visit, work or learn in, and the adoption of smart lighting systems can provide an achievable route to enrich the occupant experience. Although it may be impossible to replicate the flexibility and control of the home environment, smart lighting systems can empower occupants with enhanced levels of control over their immediate environment that would, previously, have been practically unattainable, while ensuring that the building systems operate efficiently.

Turn to page 54 for further reading and references. »

Module 169

October 2020

1. In the 'routes for better occupant satisfaction', which of these is the final destination?

- ☐ A Delivering fast speed of response
- ☐ B Fine-tuning of occupant conditions
- ☐ C Perceived control
- ☐ D Perceived productivity, comfort and health
- ☐ E Providing actual control

2. What proportion of office costs are thought to be directly related to staff?

- ☐ A Less than 25%
- ☐ B 30% to 35%
- ☐ C 45% to 50%
- ☐ D 65% to 70%
- ☐ E 85% to 90%

3. What is the recent change to the DALI standard that has enabled the wider application of lighting-system control for occupant and operational benefit?

- ☐ A Incorporation of zone control
- ☐ B Integration of field devices
- ☐ C Introduction of scene setting
- ☐ D Provision of individually addressable luminaires
- ☐ E Standardisation of wireless DALI protocol

4. What devices provide information to enable the example of detailed occupant maps, which could potentially be used as part of the HVAC control system?

- ☐ A Acoustic sensors
- ☐ B PIRs integrated into luminaires
- ☐ C Luminaire-mounted light sensors
- ☐ D Vibration sensors
- ☐ E Wireless-connected door-entry counters

5. When refurbishing and upgrading buildings with wireless-controlled lighting, which of these is most likely to be true?

- ☐ A It is very likely that it will fully replicate the flexibility and control of the home environment
- ☐ B Small, integrated DALI nodes mean that new fittings are likely to be no larger than existing luminaires
- ☐ C The new luminaires will be restricted to working in unison as a single group
- ☐ D The replacement system will require a separate power circuit
- ☐ E There will be a significantly reduced need for power cabling

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Further reading:

(All freely downloadable from **cibse.org** for CIBSE members)

CIBSE DE6.1 (2019) – *Cyber security in building services design* is a unique document that covers an increasingly important area.

CIBSE TM40 (2020) – *Health and wellbeing in building services* is an excellent document providing up-to-date guidance.

These three publications from the CIBSE Society of Light and Lighting provide key design advice for lighting system design: *SLL Lighting Handbook* (2018); SLL LG 14: *Control of electric lighting* (2016); and LG7: *Lighting Guide – Offices* (SLL, 2015a).

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1 Leaman, A and Bordass, W, *Strategies for better occupant satisfaction*, 5th Indoor Air Quality Conference, London 1997 – **www.usablebuildings.co.uk/UsableBuildings/Unprotected/StrategiesForBetterOccupantSatisfaction.pdf**

2 Society of Light and Lighting LG14 *Control of electric lighting*, CIBSE 2016.

3 CIBSE TM40 *Health and wellbeing in building services*, CIBSE 2020.

4 *In LEDs, some see an intelligence to rival smartphones* – **www.enlightedinc.com/news-coverage/in-leds-some-see-an-intelligence-to-rival-smartphones** – accessed 9 September 2020.

SLOWING THE FLOW

Overestimating water flow rates means plant is oversized and water is wasted. Heriot-Watt University's **Sarwar Mohammed** considers a new method for calculating flow rates accurately in non-domestic buildings

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It is essential for engineers and designers to have an accurate estimation of peak water demand in buildings, to design proper water-supply systems, storage tanks, boilers and booster pumps.

Previous studies have shown that the amount of drinking water used in buildings has reduced significantly as a result of a considerable change in water efficiency and user behaviour. Despite this, however, traditional design approaches are still used for determining design flow rate; which results in overestimation of water demand.

In recent research, the focus has been on residential buildings – for example, the Loading Units Normalisation Assessment (Luna) project between CIBSE, the Chartered Institute of Plumbing and Heating Engineering (CIPHE) and Heriot-Watt University is looking at the most appropriate approach for estimating the design flow in residential buildings. See **bit.ly/CJOct20SM1** and 'Stemming the flow', *CIBSE Journal*, April 2019. However, there has been little, if any, research to assess the validity of current design methods for non-residential buildings.

Non-residential buildings can be characterised as having significant water demand that is strongly influenced by occupancy profile. This means that water use during daytime hours is a specific feature that differentiates the profile from that for residential buildings. In the UK, however, the Loading Unit (LU) approach is currently used to estimate design flow rates for both residential and non-residential buildings.

Addressing oversizing and updating design methods has become more important because the problem not only introduces cost inefficiency, but can also have a negative effect on water quality.

Recently presented at the CIBSE ASHRAE Technical Symposium, this paper discusses the extent of the problem by presenting a comparison between design flow rates calculated from existing design guides and measured flow rates for four case-study buildings. It confirms that current methods result in an overestimation of design flow rate, and emphasises the need to develop a new design technique to support a better estimation of flow loading. It also presents an early-stage model that has been developed to estimate design flow rate specifically for non-residential buildings.

The loading unit method

The LU used to calculate the estimated design flow rates is based on »

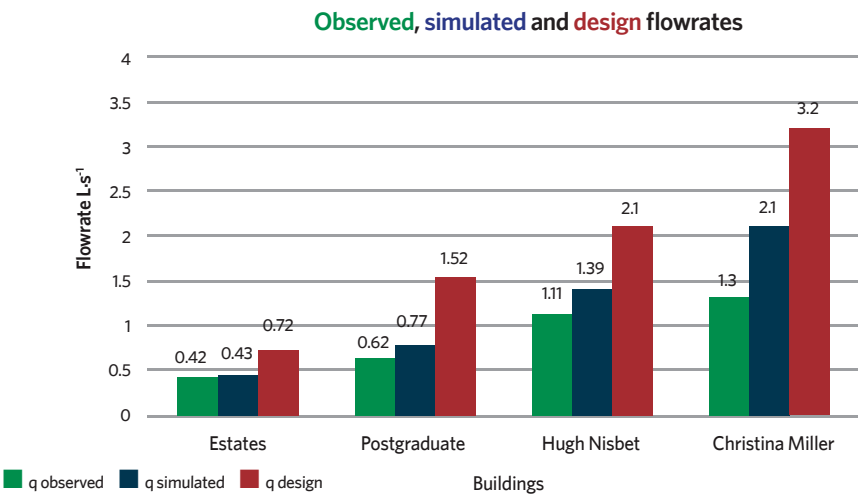

Figure 1: Flowrates for three non-residential buildings and the Christina Miller halls of residence at Heriot-Watt University

» work by Hunter, who developed the design curve in 1940. It forms the basis of the following UK design guides: BS 6700; BS EN 806; BS 8558; and CIPHE loading unit method. The CIPHE method is the only guide that can be recommended for non-domestic buildings, however, as it allows a specification of the time difference between the use of appliances. Low use is deemed to have a time difference of 20 minutes, medium 10 minutes, and high five minutes. High use would be for buildings such as theatres or sports venues.

The author measured the actual flow rate at four buildings using an ultrasonic flow meter at Heriot-Watt University. Three of them – the Estates Building, Postgraduate Centre, Hugh Nisbet– are non-domestic, and one, the Christina Miller Hall, is student accommodation.

For the Hugh Nisbet Building, the maximum flow rate was 1.6L·s^{-1}, while, at the 99th percentile, the rate was 1.11L·s^{-1}. (The 99th percentile figure is used in LU methods.)

The actual flow rates were compared with the estimated design flow rate for each building using the LU method. The design flow rate was found to be significantly higher in each building, with the Hugh Nisbet's estimated rate being 89% higher, at 2.1L·s^{-1}. The largest overestimate was the Christina Miller halls of residence, which had a design flow rate 146% higher than the actual flow rate (see Figure 1).

New design approach

A new water-demand estimation model is based on the relationship between the number of users and the number of appliances, and when they are used. The Monte Carlo simulation method is used on this data to predict the probability of different outcomes. A Monte Carlo analysis is used when there are unknown variables and involves running many scenarios with different random inputs and summarising the distribution of the results. The model gives a probability distribution of flow rates and generates a cumulative distribution function (CDF), which gives a design flow rate for the system. Figure 2 shows the simulated flow rate for the Postgraduate Centre. To design a water system to meet all the building's demand, you need 1.1L·s^{-1}, but – for the 99% percentile – the CDF gives a value of design of 0.794L·s^{-1}.

> "Oversizing not only introduces cost inefficiency, but can have a negative effect on water quality"

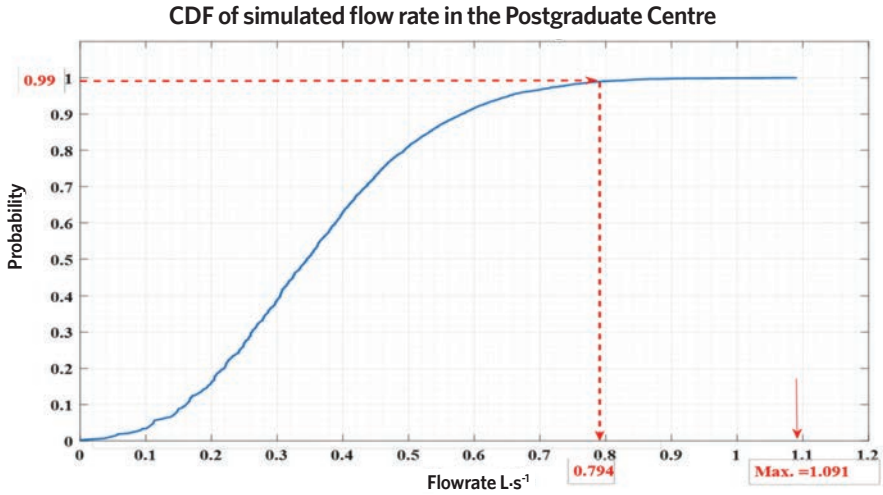

Figure 2: For a water system to meet all the demands of the Postgraduate Centre the CDF gives a value of design of 0.794L·s^{-1}

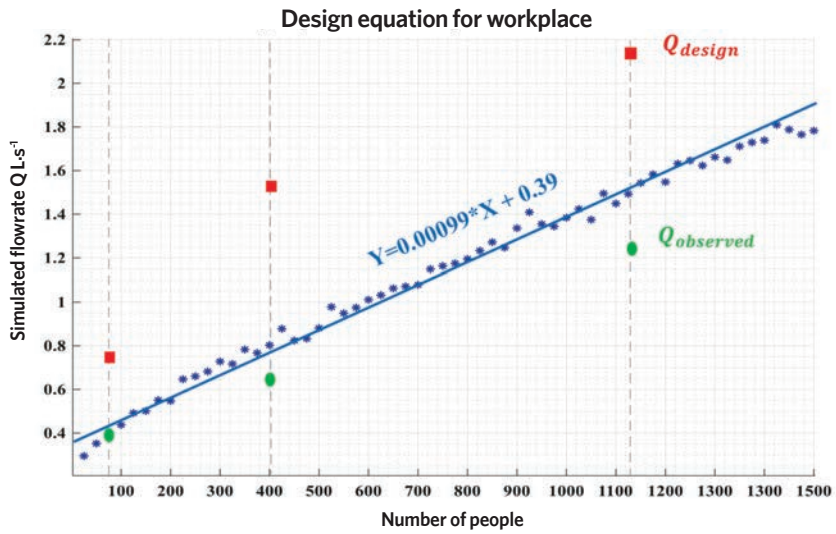

Figure 3: The design equation is very close to actual flow rate; the gaps are considered factors of safety

The simulated flow rate is very close to the actual flow in all four buildings, and there is a significant reduction in flow rates when compared with the design flow rate calculated using the LU method in current design guides (see Figure 2).

This model can be applied to calculate a simulated flow rate for a workplace with varying occupancy. In Figure 3, the X-axis represents the number of people, while the simulated flow rate is on the Y-axis. The points on the graph are obtained after running the model 200,000 times. By drawing a best-fit line, a design equation can be obtained, where Y=0.00099*X +0.39. To validate the model, actual flow rates have been measured in three buildings (plotted in green and red on Figure 3). The design equation is very close to actual (observed) flow rate. The gaps can be considered factors of safety. When compared to the rate obtained from the design guide, the actual flow rate is considerably lower.

While further research is needed to cover other types of buildings with more occupants, this research suggests the model is much better than the current design guides at estimating flow rates. This offers the opportunity to avoid oversizing of water systems and, so, cut water use and reduce expenditure on plant. **CJ**

SARWAR MOHAMMED is a PhD student at Heriot-Watt University

The paper *New method to design flow rate in non-residential buildings* was presented at the 2020 CIBSE ASHRAE Technical Symposium. All the papers and presentations are available at **www.cibse.org/symposium**, and are free to full-time student members and available for £50 for CIBSE and ASHRAE members.

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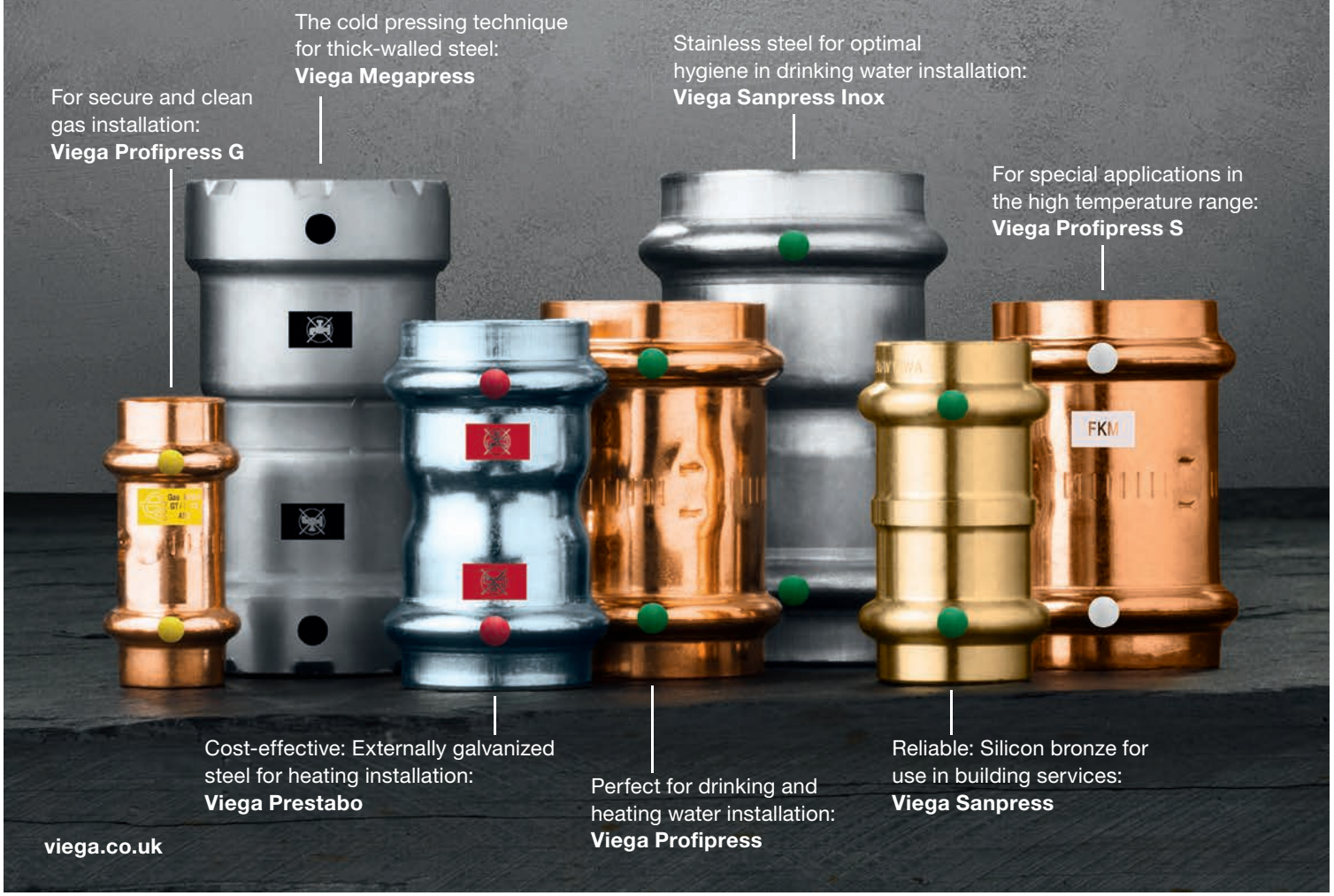

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Corroding influence

Good water quality is essential for good heat-network performance, says Telford Homes' Chris Savoy

Telford Homes is a large build-to-rent developer working predominantly in the London area. Over the past few years, we have been improving the quality of the design and delivery of our district heating installations, with the assistance of FairHeat, a specialist in heat networks with which we work on all our projects.

Obviously, it is important that the design is correct, with controls in place that allow plant to operate as intended. One thing of which we have become increasingly aware, however, is the importance of correct water quality.

For what is required, we turn to BSRIA BG29/2020 *Pre-Commission Cleaning of Pipework Systems* (the 6th, revised edition has just been published). Everyone, I'm sure, is aware of the importance of leaving a system with the correct chemical inhibitor present, but what you may be less aware of is that this needs to happen from the minute the pipework is filled with water, because corrosion starts straight away and is irreversible

Water in all parts of the system also needs to be kept moving, so consideration must be given to how the system will be progressively filled, using system pumps where possible to keep the water circulating. This is particularly important when projects take several years to complete and the works phased, and temporary pumps may be required.

With the increased use of plastic pipework, oxygen introduced in the fill water has nothing to attack, which leaves any metal in the system – such as boiler plant or radiators – as a target. To ensure water quality is optimal, regular samples need to be taken from all parts of the system and analysed, and additional chemical adjustments made if it is found to be deficient.

As advocated in BG29, plotting the results on a graph over time shows trends in the chemical properties and provides evidence about the state of the system. Trends are useful because chemical parameters that are above their limits, but which have stabilised, are less of a concern than those within the limits but increasing, as this indicates corrosion is taking place.

BG29 now includes more focus on thin-walled carbon steel pipe, which – because of its thin wall – elevates the importance of correct water treatment where it is used.

Although this all sounds expensive, bear in mind that – once a building is occupied –the potential cost of remedials to systems because of poor water quality would far outweigh the investment.

CHRIS SAVOY is head of services at Telford Homes

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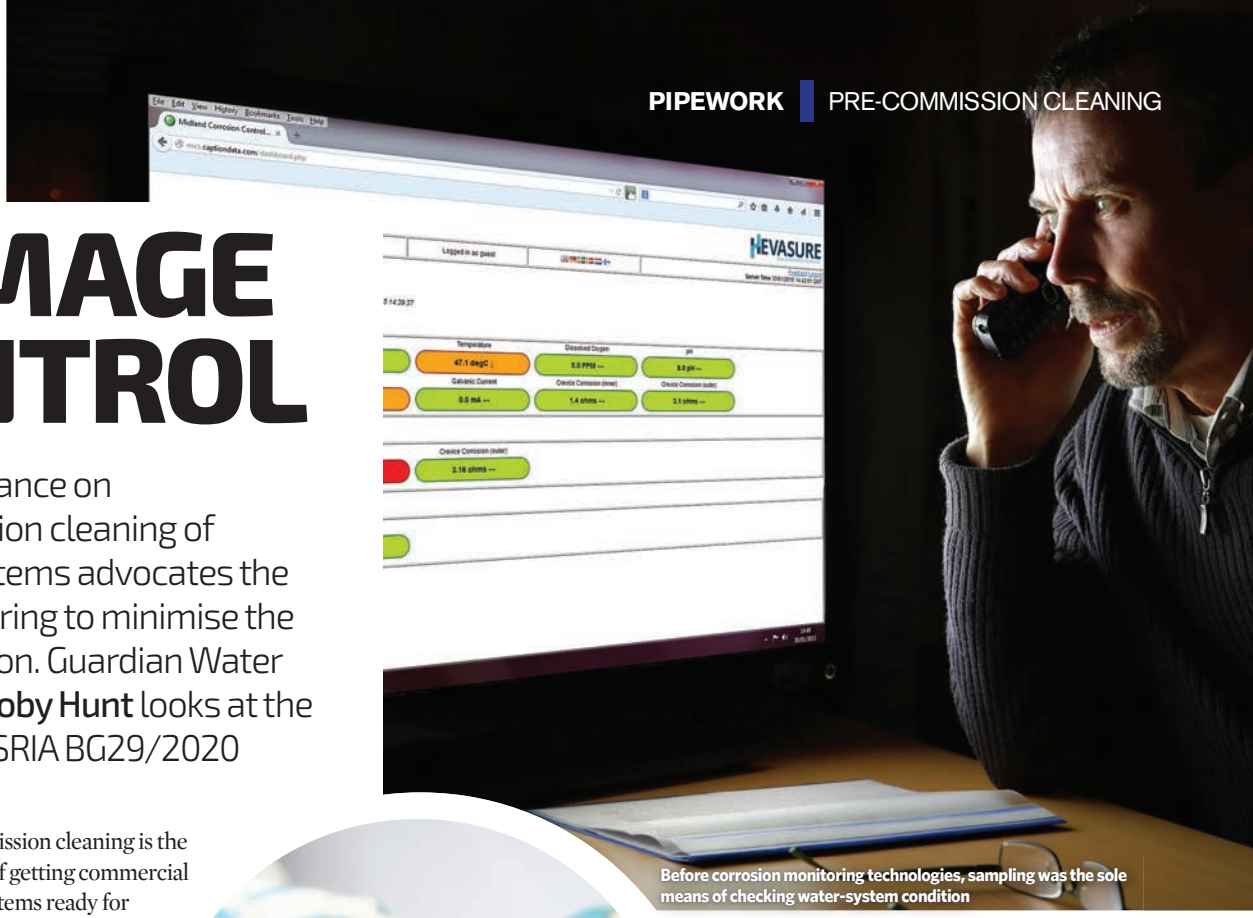

Before corrosion monitoring technologies, sampling was the sole means of checking water-system condition

DAMAGE CONTROL

Updated guidance on pre-commission cleaning of pipework systems advocates the use of monitoring to minimise the risk of corrosion. Guardian Water Treatment's **Toby Hunt** looks at the revisions in BSRIA BG29/2020

Pre-commission cleaning is the process of getting commercial water systems ready for operational life. What happens at this stage is crucial to the ongoing efficiency and longevity of a water system; get it wrong, and building managers are left with pipework that is more likely to corrode, leading to expensive repairs and possibly breakdown. In large commercial buildings, these mistakes could cost millions.

Over the past eight years, since the previous edition of BSRIA's guide to pre-commission cleaning of pipework systems (BG 29/2012) was published, our understanding of corrosion – and the development of new technologies – mean that water systems are becoming more efficient, with a much lower risk of degradation. A new version of the publication, *Pre-commission cleaning of pipework systems 6th Edition* (BG 29/2020), was released on 30 April, and includes a number of changes that incorporate the latest best-practice techniques and processes.

The latest version of BG 29 places far more emphasis on accurately detecting dissolved oxygen (DO) and the potential impact on future system health. On page 19, variables that influence corrosiveness of water are listed, including DO, CO_2, pH and the presence of dissolved solids. DO can be particularly corrosive, either directly or by microbial-induced corrosion, which 'usually occurs under existing corrosion debris and, therefore, is most likely to be a risk following a period of oxygen-induced corrosion'.

Oxygen ingress can occur for a number of reasons. The biggest cause of early pipework failure is a lack of pressurisation, whereby air is not removed from the system during the initial fill, or air is drawn down into the system because of negative pressure caused by pumps.

The advent of effective 24/7 remote monitoring is allowing us to better detect DO. Other indicators – such as changes in pressure – can also signify problems. The guide states that specialist corrosion-monitoring equipment can measure and record specific corrosion-influencing parameters. It says data can give maintenance teams early warning of conditions likely to promote internal corrosion.'

Before the development of corrosion-monitoring technologies, sampling was the sole means of checking water-system condition, a process that doesn't effectively detect for DO. This new transparency also has benefits for water-treatment experts and the facilities managers who take on responsibility for a building. We can now see if the work we have done has been effective, and track activity throughout the whole process – from cleaning to handover and beyond. We have saved our customers hefty repair bills by accurately attributing a specific activity to a problem and a liable party.

Remote monitoring is specifically mentioned in the guide in relation to carbon steel – a pipework solution that has benefits in terms of cost and ease of use, but which can be more prone to corrosion. Additions to BG 29/2020 include advice on cleaning carbon steel to prevent degradation; harsh chemicals should be avoided. The guide states that, once installed, thin-walled carbon steel must be maintained in a fully pressurised condition so that DO levels in the water are minimised. It also advises measuring DO levels in the circulating water, with corrosion monitoring used throughout a thin-walled, carbon-steel system's life.

Section 4.5 focuses on how internal pipework conditions and, consequently, water quality can deteriorate rapidly if systems are not managed properly during the period up to practical completion. Routine checks, such as operating pressures and fill water volumes, are key to ensuring condition; good circulation must be maintained to prevent bacterial proliferation and, crucially, system drain-downs should be avoided where possible.

BSRIA's BG 29/2020 gives a better understanding of the factors impacting our water systems and better ways to track their condition. A word of caution, though: it is a guide, not legislation, so anyone responsible for the maintenance and management of HVAC water systems is advised to look at every project individually. CJ

TOBY HUNT is a key account director at Guardian Water Treatment

BELLOW EXPECTATIONS

The consequences of specifying low-grade rubber bellows for pump systems can be costly and dangerous. **Eddie Warren**, of Supaflex Agencies, says a British Standard is long overdue

The failure of rubber bellows in pumps and plant can have serious consequences. A flooded plantroom where hot water is kept to 65°C to avoid legionella is dangerous to personnel, and the damage to plant and the building can be costly.

Low-pressure and medium-pressure hot-water boilers are particularly prone to sudden burst failure. I have seen numerous examples of burst bellows, and been involved in well-known projects that have had to replace all their rubber bellows. Where working temperatures of the systems are much lower – such as on chilled water and closed cooling water systems – failure is less likely, but with poor maintenance, it can still happen.

Standard IE BS 6129-1 for metallic bellows, was published in 1981. The global standard for metallic bellows is covered by the Expansion Joint Manufacturers Association. In the UK, those specifying rubber bellows can use German DIN 4809, as there is no BS EN standard.


Example of a burst rubber bellow


A high-grade EPDM tied unit with polyester ether keytone reinforcing in the body. Produced by Elaflex/Continental, it meets DIN 4809

Rubber bellows, which are used for flexible connections to pumps, are mostly ethylene propylene diene monomer (EPDM) with steel-collar reinforcing and nylon reinforcing in the body. The degradation of the nylon at high temperature is substantial; it deteriorates with age, and this also applies to the EPDM. High-grade rubber bellows are not reinforced with nylon in the body. In the mid-1970s full steel cord mesh was used, but this was found to fret through the EPDM wall. Kevlar (aramid fibre), developed by Dupont, was then used for many years, to be superseded by polyester ether keytone (PEEK).

Only a very small number of rubber bellows manufactures are approved under DIN 4809. The formation of the Rubber Bellows Manufacturers Association has been instigated to only allow membership from manufacturers of high-grade rubber bellows.

EDDY WARREN is the owner of Supaflex Agencies

Valve control

Expensive valve failure happens because specifiers do not engage with the experts in the supply chain, according to Designed Network Solutions' Craig Stanners, who says price should not be the deciding factor

So, you have a problem with a faulty valve? Again? After less than five years' use, it has corroded, causing pressure issues in the building. You call the supplier and ask for a replacement 80mm pressure-relief valve (PRV) – and they gladly say: 'Here you are, sir.' Job done.

If the valve had been specified correctly in the first place, it would have comfortably served a 25 to 30-year lifetime.

The scenario is a real-life example from a landmark London building, where the valve was the wrong specification and not suitable for a hot-water application. You'd have thought it would have been straightforward to establish at the design stage whether the water would be 'hot' or 'cold', but no. Another unsuitable, not-for-purpose valve has been ordered and installed – and so the cycle goes on.

If I get asked for an 80mm PRV, I want to know more about the installation. Is it for drinking or waste water, hot or cold? What are the flow rates, source of supply, and pipe diameters, and what detail is there on the local network or application?

"What can your supplier offer? If all they can or want to do is sell you a valve, walk away"

Expertise

In the example above, what the customer wanted – a solution – was something the valve manufacturer could not, or would not, provide. A void in expertise is partly the result of skilled engineers being replaced by outsourcing. It's also caused by classroom teaching that awards students qualifications after a very short amount of time. Working on the tools, getting your hands dirty and picking up practical tricks of the trade that allow you to think outside the box will always give you the edge over those glued to their desks and their PCs.

In the building and the plantroom, one can build up a picture of how to fine-tune what might be a relatively simple problem, such as air accumulating in the rising main that goes to the top of a structure, requiring air valves to remove the problem. The connection from a 12in utility main pipe going into a building's 4in pipework is always likely to create issues.

Toleration

While some buildings run very efficiently, a huge number are weighed down by never-ending problems with taps, toilets and pipework – but, to a large extent, they are tolerated because building managers don't know how to deal with them. Regular maintenance checks will help, rather than just waiting for things to go wrong.

It is important to understand fully what your supplier can offer. If all they can or want to do is sell you a valve, walk away. But if they want to sort out your issues for the long term – and are perhaps willing to work with a third party – then you are on the path to optimum valve specification.

Together, you can create a control philosophy, and learn how to adapt and protect assets so you achieve reliability over that 30-year timeframe, rather than a failure after five.

Valves are not really deemed as 'critical' equipment, but you are always likely to run into problems unless you fully understand the network.

CRAIG STANNERS is co-owner of Designed Network Solutions

5 STAR LUXURY DEMANDS 5 STAR SAFETY

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Safety valves for building services systems

This module explores the requirements for safety valves in building services applications and the design assessment process to ensure system safety

Building services 'piped' systems require protection where, under reasonably foreseeable service conditions, the internal pressure may exceed the maximum allowable pressure. This is a matter of risk assessment to ensure safe and effective operation and, in many cases, to control the risk will require at least one appropriately selected, installed and maintained safety device. The 'safety system' will include the safety devices, the interconnections that are free from potential blockages between the equipment to be protected, and any discharge connection to a safe place. This requires a holistic design assessment to ensure system safety.

The term 'safety valve' would typically encompass relief valves, pressure-relief valves and safety relief valves, and this 'pressure equipment' – as it is referred to in EU directives – is classified by group according to the level of hazard. Fluids used in building services engineering would most likely be those referred to in the standards as being in group 2 (whereas group 1 is for those classified as 'hazardous'). The fluid group would normally be used as part of the assessment of risk 'category'; however, general purpose safety valves will, in any case, fall under the most stringent category 4, which defines the level of design and production quality control to ensure conformity that allows a safety device to bear the legally required CE mark.

In the UK, specific requirements for system safety are principally encompassed by the Pressure Equipment (Safety) Regulations 2016[1] and the Simple Pressure Vessels (Safety) Regulations 2016[2] that implement Directives 2014/68/EU, the Pressure Equipment Directive (PED), and 2014/29/EU, the Simple Pressure Vessels Directive (SPVD). The regulations specifically come into play when the systems are operating at pressures greater that 50kPa (0.5bar, 5.1m water head).

The recently revised part 1 of *Safety devices for protection against excessive pressure*, BS EN ISO 4126:2019, specifies the general requirements for safety valves and the testing techniques for valves set at pressures of 0.1bar gauge and above. (This standard supersedes the withdrawn, but oft quoted, UK standard BS 6759.[3]) ISO 4126 has 11 parts that consider the different requirements to provide against excessive pressure. It describes a safety valve as 'a valve which automatically, without the assistance of any energy other than that of the fluid concerned, discharges a quantity of the fluid so as to prevent a predetermined safe pressure being exceeded, and which is designed to re-close and prevent further flow of fluid after normal pressure conditions of service have been restored'.

A safety valve may provide protection against hazards arising from a number of scenarios. This could, for example, be a blocked vessel or pipework discharge; excessive heat from external sources, such as the sun, or other equipment that can cause the fluid within the pipework to expand; system thermal expansion from heat fluctuations beyond the expected design conditions; and failure of a pipeline component, such as an ineffective, failed or tampered control valve or other component that may prevent adequate, or any, discharge.

When evaluating the expected performance of a valve, some terms are commonly used to describe valve operation, as shown in Table 1 and illustrated in Figure 1.

Direct spring safety valves, as illustrated in Figure 2 and Figure 3A, are commonly used »

within building services systems. The spring is precompressed to apply force downwards on the disc, holding it onto the seat to maintain a pressure-tight seal. If the system pressure increases beyond a predetermined value, it overcomes the spring force and flow commences.

Figure 3b shows a combined temperature- and pressure-relief valve. In addition to providing pressure protection, this valve also features a thermostatic probe, which gives protection against excessive temperature. If the system pressure or temperature increases beyond the set point, the spring force is overcome and flow commences. Each of these lift mechanisms works independently of each other, but are managed through a common seat and disc arrangement. Typically, the valve can be temperature set to between -20°C to 95°C.

The operation of a safety valve can be considered in three states: in equilibrium, open, and closed. When the closing forces acting to close the safety valve are in balance with the opening forces acting to open it, it is in a state of equilibrium (defined in ISO 4126 as the 'set pressure'). This is illustrated in Figure 4 for a safety valve where the valve seat and disc are just in contact. In this position, there is no flow, but flow will commence if the system pressure rises.

When fully open, as shown in Figure 5, the safety valve can pass the maximum/rated capacity at the specified overpressure (not the set pressure). For the safety valve to remain open, the force from the fluid on the underside of the disc must exceed the equilibrium force (the applied spring and backpressure force).

A valve will be fully closed when the closing force (spring + backpressure) exceeds the opening force. The term blowdown is used to represent the difference between the set pressure and reseating pressure of a safety valve, expressed as a percentage of the set pressure, so...

System pressure – blowdown pressure = reseat pressure

Safety valves should be carefully selected and sized for the specific application to ensure that they have sufficient discharge capability. Sizing will directly influence valve performance. For example, oversized valves will partially lift at set pressure and then reseat. This can potentially cause 'chattering' of the disc and damage to the seat and disc surfaces. Oversized valves may also lead to the release of excessive amounts of fluid.

There are three main considerations when sizing and selecting an appropriate, and correctly sized, safety valve – application, set pressure and discharge capacity.

Set pressure	Relative pressure at which the safety valve starts to open, measured at the valve inlet
Overpressure	Pressure at which the safety valve achieves full discharge capacity, which would normally be set pressure +10%
Accumulation	Increase in pressure over the maximum working pressure of the system during discharge through the safety valve
Reseat pressure	Pressure at which the safety valve is fully closed
Working pressure	Pressure at which the system being protected normally operates
Discharge capacity	Amount of water, gas or steam that the safety valve will discharge at a specified set pressure
Blowdown	Difference between the set pressure and reseating pressure of a safety valve, expressed as a percentage of the set pressure

Table 1: Parameters describing a safety valve operation

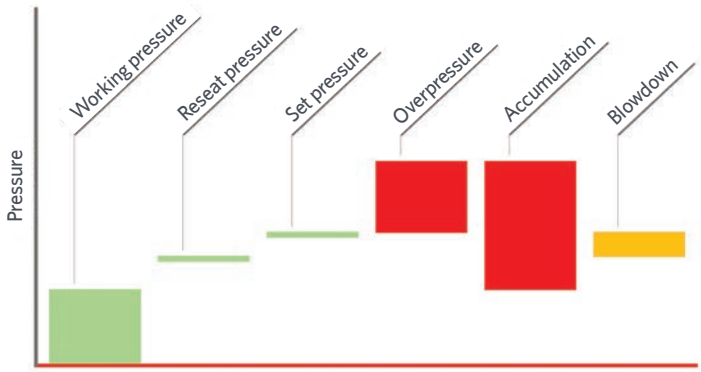


Figure 1: Relative pressures related to the operation of a safety valve (Source: NABIC)

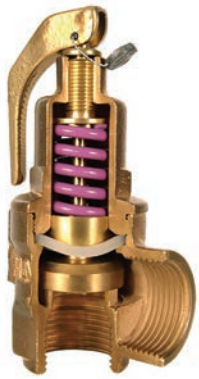


Figure 2: Example of a direct spring safety valve (Source: NABIC)

Consideration of the application includes the location of the safety valve. For example, it may be employed to protect a boiler, to relieve a pump overpressure, or to ensure the integrity of a vessel (tank). The fluid that is in the system – in building services it is likely to be water, air or steam – will influence the choice of valve material and design.

The set pressure of the safety valve will need to be established. If the required set pressure has not been specified at the time of sizing, this can be calculated from the working pressure of the system (at the point in the system where the valve is to be installed). If the working pressure is known, the set pressure may be established using empirical data established by manufacturers and building operators. So, for example, a manufacturer[4] recommends that, for a liquid/water system, set pressure would be the working pressure +0.7bar, or the working pressure x 1.1 (whichever is the greater).

Careful consideration of the requirements is needed where the only available information is the maximum pressure rating/output of a heat source, such as when protecting a system with a boiler or plate heat exchanger. This value is simply a

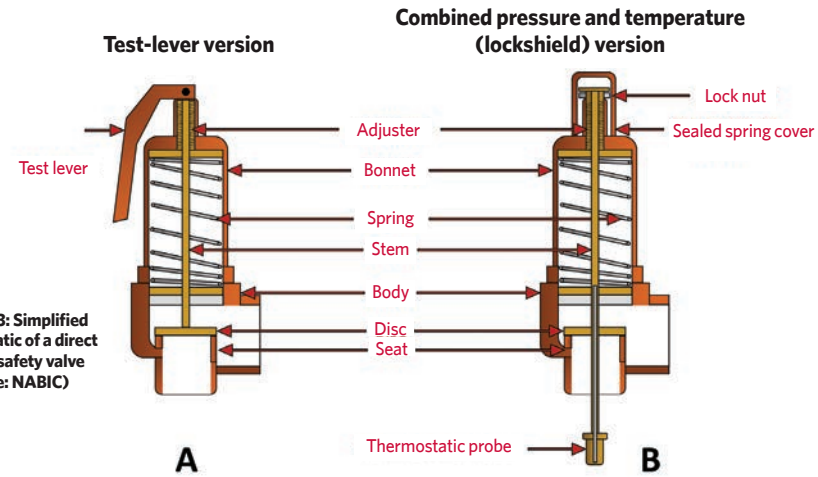


Figure 3: Simplified schematic of a direct spring safety valve (Source: NABIC)

statement of the maximum capability of the appliance and it is very unlikely to represent the actual working pressure. The UK's Health and Safety Executive (HSE) publishes a useful approved code of practice and guidance document – L122 *Safety of pressure systems*[5] – which cautions that the terminology used for different types of systems will vary. For example, the safe operating limit for a boiler may be known as the 'maximum permissible working pressure', whereas the safe operating limits for refrigeration plant will be expressed in terms of minimum and maximum temperatures. In cases of doubt, or where information is not clear, it is recommended that further detailed information should be sought from the manufacturer or other competent organisation. As the safety valve is intrinsically part of the whole system, the set pressure of a safety valve must not exceed the design pressure of the system being protected, and it should be suitably selected with reference to the working pressure of the system that is being protected by the safety device.

The discharge capacity is the rate of fluid that must be discharged at a given pressure to maintain safe system conditions. So, for example, the discharge capacity for a hot-water boiler system would be directly related to the boiler power and specified as such, and on an unvented pumped chilled water system, the discharge capacity would be the maximum chilled water flowrate.

The position of a safety valve in the system can directly affect its performance and discharge capabilities. As highlighted in BS ISO 4126-9:2008 (the part of the standard that considers the application and installation of safety devices typically used in building services systems) 'operating problems can occur in pressure relief because of the selection of an inappropriate device or because a correctly selected device is adversely affected by improper handling, wrong installation or lack of maintenance'. The experience of manufacturers and guidance from documents such as BS ISO 4126-9 will provide essential knowledge to ensure correct installation of safety valves. If valves are mounted in other than a vertical position, the valve manufacturer's recommendations must be considered. If fitted with a test lever (such as shown in Figures 2-7), this should be positioned uppermost, ensuring that it is accessible.

The inlet and outlet piping must be properly supported to ensure that no unacceptable mechanical loads are transmitted to the safety valve and, similarly, the piping must be able to withstand the effects of the reaction forces when the valve discharges. The pipework design should accommodate thermal stresses induced in the inlet and outlet piping. Vibration stresses, including those caused by poor flow geometry in the inlet and outlet piping systems, must be minimised to avoid premature valve failure. Recommendations suggest that piped connections from the protected system to the safety valve should have a pressure drop of no more than 3% of the pressure at the valve when it is operating with maximum discharge.

Flow-control valves must not be installed between the safety valve and the system that is being protected. As noted in BS ISO 4126-9, safety valves may be manually isolated from the equipment if the source of pressure, which could lead to an unsafe condition, is simultaneously isolated from the equipment to be protected. Safety devices undergoing maintenance should be isolated from operating equipment, but it is essential that operating equipment should continue to be fully protected against potential sources of overpressure. Any provision made for isolating any one safety device (for example, for testing or servicing) must ensure that the remaining safety device(s) connected to the equipment can provide the full relief capacity required

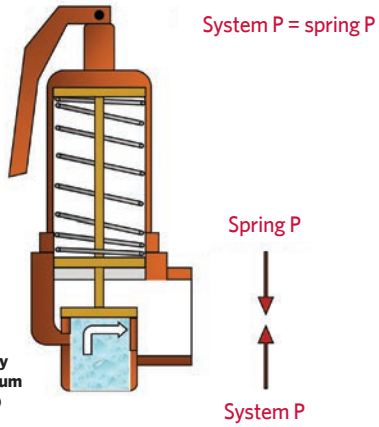


Figure 4: A safety valve in equilibrium (Source: NABIC)

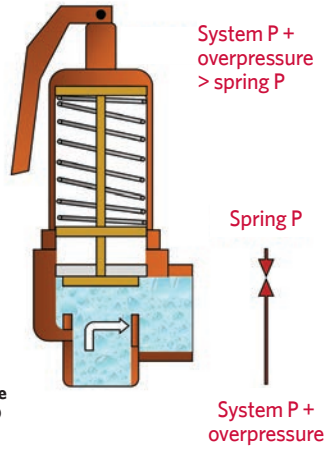


Figure 5: An open safety valve (Source: NABIC)

at any time. This may use such devices as manual three-way valves, changeover valves, mechanical interlocks, and interlocked valves.

Connection details can adversely affect safety valves. The arrangement of the pipework approaching the inlet of the safety valve – such as fittings, bends and lateral connections (as in Figure 6) – can impact its performance, as streamflow regimes will be affected. On the discharge side of the valve, an inverted outlet (as shown in Figure 6 and Figure 7) will create a backpressure on the safety valve disc, because of the head of fluid in the riser, which will affect the set pressure.

Safety valves should be included in a planned maintenance programme to ensure that the device will continue to operate appropriately, the valve life is prolonged, and that the system operation complies with insurance requirements. Manufacturers will have guidelines on testing and maintenance programmes and procedures. The specific maintenance programme must take heed of the manufacturer's recommendations, as well as account for the particular conditions of the system and its location.

■ With thanks to NABIC for core material referred to in the production of this article.

■ Turn to page 68 for references.

Figure 6: The lateral connection will impact the flow regime into the valve and so affect its performance (Source: NABIC)

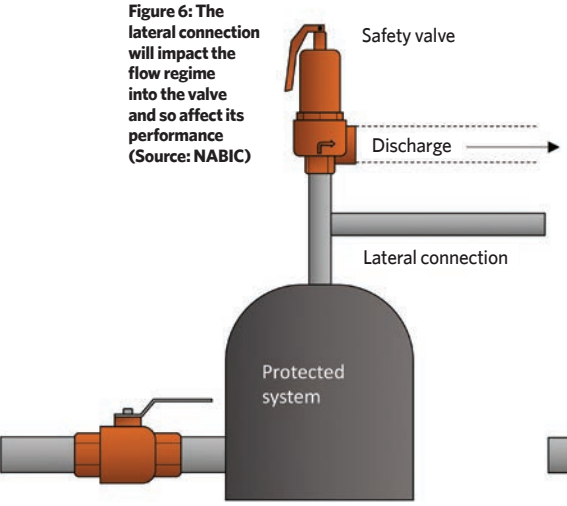
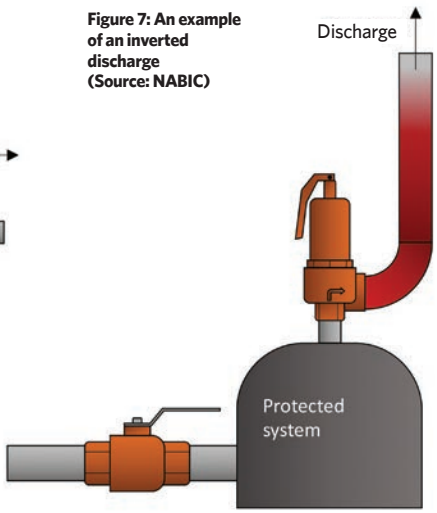


Figure 7: An example of an inverted discharge (Source: NABIC)



Module 168

October 2020

1. Which of these pressures is the smallest that is likely to come under the auspices of the pressure regulations?

- ☐ A 0.1bar gauge
- ☐ B 0.7bar
- ☐ C 3m head
- ☐ D 5,000Pa
- ☐ E 55kPa

2. Which one of these pressures is likely to be the highest?

- ☐ A Backpressure
- ☐ B Equilibrium pressure
- ☐ C Reseat pressure
- ☐ D Set pressure
- ☐ E Working pressure

3. What is the typical range of temperatures that can be set in the temperature controlled element of the combined safety valve?

- ☐ A Between -20°C and 20°C
- ☐ B Between -20°C and 95°C
- ☐ C Between -50°C and 95°C
- ☐ D Between 0°C and 50°C
- ☐ E Between 20°C and 50°C

4. If the working pressure is known, what value of set pressure is recommended by a manufacturer for a safety valve?

- ☐ A 1.1bar greater than the backpressure when using inverted discharges
- ☐ B Maximum permissible working pressure x 1.1
- ☐ C Select either working pressure + 0.7bar or the working pressure x 1.1
- ☐ D The greater of working pressure + 0.7 bar or the working pressure x 1.1
- ☐ E The smaller of working pressure + 0.7 bar or the working pressure x 1.1

5. Which one of these statements is false?

- ☐ A Flow control valves may be installed between the safety valve and the system that is being protected so long as they are practically almost always open
- ☐ B If valves are mounted in other than a vertical position, the valve manufacturer's recommendations must be considered
- ☐ C Safety valves may be manually isolated from the equipment that is being protected if an appropriate alternative safety device is connected
- ☐ D Devices such as manual three-way valves can provide connections to alternative safety devices when a safety valve is under maintenance
- ☐ E When testing, alternative safety device(s) connected to the equipment must provide the required full relief capacity

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References:

1 The Pressure Equipment (Safety) Regulations 2016 (UK Statutory Instrument 2016 No.1105).
2 The Simple Pressure Vessels (Safety) Regulations 2016 (UK Statutory Instrument 2016 No.1092).
3 Withdrawn Superseded UK standard BS 6759-1 1984 Safety valves. Specification for safety valves for steam and water.
4 NABIC recommendation – direct communication.
5 Approved Code of Practice and guidance L122 *Safety of pressure systems*, UK HSE 2014.

› Products of the month

Carrier's ultra-slim FCU enables higher ceilings or extra storeys, boosting ROI

The FCU enables higher ceiling heights to give a premium feel to residential apartments

Carrier has developed an ultra-slim fan coil unit (FCU) to maximise living space in high-rise residential buildings, boosting return on investment (ROI) for developers. At just 150mm high, the Idrofan 42EP range of ducted horizontal FCUs is the slimmest of its kind. It can be installed in buildings with very low ceiling voids and underfloor applications, saving space and enabling developers to maximise property and rental values.

The unit is quiet, with noise ratings as low as NR22, making it particularly attractive for use in residential and hotel applications. It is also ideal for use in commercial offices, where similar space constraints and expectations for high performance increasingly apply.

Carrier FCU product manager Matthew Maleki said: 'The 42EP can be used to enable higher ceiling heights within a building to give a premium feel to residential apartments. It also gives developers the opportunity to add extra floors within a given permitted building height, significantly increasing return on investment.'

The ultra-slimline profile was made possible by a number of innovations, including a new patented internal layout that incorporates a split supply and return chamber before the cooling coil. This allows use of a compact plug fan – which is perfectly positioned to minimise the use of internal space within the unit – instead of a standard bulky centrifugal fan.

To ensure high-quality indoor air is maintained for occupants at all times, an optional CO_2 sensor links to fresh air valves. If CO_2 concentrations exceed acceptable limits, fresh air is drawn into the living space to maintain air quality. On the controls side, a fresh approach to the mounting system was required because, when side by side with the FCU, the controls are effectively taller than the unit. The design gives optimal space efficiency and performance.

Options include two-pipe and four-pipe versions, offering heating between 1kW and 4.3kW, and cooling of 0.8kW to 2.5kW. Water valves are available as two-way, four-way and auto-balancing. Control options include basic electro-mechanical, water terminal controller (WTC) BACnet and third-party controls.

■ **Visit www.carrieraircon.co.uk/wp-content/uploads/Carrier-42EP-A4-brochure.pdf**

Winter-ready with limitless and continuous supply of water for hygiene regimes

End users have instant access to continuous flow hot-water heating units and systems

Rinnai is gearing all its operations, products and services to meet and exceed the temperature-accurate hot-water delivery needs of all healthcare, food-service, commercial and industrial sectors, as planning starts for the coming winter.

Rinnai operations director Chris Goggin said: 'We all need ready access to continuous supplies of safe, useable hot water and soap to ensure clean and sterile indoor environments throughout our daily lives, to minimise any infection. This is paramount.

'We must closely consider the design of the provision of hot-water services that incorporate heat engines to give limitless volumes of hot water, and provide that hot water at the precise temperature needed.'

Hot-water temperature precision and control are now being stated as major factors in the design, specification and installation of any hot-water delivery system. Reports have emerged from industries and sectors such as laundry for healthcare and care homes that the temperature of the hot water is critical to the cleaning and disinfecting process to render the possibility of transmitting coronavirus as near to zero as possible.

"The range can be manifolded for limitless hot water to a school site"

Rinnai has responded to the present conditions with a range of new products and initiatives that allow end users virtually instant access to the supply of continuous flow hot-water heating units and systems.

As long as there is a constant supply of gas and water, all Rinnai units are guaranteed to supply temperature-accurate hot water in unlimited quantities for all hygiene regimes in all types of sites, for healthcare, care homes, food handling and production, industrial production, food handling, industrial laundry, mobile hygiene units or temporary accommodation.

The Rinnai range of units is available within 24 hours. Rinnai UK has fully maintained its total service throughout the Covid-19 situation and the company has kept high stock levels of all units, plus spares and accessories.

Rinnai, manufacturer of continuous flow hot-water systems, makes and sells two million units each year. The range can be manifolded to supply limitless hot water to a school site of any size. This means fast, efficient, temperature-controlled water on demand at the point of delivery – to kitchens, showers, accommodation blocks, bathrooms, and washrooms.

■ **Call 01928 531 870, email engineer@rinnaiuk.com and sales@rinnaiuk.com or visit www.rinnaiuk.com**

New ranges extend Lochinvar heat-pump options

Rising demand for low carbon heating and hot-water solutions has prompted manufacturer Lochinvar to add two new product ranges. It now offers an extensive portfolio of heat pumps suitable for a wide range of non-domestic applications.

Amicus LT air-to-water heat pumps provide low temperature hot water (LTHW) at up to 60°C for space heating and domestic hot-water systems. The technology works by capturing energy extracted from ambient air. Amicus Boost water source heat pumps are designed to be used as part of hybrid systems. They extract energy from water sources, such as heat-recovery and reclaim systems.

Lochinvar's sales director, Liam Elmore, said: 'This is a very exciting time to be involved in heat pumps. These two new product ranges further extend our coverage of the many potential applications for heat pumps and will allow us to provide comprehensive low carbon solutions to even more customers in the coming months and years.'

Visit www.lochinvar.ltd.uk

Kohler Uninterruptible Power unveils new PowerWAVE 3000/P1

Kohler Uninterruptible Power has launched the new PowerWAVE 3000/P1, the most energy efficient UPS unit in its class.

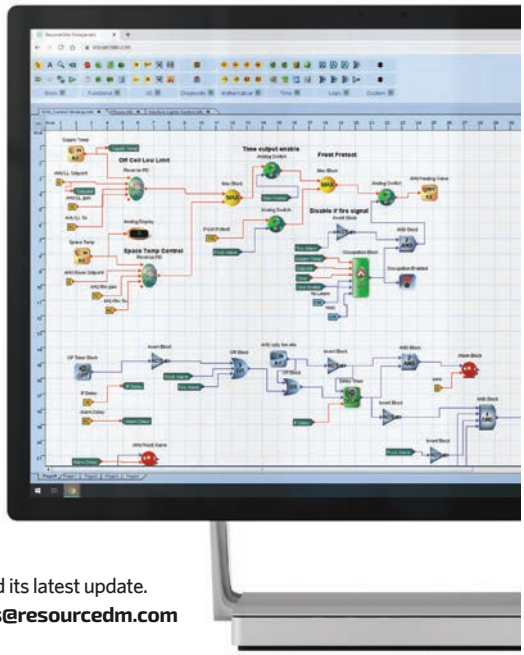
It solves the problem of providing economic-to-run, dependable critical power protection for higher-load, single-phase applications such as vital servers, networks and telecommunications.

Compact in size and easy to install and operate, this advanced new 10kVA or 20kVA double-conversion model lowers energy costs and carbon emissions, while providing a stable and resilient supply of power.

Visit www.kohler-ups.co.uk

No annual licence fees for RDM's PLC software

Programmable logic controller (PLC) software TDB gives the user the capability to create custom control algorithms for any BMS application, including HVAC, refrigeration, lighting, and much more. With a software licence that lasts for the lifetime of the product, unlimited users, no annual fees, and free-to-download desktop editing software, it is a standout PLC software option from Resource Data Management (RDM). Proven to achieve significant energy savings, TDB is a powerful automation software that facilitates the optimisation of BMS operating efficiency.



It is built-in as standard on a range of RDM's controllers, designed for use in BMS, HVAC and refrigeration applications. This includes the versatile Intuitive TDB controller, small-format Mini Intuitive TDB controller and TouchXL TDB controller, featuring a 10in colour touch display. The latest TDB software update for the controllers is now available, and expands the functionality and connectivity of RDM's PLCs even further. Contact us for more information on TDB and its latest update.

Call +44 (0) 141 810 2828, email Sales@resourcedm.com or visit www.resourcedm.com

Panasonic announces raft of new strategies, placing customer service at the heart of operations

Panasonic has embraced next-generation technology in a new approach designed to offer a consistent customer service experience for Heating & Cooling Solutions across Europe. This new initiative reinvigorates the company's focus on delivering excellent customer service.

The new system has been trialled, and initial feedback has been extremely positive. When a customer contacts the service department, service sessions can be initiated immediately via the IFS Remote Assistance, to determine what the issue is and whether it requires a physical site intervention.

Visit www.aircon.panasonic.eu

Draka releases guide to bend-insensitive fibres

Cable company Draka, a brand of Prysmian Group, has produced a comprehensive new technology guide, *Bend-insensitive fibres: a key component of future-proof networks*.

Bend-insensitive, single-mode fibres are the only fibres capable of securing the whole fibre spectrum, especially at the longer wavelengths, by minimising losses linked to macro and micro bends. These fibres enable the development of extreme fibre count and reduced diameter cabling solutions, to help meet today's demand for the highest bandwidth capacity in duct installations.

Visit mms.drakauk.com

Hospital targets energy savings

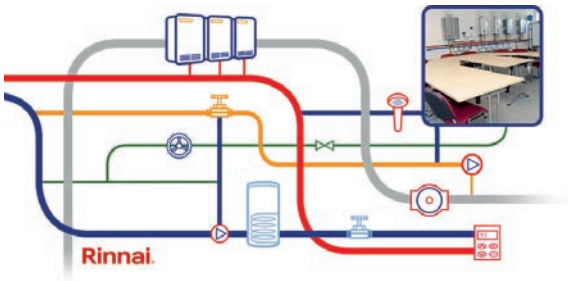
So much is written about hospital waiting times and the many pressures that the health services are under, it is very easy to overlook the fact that there are also many positive activities taking place. The fact that some of these improvements are happening, literally behind closed doors, highlights the importance to place a spotlight on them.

Sligo University Hospital, a busy 359-bed, acute general hospital in the west of Ireland, has recently had its efforts to reduce energy use recognised by the SEAI, announced as the winners of the Sustainable Energy Public Sector Award for delivering savings of 20%.

Grundfos Pumps was delighted to play its part by giving the hospital a detailed energy check report that outlined the energy savings that were achievable by exchanging the existing pumps with intelligent MAGNA3 and TPE3 pumps. These pumps, now in-situ, are remotely monitored via Grundfos CIM300 BACnet cards that allow the operators to monitor and trend individual pump performance.

Visit www.grundfos.co.uk

Rinnai range of accredited CPD subjects for continuous flow hot-water heating units and systems



Designers, specifiers and building services consultants and engineers working on commercial sites requiring limitless flows of temperature-accurate hot water for personal hygiene, laundry, food production and all other cleaning and disinfecting regimes can now access a freely available range of CPDs from Rinnai.

The CPDs are available via Microsoft Teams or Zoom, or – as long as all safety measures are strictly observed and practised – in face-to-face meetings on the site of the end user, specifier or building services consultant and engineer.

Through its CPD and training programmes, Rinnai looks to clarify and engage with the market to assist decision-making and understanding of the different messages faced by today's engineers, installers and designers. Operation director Chris Goggin said: 'We can demonstrate how innovation can reduce the burden on fossil fuels while maximising renewable gains. We will look at the growing support for continuous flow technologies and how this can benefit the industry versus traditional storage systems.'

Call 01928 531 870, email sales@rinnaiuk.com or visit www.rinnaiuk.com

Rinnai's team ready to answer all your questions

Water heater manufacturer Rinnai UK has a dedicated technical service team to ensure customers get service performance that matches the excellence of product performance, with a view to adding value that surpasses the transaction stage, creating long-term value for its customer base.

Rinnai Technical Services offers all customers help and advice throughout the complete life-cycle of a product. The team can, and will, respond to any queries on specification, installation and operation of Rinnai units.

Technical team leader Pete Seddon said: 'Architects and consultants are really into conservation, energy efficiencies and gas consumption and, nowadays, they are looking at the complete building – whereas, before it was all about product choice, space and siting of a unit. We offer assistance to help them decide.

'Some people need talking through the advantages of changing from a traditional storage system to a wall-mounted instantaneous water-heater system; we can help them make the decision and then the transition.'

Visit www.rinnaiuk.com

Underfloor air conditioning system brings increased design freedom and headroom benefits to 77 Coleman Street

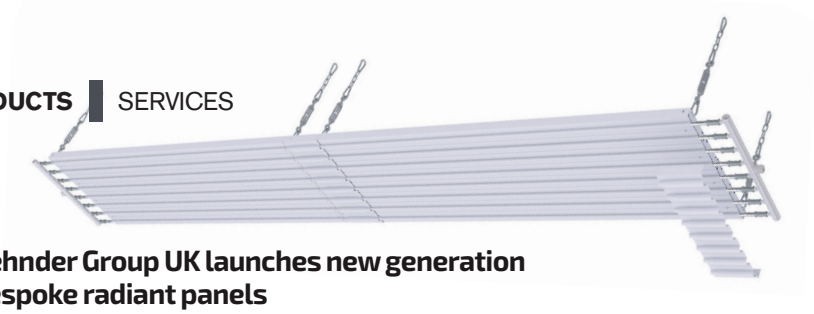
An innovative underfloor air conditioning system from AET Flexible Space has allowed architects to highlight key architectural features in a new high-concept refurbishment in the heart of central London. The 77 Coleman Street development, designed by Buckley Gray Yeoman architects on behalf of Kajima Properties, offers outstanding office space overlooking Coleman Street Gardens and is less than a minute's walk from the new Elizabeth Line station at Moorgate.

AET's underfloor air conditioning system makes use of the void within the building's raised-access floor, so removes the need for traditional ceiling-based services and suspended ceilings.

Moving away from conventional ceiling-based services has allowed 77 Coleman Street to boast unusually high floor-to-ceiling heights, creating a far brighter, more open and inviting office environment. When used in refurbishments, underfloor air conditioning technology can typically offer increased headroom of 300mm or more.

AET's unique Fantile units induce conditioned air into the office space, eliminating cold draughts, while giving the end user complete control over temperature and air flow.

Visit www.flexiblespace.com



Zehnder Group UK launches new generation of bespoke radiant panels

Indoor climate solutions specialist Zehnder Group UK has launched the Zehnder ZFP, a new generation of radiant ceiling panels, to ensure businesses and other organisations can heat and cool their buildings comfortably and efficiently, while achieving substantial energy savings.

The panels are suitable for a wide range of environments requiring heating and cooling solutions – from sports halls and showrooms to logistics facilities, fulfilment centres and factories. Zehnder ZFP delivers a number of benefits and advantages, including an optimum indoor climate all year round. The panels can achieve a proportion of radiation of more than 80%, meaning the supplied energy can be transferred effectively.

David Simoes, marketing and product manager – RHC at Zehnder Group UK, said: 'The technology within the Zehnder ZFP can be operated with a broad range of system temperatures, and can be combined with modern heat pumps, with their lower flow temperatures, without any problems.'

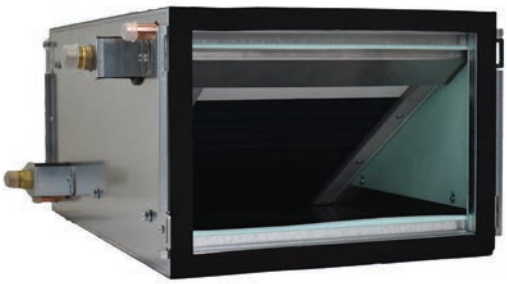
Visit www.zehnder.co.uk/zfp

Zehnder Group UK enhances cooling portfolio with ComfoPost launch

Zehnder Group UK has further strengthened its extensive cooling portfolio with the launch of the ComfoPost range. This is the first time the products, manufactured by Zehnder Italy, have been made available within the UK marketplace.

ComfoPost is an air-to-water exchanger used with ComfoWell air distribution connections. These connections allow for selection flexibility, offering a range of rigid circular ductwork or Zehnder ComfoTube semi-rigid ductwork to attach.

Visit www.zehnder.co.uk, LinkedIn: @ Zehnder Group UK Ltd, Twitter: @Zehnder_UK



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Apprentices need passion, focus and effective communication skills


Vince Arnold

Master and apprentice

Vince Arnold's career from apprentice to running his building services consultancy puts him in the perfect position to chair the judges at CIBSE's first Apprentice of the Year contest

CIBSE's first Apprentice of the Year will be announced on 8 October, and chair of the judging panel selecting the inaugural winner is Vince Arnold FCIBSE, who was an electrician apprentice himself when he joined the Post Office 45 years ago. His career progression shows how much can be achieved as a building services engineer starting out as an apprentice.

On one of his early projects, in Milton Keynes, he met a consultant who inspired him to get a degree and become chartered. Arnold studied part-time at the Open University and gained chartership with the IEE (now the IET). While studying, he changed jobs and became a college lecturer for five years. He returned to the Post Office in an executive role and was responsible for its building services standards and policies before joining National Design Consultants – part of Royal Mail – in 1991. He was part of a management buyout at NDC and ran the company's London office before establishing his own consultancy, Grinstead.

Arnold has been volunteering at CIBSE for 20 years; he chaired the membership and registration panel for 12 years and was a professional interviewer for more than 20 years. He chaired the education training and membership committee, and is on the Engineering Council registration standards committee. Here, he explains why CIBSE has launched the apprentice award and what he is looking for in the winner.

Why has this new category been introduced?

In early 2019, CIBSE became an End Point Assessment Organisation for four apprenticeships – BSE Design Technician, Design Engineer, Technician and Site Management. As members of CIBSE's Membership and Registration Panel, we see a number of End Point Assessments for final approval, on completion of the candidates' apprenticeships. I am always impressed with the quality and experience demonstrated by the candidates, and it is right to recognise and applaud their achievement. The Apprentice of the Year Award provides a great platform for this recognition.

Apprenticeships play a key role in the development of engineers for the future, and can include a degree, leading to Incorporated Engineer.

What attributes are you looking for in the Apprentice of the Year?

Passion, focus, effective communication skills, an ability to inspire others, and self-confidence. We like to see candidates that show a level of maturity in recognising their own limits and who know what to do to continuously develop. They should also have an ability to put theory into practice, be a keen problem solver, and be open to constructive feedback. Their enthusiasm should rub off on others and they should be keen to make a valuable contribution. In short, we're looking for ambassadors for the industry.

Why are presentation skills important as an apprentice?

Communication is an important skill at all levels and at all times in our industry. It is needed to establish professional relationships and networks. It is important to instil confidence in clients and customers at all levels of our work, from large construction sites through to homes.

Looking back on my career in construction and consulting, if anything was going wrong on a project, it would nearly always involve a communication issue – someone thought someone said something to someone; it was acted upon, but because of misinterpretation had become an issue.

Having the maturity to raise an issue clearly, concisely and with confidence is a very important competence. Engineering can be technically demanding and has its own language, so being able to communicate clearly with the client/customer is important.

Have the candidates impressed you?

I have been very impressed and encouraged by the quality of this year's candidates. Apprentices – and graduates, of course – are the future of our industry. They bring enthusiasm for sustainable design and building performance across the full range of construction and maintenance.

Do you think video presentation will still be important after the pandemic?

Yes, I believe the candidates' recorded presentation will continue into the future.

The new common phrases 'we are living in unprecedented times', closely followed by 'turn your microphone on – you are muted', are reasonably new to us. But we are all aware of the many cost-saving new ways of working that the current situation has brought us.

The 'new normal' is developing fast. Video-conferencing will continue to develop and improve, becoming more efficient and with more facilities. We have all witnessed the reduction in the carbon footprint and cost savings from reduced travel.

EVENTS

Event details are correct at the time of going to print, but as a result of the ongoing coronavirus (Covid-19) situation, they may be subject to change. For updates, please check **cibse.org/training** for training and **cibse.org/events** for CIBSE groups and regional events. CIBSE has a range of online learning courses available to support your learning. visit **cibse.org/training-events/online-learning**

NATIONAL EVENTS AND CONFERENCES

Young Engineers Awards
8 October
The annual Young Engineers Awards, bringing together the Graduate of the Year and Employer of the Year awards to celebrate rising talent, and those who mentor, nurture and encourage people new to the industry. To coincide with the 25th anniversary of the awards, this year will also include a new Apprentice of the Year award, established to recognise the invaluable contribution played by apprentices in our industry. This will be an online event.
cibse.org/yea

Build2Perform Live
24-25 November
Registration is open for the 2020 Build2Perform Live event and exhibition. The free, two-day event will feature 160 speakers and more than 80 hours of CPD.
build2perform.co.uk

CIBSE REGIONS AND GROUP EVENTS

For up-to-date information on regions and groups meetings, webinars and podcasts visit **cibse.org/events**

ILEVE AGM
7 October
Online AGM.

Intelligent Building Group and CIB: Transdisciplinary workplace research
7 October
Webinar.

SoPHE Northern: Energy-efficient hot water
7 October
Webinar with presentation from Zip Industries UK.

CIBSE Southern: Building services and the circular economy
20 October
Webinar, with presentation on the CIBSE Research Insight on circular economy.

Intelligent Building Group and CIB Commission: Intelligent buildings post-Covid
4 November
Webinar exploring the challenges for intelligent buildings after Covid-19.

NEW LIVE ONLINE TRAINING COURSES

A full programme of live online training courses has been released through to the end of 2020. The courses have been reformatted to work online, with a live trainer, so you can expect the same interaction and participation as you would in a classroom. For details, visit **cibse.org/training**

High-voltage (11kV) distribution and protection
6 October

Low carbon consultant design
7-9 October

Building services explained
7-9 October

Emergency lighting to comply with fire-safety requirements
13 October

Low carbon consultant building operations
13-16 October

Mechanical services explained
14-16 October

Electrical services explained
14-16 October

Air conditioning inspection for buildings – TM44
15 October

Fire-safety building regulations: Part B
20 October

Electrical distribution design
23 October

Successful design management
28 October

Standby diesel generator
30 October

Running projects effectively
4 November

Designing water-efficient hot and cold supplies
6 November

Mechanical services explained
10 November

Building services explained
11-13 November

Below-ground building drainage
12 November

ONLINE LEARNING

CIBSE has a portfolio of online learning courses that contains interactive content, with quizzes and additional resources, to support your learning.
cibse.org/training

#GrowYourKnowledge webinars

CIBSE's free webinar series continues in October. Taking place every Thursday at 11am, the webinars are designed to support the CIBSE community in maintaining its CPD remotely. To register for the webinars, visit **cibse.org/growyourknowledge**
All previous webinars are available on the **#GrowYourKnowledge** GoToWebinar channel.

CIBSE Membership Webinars

CIBSE Membership is hosting free webinars to support members with applications for the Associate and Member grades and registration with the Engineering Council at Incorporated Engineer and Chartered Engineer levels.

The series includes two separate webinars, with session one covering routes to membership and session two focusing on how to write the Engineering Practice Report.

For further details and to register, visit **cibse.org/webinars**

Upcoming webinars:
6 and 20 October
10 and 17 November

To register for the webinars, visit cibse.org/webinars

CIBSE Training

Take Control of Your Learning Journey

September - December 2020

Updated training brochure released

Current events have proven challenging for people and businesses across the globe.

Therefore, as part of the CIBSE mission to support its community of built environment professionals in their pursuit of excellence, the CIBSE Training team have worked hard to make sure that they are still offering quality and expertly led training to those who need it.

Discover how training with CIBSE has been adapted to the current Covid-19 situation, so it now fits your learning and development needs better, enabling you to develop your skills and abilities, grow as a professional and individual, and enhance your value to the organisation you work for.

Download your copy at cibse.org/training

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

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

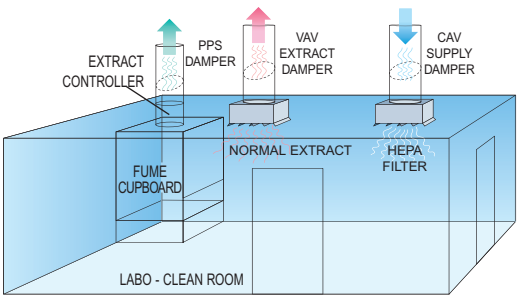
CAV AND VAV DAMPERS

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

Metal Damper

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.



PPS EXTRACT DAMPER

Poly-propelene 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

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