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## The bigger picture



While coronavirus has taken much of our attention in 2020, it is important not to lose focus on other areas of our industry that will have a significant long-term impact on the health of society and the environment.

Building safety is, of course, one area of prime concern. Last month, the government published its Draft Building Safety Bill, aimed at implementing the recommendations of Dame Judith Hackitt's report, written in the wake of the Grenfell Tower disaster.

While the proposed regulatory regime is targeted at buildings above six storeys or 18 metres high containing apartments, the bill will have

repercussions for the whole industry. A national Building Safety Regulator will have strong oversight of the safety and performance of all buildings (see page 14).

The bill aims to improve the competence of those designing, constructing and operating high-rise residential buildings, and building control professionals will have to demonstrate – and maintain – competence.

The Building Safety Regulator will also scrutinise high-rise apartments already built and occupied, while an accountable person and building safety manager will have to prepare and maintain safety cases for those buildings.

Safety of buildings will be paramount in the drive to improve the energy efficiency of the UK's ageing building stock and achieve the country's carbon-reduction targets. The terrible irony of Grenfell Tower is that the fire would not have spread if insulation intended to improve the building's energy efficiency had not been installed.

Last month, the government announced £3bn of funding for improving the energy efficiency of existing homes and public buildings. It's an opportunity that should not be squandered, and government must put in place mechanisms to ensure the work is done appropriately and safely. The risks were apparent within days of the £2bn Green Home Grant being announced, with reports of cowboy builders knocking on doors of vulnerable people under the cloak of the government scheme.

With the Green Homes Grant, a coordinator will oversee the retrofit process and protect the interests of the public. Their task will be to prevent the performance gaps detailed in the *Journal* by Neil May six years ago in the wake of the Green Deal ([bit.ly/CJAug20Ed1](https://bit.ly/CJAug20Ed1)). Sarah Price and Akta Raja say the new grant should only be made available if work complies with PAS2035 (page 17). This defines the competency required for retrofit designers, assessors, advisers, installers and evaluators – and the signs are good, because compliance with PAS2035 becomes mandatory for all Energy Company Obligation (ECO) projects from 1 July 2021.

**ALEX SMITH, EDITOR** [asmith@cibsejournal.com](mailto:asmith@cibsejournal.com)

### Editorial

**Editor:** Alex Smith

**Tel:** 01223 378034

**Email:** [asmith@cibsejournal.com](mailto:asmith@cibsejournal.com)

**Deputy editor:** Liza Young

**Tel:** 01223 378048

**Email:** [lyoung@cibsejournal.com](mailto:lyoung@cibsejournal.com)

**Technical editor:** Tim Dwyer

**Designer:** James Baldwin

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### Advertisement sales

**Display and sponsorship** Jim Folley

[jjim.folley@redactive.co.uk](mailto:jjim.folley@redactive.co.uk)

**Tel:** +44 (0) 20 7324 2786

**Products & services** Jonathan Adebayo

[jonathan.adebayo@redactive.co.uk](mailto:jonathan.adebayo@redactive.co.uk)

**Tel:** +44 (0) 20 7880 6217

**Recruitment advertising**

[cibsejournaljobs@redactive.co.uk](mailto:cibsejournaljobs@redactive.co.uk)

**Tel:** +44 (0) 20 7880 6215

**Advertising production** Jane Easterman

[jane.easterman@redactive.co.uk](mailto:jane.easterman@redactive.co.uk)

**Tel:** +44 (0) 20 7880 6248



## CONTRIBUTORS



### Hywel Davies

How the Building Safety Bill will make those working on tall buildings accountable for building safety



### Julie Godefroy

CIBSE's first Climate Action Plan is assessed and updated, a year after its introduction



### Akta Raja

Why ensuring competency must be central to the government's £2bn Green Homes Grant



### Tim Dwyer

Design and implementation for effective smoke control is the subject of this month's CPD

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## FOR CIBSE

Journal production manager: Nicola Hurley  
Tel: 020 8772 3697, [nhurley@cibse.org](mailto:nhurley@cibse.org)

CIBSE, 222 Balham High Road,  
London SW12 9BS

Tel: +44(0)20 8675 5211

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# CIBSE BUILDING PERFORMANCE AWARDS 2021

## ENTER NOW

**ENTRY DEADLINE:** 3 September 2020

## CATEGORIES

Categories open to enter include:

**PROJECT OF THE YEAR -  
COMMERCIAL / INDUSTRIAL  
PUBLIC USE  
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This award is split into three sector-specific project categories, recognising new build projects delivering outstanding measured building performance and high levels of user satisfaction and comfort. Open for entry to organisations worldwide, entries must relate to projects completed in the United Kingdom during the period 1 June 2017 - 31 August 2019.

**PROJECT OF THE YEAR -  
INTERNATIONAL**

This category celebrates new build and refurbishments completed outside the United Kingdom that have delivered high levels of user satisfaction and comfort.

**PROJECT OF THE YEAR - RETROFIT**

This category recognises the retrofit of a building that most effectively demonstrates high levels of user satisfaction and comfort while delivering outstanding building performance.

**WINNERS ANNOUNCED:** Thursday 25 February 2021  
The Park Plaza Westminster Bridge London

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## Working group proposes building control overhaul

A working group of eight construction industry bodies, including the LABC, RICS and CIOB, has drawn up 11 recommendations to help reshape the building control process.

Better regulation of the building control sector is seen as important to the overhaul of building safety prompted by the Hackitt Review, and the proposals were formed after discussions with the Ministry of Housing, Communities and Local Government.

Key recommendations include: a unified code of conduct for building control bodies and professionals; an independent body to oversee professional registration and organisational audit; a new competence framework for people working in building control, including those working on higher-risk buildings; a unified career structure that sets clear expectations of competence; and simplification of building control legislation, process and procedures.

'These proposals will help give everyone confidence that building control is working, first and foremost, in the interest of their safety and welfare, and in supporting development of an inclusive and sustainable built environment,' a statement from the working group said.

## Car batteries to power university building

A new £20m heritage facility being built at the University of Suffolk is to be powered by reused car batteries.

Norfolk-based Connected Energy is setting up the project and creating a knowledge exchange partnership with Suffolk County Council and the university.

The Hold, which is due to open later this year, will house one of the firm's E-STOR energy-storage systems, reusing 24 old Renault Kangoo electric vehicle batteries, with a total energy-storage capacity of 360kWh.

The energy store will assist in maximising the use of solar power, support the charging of electric vehicles, help power the air conditioning, and manage electricity costs.



Inside of a Connected Energy E-STOR facility



The third anniversary of the Grenfell Tower fire was in June

## Safety regulator to be appointed this year

**New bill also obliges clients to set up online system for reporting potential building safety issues**

A draft bill published last month will bring about the biggest changes to building safety in 40 years, the government claims. Ministers have promised to appoint the UK's first national chief inspector of buildings before the end of this year and distribute £1bn in new funding to remove unsafe cladding.

The bill will enshrine in law the recommendations made by Dame Judith Hackitt in her independent review of building safety, held in the aftermath of the Grenfell Tower fire, including tighter regulation of blocks of flats taller than 18m or more than six storeys high.

A new regulatory authority, led by the chief inspector, will be part of the Health and Safety Executive and will have full powers to hold building owners to

account. The legislation will also create new regulations for managing the safety of construction materials and products.

Clients will be obliged to set up an online system through which onsite workers can report potential safety issues, which must be passed on to the regulator within three days. Building inspectors will have to register with the regulator and adhere to the regulations.

Dame Judith welcomed the bill, hailing it 'as an important milestone in delivering the fundamental reform this industry needs to make residents and buildings safer'. She said it met the ambitions and recommendations set out in her review, but reiterated her warning to the industry that it should already be implementing improvements to working practices.

'It is not enough to wait for the bill to become law before they implement changes; we expect them to start taking action now,' she said.

## Grenfell contractor lacked expertise

None of the staff working for the contractor on the Grenfell Tower refurbishment had the technical expertise to know whether cladding designs complied with Building Regulations, according to an employee who gave witness testimony to the public inquiry into the fire.

Simon Lawrence, a contracts manager at Rydon, said his company was contractually obliged to tell its client if any materials failed to meet regulations, but no-one in his team had the depth of knowledge needed to make an informed judgement about the designs proposed by the architect Studio E or cladding specialist Harley Façades.

Lawrence said he had only a 'general understanding' of the relevant Building Regulations and had not read the cladding compliance standard. He said it was the responsibility of specialist subcontractors to check design work by other specialist firms, and the Harley proposal was designated 'approved for construction' without being checked. He said there was no 'design responsibility matrix', but that overall approval would have been given by Studio E as the 'lead designer... best-placed to handle and move the drawings to the client'.

This contradicted evidence given earlier by Studio E's Neil Crawford, who said Lawrence had told him the architect's role should be 'more responsive, with Rydon maintaining a greater degree of control over the design process than I would normally expect'.

**IN BRIEF****CCC says Covid-19 can be turning point in tackling climate crisis**

In its annual Progress Report to Parliament, the Committee on Climate Change (CCC) stated that the UK government 'must seize the opportunity' for a 'green recovery'.

The report highlights five investment priorities in the months ahead, including: low-carbon retrofits and buildings that are fit for the future; tree planting, peatland restoration, and green infrastructure; strengthened energy networks; and moving towards a circular economy.

**Water-filled glass could transform building design**

A new research project says that water-filled glass (WFG) systems could be used to heat and cool structures and save energy in buildings all over the world.

The research – led by Dr Matyas Gutai, of Loughborough University – demonstrated that WFG systems could perform well in 13 types of climate without the need for additional energy. He built two prototype systems in Hungary and Taiwan using WFG as part of a larger mechanical system, with water-filled window panels connected to a storage tank by pipework concealed in the walls.

The water absorbs external and internal heat, and is circulated to the storage tank. When the temperature falls, heat stored in the tank can be recirculated to warm the building or to produce hot water. Gutai has also developed a version of the system that works with a heat pump.

**Energy-efficiency experts wanted**

The BBP is seeking expressions of interest (EOI) for suitably experienced energy-efficiency experts to become members of the Nabers UK Independent Design Review Panel. Successful applicants will join the panel to give independent design reviews for Nabers UK Design for Performance Agreements.

Submissions must be received by 6 August 2020, and online training will take place between 10am and 12pm on 7, 9 and 11 September 2020. For the EOI brief and application templates, visit [bit.ly/CJAug20EOI](https://bit.ly/CJAug20EOI)

**Scheme aims to preserve construction jobs and skills****New government-industry partnership looks to retain talent in the sector**

CIBSE has welcomed the new Construction Talent Retention Scheme (CTRS), which is part of a package of measures announced by the Chancellor, Rishi Sunak, to help the industry deal with the aftermath of the Covid-19 crisis.

The CTRS is a partnership between the government and industry, aimed at minimising unemployment and retaining/redeploying talent throughout the construction, engineering and building services sectors. It was launched in July as an online portal, to help with the redeployment of staff at risk of redundancy and enable temporary employee loans between businesses. The scheme will also give displaced workers from other industries a chance to take up roles in construction related professions.

Funded until April 2021, the not-for-profit programme will provide a free online platform

for organisations looking to hire skilled people, and allow individuals to advertise their skills and experience to potential employers.

'CIBSE welcomes the Chancellor's commitment to preserving jobs and skills in the sector,' said CIBSE President Stuart MacPherson. 'If we are to deliver the energy-efficient, high-performing buildings we need, it is essential that we retain and develop those with the skills and expertise to design and construct our new buildings, and refurbish and maintain our existing stock to the highest standards.'

Construction Leadership Council (CLC) co-chair Andy Mitchell added: 'This is a great example of what we can achieve when we work with the government, and we look forward to continuing in this spirit when the proposals and recommendations of our broader Roadmap to Recovery are published. In the meantime, we will work with our members and industry stakeholders to encourage the scheme's use.'

**'German-style' plan for tech education**

The government has announced a complete overhaul of the further education (FE) system to boost technical training and apprenticeships.

Education Secretary Gavin Williamson lambasted the two-decade-old New Labour flagship policy of encouraging 50% of young people to go to university. It will be replaced by a 'German-style' system that aims to simplify the number of courses on offer and encourage more young people to opt for technical qualifications – including engineering – delivered by the FE sector.

The number of adult learners in FE has fallen from 3.1 million in 2000 (the year after Tony Blair launched the 50% policy) to 2.1 million last year, thanks to a 'systemic decline' in technical qualifications in favour of degrees, according to the government. 'I don't accept this absurd mantra that if you are not part of the 50% of the young people who go to university that you've somehow come up short,' said Williamson. 'Especially when the evidence demonstrates that further education can open the doors to greater opportunity, better prospects and transform lives.'

He added that the 50% figure was 'a target for the sake of a target, not with a purpose', and that new standard apprenticeships would start this month, with a white paper published in the autumn outlining the details of the FE overhaul.



## WHO says virus is airborne

**Letter from 239 researchers quoted evidence showing tiny particles with the virus could be suspended in the air**

The World Health Organization (WHO) has changed its stance on how the Covid-19 virus is transmitted after scientists from 32 countries presented evidence that it can remain airborne for several hours.

'Evidence was emerging', it said, that Covid-19 can spread through the air in enclosed spaces, with scientists suggesting that building

ventilation systems will be crucial in limiting the chances of future 'super spreader' events that could spark a second wave of the pandemic.

Benedetta Allegranzi, the WHO's technical lead for infection prevention and control, said evidence emerging of airborne transmission of coronavirus in 'crowded, closed, poorly ventilated settings... cannot be ruled out'.

The WHO's change of stance was prompted by an open letter, written by 239 researchers in virology, aerosol physics and epidemiology, quoting evidence that showed tiny particles containing the virus could become suspended in the air and were not immediately deposited on surfaces, as previously believed.

CIBSE has said since April there is a potential for airborne aerosol transmission of SARS-CoV-2. For the spring and summer, its *Covid-19 Ventilation Guidance* advised ventilating spaces with outdoor air as much as possible ([cibse.org/coronavirus](http://cibse.org/coronavirus)).

The guidance is under continual review and CIBSE is currently evaluating evidence to provide guidance for the cooler autumn and winter seasons.

In an introduction to the latest update on 15 July, CIBSE said some recirculation of air in the heating season may be needed because heating coils may not have the capacity to heat the cooler outdoor air.

For naturally ventilated spaces, the guidance advises that sensors to assess ventilation effectiveness should be of the nondispersive, infrared CO<sub>2</sub> type.

## IN BRIEF

### Changing Places to give greater access

From next year, larger accessible 'Changing Places' toilets will be required in a range of new public buildings. The government estimates that more than 150 buildings a year will have the facilities for severely disabled people, which will include hoists, curtains, adult-sized changing benches and space for carers. A £30m fund will also help extend coverage in existing buildings.

More than 250,000 severely disabled people will be helped to access public places as a result of the move, with shopping centres, supermarkets, cinemas, stadiums and arts venues required to include at least one Changing Places toilet.

See the government's full response to the consultation, held last year, at [bit.ly/CJAug20places](http://bit.ly/CJAug20places)

### Soft landings report published

A joint report on the benefits of the 'soft landings' approach to building handover has been published by the Better Buildings Partnership (BBP) and BSRIA. *Soft Landings: The Benefits to Commercial Property Owners* addresses the 'significant gap that exists between the design expectations and operational performance of buildings'.

Soft landings complements the partnership's Design for Performance approach by addressing problems in construction before and when they arise. The report focuses on how property owners can benefit from implementing 'soft landings', and features case studies and quotes from BBP members who have used it in one or more of their buildings.

## Turn thermal wheels on in winter

CIBSE has advised that thermal wheels be turned on in winter to ensure there is adequate outdoor airflow to dilute any indoor viral contaminant in the heating season.

In an update to *Covid-19 Ventilation Guidance* ([cibse.org/coronavirus](http://cibse.org/coronavirus)), CIBSE said the heat-recovery function was integral to system design in terms of airflow and meeting heating demand.

With the wheel turned off in cooler weather, CIBSE said there may be less outdoor air entering the building and lower airflow rates, leading to a potential reduction in dilution of any indoor virus. This is deemed a greater risk for viral transmission than the potential viral transfer across the thermal wheel.

CIBSE added that thermal wheels should be switched off outside of the heating season, or bypassed, because there is a risk of air leakage and moisture transfer between the supply and exhaust airstreams.

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# Chancellor puts energy efficiency at heart of recovery

**Round of financing includes a £2bn Green Homes Grant and £1bn for improving public buildings**

Household energy efficiency measures, upgraded schools and hospitals, and 'green jobs' will be key planks of the economic recovery, according to Chancellor Rishi Sunak.

His Summer Statement confirmed plans for a new £3bn programme that would make more than 650,000 homes more energy efficient, saving households up to £300 a year on their bills and supporting around 140,000 green jobs.

In addition, £1bn will be spent on improving the energy efficiency of public buildings – such as schools, hospitals and council buildings – and £2bn on a Green Homes Grant. This will give householders access to grants worth up to £5,000 to install energy-saving improvements, such as heat pumps and

improved insulation. Starting in September, the grants will cover at least two-thirds of the cost, but the government will issue vouchers covering the full cost of up to £10,000 for low-income households.

Sunak said the scheme would be supported by a £50m fund to help develop the best low carbon heating solutions.



Rishi Sunak

## Plan needed to spend £5bn a year on homes

The government should create a Home Improvement Plan to deliver £5bn of spending per year on improving the energy efficiency of Britain's homes, according to political think tank the IPPR.

It estimates at least 12 million homes in England will need to be fitted with heat pumps, insulation and other measures between now and 2050 if the country is to meet its zero carbon emissions targets.

According to the IPPR, the plan could facilitate the creation of a Retrofit Fund for England, through which £5.3bn could be funnelled into retrofitting annually up to 2030, followed by £3.5bn per year for the next 20 years. It would also tighten up Minimum Energy Efficiency Standards for the private rented sector, with properties required to have at least a 'B' Energy Performance Certificate by 2030.

## £100bn can be unlocked for recovery

The government could access more than £100bn to help finance its 'green recovery' and create more than 300,000 jobs, according to a group of businesses and local political leaders. The UK100 network believes the government should spend £5bn to unlock £100bn in capital investment, including £40bn for energy efficiency improvements and technologies through a 'net zero development bank'.

A pipeline of measures could grow to £100bn, according to the group's analysis, with £40bn from energy savings in homes and business, £30bn for low carbon heating, and £10bn each for renewables, smart energy systems, and low-emission transport.

## Cooling industry must mitigate growth

With demand for air conditioning and refrigeration set to grow exponentially worldwide, the industry has been urged to redouble its efforts to improve energy efficiency. The market is expected to expand from 3.6 billion appliances in use today to 14 billion by 2050, but, despite this, a joint report from the United Nations Environment Programme (UNEP) and the International Energy Agency (IEA) states that up to 460 billion tonnes of CO<sub>2</sub> equivalent emissions from cooling technology could be avoided.

*Cooling Emissions and Policy Synthesis* says improving energy efficiency and switching to climate-friendly refrigerants would mitigate the industry's impact on climate change. This would also depend on all countries implementing the Kigali Amendment to the Montreal Protocol to cut production and use of HFC refrigerants. This could reduce global warming by 0.4°C by 2100, says the report.

UNEP executive director Inger Andersen said the recovery from the Covid-19 emergency was an opportunity for all nations to refocus their use of resources to protect nature and minimise the impact of future pandemics. The IEA stated that doubling the energy efficiency of air conditioning by 2050 would reduce the need for 1,300GW of additional electricity generation capacity and could save up to \$2.9tn in reduced electricity generation, transmission and distribution costs.

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## Young Lighter of the Year shortlist announced

The Society of Light and Lighting (SLL) Young Lighter of the Year awards shortlist has been announced.

The eight shortlisted individuals, together with their submission titles are:

- Martina Alagna – *Biophilic Design: LED Lighting for Biological Maintenance of Ornamental Plants in Environments with Daylight Deficiency*
- Hannah Baxter-Gale – *Illunacy: Lighting the Black Dog*
- Aleix Llenas – *Spectrally Tunable Lighting for the Real World: A UK Case Study in Tracking Human Behaviour and Implications for Future Technology*
- Aluwaine Manyonga – *Offgrid Solar Lighting and Chigubhu Lantern Concept: Africa's Education System Game Changer*
- Georgia Rossi – *Open Beams: A Laser Lighting System for the Future*
- Dipali Shirsat – *Redefining the Image of a City: Lighting for Disabled Spaces*
- Ashley Vo – *To Create an Integrative and Modern Lighting System for Schools*
- Farida Zohair – *Light Pollution in Singapore*

They will each now have to submit their developed entries and a short video presentation by 21 August, with the four finalists selected by the judging panel to be announced at the end of September. See [bit.ly/CJAug20SLL](http://bit.ly/CJAug20SLL)

## CIBSE member on Top 50 Women in Engineering list

CIBSE member Professor Sandy Halliday has been recognised in this year's Top 50 Women In Engineering awards.

Professor Halliday gained the award in recognition of her contribution to sustainability within the industry.

She established Gaia Research (now Gaia Group) in 1995 to develop sustainable solutions for the built environment. It is currently involved in research, design, evaluation, dissemination, training and capacity building. Her own research covers solar air conditioning, the circular economy, zero waste, future proofed, low-allergy housing and urban design.

The awards, run by Women's Engineering Society (WES) as part of International Women in Engineering Day, celebrate the outstanding contributions from women in the industry. For 2020, the awards focused on exceptional achievements in sustainability.

For the full Top 50 list, visit [inwed.org.uk/we50](http://inwed.org.uk/we50)

# Design Guides for Dubai

## New publications focus on public health and mechanical and electrical services

Three new publications offering guidance on design in Dubai have been released by CIBSE.

The Design Guides for Dubai focus on design standards for mechanical, electrical and public health services. They have been produced to be used for initial design guidance, and provide minimum design requirements for specific design issues.

### The three guides are:

- *Design Guide for Dubai 01: Minimum design standards for mechanical services* – this aims to establish the minimum standards for the

design of HVAC and mechanical systems for buildings in Dubai.

- *Design Guide for Dubai 02: Minimum design standards for electrical services* – this looks to establish the minimum standards for the design of electrical systems for buildings in Dubai. It covers design codes, standards and guidance; incoming services; electrical loads and diversity; main distribution; standby generation and distribution; uninterruptible power supplies; cabling; lighting; and earthing and bonding.
- *Design Guide for Dubai 03: Minimum design standards for public health services* – this publication covers design codes, standards and guidance; local green building requirements; domestic cold water services, design criteria, codes and standards; water storage design criteria; domestic hot water services; water services design considerations; stormwater drainage; and liquid petroleum gas systems.

The guides have been produced by the CIBSE UAE Technical Committee to promote best engineering practices in Dubai, and to assist engineers going to work there. It should be read alongside existing CIBSE guidance relevant to the region, including *Buildings for Extreme Environments: Arid*.

- The guides are available at the CIBSE Knowledge Portal [cibse.org/knowledge](http://cibse.org/knowledge)



## Overheating and airtightness papers win awards

Technical papers looking at summertime overheating predictions, and the relationship between airtightness and ventilation methods, have been recognised with awards by CIBSE as the most notable papers exciting the greatest global interest published in *Building Services Research and Technology (BSERT) Journal* during 2019.

Both papers focused on domestic dwellings for their research – with one looking at the problems with modelling summertime room temperatures, and the other focused on the benefits of linking air tightness and ventilation strategies for improving energy performance and air quality.

Ben M Roberts, David Allinson, Susie Diamond, Ben Abel, Claire Das Bhaumik, Narguess Khatami and Kevin J Lomas won the Carter Bronze medal for their paper *Predictions of summertime overheating: comparison of dynamic thermal models and measurements in synthetically occupied test houses*.

The Napier Shaw Bronze medal was awarded to Jenny Crawley, Jez Wingfield and Cliff Elwell for their paper *The relationship between airtightness and ventilation in new UK dwellings*.

Both papers are currently available to view: the Carter Bronze medal paper can be read at [bit.ly/2ZpisYY](http://bit.ly/2ZpisYY) and the Napier Shaw Bronze medal paper can be viewed at [bit.ly/CJAug20CNews2](http://bit.ly/CJAug20CNews2)

CIBSE members can read the *BSERT Journal* and *Lighting Research and Technology (LR&T) Journal* as part of their membership at [cibse.org/knowledge](http://cibse.org/knowledge)



# Major update for sustainability guide

## New Guide L aims to put engineers at heart of sustainability agenda

CIBSE's new updated Guide L aims to empower building services engineers to deliver the next generation of low carbon, sustainable buildings.

The updated *Guide L: Sustainability* recognises the huge influence engineers have over sustainability and the health and wellbeing of building occupants.

This guide, an update on the previous 2007 edition, explores the actions that building services engineers should take to ensure their projects deliver sustainable results. It gives clear focus on the areas of work where engineers have greatest control and influence.

It outlines the principles for sustainability for engineers and covers energy use, carbon dioxide emissions, health and wellbeing, water use and other sustainability outcomes.

In the foreword, CIBSE vice-president Susan Hone-Brookes emphasises the importance of the guide in embedding sustainability in everything engineers do. She calls on engineers to be informed, committed, bold and creative in their work.

She said: 'Your actions as an engineer are pivotal to the successful management of our home planet ecosystem, the safeguarding of all species and the security and prosperity of our future generations.'

David Cheshire, Aecom regional director and co-author and chair of the Guide L steering committee, said: 'Having been involved in both the original and the new guide, it was inspiring to see how much has changed over the last 13 years and how engineers have used the increased awareness of the climate crisis to challenge and influence projects.'

'This new edition calls for engineers to use systems thinking, building physics and even ecosystems services to create a zero carbon, circular and sustainable future.'

The guide acknowledges the changes in society that will be needed to achieve real, measurable results, while setting out best practice for what can be achieved now. Case studies also illustrate where best practice has achieved real progress towards more sustainable buildings and places.

● *Guide L: Sustainability* is available at [cibse.org/knowledge](http://cibse.org/knowledge)

## Ken Dale Travel Bursary 2020 winners announced

John Smyth and Joey Aoun have been announced as the winners of the 2020 Ken Dale Travel Bursary. They will each be awarded a grant of £4,000 to travel while undertaking a research project.

Smyth plans to visit Singapore, Australia, Korea, China and Israel for his research topic: 'How building services can help in the fight against viruses and contaminants'.

Aoun's research title is 'The social housing retrofit challenge: lessons learned from pioneering projects', and he plans to conduct his research in the UK, Germany, Japan and New Zealand.

Aoun's research aims to produce a best-practice summary guide for designing and maintaining healthy and resilient indoor building environments for the 'new normal'. He plans to analyse the measurement of building performance metrics related to indoor air quality, energy consumption and occupant comfort of building case studies in the countries to which he travels.

The judges decided to award the bursary to two people this year, with no award next year, allowing time for the winners to complete their research and travels once travel restrictions are lifted.

The annual Ken Dale Travel Bursary offers between £1,500-£4,000 to members in the developmental stage of their career, who wish to spend three to four weeks abroad researching aspects connected to their field of work.



John Smyth

Joey Aoun

## New members, fellows and associates

### FELLOWS

**Black, Gordon John**  
Glasgow, United Kingdom

**Gilbey, Mark John**  
Shalford, United Kingdom

**Howe, Martin**  
York, United Kingdom

### MEMBERS

**Chan, Wai Lok**  
Tseung Kwan O, Hong Kong

**Cheng, Kwok Pan**  
Sai Ying Pun, Hong Kong

**Croft, Joshua**  
Nottingham, United Kingdom

**Kin Wang, Kwong**  
Tai Po, Hong Kong

**Lam, Ho Tak**  
Tsuen Wan, Hong Kong

**Lam, Kwan Yu**  
Shatin, Hong Kong

**Lau, Ka Chi James**  
Tai Po, Hong Kong

**Law, Man Yuen**  
Yuen Long, Hong Kong

**Leung, Chun Wai**  
Yuen Long, Hong Kong

**Liu, Cheuk Wai**  
Kowloon, Hong Kong

**Mak, Tsun Ho**  
Quarry Bay, Hong Kong

**Meng, Danqing**  
Hung Hom, Hong Kong

**NG, Ka Long**  
KLN, Hong Kong

**Pun, Mun Wai**  
Shatin, Hong Kong

**Twaddle, Alan Richard**  
Coleraine, United Kingdom

**Wai, Koon Lun**  
NTM, Hong Kong

**Wan, Chiu Ling**  
Ma On Shan, Hong Kong

**Wong, Kwan Ho**  
Tai Po, Hong Kong

**Wong, Wai Keung**  
NT, Hong Kong

**Yip, Tze Ho**  
NT, Hong Kong

### ASSOCIATES

**Arbon, Jamie**  
London, United Kingdom

**Concannon, Paul**  
Prescot, United Kingdom

**Newman, Oliver**  
London, United Kingdom

**Ronan, Pierce**  
London, United Kingdom

**Stobbs, Jake**  
Leeds, United Kingdom

**Wilson, Peter**  
Liverpool, United Kingdom

### LICENTIATES

**Dark, Christopher James**  
Bristol, United Kingdom

**Green, Tyla**  
Manchester, United Kingdom

**Justin, Alexandro**  
Nottingham, United Kingdom

**Kelly, Timothy Adam**  
Warwick, United Kingdom

**Millward, Gerald Adrian**  
Nr Newquay, United Kingdom

**Silk, Dane**  
Manchester, United Kingdom



## How a domestic BMS works to make homes energy efficient

An article on smart homes ('Streetwise', August 2020, *CIBSE Journal*) prompted many questions on social media about how a BMS system can work on a domestic scale. Co-author Dan Cash, of Atamate, responds to the key questions raised.

**Smart home technologies (SHTs) are very demanding and require considerable work from householders, yet there is little support available. There's also a lack of expertise among trades to deal with SHTs. How do you overcome this?**

We recognise this as a familiar story with many SHTs, where a number of different systems/products are used to provide a solution for the client. This leads to a need for a systems integrator to implement the end solution. The upshot of this is a bespoke system that is not easy to install or to use.

Addressing this issue was a founding principal of Atamate; first, the system is designed as a 'building operating system' where all devices sit on a common platform. Second, we have developed a set of digital tools that simplify the system configuration, and output a set of wiring instructions to allow the installation to be carried out by any qualified electrician. The system can be commissioned using a smartphone.

**Controlled vents sound a lot like actuators. Is there a risk of burn out?**

Dampers involved in the vents require significantly less load than a window to actuate. This combined with the fact we limit movement frequency means burn out is not a concern. The actuators used are similar to those in commercial mechanical vent systems, which are designed for many cycles per day.

**Economically, there is no point pushing building fabric such that space heating demand is much lower than the 15kWh set out by Passivhaus. Isn't summer comfort and DHW production more important?**

This is our experience too. Improving the building fabric leads to domestic hot water (DHW) becoming more dominant. This is why we use exhaust heat pumps (EAHP) for DHW in the majority of recent projects.

EAHP also produces cooling as a byproduct in summer; we're trialling the use of this 'waste' cooling to reduce summer time temperatures. This can be useful but we always look to maximise passive cooling first.

**There is no mention of parasitic energy of BMS. Was this factored in?**

The Bluetooth technology we use is very low energy. Each room sensor unit consumes around 0.1W; each flat has around six sensor units, so this means less than 1W. There is also a main edge computer, which requires around 5W. Our approach has looked to reduce parasitic loads at each step. For example, the relays used to control the vents are bistable so do not need to be continuously energised, which can reduce efficiency.

● Read more questions and answers at [cibsejournal.com](http://cibsejournal.com)

*CIBSE Journal* welcomes readers' letters, opinions, news stories, events listings, and proposals for articles. Please send all material for possible publication to: [editor@cibsejournal.com](mailto:editor@cibsejournal.com) or write to: Alex Smith, editor, *CIBSE Journal*, CPL, 1 Cambridge Technopark, Newmarket Road, Cambridge CB5 8PB, UK. We reserve the right to edit all letters.

# The knowledge

Engineers understand how products work, but it is specialist knowledge that sets apart the most successful systems, says **Josh Emerson**

Lockdown has been eased, but how much more do we know about how the virus behaves in buildings that we didn't know four months ago?

Naturally, the World Health Organization (WHO) is a heavily science-led body, so it will reserve judgment before making any public pronouncement, but it has finally confirmed what many building services experts had already worked out: Covid-19 can remain airborne for several hours and is not always immediately deposited on surfaces.

Benedetta Allegranzi, WHO's technical lead for infection prevention and control, said that evidence emerging of airborne transmission in 'crowded, closed, poorly ventilated settings... cannot be ruled out'.

Its change of stance was prompted by an open letter from 239 researchers working in the fields of virology, aerosol physics and epidemiology, who showed how tiny particles containing the virus could become suspended in the air. This must lead to greater focus on ventilation and the movement of air in enclosed spaces.

Facilities managers will also need to understand the problem they face, and that comes from measuring and monitoring indoor air quality. Increasing ventilation flowrates and switching to 'fresh air only' is part of the answer; but, equally, there are unknown elements we must research to better understand how we should set up existing ventilation systems and adapt future designs.

However, we do not need further research to recognise that every building is unique, and that we need to understand how it operates in detail in order to get the right solution. Hence the equation: P=HxSxK (performance equals hardware multiplied by software multiplied by knowledge).

Our industry is good on products (hardware) and understands how controls (software) can bring a series of components together to create a 'system' to suit the characteristics of the building, but it is the combination of our specialist and holistic understanding of how the building operates that provides the vital link between people and technology.

It is important, too, that we fully understand the implications of switching off ventilation systems or disabling heat recovery features 'to be on the safe side' because that kind of action can have adverse effects on the indoor environmental quality (IEQ).

That 'knowledge' factor will make all the difference in narrowing the performance gap and, as ever, this is not just about wasting energy - it has real long-term health and wellbeing implications.

● For details, visit [www.swegon.com/UK](http://www.swegon.com/UK)



# Climate action plan

A year after the Institution published its debut plan for climate action and mitigation, CIBSE's Julie Godefroy summarises the first update

A year ago, CIBSE published its first climate action plan to frame how we could increase our efforts on climate action and mitigation. We mapped our current, and planned, activities in the areas where we have a duty and the ability to act.

The plan is now going through its first annual update, with key points summarised below. For the full plan and webinar, visit [bit.ly/CJSept19plan](http://bit.ly/CJSept19plan)



## Education

We have started to engage with academia and explore how we could increase the emphasis on climate change, adaptation and the transition to zero carbon in CIBSE course accreditation; we welcome feedback from academia, recent graduates and members of accreditation panels.

## Events, dissemination and awards

- Further encourage and reward the monitoring of building performance, and disclosure of data
- Review awards criteria to increase consideration of embodied carbon.

## Guidance

### Setting a strategy and objectives towards net zero:

- Input in RIBA 2030 Sustainability Challenge
- Revised *Guide L: Sustainability, 2020* – [bit.ly/CJAug20GuideL](http://bit.ly/CJAug20GuideL)
- Input and support to the LETI 'one-pager' on new operational net zero carbon buildings – [bit.ly/CJAug20LETI](http://bit.ly/CJAug20LETI)
- Online energy benchmarking tool ([bit.ly/CJAug20tool](http://bit.ly/CJAug20tool)); upcoming 2020 update, including domestic benchmarks; collaboration with others to share data
- Further development of benchmarking tool.

### Delivering performance:

- New mapping of how our guidance can help deliver net zero, against LETI one-pager – [bit.ly/CJAug20netzero](http://bit.ly/CJAug20netzero)
- New working group on hot water temperatures for energy efficiency and low-carbon heat; guidance being drafted for instantaneous systems
- New working group on electrical engineering for net zero; strategic guidance being drafted
- Input to the LETI Embodied Carbon Primer
- Guidance on assessing embodied carbon of building services products being drafted
- New and updated guidance on heat pumps being drafted or scoped: Domestic heating design guide (DBSP); TM51; heat pumps in large residential schemes
- Produce new electrical engineering guidance including benchmarks, plant sizing, demand reduction and management, interaction with the network and EVs
- Produce new guidance on heat networks: 5th gen/ ambient loops, and low carbon retrofits
- Develop our guidance on domestic and non-domestic retrofit, including historic buildings
- New Code of Practice for zero carbon buildings.

## KEY

- Current activities
- Plans for further action
- Possible further activity to be explored – members' feedback welcome

## As a professional institution

- Member of CIC Climate Change panel; contributing to cross-industry climate action plan and working groups, for example data and retrofit
- Increase awareness of the Code of Conduct; this is now promoted in 2020 Guide L; suggestions from members welcome, for example summary of benefits for clients?

## Practising what we preach – our Balham office and activities

- Disclosure of performance: Display Energy Certificate, updated in December 2019.

## Research

- New research areas ([cibse.org/knowledge/research](http://cibse.org/knowledge/research)) include retrofit, embodied carbon in building services, and circular economy
- New research insights ([bit.ly/CJAug20insight](http://bit.ly/CJAug20insight)) on retrofit to NZEB standards, and circular economy principles in building services
- BSSERT special issues, for example zero carbon, retrofit.

## Policy

- Regular input to policy consultations and government working groups
- New position statements on net zero carbon buildings, planning, and overheating – [bit.ly/CJAug20Pos](http://bit.ly/CJAug20Pos)
- Briefing of green recovery – [bit.ly/CJAug20Green](http://bit.ly/CJAug20Green)
- Signatory to joint BPN statement on regulations for operational performance – [bit.ly/CJJan20BPN](http://bit.ly/CJJan20BPN)

## Competence and training

- New joint webinar with ASBP on embodied carbon in building services (23 July 2020) – [bit.ly/CJAug20asbp](http://bit.ly/CJAug20asbp)
- Reviewing our training programme against latest guidance and the net zero agenda
- Part of RIBA-led working group to develop joint industry curriculum on climate change and sustainability
- Introduce mandatory CPDs on climate change and zero carbon buildings.

## FEEDBACK CALL

This climate action plan has been informed by input from members, other professional institutions and the wider industry. Please send your thoughts, how we could help you, and where you could support our activities, to [JGodefroy@cibse.org](mailto:JGodefroy@cibse.org)

**DR JULIE GODEFROY**  
is technical manager at CIBSE

# Second chance

If the government's £5bn Green Homes Grant is to be successful, lessons must be learnt from the Green Deal, say Enhabit's Dr Sarah Price and Akta Raja

After the failure of the Green Deal and the string of unintended consequences related to Energy Company Obligation (ECO) projects, are we finally going to get the kick-start the industry so desperately needs?

Done well, the government's new Green Homes Grant could result in new jobs, upskilling of the workforce, healthier buildings, recurrent carbon savings – and a consumer who understands that buildings can perform better. Another failure, and we will lose the confidence of the consumer completely, carbon will become locked-in, investments won't be made – and we will have missed a massive opportunity.

The architecture of the Green Homes Grant must avoid the performance gap and allow consumers to understand the benefits of retrofitting: lower carbon, high comfort, and lower running costs. If this is achieved, the market will start to understand the real benefits of retrofit, and it will become more widely adopted, the industry will grow, and taxpayers' money will be well spent.

## Performance gap

The causes of the performance gap are well known. For example:

- Applying insulation without appropriate ventilation has led to mould growth and poor indoor air quality
- Installing modern vapour-impermeable insulations to older buildings has led to trapped moisture, interstitial condensation, and degradation of the building fabric
- Neglecting airtightness has led to excess heat loss, thermal discomfort, interstitial condensation, and poor insulation performance
- Poor building surveys and ignoring remedial works has led to trapped moisture and degradation of the building fabric
- Poor quality control in design and construction leads to moisture ingress, excess heat loss, thermal discomfort, and structural and fire safety compromises.

While the government has yet to release full details, there are early signs that it may have finally paid attention to the experts and embraced the right way of retrofitting, by making sure that the Green Homes Grant will only become available if the work complies with PAS 2025: 2019 'Retrofitting dwellings for improved energy efficiency.



**"Together, we are powerful and can make a meaningful impact on how the policy is implemented"**

Specification and guidance'. Compliance with PAS2035 will become mandatory for all ECO projects from 1 July 2021, so it makes sense for the Green Homes Grant to make use of the regime.

Under the scheme, the retrofit coordinator oversees the process and protects the interests of the client and the public. The PAS defines the levels of competencies required for other roles, including retrofit designers, assessors, advisers, installers and evaluators for different levels of retrofit, and recognises a whole-house retrofit should be treated in the same way as a new-build project.

## Retrofit coordinators

Using retrofit coordinators will reduce the risk of damage to the building's fabric and shrink the performance gap – and may also be a way of protecting the consumer against the cowboys who appeared solely to take advantage of the Green Deal, ECO and free cavity wall insulation schemes.

Retrofit coordinators are not a panacea; ultimately, the training is only six days long and only a few hundred people have completed the course. The real test will be of the regulating body TrustMark, to see if it can maintain the quality required for retrofit. Retrofit projects are going to require the best building physics and engineering minds, so it's also important for engineering bodies such as CIBSE to ensure that they provide the right support and guidance for all types of retrofit. But it also needs the entire industry to work together.

The wide range of industry bodies needs a coordinated response to the grant; engineers and architects need to work closely with manufacturers, distributors,

contractors and project managers. Together, we are powerful and can make a meaningful impact on how the policy is implemented, and ensure that there's not just a race to the bottom. Individually, we are too disparate to achieve that level of impact.

Ultimately, the Green Homes Grant is just the tip of the iceberg – an average of £5,000 per home will not be sufficient to deliver the depth of retrofit required to meet zero carbon targets by 2050. Also, the £2bn pledged will provide some retrofit measures to around 400,000 homes – a tiny fraction of the 24 million housing stock that will need retrofitting by 2050. So let's hope this is just the start.

**DR SARAH PRICE**  
is head of building physics at Enhabit  
**AKTA RAJA**  
is founder of Enhabit

# AGE OF CONNECTION

Taking over as ASHRAE President, Charles E Gulledge III heralded a collaborative future at the ASHRAE virtual meeting. **Tim Dwyer** reports



The renovation of ASHRAE's HQ is still on target for a late-2020 opening



Charles E Gulledge III heralded 'Industry 4.0'

**T**he ASHRAE summer conference was to be held in Austin, Texas, in 2020, but the Covid-19 pandemic meant this year's series of seminars and speeches were held online.

Opening the conference, ASHRAE executive vice-president Jeff Littleton told the audience that the resilience and dedication of members had endured, and that activities were continuing, practically unabated. In his address, he highlighted ASHRAE's successes – aside from concerted actions in responding to the pandemic – including thousands of hours of online learning; numerous publications and standards; and hundreds of learned meetings.

With more than 55,750 members, Littleton noted that membership remained resilient, but there was underlying caution of 'financial adjustments' in the coming year to see ASHRAE through a 'short-term coronavirus economy'.

The ambitious ASHRAE HQ renovation, which had, so far, attracted more than \$10m of company and individual support, was still on target for an opening in late 2020, added Littleton.

He celebrated the 46 years of contribution to ASHRAE by Steve Comstock, who built the institution's 'powerhouse publication and education business from the ground up'. Comstock, who retired from ASHRAE on 2 July, has been a driving force in maintaining active links between ASHRAE and CIBSE, and has played a key part in all the joint meetings between the organisations.

At this year's summer conference, Charles (Chuck) E Gulledge III also took over as ASHRAE President. In his presidential speech, Gulledge offered a vision of a future world based on a clear set of practical and – to a large degree – extant working practices that he believed would be transformational for members, the industry and the wider community. He heralded 'Industry 4.0 and the Age of Connection', and said digital maturity and collaborative working could deliver a 'rich harvest' that enables differentiation from the competition, recognition of innovators, improved profit margins, and maturation of a digital savvy workforce, as well as value.

Gulledge imagined a world where work silos disappeared and collaboration provided engagement with all stakeholders from project inception onwards. Digital intelligence amplifying human intelligence would relieve the 'exhaustive and repetitive' to enable the 'analytical and strategic'. 'Projects will move to connected platforms so the building process will connect virtually, using cloud resources for universal access and contribution,' he said, outlining the steps to make this the new reality:

**Lean processes** to create better customer experiences – lean integrated project delivery (Lean IPD) was created for this purpose. Such an integrated process changes the timing and order of engagement. 'Who will build what' now precedes 'how it will be built'. In all phases, nothing is done until it should be done.

**Embracing digital technology** will empower the design, construction and operation of buildings. Gulledge gave several examples of digital technology that will power 'Industry 4.0':

- The common data environment (CDE) to provide the framework for information

**"Digital maturity and collaborative working could deliver a rich harvest that enables differentiation from the competition"**

management and exchange: 'a single-source, single-truth lighthouse'

- Virtual design and construction (VDC) to move a project from static drawings to 7D BIM models
- Generative design where algorithms test hundreds of variables in thousands of iterations. Humans define the boundaries and goals, but software handles comparison
- Computational fluid dynamics (CFD) to visualise thermal impact and understand the path of air movement, so enabling evaluations of ventilation strategies and ventilation effectiveness
- The digital twin to provide a virtual mirror of the physical asset, allowing 'a continuous journey' through the building's life-cycle
- Drones to support logistics, such as aerial mapping, construction monitoring and thermography
- Scanning via light detection and ranging (Lidar) to deliver precise-point cloud maps of surfaces and complex geometries, to capture true as-built conditions that can be integrated into the digital models
- Augmented reality (AR) to model data and project a precision reference in the physical

world, opening up possibilities to experience, explore and assess the detail of buildings while still virtual

- Design for manufacture and assembly (DfMA) strategies to challenge where work is physically performed. In its simplest form, basic assemblies can be fabricated for onsite or offsite use. Materials and components can be procured, cut, assembled and staged to support just-in-time flow.

Gulledge said digital technologies to 'imagineer' buildings are sufficiently mature, so a virtually precise building may be designed, built off site, and delivered as 'just in time' modules to the pre-prepared site, to feed a sequenced assembly of modules to form a complete structure.

'Work results no longer need to adhere to start-to-finish thought. We have decoupled the sequential supply chain,' he said, adding that collaboration would break the current fragmentation and enable workforce engagement in activities that seek and create value. Committing to a digital culture would increase appetite for risk, encourage experimentation and investment in digital talent, and expand collaboration skills. **CJ**

- The full presentation is available at [bit.ly/CJAug20Ash](https://bit.ly/CJAug20Ash)
- This first virtual ASHRAE Conference included 20 live sessions across four days, and more than 80 on-demand seminars with associated live, online, Q&As. All the presentation recordings are available online until December 2021 (for a registration fee) at [bit.ly/CJAug20conf](https://bit.ly/CJAug20conf)
- Experiences from the ASHRAE Conference are helping to inform the planning for the upcoming CIBSE ASHRAE Technical Symposium that will be held online in September. See [cibse.org/symposium](https://cibse.org/symposium) for details.

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**GEBERIT**

# BOX-OFFICE HIT

CIBSE's international winner of its Project to the Year Award is an exemplary retrofit, in which new offices have been carved out of the shell of a 1920s warehouse. **Andy Pearson** finds out how the Mason Bros building in Auckland, New Zealand, exploits passive design and digital technology to minimise building energy use before, and during, occupation

**T**he Mason Bros project does not have any revolutionary technology or world-first innovations; from the outset, there were no grand objectives (or the corresponding budget) to demonstrate world leadership in sustainable design – yet this is what we achieved,' says Anthony Calderone, technical director, built environment, at Mott MacDonald.

The scheme gained the accolade Project of the Year – International at the CIBSE 2020 Building Performance Awards.

Judges were highly impressed by the building getting the highest possible ratings for energy performance from the New Zealand Green Building Council. It is the first adaptive reuse building in New Zealand to achieve a 6 Green Star for as-built design, and a 5.5 Star NabersNZ rating for the effectiveness of the operation of the building.

The judges said the project team had excelled in getting the fundamentals right. The building services have 'achieved great results by applying existing technology and methods well, rather than by reinventing the wheel,' they said.

What makes the building's sustainable achievements impressive is that this is not a purpose-built low energy development; before its imaginative transformation into a multi-tenant office building, Mason Bros was an industrial warehouse, built in the 1920s.



The warehouse is located in the Wynyard Quarter redevelopment area of Auckland, a precinct undergoing a major transformation under the control of Auckland Council. Precinct Properties were selected to develop the building. Working with building services engineers Mott MacDonald and architect Warren and Mahoney, the developer initially targeted a 5 Green Star rating and 4.5 Star NabersNZ rating.

In addition, the project had to meet a number of targets and obligations on water consumption, construction waste recycling and materials selection, which were enshrined in the development agreement from land owners Panuku Development Auckland – the council's development vehicle.

Although the former warehouse was at the end of its serviceable life, a decision was taken to retain much of the existing structure and building fabric. 'Considering studies have estimated that it can take 20 to 30 years for energy and emissions from a building to outpace the embodied energy, the decision to retain the building's envelope provides the Mason Bros redevelopment with a significant lifecycle benefit when compared with an equivalent new building,' says Calderone.

To quantify the benefits of reusing the building's envelope, Mott MacDonald undertook a lifecycle assessment. 'The analysis showed the Mason Bros building to have a 50% or better decrease in global warming potential, acidification potential, eutrophication potential, mineral depletion and fossil fuel depletion compared with a benchmark new

**The Mason Bros building was originally an industrial warehouse, which was built in the 1920s**



**"The decision to retain the building's envelope provides the Mason Bros redevelopment with a significant lifecycle benefit when compared with an equivalent new building" – Anthony Calderone**

building in New Zealand as quantified by Branz [Building Research Association New Zealand],' Calderone explains.

The retained industrial envelope includes the sawtooth roof, complete with south-lights, and its red brick façade. Inside this shell the building has been transformed with the addition of two new floor plates to create 5,500m<sup>2</sup> of flexible workspace. Impressively, the floor plates are set back from the façade, where they are hidden behind a screen of highly-reflective glazing.

The overall effect is that the workspace appears as a giant shiny new box placed inside the building's gritty industrial shell. Scott Pritchard, CEO of the developer Precinct Properties, has described the scheme as 'like creating a ship within a bottle'. An atrium incorporating a large feature staircase allows occupants access from a ground floor arcade into the box.

To develop a cost-effective building services solution to meet both Green Star and NabersNZ criteria, Mott MacDonald looked at various combinations of building services and building fabric modifications using IES-VE software. It ran more than 30 different simulations to find a solution that would ensure low energy >>

## REOCCUPATION AFTER COVID-19

New Zealand's successful containment of the coronavirus has meant the Mason Bros building has been able to fully reopen. When the country was at the highest level of its four-tier alert system, the building was closed to tenants. No specific HVAC Covid-19 measures were put in place, but the building manager brought forward a filter replacement.

When the alert fell to level two, most tenants operated with 50% of their staff on alternating weeks. This lasted only 2.5 weeks before restrictions were eased to level one, and the building was reoccupied.





PROJECT TEAM

**Land owner:** Panuku Waterfront Auckland  
**Developer:** Precinct Properties  
**Architect:** Warren and Mahoney  
**Building services, façade and sustainability:** Mott MacDonald  
**Independent commissioning agent:** Pacific Commissioning and Co-ordination  
**Structural engineer:** Holmes  
**Project manager, civil, fire engineer and asset management:** Beca  
**Main contractor:** NZ Strong  
**Mechanical sub-contractor:** Aquaheat  
**Electrical sub-contractor:** Allendale  
**Hydraulic sub-contractor:** DL Good  
**Fire protection sub-contractor:** Ask Metro Fire

» consumption and offered plenty of natural light.

Each simulation scenario was assessed against capital cost, long-term energy efficiency and occupant amenity. ‘Through completing this assessment process early in the design phase, we were able to influence the architectural design to determine optimal performance,’ explains Calderone.

The optimised design is based on exploiting passive design features, such as the exposed thermal mass offered by the new floor plates, and using natural ventilation through the building’s main arcade to maintain comfort while minimising energy consumption.

The scheme’s roof also provides a large area of south-light glazing, and additional glazed openings were incorporated in the façade to increase the amount of natural light entering the building. ‘Getting the passive design strategy right and then minimising operational energy are obvious steps in the move towards sustainable design,’ says Calderone.

The services are suspended from the underside of the exposed concrete soffits, with the pipework, ductwork, cable trays and seismic restraints enhancing the building’s industrial aesthetic.

Variable speed fan coil units (FCUs) provide heating and cooling to the offices. These

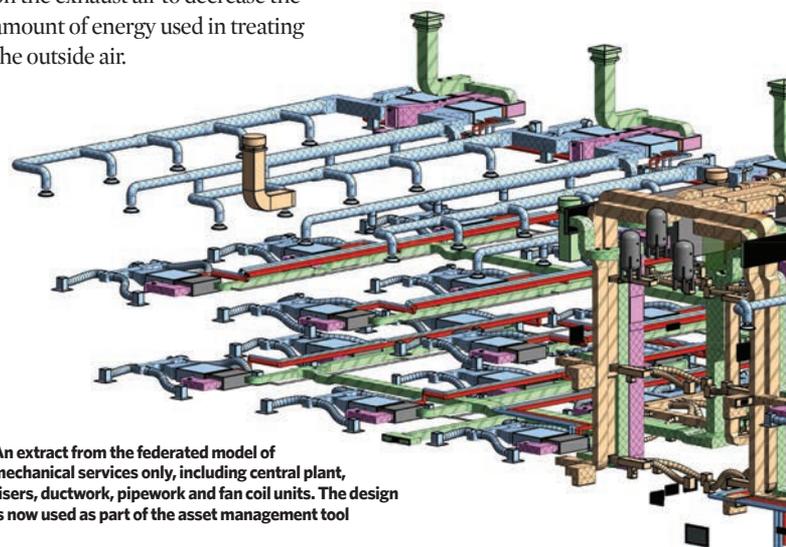


incorporate electronically commutated fan motors to vary the fan speed based on heating and cooling demand. On the ground and first floors, the services are typically split into perimeter and internal zones.

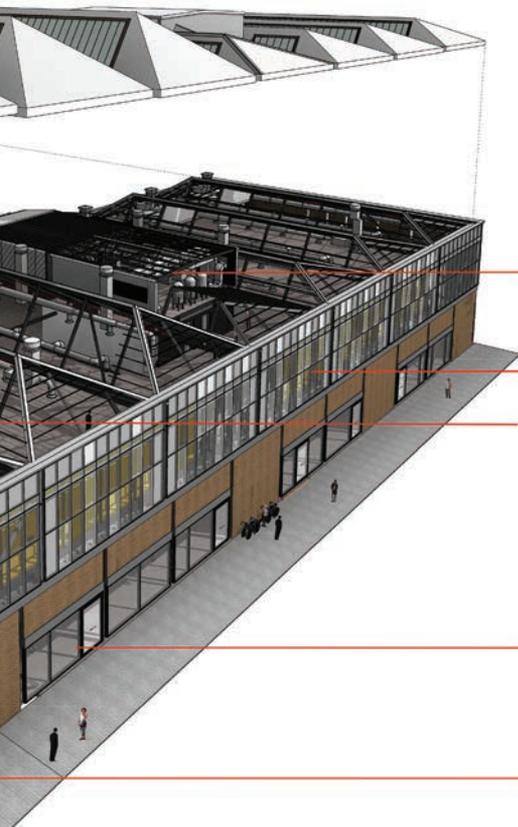
On the second floor, a more minimalist approach was taken to maximise daylighting from the south lights. The FCUs at this level serve larger zone sizes to decrease the amount of ductwork. Supply air is via variable flow diffusers and fan speed is modulated according to static pressure, which ensures the supply fan operates efficiently. The system incorporates a reset strategy that decreases the static pressure setpoint, which results in a slower fan speed to achieve the required air volumes and, therefore, a decrease in energy consumption.

Two air handling units (AHUs) supply 100% outside air to the FCUs at more than double the NZ Building Code requirement. ‘We prioritised outside air rates and filtration efficiency ahead of energy efficiency to ensure the best internal environmental quality for the occupants,’ explains Calderone.

The AHUs incorporate electronically commutated fan motors to control the volume of outside air, based on CO<sub>2</sub> levels in the space, through a combination of modulating dampers and velocity grids in the ductwork to each office space. The AHUs also incorporate heat recovery on the exhaust air to decrease the amount of energy used in treating the outside air.



An extract from the federated model of mechanical services only, including central plant, risers, ductwork, pipework and fan coil units. The design is now used as part of the asset management tool



Roof plant with ground and level one AHUs, chillers, heat pumps and miscellaneous fans

East and western façade replaced with high-performance glazing

Decreased extent of ductwork at level two to maximise daylight coupled with variable volume diffusers

Ground and level one served by chilled and heating water variable speed fan coil units

Naturally ventilated atrium with high-level window openings and in-slab heating and cooling

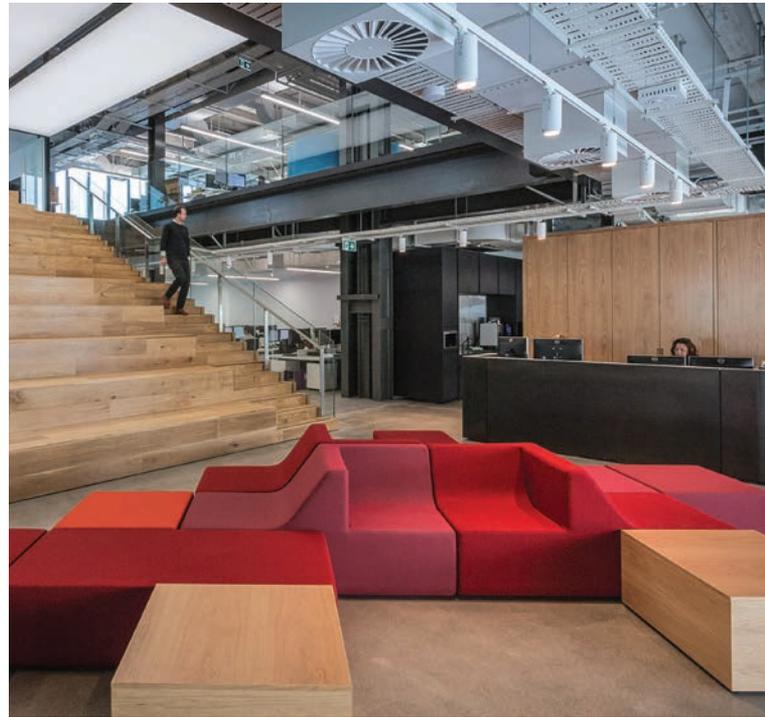
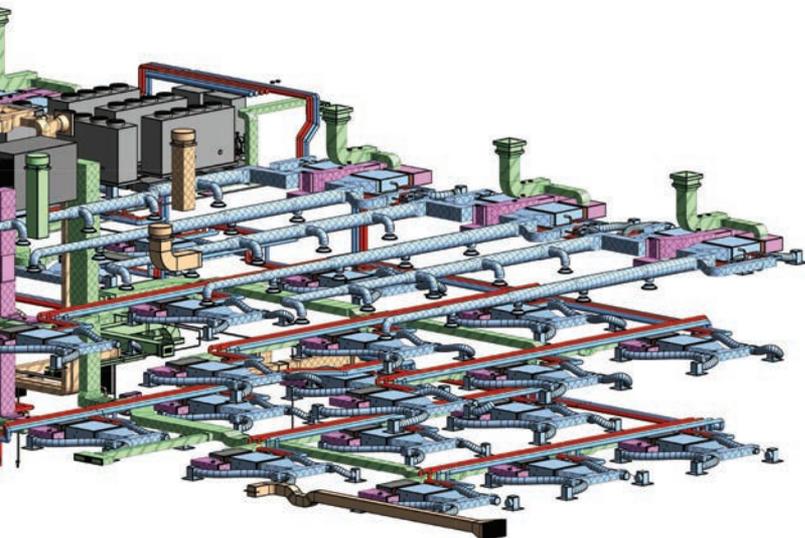
The FCUs and AHUs are provided with chilled and heated water from four reversible air source heat pumps. ‘Standard, published “seasonal energy efficiency” figures commonly used in chiller selection are not particularly useful in heat pump selection, as they do not account for differences in building geometry, climate, user interaction and system design, which is different in almost all buildings,’ says Calderone. For this project, the design team employed a modelled building load profile mapped directly to detailed manufacturer’s part load performance data to more accurately predict energy use.

‘For Mason Bros, a chiller was selected with a non-standard part load value (NPLV) of 3.6 rather than an alternative with an NPLV of 4.1, because across the load curve, the chiller with the lower NPLV was better performing and was predicted to deliver a 5% decrease in energy consumption when compared with the alternative,’ he adds.

A fifth air source heat pump is dedicated to supply heat to the domestic hot water via a calorifier; an electric element is used to boost the water temperature and provide system disinfection.

The offices are illuminated by an LED lighting system – which uses 60% less energy than the New Zealand building code requirement – with intelligent controls incorporating both occupancy and daylight level sensors. ‘The lighting levels are designed to minimise operational energy use, targeting less than 1.1W·m<sup>-2</sup> per 100lux with a uniformity of more than 70%,’ says Calderone.

Perhaps the building’s most sustainable aspect is the comprehensive building tuning and commissioning programme Mott MacDonald >>



**“Seasonal energy efficiency figures commonly used in chiller selection are not particularly useful in heat pump selection, as they do not account for differences in building geometry, climate, user interaction and system design, which is different in almost all buildings” – Anthony Calderone**

#### DIGITAL HANDOVER

Mott MacDonald’s building services design has transformed the Mason Bros building into a highly efficient, innovative and functional commercial workspace. To ensure it remained this way, Precinct Properties is using a digital asset information management system developed by Beca to allow vital asset information to be accessed via the Cloud directly from iOS devices.

The scheme was designed and constructed in a BIM environment. In addition, asset information was captured on site during construction using iPads. This was combined with data provided by the supply chain along with documents including manuals, commissioning data and warranty information, all of which was embedded into the 3D environment.

This enabled Beca to digitally hand over the asset information to support the building’s ongoing operation. The solution enables the digital management of the building’s plant and equipment with greater efficiency, transparency and accuracy.

» developed with Precinct Properties. ‘The client’s commitment to building tuning played a huge part in its success, along with the project team’s adoption of BIM to enable working in an integrated way throughout the project, from design through to asset management,’ says Calderone (see ‘Digital handover’ panel on page 23).

This collaboration began early in the project’s design and has continued into the operation of the building. ‘Through early engagement with the facilities management team, Mott MacDonald was able to understand how the landlord intended to operate the building and was able to adapt its design accordingly,’ Calderone says. In addition, the project used an independent commissioning agent both pre- and post-system commissioning to further optimise performance.

Mott MacDonald continued its collaboration with the building’s facilities team and the commissioning agent after the building was occupied, as part of an 18-month tuning and commissioning programme, following practical



completion. This ongoing involvement helped to ensure the energy efficient operation of the building services, and has minimised any residual problems to ensure the systems align with the design intent.

The commissioning was highly effective: after the first year of operation, the building’s energy use was 57kWh-m<sup>2</sup>, representing a 30% improvement on typical best practice, achieving a 5 Star NabersNZ.

In its second year of operation, optimisation of the building services operation saw energy consumption reduce further to 48kWh-m<sup>2</sup>, a 40% improvement over typical new building performance (assumed as 4.5 Stars under the NabersNZ protocol). The further improvement in energy use saw the building achieve a 5.5 Star NabersNZ rating, making this the highest rated building in Auckland and one of only five 5.5 Star-rated buildings in the country.

Andrew Eagles, CEO of the Green Building Council in New Zealand, sums up the scheme: ‘This building isn’t just one of the very greenest buildings in Aotearoa [the Māori name for New Zealand] – it’s one of the greenest in the world.’ And, if further endorsement of the scheme’s success was needed, both the scheme’s architect Warren and Mahoney and its engineer Mott MacDonald have moved into Mason Bros. **CJ**

## POST-OCCUPANCY SURVEY

To find out whether Mason Bros was delivering on its strategy to create spaces that are healthier and more productive environments for its clients, a building use study (BUS) was conducted. The BUS is based on a user survey, which included questions on workspace design, access to windows, thermal comfort, air quality, noise, lighting productivity and perceived control. It was carried out approximately 12 months after practical completion.

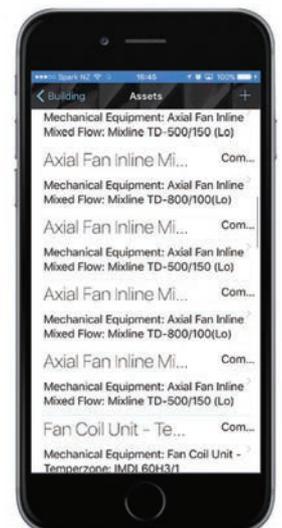
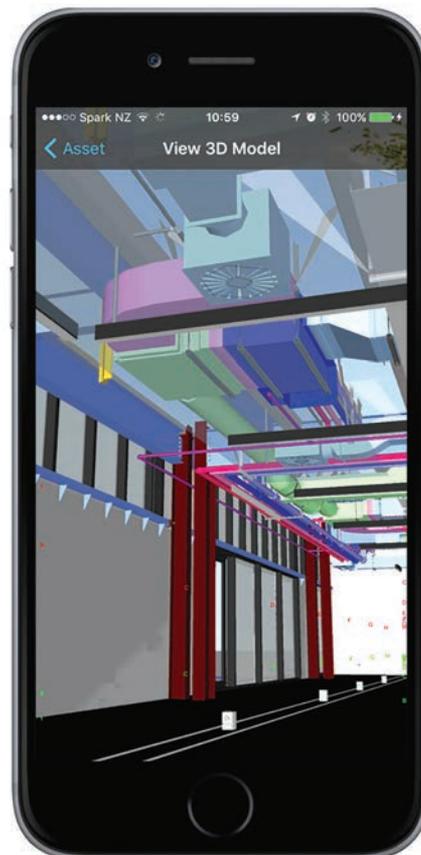
The developer had already carried out a BUS survey on four of its buildings located in Auckland’s central business district, none of which were Green Star rated. So in 2018, a BUS was carried out to see how Mason Bros compared against these.

### The results show:

- Respondents rated the overall design of Mason Bros very highly.
- In terms of amenity, access to outdoor spaces rated highly.
- That the end-of-trip facilities such as bicycle parking, shower facilities, changing rooms and lockers were lower than for the non-Green Star buildings. Interestingly, further investigation found that the building was actually a victim of its own success, and that the facilities were not large enough to cope with a significantly higher number of occupants cycling to work (16%) than had been anticipated, given the Auckland average is 2%.
- Of the variables measured for heating, ventilation and air-conditioning, the responses in relation to freshness and odour demonstrate the greatest improvement compared to the non-Green Star sample. Mason Bros respondents rated their environment as fresher and less smelly than the non-Green Star sample. This is almost certainly because outdoor air is supplied at a rate at almost 100% more than New Zealand Building Code.
- Occupants also said they feel more productive working in the spaces at Mason Bros compared with those working in the non-Green Star buildings.
- Sick leave is reported to have decreased by approximately 20-25% from the two major tenants occupying the building.

‘Post-occupancy research in the Mason Bros property has confirmed the advantages with up to a 25% drop in absenteeism, occupants indicating an increase in their personal productivity of 8.5%, and a massive 130% increase in cycling following the move,’ says Alain McKinney, senior development manager at Precinct Properties.

■ The CIBSE Building Performance Awards 2021 are now open for entries. For details, visit [cibse.org/bpa](http://cibse.org/bpa)



A digital asset information management system developed by Beca allows vital asset information to be accessed via the Cloud directly from iOS devices

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# LIGHT RELIEF

Experts are looking to ultraviolet light to help limit the transmission of coronavirus. **Andy Pearson** finds out how UVC light technology works and whether it could be used in buildings

**T**he World Health Organization (WHO) last month acknowledged emerging evidence that coronavirus might be spread by tiny particles that can remain suspended in the air for hours.

By breathing, talking, coughing and sneezing, people produce aerosols that may, if the host is infected, contain pathogens. Most of the larger droplets emitted fall on surfaces within 1-2m from the source. A few larger droplets may, depending on environmental conditions, shrink by evaporation before they settle, to become an aerosol.

ASHRAE, among others, says small aerosols (less than 10 µm) can stay airborne and infectious for hours – even days – and, consequently, can travel longer distances and infect secondary hosts without contact with the primary host. The evidence has yet to be thoroughly evaluated, but – if confirmed – it will make management of indoor air quality even more critical for infection control and may lead to changes in government advice on measures to prevent the spread of Covid-19.

The design and operation of HVAC systems can have a major impact on infectious aerosol transport. Experts recommend flushing rooms with lots of outside air to dilute airborne concentrations of the virus. But increasing the volume of outside air might not be possible in all buildings (or weathers) and for all ventilation systems, which is why some experts are looking to ultraviolet light technologies as a means of limiting the transmission of coronavirus.

Ultraviolet (UV) light can inactivate a virus. There are three main types of UV radiation,

classified according to their wavelength: UVA (400nm-315nm); UVB (315nm-280nm); and UVC (280nm-100nm). All three are present in sunlight; the shorter the wavelength the more harmful the UV radiation. UVA makes up the bulk of UV radiation reaching the Earth's surface, and can penetrate deep into the skin. UVB can also reach the Earth's surface and can damage DNA in our skin. UVC radiation is the most dangerous to humans, but is filtered out of sunlight by ozone in the atmosphere.

UVC is part of the ultraviolet spectrum that has the greatest germicidal effect. Its ability to kill bacteria was discovered more than a century ago. Since then, artificial sources of UVC – such as mercury lamps and, more recently, UVC LEDs – have been used to produce light with a wavelength of 254nm as a means of sterilising surfaces.

UVC light renders micro-organisms, such as bacteria and viruses, ineffective by destroying the genetic information in their DNA, so preventing them from reproducing and, effectively, inactivating the virus. When used in this way, UVC lighting is sometimes termed ultraviolet germicidal irradiation (UVGI).

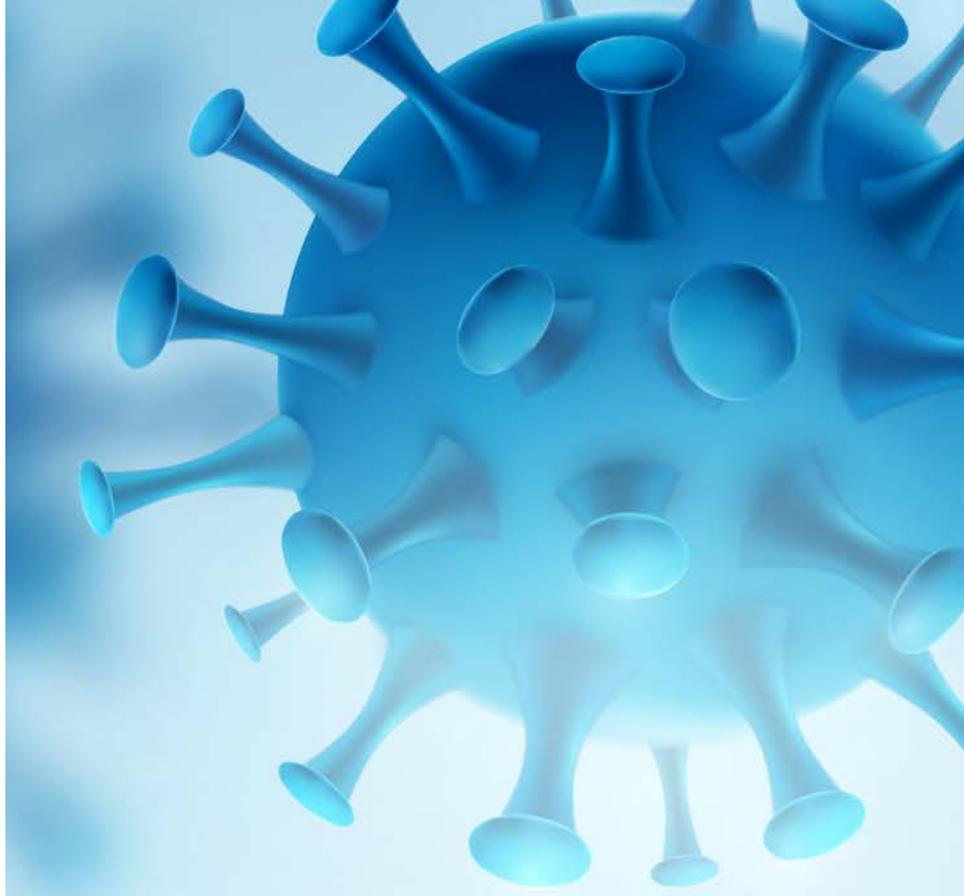
## UVC applications

A common use of UVC lamps is inside air conditioning units. Here, the lamps' disinfection properties are employed to keep the cool, moist surfaces of cooling coils and drain pans free of mould, virus and bacteria. When the virus or microbe is on the surface, the lamps are able to deliver an effective dose. UVC lamps are also used to irradiate surfaces in labs and clinical spaces, but only when the rooms are unoccupied. This reduces the likelihood of virus transfer from objects and materials.

Signify, which manufactures UVC lighting, has been working with Boston University to validate the effectiveness of its UVC mercury vapour light source, with a wavelength of 254nm, to inactivate SARS-CoV-2, the virus that causes coronavirus disease 2019 (Covid-19). The researchers applied a dose of UV light with a radiant energy density of 5mJ/cm<sup>2</sup>; this resulted in a reduction of the SARS-CoV-2 virus of 99% in six seconds. Based on the data, it was determined that a dose of 22mJ/cm<sup>2</sup> will result in a reduction of 99.9999% of surface bacteria in 25 seconds.

A pre-paper by Beggs and Avital<sup>1</sup> also found evidence suggesting that SARS-CoV-2, when suspended in air, is reasonably easy to inactivate using UV light at 254 nm.

**“UVC is not the silver bullet, but it is good at getting to the virus in places where it is difficult to clean using conventional cleaning methods”**





‘Where you can shine a light, you will get UV disinfection on the surfaces where it falls; where there is shadow, there will be no disinfection,’ says Mike Simpson FCIBSE, global application lead at Signify, and CIBSE past-president.

When UVC is used for surface sterilisation, the number of fittings used is determined by the need to achieve a minimum irradiance level and by the need to eliminate shadows, says Simpson. ‘UVC is not the silver bullet, but it is good at getting to the virus in places where it is difficult to clean using conventional cleaning methods,’ he adds.

Safety has to be paramount when using UVC lamps; systems must be equipped with sensors and controls to ensure they only operate when people and animals are not present. ‘There should be no exposure to human skin or the eyes; if you are going to irradiate a room, you’ve got to do it in a way that ensures no-one is present when the UV lighting is on,’ Simpson says.

Signify has recently broadened its UVC offering of lighting fixtures to include devices to disinfect air, surfaces and objects. In North America, for example, a large retailer is piloting a UVC tunnel for disinfecting shopping trolleys. Other products include mobile, freestanding UVC luminaires and robot-mounted vertical lamps that can be wheeled into a hotel room or office.

While unshielded UVC lamps are used to disinfect surfaces in unoccupied rooms, upper-room air disinfection luminaires can be used in occupied rooms. These devices use shielded UVC lamps to create a germicidal UV zone at high level. ‘The technique for dealing with aerosol particles is to irradiate the air above the occupied zone,’ says Simpson. The upper-room units remain on all the time. Air disturbed by people moving around and by ventilation systems will eventually drift into the upper part of the room, where any aerosol droplets containing coronavirus will be zapped by the UVC, inactivating the virus.

If, however, air is moving too quickly, the virus will not be exposed to the UV light for long enough for it to suffer harm – which is why Simpson says ‘putting a UV light in ventilation ductwork is not effective’. A ‘belt and braces’ solution, he says, is to use upper-room air devices to disinfect the air continuously and combine this with unshielded lamps to disinfect surfaces at night, when the room is unoccupied.

### Word of caution

Shaun Fitzgerald, co-author of CIBSE’s guidance on emerging from lockdown and a Royal Academy of Engineering visiting professor, acknowledges that UVC has been shown to be effective at inactivating viruses. However, he says the benefits of UVC can be marginal in well ventilated spaces: ‘If you have spaces that can be properly ventilated, then that is what I and other members of the CIBSE task group advise.’

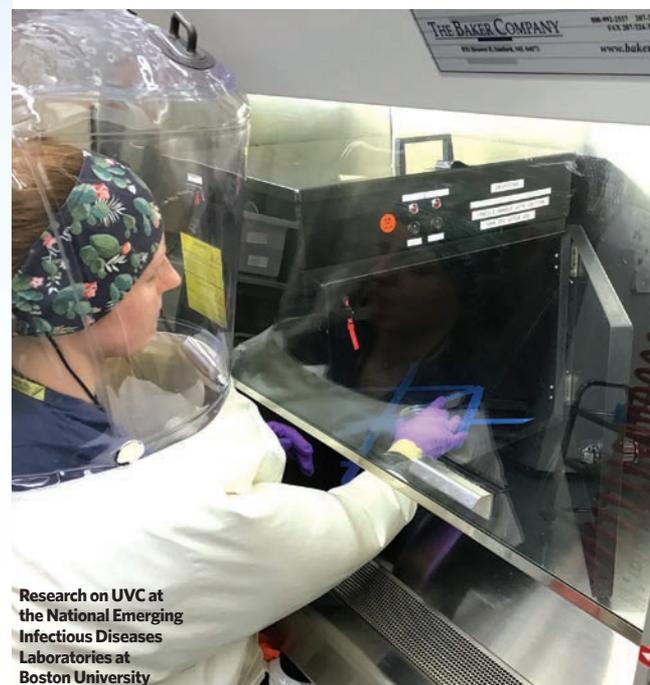
Fitzgerald says, if you are pursuing a strategy of enhanced levels of ventilation, it is the law of diminishing returns for the use of UVC. ‘If you are doing an awesome job at removing the virus, then, to make a meaningful dent on the remaining virus with UVC – or any [air] cleaning technology – you’ve got to go at it really aggressively to get a lot of the room air through the system, which is just impractical,’ he adds.

In spaces where it is difficult to flush with large amounts of fresh air, Fitzgerald says there are other technologies that may be worth turning to, and which may include UVC – but ‘it’s not what I’d turn to first’.

CIBSE coronavirus advice ([bit.ly/CJAug20Covid-19](https://bit.ly/CJAug20Covid-19)) says that, in poorly ventilated spaces with high occupancy, ‘it may be appropriate to consider using air-cleaning and disinfection devices’. However, it cautions against an over-reliance on UVC: ‘There are currently uncertainties about a variety of factors affecting UV performance, including dosage, wavelength and exposure time.’ The advice also includes a warning that ‘any potential equipment will need to be properly tested, validated and quality assured, and demonstrated to provide the specific irradiation properties it is designed to and nothing else’.

### Research from the US

Professor William Bahnfleth, of Pennsylvania State University, is chair of the ASHRAE Epidemic Task Force. He is in favour of UVC >>



Research on UVC at the National Emerging Infectious Diseases Laboratories at Boston University

**“UVC might yet be a powerful weapon, but it is not a panacea... which is why face coverings, social distancing and hand washing are still necessary”**

» systems for germicidal irradiation as part of a multifaceted approach to limiting the transmission of coronavirus; this could include increasing outdoor airflow in a space, upgrading air filters and adding air disinfection equipment, such as UVC. ‘My hope is that the revised WHO position will result in more willingness to use all appropriate engineering controls to reduce airborne exposure, including UVGI,’ he says.

According to Bahnfleth, germicidal UV technology has a long history in the US: ‘In the first half of the 20th century, upper-room systems were used to help control measles outbreaks in schools.’ The ASHRAE Handbook has two chapters on UVC fundamentals and applications, and the *ASHRAE Journal* has published articles on applications.<sup>2,3,4,5</sup> In addition, he says studies of the effectiveness of upper-room systems have suggested that their ability to inactivate airborne pathogens in a space ‘may be equivalent to as much as 10 air changes per hour of outside air’.<sup>6,7</sup>

‘It is only my impression, but there seems to be a somewhat greater interest in, and willingness to use, air cleaners as adjuncts to ventilation and particulate filtration in the US,’ Bahnfleth says.

A study in the US by Columbia University is looking at the potential of UVC light, at a wavelength of 222nm, as a means of killing coronaviruses. UV light at this wavelength is known as far-ultraviolet C (far-UVC).<sup>8</sup> According to the researchers, the advantage of using light at this wavelength is that it cannot damage human cells, so, potentially, would be safe for use in occupied public spaces to kill pathogens in the air before the occupants breathe them in.

To investigate how effective far-UVC light is at killing coronaviruses, a team at Columbia University Irving Medical Center aerosolised two common coronaviruses (the ones that cause coughs and colds), which it then flowed through air in front of a far-UVC lamp. The tests showed that continuous exposure to the far-UVC light in a room inactivated 90% of airborne viruses in about eight minutes, 95% in 11 minutes, 99% in about 16 minutes, and 99.9% in 25 minutes. The team expect far-UVC to have the same impact on SARS-CoV-2. If successful, the research could lead to far-UVC lamps being retrofitted into existing light fixtures in buildings, aircraft and public transport, as part of a holistic approach to limiting coronavirus transmission.

Bahnfleth says the research is encouraging and, if far-UVC passes all safety tests for human exposure, it will open up new applications for germicidal ultraviolet. For example, safe germicidal UV could be used to treat occupied spaces, decontaminating both the air and exposed surfaces, displacing conventional upper-room technology. ‘It could open up a market of consumer disinfection products that would be safe to use and could be used for applications such as disinfecting

elevator cars, toilet stalls, and other spaces for which it has been hard to identify good decontamination approaches using existing engineering controls,’ he says.

UVC might yet be a powerful weapon against an airborne virus, but it is not a panacea. UV does not prevent someone from being exposed to infectious aerosols emerging from an infected person close by, nor will it prevent people from being exposed to heavier droplets ejected when people nearby cough or sneeze – which is why face coverings, social distancing and good hand-washing hygiene are still necessary.

However, the benefit of UVC – and far-UVC in particular – is that, even if researchers develop a vaccine against the virus that causes Covid, UVC technology does not suddenly become redundant. Rather, it will be in place to help inactivate more familiar viruses, such as influenza and measles, helping making public spaces, offices and transport safer and healthier. More importantly, it will be ready for when the next virus pandemic occurs. **CJ**

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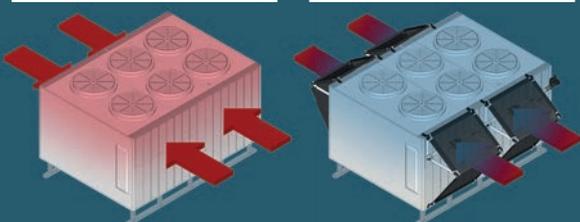
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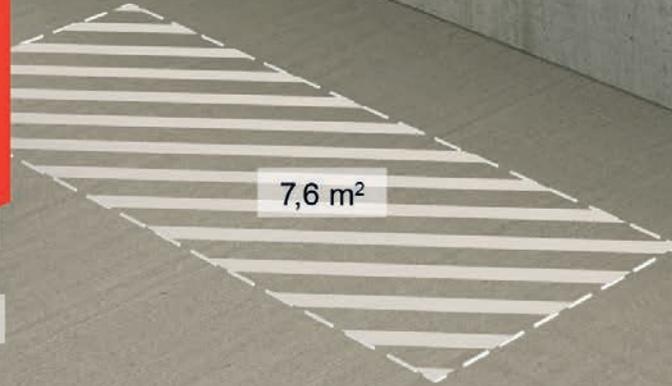


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With investment in heat networks expected to rise exponentially, the government is proposing mandatory testing to ensure the new wave of low carbon district heating delivers performance and value for consumers. **Alex Smith** reports

**T**he government is banking on heat networks to help the UK meet its 2050 carbon-reduction targets. In 2015, the Committee on Climate Change estimated that around 18% of the country's heat will need to come from heat networks by 2050 if it is to meet its carbon targets cost-effectively.

According to the Department for Business, Energy and Industrial Strategy (BEIS), £16bn of capital investment is likely to be needed to deliver such growth.

In 2017, with the industry set for rapid growth, the Competition and Markets Authority (CMA) recommended that the gas and electricity regulator, Ofgem, be given powers to regulate domestic heat networks. In February this year, BEIS launched a consultation for a regulatory framework that would give Ofgem oversight and enforcement powers across quality of service and pricing for domestic heat network consumers.

The consultation, *Heat networks: building a market framework*, proposes mandatory regulation of new heat networks and urges developers to join the Heat Trust, an independent consumer-protection scheme for heat network customers.

The trust aims to ensure a minimum standard of quality and a level of protection for consumers equal to other energy customers. Scheme rules include a guaranteed performance standard for temperature, continuity of service and reporting faults. Heat interface units (HIUs) must also be maintained regularly, and suppliers signed up to the Heat Trust can be penalised if standards are not met.

'Heat networks are maturing and becoming a central feature for the decarbonisation of heat'



Assurance schemes would assess whether heat networks meet technical standards at design and build

says Gareth Jones, managing director at heat network specialist FairHeat. 'This is apparent in increasing consumer protection, better technical standards – through the ADE-CIBSE Heat Networks Code of Practice – and proposed certification.'

Jones believes it is a pivotal moment for heat networks, because of the move away from gas-fired CHP energy source towards heat pumps, which has huge implications for the design of heat networks. 'There needs to be a significant change in the way people design dwellings and systems. We need lower temperatures, which will increase the performance for heat pumps and increase the number of heat pumps that can be used,' he says.

### Regulating heat networks

The BEIS consultation looked at options for ensuring heat networks are designed, installed and operated to robust technical standards, and concluded that there should be some form of mandatory assurance schemes.

'We know that, as the market builds, some heat networks have struggled to keep up standards in line with the rest of the sector, leading to less effective and poorer performing networks,' says the report. 'It is important to address this gap, both to improve the experience of consumers on poorer performing networks and to address the negative impact on the sector's overarching reputation.'

The consultation states that assurance schemes would assess whether new heat networks had met technical standards required at design and build. It would consider whether large extensions to existing networks could be covered by the assurance scheme and whether operational requirements should be applied to existing sites.

A body such as the UK's National Accreditation Body could have responsibility for monitoring organisations offering assurance and certification, says the CMA report, which advises organisations to join the Heat Trust to prepare themselves for future standards. >>

» Lowering temperatures

With the decarbonisation of electricity, heat networks are being designed with heat pumps as the energy source, rather than gas-fired CHP. For heat pumps to be truly effective, says Jones, the flow and return temperatures should be lower than for a traditional CHP district network.

Heat pumps are affected by changes in temperatures, both in terms of the efficiency of the refrigeration cycle and the system complexity required to reach high temperatures from cold sources. 'The coefficient of performance of heat pumps drops quite dramatically at higher temperatures; 5K can make a really big difference,' says Jones. A review of three heat pump manufacturers, for example, showed an increase in seasonal coefficient of performance of 13%-21% when generating and distributing at 60°C as opposed to 65°C.

Where heating systems serve DHW and space heating, it will be the DHW supply temperature that defines system temperatures, as the space heating can be a lower temperature. So, a 5K reduction in DHW allows a 5K reduction in generation and distribution temperatures.

One barrier to lower temperatures has recently



These Telford Homes apartments near London Docklands had acceptance testing

been overcome after the HSE clarified that HIUs with instantaneous hot water generation are deemed a low legionella risk. Heating systems with hot-water storage have typically had to maintain water at a high enough temperature to prevent the growth of legionella bacteria. However, this is not necessary for low-volume systems where, for example, hot water is supplied instantaneously through a heat exchanger. The HSE says that, under HSG274, Part 2, HIUs should be able to achieve a peak temperature of 50°C to 60°C.

Jones says that network temperatures should be 55°C at the HIU, with 50°C from the HIU to the tap. Many designers have used a 55°C minimum to the tap. This requires a minimum 60°C network temperature.

The new version of CPI: *Heat Networks: Code of Practice for the UK* will include far more performance metrics and introduces the concept of acceptance testing. Acceptance testing allows validation of whether heat networks meet specified performance requirements and, as such, is well aligned with the move toward technical certification, as proposed by BEIS. Effectively, acceptance testing will be one of the core mechanisms for any future heat network assurance scheme, says Jones.

'Our experience is that acceptance testing has a significant positive impact on network performance, with many networks performing better than design because of rigorous commissioning' he adds.

Telford Homes is using acceptance testing to check its heat networks before handover (see 'Site test', *CIBSE Journal*, August 2018), and now also uses FairHeat to test the design, installation and commissioning. (See panel, 'Testing every home'.)

Jones says the experience of acceptance testing out in the field will form the basis of an assurance scheme that aims to make sure developers build low carbon heat networks that offer comfort for consumers without the expense. CJ

TESTING EVERY HOME

'A consultant is like a GP,' says Chris Savoy, head of services at Telford Homes. 'They know a lot about heat networks, but they're not specialists.'

Telford Homes has been acceptance testing new dwellings on heat networks to ensure that performance is in line with the design intention. It has been using FairHeat to check consultant designs for heat networks, and uses the specialist to carry out checks at design, installation and commissioning stage. It also uses FairHeat to ensure water quality and that the BMS controls are implemented properly.

Savoy says checks allow him to identify competent designers and contractors, which helps him select the supply chain. 'The good ones are those that are prepared to be educated and follow British Standards and the ADE CIBSE Heat Network Code of Practice,' he says.

The focus for Savoy is now on gathering performance evidence - including water quality - from the first year of operation to ensure that the maintenance contractor is running the system properly. 'You have to have evidence. You have to prove performance,' he says.

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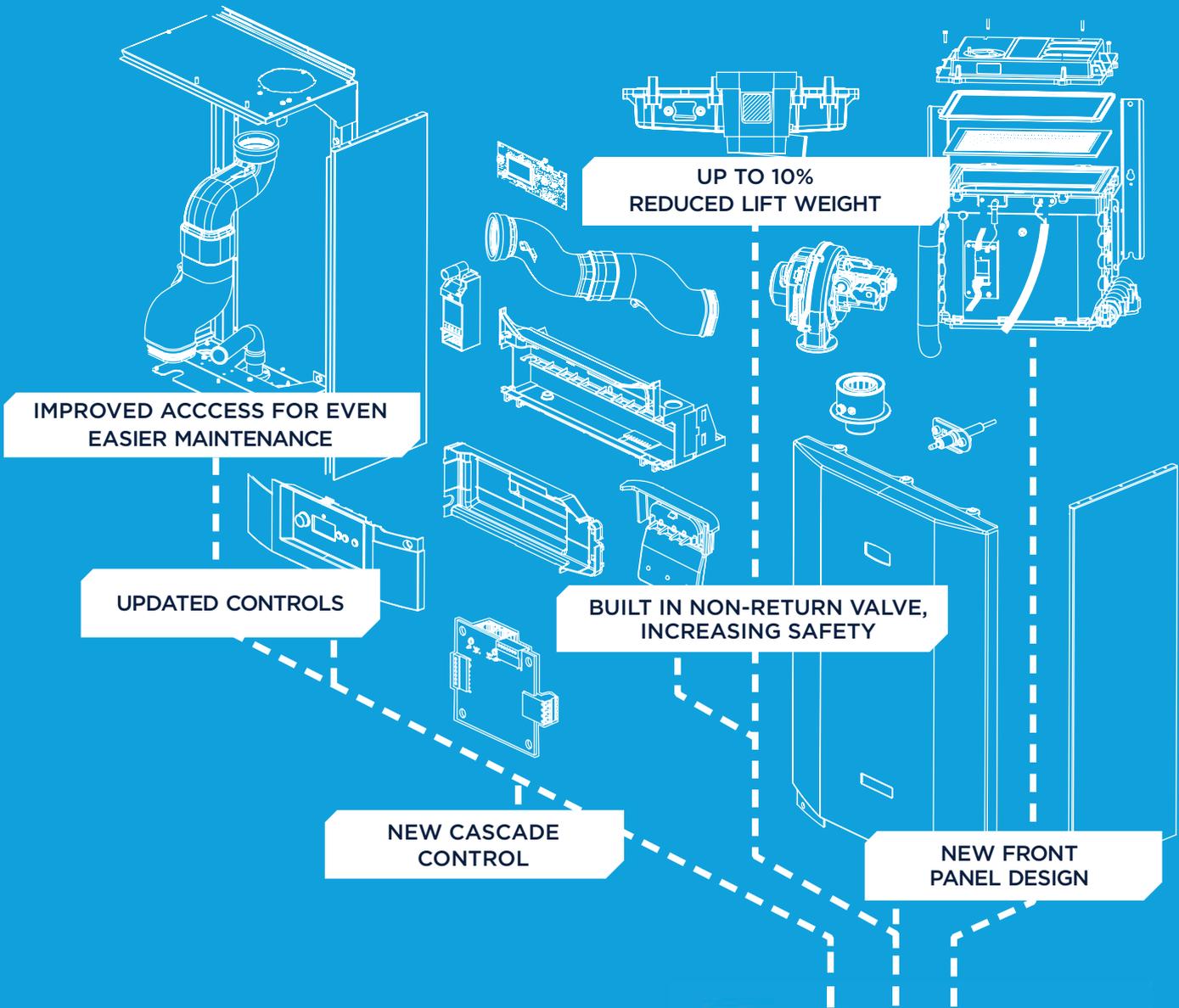
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# TAKE IT DOWN LOW

As the government aims to decarbonise heat, Locogen's **David Linsley-Hood** investigates how ambient loop heat pump networks could be a potential mechanism for providing low carbon domestic heat in the UK

**D**omestic energy accounts for 14% of the UK's carbon emissions. To implement the government's 2050 carbon reductions and local authority net-zero carbon targets, alternative proposals for supplying space heat and domestic hot water have been receiving greater attention.

Currently, two competing strategies are proposed for the wider decarbonisation of heat in the UK. One is to electrify heat, making use of the anticipated decrease in carbon intensity of the electricity grid to reduce the carbon footprint of the delivered heat. The other is to introduce low carbon hydrogen into the gas network and so, partially – or completely – offset the carbon emissions generated from burning gas in each property. This article will focus on the use of decarbonised electricity to provide domestic heat.

For electrification of heat, the more efficiently a system can deliver heat, the greater the carbon benefit and cost reduction per kWh. Direct electric heating operates at conversion efficiencies of around 100%. By using heat pumps, however, the ratio of heat delivered to electricity consumed can go up by 250-400%. The difference in these heat pump efficiencies is broadly based on differences between input and output temperatures: the smaller the temperature gradient, the less electricity required to generate heat.

Ground temperatures can deliver source temperatures of between 1-10°C reasonably consistently throughout the year, so give a more stable base than air source systems in the colder winter months, when more heat is required. As a

**"The network experiences much lower system losses as the temperature gradient between the network and ambient is very close"**



result, the seasonal performance factors (SPFs) for ground source heat pump (GSHP) systems are typically higher than air source heat pump (ASHP) equivalents. Where cooling is required, ground source systems have the advantage that heat absorbed during the summer cooling season could be used to recharge the ground array. The efficiency gain comes from the increased cost of a ground array to collect the ambient heat needed as the source. A domestic GSHP system can cost two to four times more than an equivalently sized ASHP system, so reducing this cost improves the attractiveness of the GSHP option.

## Shared-loop system types

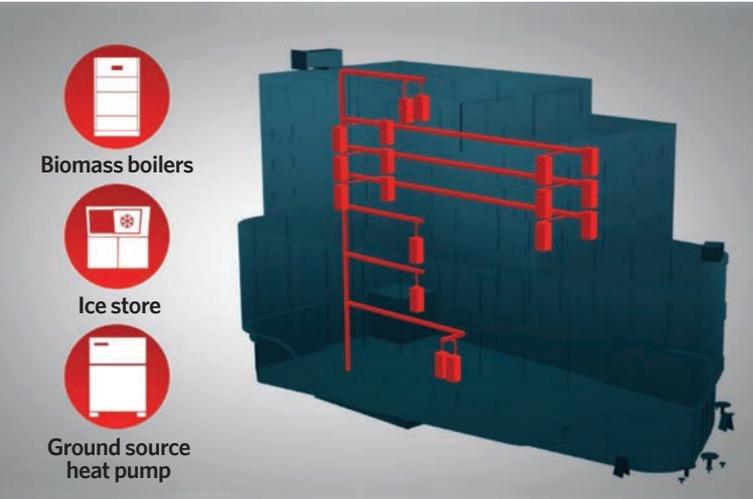
Shared-loop heat networks consist of a communal distribution system moving low-grade heat between the source and the individual heat pumps contained within each property. This differs from the traditional centralised district heating network (DHN), as each property is fitted with its own heat pump unit, rather than relying on centralised plant.

Shared-loop systems take source heat from a range of resources. This can be in the form of an ambient district heating network collecting heat from open or closed loops, gathering energy from the ground, aquifers, surface water or seawater. This network circulates the fluid through the collector at ambient ground temperatures (1-10°C). For larger schemes, it could take its heat from sewage treatment or minewater sources, where the resource could be 10-20°C. These schemes need coordination with the Coal Authority or relevant utility, and there may be a charge for the ambient energy. Both networks are installed using plastic uninsulated pipework between the collector structure and heat pumps.

Finally, an ambient network can be operated with an active heat source, such as a waste heat recovery system, a return leg of an existing DHN, or a dedicated low-grade heat source (such as ASHP). This system typically operates at temperatures of 20-25°C. As this type of network is operating at slightly higher temperatures, the pipework is usually insulated, although to a lower specification than standard DHNs.

## Benefits and challenges

A key benefit of any shared-loop network is reduced capital expenditure (capex) of the network. The operating temperatures mean the pipework can be installed in plastic pipe and retain an extended working life. This pipework can be uninsulated in most situations, and have external >>



Low-temperature network (image courtesy of Dimplex)

» insulation added easily for required sections. As such, network infrastructure costs are lower than the installation of high-temperature DHN systems.

The network also experiences much lower system losses, as the temperature gradient between the network and ambient is very close. This is in comparison to high-temperature networks, where an ongoing issue for many buildings is the standing loss from the distribution network into shared spaces, creating summer overheating.

Having individual plant but a common fuel source is more in line with most residents' experience, with individual control and responsibility for the domestic boiler. Each recipient is free to change their electricity provider.

One of the key limitations to the implementation of shared-loop networks is capital costs. At present, the capex for shared-loop infrastructure is a lot higher than corresponding gas or direct electric alternatives. The Renewable Heat Incentive offers support, but will stop accepting commercial applications in March 2021 and domestic applications a year later. The Clean Heat Grant consultation, launched in April 2020, indicated that shared-loop networks would be eligible for a

## AMBIENT LOOP COSTS

A feasibility study using waste heat from a supermarket chiller to heat housing via an ambient loop heat network has revealed higher costs than expected as a result of the use of ground source heat pumps in the design.

The analysis, by Martin Crane, director at Carbon Alternatives, found that the ambient loop had been designed more like a heat pump ground loop, because the available heat pumps are primarily designed for ground-source applications. As a consequence, the heat network design required larger pipes and more pumping energy to maintain the constant circulating flow required.

Crane says most of the source pumps in GSHP are either on or off, so – when the heat pump is operating part load – the source flow rates are as per peak demand, reducing flow diversity on the ambient loop.

The analysis found ambient loop network costs were higher because of the requirement for larger pipes, leading to the need for larger trenches.

A longer article based on this research will appear in September's *CIBSE Journal*. The analysis is part of a feasibility study funded by the Heat Networks Delivery Unit and research funding from OxFutures.

£4,000 grant per heat pump (below 45kW). However, funding for this scheme is currently only described for 2022-24.

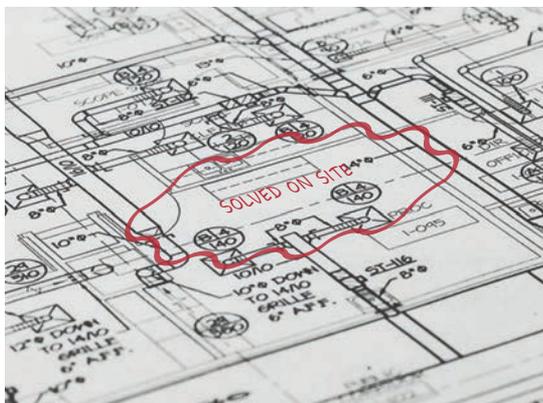
DHW is also an issue, as heat pump systems require a local hot-water cylinder, unlike combi-boiler or DHN direct plate installations. Only 11 of the 26 million UK residences are believed to still have a hot-water vessel. Implementing heat pump solutions would require their reintroduction, with corresponding space implications. The higher delivery temperatures to generate DHW also reduce heat pump efficiencies.

Until recently, most multi-occupancy developments in London were delivered with gas CHP-driven, high-temperature networks – but the decision to implement SAP10 carbon weightings as a consideration to planning has resulted in a significant shift to low-temperature and ambient shared-loop networks. This shows the effect of a small policy change where there is a competitive market for development. It is to be seen if similar policy changes can give the same impetus across the UK.

The integration of heat pumps into smart energy networks, where they respond more flexibly to demand signals within the grid system, offers potential operational savings and a useful grid service, but research on these impacts once heat pumps are adopted at scale is still to be tested outside a few isolated trials. **C**

■ **DAVID LINSLEY-HOOD** is consultancy director at Locogen

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# HEALTH PROVIDER

With significant variation in seasonal temperatures and occupant density, the HVAC systems modelled at the Samson Pavilion in Cleveland, Ohio, USA, by Foster + Partners had to be highly flexible. This was borne out by its recent conversion into a Covid-19 surge hospital, as Phil Lattimore found out

## SYSTEM SPECS

**AHUs** - 13 x York medium-pressure, horizontal draw through, using supply and return fan arrays. Ranging in size from 5.19 to 25.39m<sup>3</sup>·s<sup>-1</sup>

**DOAS units** - 4 x York custom draw-through with energy recovery wheel, medium-pressure with supply fan array. Ranging in size from 11.80 to 14.16m<sup>3</sup>·s<sup>-1</sup>

**Chilled beams** - 848 x Price 0.9m (3 feet) or 1.2m (4 feet) long two-pipe beams, with air flowrates ranging from 0.007 to 0.097m<sup>3</sup>·s<sup>-1</sup>

**Chillers** - 3 x 1.93MW (550 ton) York centrifugal water-cooled chillers with variable speed drives. Chilled water distribution is arranged in a variable primary pumping system

**Hot water boilers** - 3 x 3.5MW (12 million BTU per hour) Cleaver Brooks high efficiency, condensing hot water boilers

Engineering and consulting firm Smith Seckman Reid (SSR) was Foster + Partners' local collaborator through the early design stages and then engineer of record through construction administrations and site supervision. Led by Chad Miller, SSR delivered HVAC, electrical and plumbing engineering.

**T**he building services for the vast courtyard at the Samson Pavilion in Cleveland, Ohio, is designed for an annual temperature swing of up to 42°C, and a wide variety of occupancies – from a few dozen people walking through the space to a 1,200-strong graduation ceremony.

It was therefore designed for substantial flexibility, but its architect and environmental engineer Foster + Partners could not have foreseen its transformation into a Covid-19 surge hospital within a year of opening.

In April 2020, the Samson Pavilion was temporarily converted to a surge hospital with the moniker Hope Hospital. The courtyard, named after past-president of Cleveland Clinic Delos M Cosgrove MD, provided 327 beds.

The building was converted in less than a month and the HVAC systems' flexibility and capacity meant they hardly needed altering with the refit concentrating primarily on fitting piped oxygen and UPS sockets.

In the courtyard, the high-volume fresh air displacement ventilation, underfloor thermal systems and high daylight levels have come into their own, providing comfortable and safe treatment areas for any prospective patients.

Part of the Health Education Campus in Ohio, the 44,315m<sup>2</sup> Samson Pavilion building accommodates around 2,200 students from Case Western Reserve University's dental, nursing, and medical schools, in addition to those from Cleveland Clinic Lerner College of Medicine. Its most significant feature is the four-storey courtyard, which is open on all four sides to the two institutions' medical schools and colleges.

Designed as a large, social and academic space for faculty, staff and students, this 24m-high space has a wide variety of uses from informal meetings to graduation ceremonies.

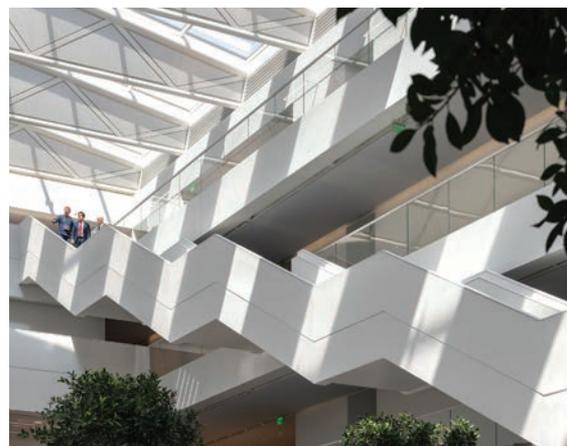
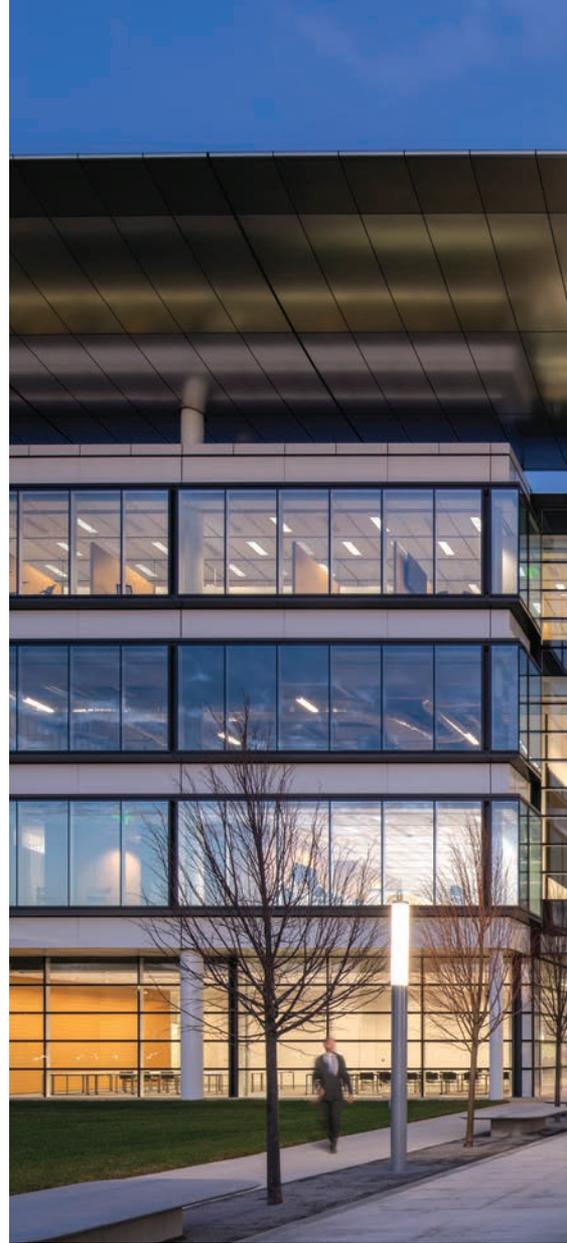
'It's an important hub, it's very adaptable and brings together the client philosophy for the building – encapsulating a healthy, holistic, transparent ethos,' says environmental engineer Emma Clifford, who is an associate partner at Foster + Partners and multidisciplinary lead on the project.

As well as the atrium, other shared spaces in the building encourage collaboration across the health disciplines. These include a fully

equipped conference centre on the first floor with a 650m<sup>2</sup> auditorium with supporting spaces, designed to promote group learning, with recording and broadcast.

Foster + Partners was engaged for the architectural and environmental design and MEP engineering. Smith Seckman Reid (SSR) was its local engineering collaborator through the early design stages and then engineer of record on the project.

One of the challenges was the large seasonal variations in temperature in Cleveland, ranging from 35°C in summer to -17°C in winter. The severe winters meant renewable energy from PV or wind technology could not be used effectively to offset building





The Samson Pavilion in Cleveland, Ohio, USA

energy demand. With such wide variation in occupation loads and external temperature, extensive modelling had to be done to ensure the design was optimised for thermal comfort, system selection and energy efficiency.

The skylight design, for example, required analysis of daylight penetration, glare, heat loss, snow and ice build-up and thermal impacts to the space below. The modelling helped to determine the pitch of the roof trusses necessary to allow seasonal snowfall to slide off the glass and onto the solid roof around the courtyard.

'Intense design collaboration across the integrated design team was fundamental to creating a viable year-round space for a wide range of functions,' says Clifford.

The services strategy of the central courtyard uses displacement ventilation for the occupied zones. Thermal studies were carried out in circulation zones open to the atrium, where there may have been possible downdraft in cold winter weather. At the courtyard's ground level, the underfloor heating and cooling needed careful thermal and energy analysis to support the design, requiring close collaboration with

manufacturers and facilities management.

To determine the optimum system selection and configuration, thermal loads and iterative thermal modelling was undertaken. The thermal comfort studies mainly focused on the small winter garden areas within the extreme north and south ends of the building, and the perimeter zones, because of their sensitivity to significant climatic influences. 'We had to

ascertain whether under extreme internal loading these areas could maintain comfort,' says Clifford. The team used IES's MacroFlo virtual environment module to calculate bulk airflow movement between zones and assess any local thermal discomfort.

Peak coincident load sizing was crucial, as there were several different sizing systems proposed and there were many types of facilities within the building – more than 30 main thermal templates had to be assigned to almost 1,000 thermal zones within the building.

The project was targeting LEED Gold, so it was essential the energy credits were correctly estimated from the early stages of design. At each stage, and when major changes were proposed, sensitivity analyses or even full energy models were simulated.

### Services design

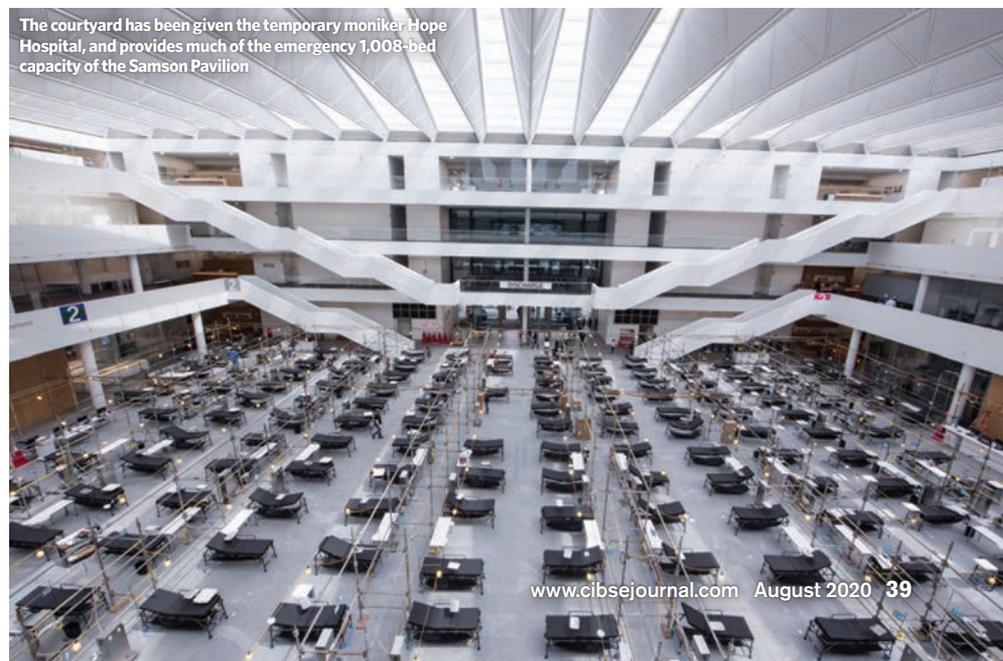
The building's main heat sources are gas-fired boilers. Centralised dedicated outdoor air system (DOAS) air handling units (AHUs) provide minimum outdoor air to the building's variable air volume (VAV) AHUs serving separate zones. To reduce the amount of mechanical cooling during mild or cold weather, bypass on the AHUs has been incorporated for airside economisers to maximise free cooling.

Active chilled beams are used to provide heating and cooling on the building's administrative fourth floor. The system comprises 848 Price 0.9-metre or 1.2-metre long two-pipe beams with seasonal changeover valves. They are controlled via VAV boxes to modulate supply air with flowrates of up to 97 L·s<sup>-1</sup>. Here, supply air temperature is held constant until a zone falls below its setpoint. When a zone is above its setpoint, the damper opens to allow air into the zone to cool the space.

Applying the baseline specification of



The courtyard has been given the temporary moniker Hope Hospital, and provides much of the emergency 1,008-bed capacity of the Samson Pavilion



» ASHRAE Standard 90.1 'Energy Efficiency for Commercial/High-Rise Residential Buildings' and using more exacting local weather design conditions modelling predicts a 6% energy saving with the use of the DOAS with chilled beams, compared with a VAV-only solution – in large part this is likely because of free-cooling from direct use of a higher flow rate of outdoor air. Using the temperature of the outdoor air more directly helped to improve efficiency in what is a cooling-led load.

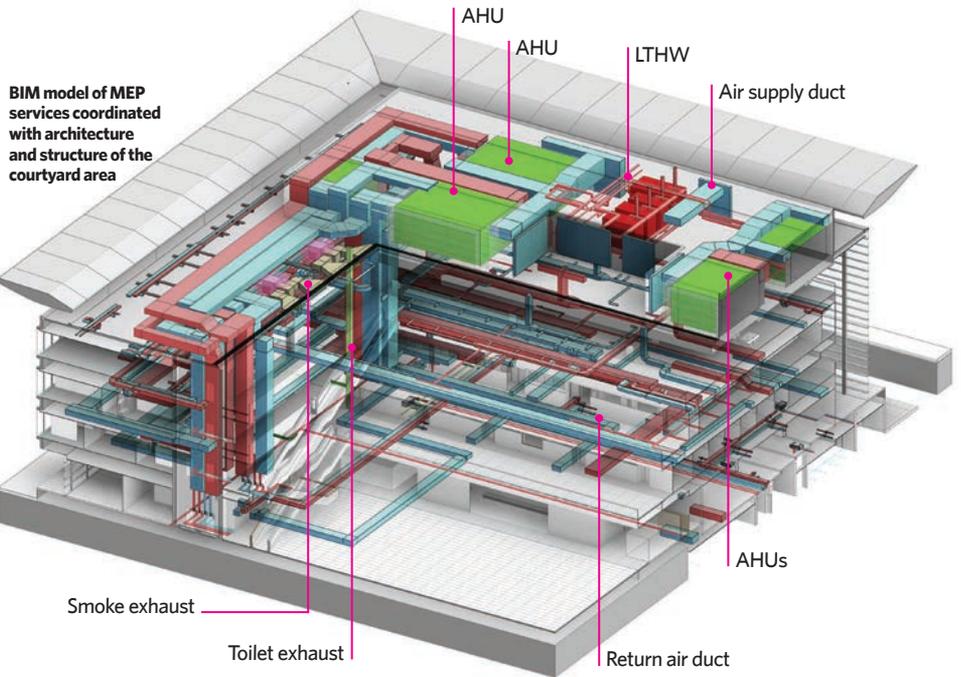
In reality though, there's even more of an energy saving than on that basic standalone modelled comparison, says Clifford. 'When you get to the LEED credit on an energy-cost basis, there's a vast improvement in performance, as the DOAS and chilled beams are a small part of a family of energy efficient solutions being used – which include heat recovery, efficient fan-wall AHUs, variable-speed fans and a high-performance envelope,' she says. 'Along with the other elements affecting building performance, this improved performance significantly against Ashrae 90.1.'

The use of chilled beams wasn't a typical approach for the client, who would initially have preferred to have used VAV throughout. 'But this energy-saving synergy between the operation of the DOAS and the beams was pretty critical, alongside the improved quality of internal environment,' says Clifford.

'We didn't feel that using a VAV-only solution was appropriate, especially as the integrated team improved the façade performance to such an extent that the normal perimeter loads did not apply.'

Clifford says an integrated approach meant client concerns, particularly on maintenance, could be tackled at an early stage.

The active chilled beams were configured with a modular ceiling grid system that enabled a flexible floor layout that



was developed with the client to allow reconfiguration of the space in future.

'A significant element of our systems design and resilience strategy focused on enabling future flexibility in refit and function,' explains Clifford. 'This generated a robust four-riser layout with central plant and distribution capacity to absorb future change.'

The building has symmetry across its four corners, with each riser and the footprint of roof plant above symmetrical, so that within each quadrant there is flexibility for maximum reconfiguration. 'Even if the service isn't fitted out into a particular riser, there is the capacity to fit out later. Each riser is big enough to serve the "worst-case" quadrant, so departments can move their facilities around and work up to quite a high density of function, while still having the plant space and riser capacity to accommodate changing needs,' says Clifford.

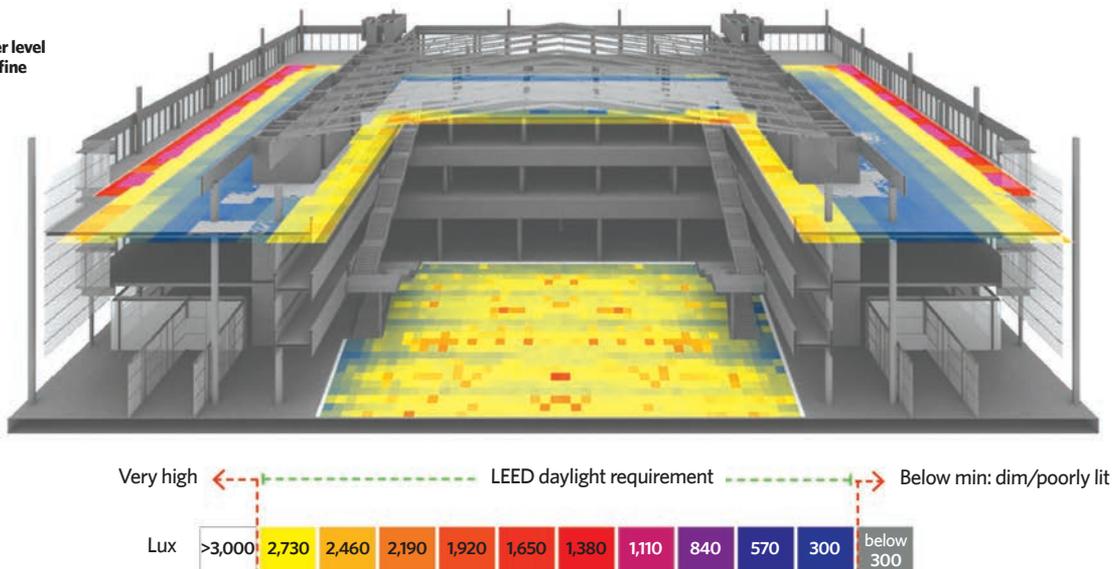
Sensors are used to check room

temperature and humidity to calculate space dewpoint; if it is above 14.4°C, the chilled water set point is adjusted to 1.1K above dewpoint and generates a building automation system response, whereby VFD-driven AHU supply fans continually adjust the air volume supplied.

The building's perimeter zones were carefully treated to ensure occupants are comfortable. *Ashrae 55 Thermal Environmental Conditions for Human Occupancy* was used to assess the temperature gradients at the façade glazing to ensure that comfort criteria were met in the difficult conditions. Additional perimeter services were applied as necessary.

Clifford says collaboration with the client was key in enabling innovative energy efficient solutions, which helped create the state-of-the-art health education pavilion the client desired. Its recent Covid-19 facility role is testament to the flexible HVAC system, and the healthy, comfortable environment it has enabled. □

Daylight and glare analysis at the upper level and courtyard to define roof properties



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## Design and implementation for effective smoke control in buildings

This module will draw on practical experiences in the provision of smoke-control solutions to satisfy current regulatory and advisory requirements

This CPD will draw on practical experiences, identifying examples of areas that commonly cause uncertainty when designing, specifying, constructing and commissioning systems to control smoke risks to occupants in the event of a building fire.

The 2019 revision to CIBSE Guide E *Fire safety engineering* encompasses 'smoke control' as one of the engineer's responsibilities when designing the fire strategies for a building. Writing about that revision in *CIBSE Journal*, chairman of CIBSE Guide E Steering Committee Martin Kealy explains:<sup>1</sup> 'Smoke is the major risk to occupants in a high-rise building fire. The toxic products of fire include irritant and narcotic components, so, as well as preventing escape routes from being used because of poor visibility, smoke also causes disorientation, incapacity or death.'

Successfully implemented, smoke-control design extends the amount of time available to evacuate a building safely, without occupants being overcome by the effects of the smoke. A preconception held by some is that 'smoke control' is a single standalone item. As with many of the design and operational aspects of delivering a successful building, however, it encompasses many elements, including a whole set of building design decisions, products, processes and procedures, installation, final test, and sign off. It might be considered as a 'system' in its own right, as all these areas need to work together as part of the smoke-control system, properly documented as part of a 'golden thread' so that the 'original design intent is preserved and recorded, and any changes go through a formal review process involving people who are competent and who understand the key features of the design'.<sup>2</sup> This should, ideally, be reflected in a single holistic smoke-control specification, drawing together all the requirements. Historically, however, detail has been spread across a number of areas in the documentation, including diverse sections such as those notionally covering smoke ventilation, controls, wiring, product specifications and the building's acoustic requirements.

Smoke control has become more challenging with the increasing prevalence

of complex multi-use buildings – including combinations of commercial, institutional, residential and recreational – that are reaching higher into the sky. Globally, there are many hundreds already existing, particularly in locations such as Hong Kong, New York City, Shenzhen and Dubai, and it is thought<sup>8</sup> that, in London, nearly two-thirds of the 250 skyscrapers taller than 100m (conceived, planned or completed) will include residential use.

There is already a great deal of guidance, standards and regulation on the implementation of fire and smoke products, and there is a shifting emphasis in upcoming UK legislation to ensure that there is a proper 'whole building' approach to building safety legislation. When designing a smoke-control system, there are several routes – all of which are likely to intertwine – that may be informed using publications such as CIBSE Guide E; state guidance such as *England and Wales Approved Document B: Fire Safety*,<sup>3</sup> the *Scottish Technical Handbook Section 2*<sup>4</sup> or *Northern Ireland Technical Booklet E*<sup>5</sup>; employing information from appropriate standards such as BS 9999:2017<sup>6</sup> and BS 9991:2015<sup>7</sup> *Fire safety in the design, management and use of buildings/* >>

» residential buildings; or by applying a fire-engineered solution that is based on guidance from experts and institutions.

The multiplicity of guidance can, itself, obfuscate the path to an appropriate smoke-control solution.

Smoke-control design is often developed, evaluated, demonstrated and proved by modelling and computational fluid dynamics (CFD). It can be an extremely useful tool to assess the potential impact of a smoke-control system, which is particularly valuable when assessing fire-engineered solutions for high-rise buildings and those with complex arrangements, including extended corridors. CFD modelling of smoke movement is a specialist activity, and may be outside of the competence of the company responsible for the design – or, at least, it might benefit from being independently checked by an expert third party. As with all modelling activities, the output is highly dependent on inputs and assumptions, and outsourcing to modelling specialists – or product suppliers – requires careful consideration and information management, to ensure that the modelling activity closely reflects the designer’s intent, as well as being supported by the appropriate knowledge and expertise.

Fire engineering provides a route towards a successful smoke-control solution for increasingly complex applications; however, if smoke control has been designed and modelled before being tendered, the project tender document would benefit from including the specification as a single clear section. In some cases, details can be clouded by a general project specification that may state that the design must also meet the requirements of, for example, approved statutory guidance documents or other standards that may contradict elements of the fire-engineered solution. So, it is essential, at the design stage, to ensure the general specification does not conflict with specific details of the project’s smoke-control specification, and that the final documentation is explicitly clear.

Natural and mechanical smoke shafts are used as part of the smoke-control system to protect adjoining staircases and keep them clear of smoke by ventilating the corridor or lobby that gives access to the escape route. There are basic parameters prescribed by local and state fire regulations that encompass the fire resistance of the construction materials; the geometry of the smoke shafts; the provision of the inlets and outlets; and the restrictions on services that otherwise may share the shaft. When construction takes place, the builder may make changes to the smoke shaft ‘to fit’ the building, or possibly

suggest that other services make use of the shaft, or potentially want to deviate from the specified materials and construction details. These will all create the need for a potentially significant redesign and additional costs that, depending on when the changes are realised, can impact commissioning and practical completion – a poor-quality, or leaking, smoke shaft is likely to seriously impact the commissioning effort and would probably delay building handover.

It would be appropriate to note clearly in the specification that no other services can be fitted into the smoke shaft without explicit approval, and highlight that, as a life-safety component, the specific scheduled details of the smoke shaft are critical, and not candidates for unapproved adjustments.

The required acoustic performance of smoke shafts will be determined by whether they incorporate day-to-day ventilation or are dedicated smoke shafts. When the smoke shaft is part of the main ventilation distribution, the acoustic performance would need to be considered alongside that of the ventilation system. (If solely used as a smoke shaft, the operational noise impact is practically irrelevant.) Accordingly, the specific noise criteria, as required to meet local requirements, need to be explicitly included in the specification. This should account for the regular post-occupancy testing of any fans and include appropriate requirements in the noise specification. If it is unclear, then there is a greater risk that, after completion of the main design, there is additional – or possibly remedial – action required to deliver appropriate acoustic performance. This will add time and cost to the development and, for example, if attenuators are subsequently required, there may be knock-on impacts in the system space requirements, additional fire protection and increased airflow resistances that will, in turn, impact fan performance and ventilation effectiveness.

An approval process could usefully be added into the specification that ensures that the smoke shaft has to be approved, and signed off, before the smoke specialist is required on site to undertake the commissioning tests.

There is increasing use of full-height internal doors as part of the building design. As the area above the door is often used as a potential reservoir for the smoke, its unexpected absence can present a challenge when evidencing smoke-control regimes. If full-height internal doors are proposed, their use – and impact on the smoke-control regime – needs to be assessed by appropriate analysis (which would normally include computer modelling). If the client or designer changes a design subsequently to include full-height doors, it is very likely that the original smoke-control design would not function appropriately without some changes to the systems or the building, so adding to design time and project costs.

BS EN 12101<sup>9</sup> *Smoke and heat control systems*, divided into 10 parts, provides a suite of guidance for system components. Smoke ventilators should be designed, tested,

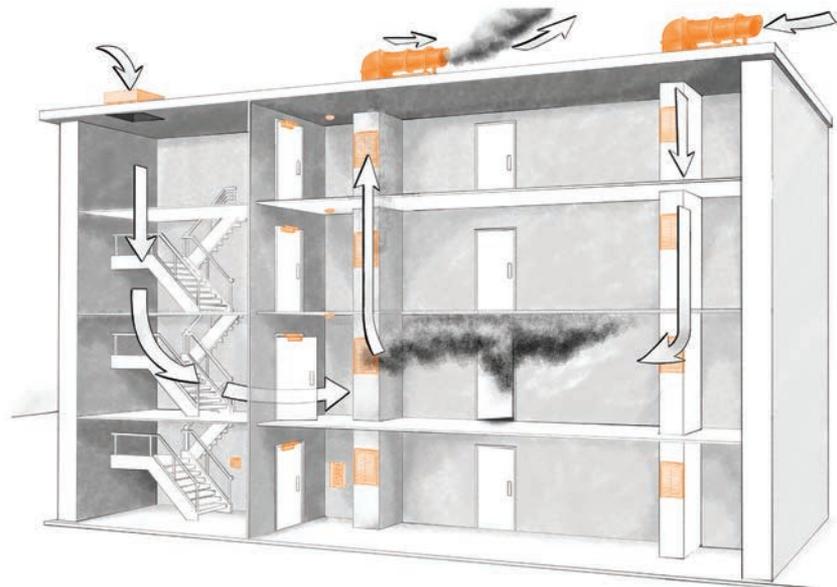


Figure 1: A sketch illustrating the application of a smoke-control system to extend the time available to evacuate a building safely in the event of a fire. This uses mechanical smoke shafts that provide substantial space-saving benefits compared with natural systems, and can be implemented in buildings with longer escape-route corridors



and manufactured as a single entity to ensure compliance with BS EN 12101-2, which covers smoke- and heat-control systems. However, other guidance – notably including Approved Document B – specifies a minimum free area, which is not a defined entity in BS EN 12101-2, and this can lead to unrealistic expectations of ventilation performance in some product categories. To remove ambiguity, the Smoke Control Association<sup>10</sup> suggests that the area used is taken as the aerodynamic free area as defined and tested characteristic under BS EN 12101-2. This is different from the geometric free area, so it is important to ensure products are clearly and correctly specified – and subsequently fitted – so that the actual clear area for smoke movement coincides with that used in the smoke-control design.

If a window is specifically employed for smoke clearance, so as to admit light during normal use and then motor open in the event of a fire, a bottom-hung window is often used, as it is safer than a side-hung window, as there is little chance of somebody falling from the window opening. However, the free-area calculation must include only the area at the top of the window opening and not the sides. An incorrect calculation of available area that includes the sides is a tempting mistake, as it reduces the required window size, which otherwise can become incongruously large. Larger windows will require a larger motor (with inherent maintenance) to compensate for the weight of the window. An alternative solution is to use a glazed louvre that has been tested to BS EN 12101 – there are many manufacturers’ options for this, such as the example in Figure 2.

When windows are being used for smoke extract, BS EN 12101 requires that a product should be tested as a complete unit, which means window and actuator together. This precludes the supply of a window from one manufacturer and a motor from another, whether fitted together on site or off-site. It is not permissible to claim, because both items are tested to BS EN 12101, that, combined, they make an appropriately tested product. The unit must be tested together and assembled in a factory-controlled environment – there are products that offer this, although they are more expensive. It is not inconceivable that the building designer may prefer the appearance of a ‘standard’ window. However, as this is a life-safety product, it should be installed as such, and so comply with the appropriate standards.

The Construction Product Regulation has a mandatory requirement that manufacturers should only market products that comply with the relevant harmonised standard. Compliance is demonstrated by the manufacturer through issuing a declaration of performance (DOP). This DOP will be based on the type-testing of the product, initial inspection of the factory production control, and continuous surveillance and assessment of the factory production control. All specifications of smoke-control system elements should ask for DOP certification. It is not sufficient for companies to claim that products are in accordance with, or designed to meet, requirements. The specification should clearly require that every manufacturer must supply appropriate product DOP documentation that should form part of the certification pack to be compiled at building handover.

Control systems are a key integrator in providing a suitable smoke-control solution. The responsibility for the complete system, particularly when on site, can be unclear.

**Figure 2:** Glazed louvred ventilator suitable for natural day-to-day building ventilation, as well as smoke control (conforming with BS EN 12101-2)



For example, it might be considered as part of packages provided by the ‘smoke specialist’ or the fire alarm company, or it might be thought to fall under the purview of those responsible for the digital building management system. The responsibility should clearly be with one named party, and the most appropriate one is most likely to be the smoke specialist.

An example of a potential consequence of the smoke-control system being specified in isolation from the building controls might result from the need to meet the requirement for the ‘form of separation’. This is the type of subdivision provided within the electrical switchboard by means of barriers or metallic or insulating partitions, ranging from ‘form one’ to the more exacting, and expensive, ‘form four’. A smoke system normally employs a ‘form two’ separation.

However, it is not uncommon that, within the building controls section of the specification, it will ask for ‘form four’ separation for other types of controls being employed on the project. The cost is typically several times that of a ‘form two’, as the whole switchboard – which includes the supply to the smoke-control systems – would have to be the more stringent ‘form four’.

It is important to identify the necessary feedback to the supervising control system from items such as fire dampers, motorised windows and louvres, and to ensure that there is coherence between the building controls specification and that required to meet the demands of the smoke-control system. Any requirements for the provision and monitoring of primary and secondary power supplies should be explicit within the specification.

After the tragic losses of life in recent building fires, the Fire Safety Bill<sup>11</sup> – which is currently making its way through the deliberations of the UK parliament – will change the scope of the Fire Safety Order (which covers general fire safety in England and Wales) to clarify the role of the ‘responsible person’ for maintaining the safety of building occupants. As illustrated by the examples in this article, it is critical that smoke-control design is considered with a similarly holistic approach led by appropriately competent engineers. This, in part, is driving calls for competence schemes to ensure that practitioners may be appropriately identified as being competent to develop solutions that are informed properly, and based on best procedures and up-to-date knowledge.

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- Developed by Tim Dwyer from practitioner experiences.
- Turn to page 46 for references.





# Module 166

August 2020

» 1. Which CIBSE Guide provides specific guidance on smoke control?

- A Guide A
- B Guide B
- C Guide C
- D Guide D
- E Guide E

2. What is the approximate estimate of the likely proportion of London skyscrapers taller than 100m that will include residential use in the foreseeable future?

- A 10%
- B 25%
- C 50%
- D 67%
- E At least 75%

3. Which suite of standards covers smoke- and heat-control system components?

- A BS EN 12001
- B BS EN 12010
- C BS EN 12100
- D BS EN 12101
- E BS EN 12111

4. Which one of these statements is least likely to be true when considering the design and implementation of smoke control?

- A All specifications of smoke-control system elements should ask for DOP certification
- B Any changes should go through a formal review process involving people who are competent and who understand the key features of the design
- C Both mechanical and natural smoke shafts practically occupy the same space
- D CFD requires specific competence and can be a useful tool when assessing fire-engineered solutions for high-rise and complex buildings
- E Control systems are a key integrator in providing a suitable smoke-control solution

5. Which bill is currently passing through the UK parliament that will clarify the role of the 'responsible person'?

- A Fire Assessment Bill
- B Fire Prevention Bill
- C Fire Protection Bill
- D Fire Safety Bill
- E Fire Smoke Control Bill

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### References:

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- 9 *BS EN 12101 Smoke and heat control systems*, multi-part document, BSI.
- 10 *Guidance on smoke control to common escape routes in apartment buildings (flats and maisonettes) rev 3.1*, Smoke Control Association, July 2020.
- 11 *Fire Safety Bill 2019-21 (England and Wales)*, [bit.ly/3eXM8km](http://bit.ly/3eXM8km) - accessed 3 July 2020.

# PRODUCTS & SERVICES



## Edinburgh welcomes whisky galore

Historic Princes Street in Edinburgh is the new home of a £150m investment that promises to be the focal point for whisky devotees from all over the globe. The Johnnie Walker visitor centre will employ 160 people in a wide variety of roles across this well-positioned seven-floor building, which has been extensively refurbished and will pay homage to Scotch whisky.

This flexible space offers retail opportunities and a multi-sensory experience that will take visitors on a journey through the brand's 200-year history, and will also incorporate an academy. This learning hub has the ambition of creating opportunities to promote best practice and will offer unemployed people the opportunity to gain skills to help them seek work.

Grundfos Pumps has added this development to its extensive portfolio of projects. Working with Harley Haddow, who designed the M&E element of the project, and FES Stirling, who were the contractors, Grundfos supplied the complete HVAC system as well as delivering the peace-of-mind fire system.

■ Visit [www.grundfos.co.uk](http://www.grundfos.co.uk)

## Elco aims to shake up the boiler market with new design

Elco Heating Solutions has further strengthened its range of high efficiency commercial gas boilers with the launch of the new wall-hung Thision L Plus and floor standing Trigon L Plus.

The new boilers have been designed to cater for modern heating demands, boasting a wealth of features and benefits that enable them to be fitted in many commercial applications. With their impressive footprint to power ratio, the new boilers offer greater levels of flexibility and allow for installation in tighter spaces.

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



## Jung Pumpen equipment supplies in the UK

Jung Pumpen wastewater and sewage pumping equipment is only available in the UK via two authorised specialist distributors.

Pump Technology, based in Berkshire, is the largest Jung stockholder, with an experienced Jung Pumpen team dedicated to supporting public health consultants and contractors. Contact them for equipment specification, 3D BIM library, factory training courses and virtual product demonstrations.

■ Call 0118 9821 555 or visit [www.jung-pumps.co.uk](http://www.jung-pumps.co.uk)



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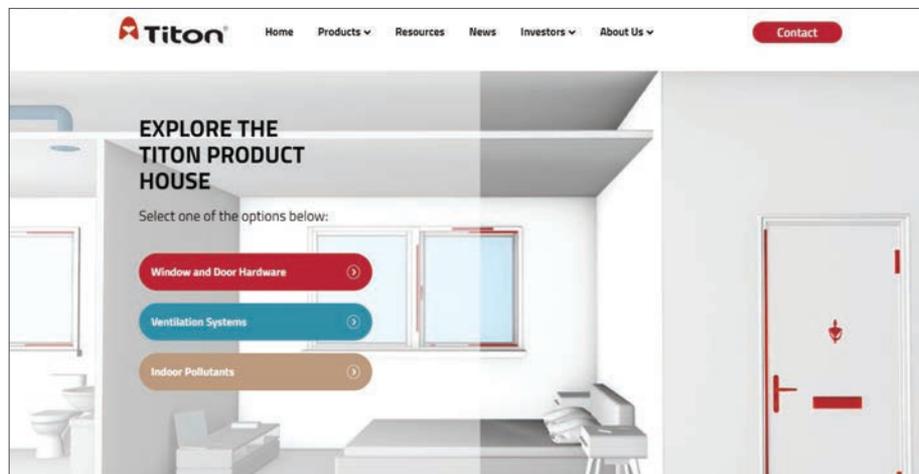
- Authorising engineer consultancy
  - Electrical discrimination duties
  - Authorised person devices
  - Compliance audits
  - Asset/condition survey
  - Bespoke services.
- Visit [www.ppltraining.co.uk](http://www.ppltraining.co.uk)

## Titon launches the 'Titon product house' – a new interactive online experience

Titon has added a dynamic and fully interactive CGI environment – the 'Titon Product House' – to its website, showcasing the array of products available throughout the company's window and door hardware and ventilation systems divisions.

In addition to enabling a view of Titon's product portfolios in a 3D virtual environment, the 'indoor pollutants' version of the room identifies the most common sources of volatile organic compounds found inside a home. It also contains links to the latest expert advice and information on improving levels of indoor air quality.

■ Visit [www.titon.com](http://www.titon.com)





### ◀ New Condair condensing gas-fired humidifier

Condair is launching a new condensing gas-fired humidifier – the Condair GS. Its condensing system transfers heat from exhaust flue gases into the incoming water supply. This feature improves humidity control, as the water being introduced to the water tank is pre-heated, so doesn't reduce the internal temperature as much or the steam output.

Similar to the technology employed in domestic gas boilers, the introduction of condensing technology in gas-fired humidifiers results in lower temperature flue gases and allows the use of PVC flues.

■ Visit [www.condair.co.uk](http://www.condair.co.uk)



### ▶ RLS establishes European office and announces managing director

RLS, the US-based manufacturer of the RLS Rapid Locking System line of flame-free press fittings for the HVAC and refrigeration industries, has announced that Grant Phipps has joined the company as managing director.

With a background in mechanical and design engineering, Phipps brings a wealth of experience in the HVAC segment to RLS, having served most recently as the CEO of a large engineering group based in the Middle East. Previously, he held executive roles at several UK- and US-based companies.

Paul Schubert, general manager of RLS, said: 'We're excited to have Grant as a member of our team, and for him to serve our distributor partners throughout Europe from his base in the UK.'

RLS offers a wide range of fittings, such as couplings, elbows, tees, reducers and more, as well as ancillary products that are compatible with RLS technology, including Y-joints, P-traps, valves, filter driers and sight glasses.

■ Visit [www.rapidlockingsystem.com](http://www.rapidlockingsystem.com)

### AET Flexible Space underfloor air conditioning delivers for 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.

AET's underfloor air conditioning system makes use of the void within the building's raised-access floor, and so removes the need for traditional ceiling-based services and suspended ceilings. By using the existing 270mm floor void, the design team was able to preserve and highlight key architectural design features, including a unique terrazzo-patterned soffit.

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

■ Visit [www.flexiblespace.com](http://www.flexiblespace.com)



## ▶ DIRECTORY Your guide to building services suppliers

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### Energy Efficiency



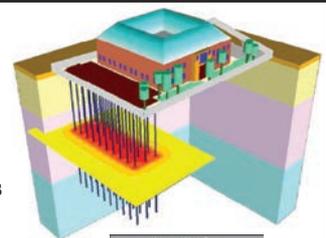
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Amajuoyi visited San Francisco as part of his research

Raphael Amajuoyi

## Gender agenda

HDR | Hurley Palmer Flatt's Raphael Amajuoyi discusses how winning the 2019 Ken Dale Travel Bursary enabled him to research potential gender bias in the built environment

Raphael Amajuoyi's winning proposal for the CIBSE Ken Dale Travel Bursary 2019 focused on the design of offices in relation to female occupancy, exploring the thermal comfort differences experienced by men and women. Funded by the bursary, his research on designing for gender equality took him to locations across the globe, including London, Doha, San Francisco and Rio de Janeiro. Amajuoyi, who was named CIBSE ASHRAE Graduate of the Year in 2017 while on the graduate training programme at Hurley Palmer Flatt (now HDR | Hurley Palmer Flatt), is an energy and sustainability development consultant at the firm. His report – *A Global Study: Designing for Gender Equality* – is available at [bit.ly/CJAug20gender](http://bit.ly/CJAug20gender)

### What motivated you to focus on design and gender bias?

Personal observations suggested male workers (including myself) found the office more thermally satisfying than our female co-workers did. The research question, 'Are buildings designed with a gender bias?', came from reading a newspaper article published in early 2019, in which the author listed items that had, consciously or subconsciously, been designed for men, including stab-proof vests and personal protective equipment, and wrote about the automotive industry using male-only crash-test dummies. This research set out to assess if the built environment is guilty of similar gender biases.

### What were the main findings of your research?

The study benefited from 193 participant survey responses across nine case-study offices in London, San Francisco, Rio de Janeiro and Doha. Observatory studies were also conducted in each office, typically lasting two to three hours, during which occupants' behavioural patterns were noted and compared with survey responses. The results showed most males considered their conditioned office as on the 'warmer spectrum' or 'neutral' compared with their female co-workers, who considered the same offices as being on the 'colder spectrum'. This was observed irrespective of local weather and climatic conditions – and females were often seen wearing additional clothing, or using local heaters or hot water bottles to remain thermally comfortable.

### What did you learn from the places you visited?

The selection of cities was based on several variables that offered differences for a

robust comparison when analysing the results. The research sought to understand if, and how, changes in local and climatic conditions, office dress culture, working structure (internal office layout, typical working hours, and so on) played a part in determining perceptions of thermal comfort across genders. An interesting observation was the relative similarity in results across case-study offices based on the consistency of them being conditioned (using air conditioning and mechanical ventilation with no openable windows), irrespective of city location. The research discusses this phenomenon as a 'bubble effect', where conditioned offices with sealed windows offered no thermal exposure to the outdoor (ambient) environment. So, whether outdoor temperatures were 10°C or 35°C – as may have been the case with London or Doha, respectively – occupants were likely to report consistent satisfaction (or lack of satisfaction) levels.

### How will this experience help you in your current role?

Occupancy thermal comfort has been a key focus area in my role as an energy and sustainability development consultant. I have become familiar with assessing the potential risk of overheating using CIBSE TM52 and TM59 guidance on projects. This research has given me the freedom to partake in essential knowledge-sharing opportunities from the occupier's point of view, to further understand how spaces are used in practice. I'm confident this will increase my scope by adding valued perspective to identify how we can design better indoor spaces for male and female occupants.

### Did your research raise any other issues you'd like to explore further?

The review of existing literature to inform this research's methodology highlighted the potential thermal comfort benefits offered by naturally ventilated offices compared with conditioned offices. Research suggests occupants who are provided with access to openable windows tend to have increased perceptions of thermal satisfaction compared with in offices reliant on mechanical cooling and ventilation. This study acknowledges several challenges associated with openable windows in a commercial office, particularly in built-up city locations, but puts forward this observation as a recommended focus area to determine its scale of feasibility for further research, either through academia or industry.

# EVENTS

Event details are correct at the time of going to print but, please note, as a result of the ongoing coronavirus (Covid-19) situation, they may be subject to change. For updates, please check [cibse.org/training](http://cibse.org/training) for training and [cibse.org/events](http://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](http://cibse.org/training-events/online-learning)



## NATIONAL EVENTS AND CONFERENCES

### CIBSE ASHRAE Technical Symposium 2020

14-15 September

An online two-day event this year, the symposium will include live and on-demand presentations, alongside live Q&A and discussion sessions. The programme will be released soon, and is likely to include: real world sustainable development; digital techniques to optimise built environments; enhanced energy performance and wellbeing; grid decarbonisation; heat networks; fire safety and smoke control; applying BIM; and design tools for lighting. [www.cibse.org/symposium](http://www.cibse.org/symposium)

### 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 the rising talent, and those who mentor, nurture and encourage those new to the industry. To coincide with the 25th year of the awards, this year will also include the new Apprentice of the Year award, recognising the contribution of apprentices in our industry. This is likely to be an online event, with details still being finalised. [www.cibse.org/yea](http://www.cibse.org/yea)

### Build2Perform Live

24-25 November

Registration is now open for the 2020 Build2Perform Live event and exhibition at London Olympia. The free two-day event will feature more than 80 hours of CPD, 160 speakers and 70 exhibitors. [www.build2perform.co.uk](http://www.build2perform.co.uk)

## CIBSE REGIONS AND GROUP EVENTS

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20 August

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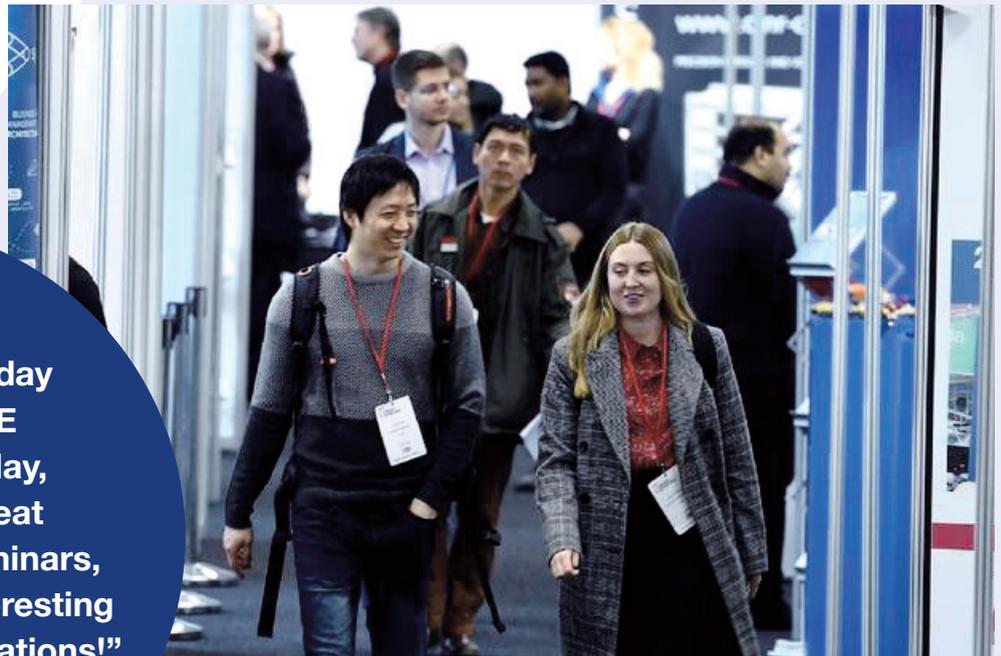
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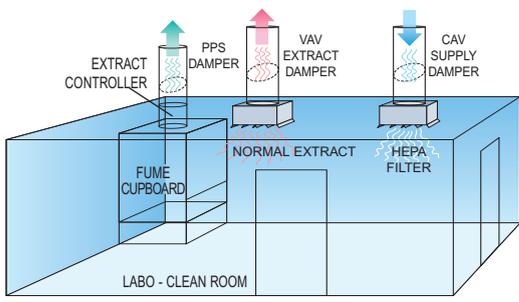


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Panel Mount Pressure or Velocity Transducers with remote alarms, analogue and digital interfaces. Traceable calibration certificates supplied as standard.

### AIR MANAGEMENT SYSTEM

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



### PRECISION COMPONENTS FOR VENTILATION AND PROCESS CONTROL

## CMR CONTROLS

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

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

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



### DPC CONTROLLER

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

### CAV AND VAV DAMPERS

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



Metal Damper

### PPS EXTRACT DAMPER

Poly-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