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Living with Covid-19

Around six months after it was first identified, Covid-19 is continuing to impact communities around the world. At the time of writing, the pandemic is cresting in South America, while in the UK, and much of Europe, infection levels and deaths have declined steadily, but not to the point of eradication. These governments now have the challenge of reopening their economies without triggering a second wave of infections.

Societies are having to learn to live with the virus – and to do so successfully, they must ensure that workplaces, shops and schools can be occupied safely. This means minimising their risk of transmitting the virus, and the role of building services engineers will be crucial in achieving this. Many have been advising clients on how they can return to their buildings safely, based on their own expertise, plus guidance from CIBSE, ASHRAE, REHVA and others.

Engineers must now also consider what services design will look like for projects planned for the medium to long term, when the threat of the virus could still be in the air.

On page 20, we asked leading engineers from four consultancies what they think will be the new norms for HVAC design as a result of Covid-19. It's a challenging brief. Most advice on minimising airborne transmission is focused on boosting ventilation, which means, potentially, more energy being used to clear buildings of airborne viruses.

Maintaining two-metre distances between workers will mean occupant densities will be lower in offices. Rod Bunn, former editor of the *CIBSE Journal*, has been studying the effect of office densities on occupant satisfaction, and says the pandemic offers an opportunity to test the relationship between comfort and lower densities (page 17).

It's been three years since the Grenfell Tower fire, and two years since 12 working groups were tasked with raising the competency level of those responsible for delivering high-rise residential buildings. The work on smoke control is now coming to fruition. On page 35, Allan Hurdle describes a competency scheme for designers and installers, and a European product standard that ensures fire-safety products are tested by an independent third party, rather than in-house.

For the benefits of the initiatives to be fully realised, it is key that contractors and consultants make sure they work with accredited companies using certified products. This is especially the case when you consider that smoke is responsible for 60% of deaths in fires.

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Hywel Davies
In light of the third anniversary of the Grenfell Tower fire, what does Covid-19 mean for building safety?

Chris Twinn
Zero carbon buildings can be achieved with offsite renewables and performance targets

Kavita Kumari
How engineers are responding to guidance and research on designing Covid-19-safe buildings

Tim Dwyer
The control of legionella in wholesome hot-water systems is the subject of this month's CPD

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24

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Sullivan appointed deputy chair of CIC

The Construction Industry Council (CIC) has appointed Justin Sullivan as its new deputy chair, with a view to succeeding Stephen Hodder MBE as chair at next June's AGM.

Sullivan is a quantity surveyor with more than 30 years' experience and CEO of Adair, which he founded more than 25 years ago. He specialises in project management, quantity surveying and project monitoring for commercial projects, and is responsible for some significant developments in the high-end residential sector.

A Fellow of the Royal Institution of Chartered Surveyors (RICS), he is also chair of the International Construction Measurement Standards Coalition (ICMS) and vice-chair of the RICS Construction Market Forum.

Cooling gets personal

Air conditioning manufacturer Fujitsu has developed a wearable device that cools the blood to lower the body's core temperature.

The Cómodo gear is worn around the neck and contains three small Peltier elements that cool the blood flowing through carotid arteries. It sends heat to a water-cooled heat sink worn on the waist and, according to Fujitsu, the system can cool the body even at temperatures above 35°C.

The cooling unit weighs around 170g and the radiator/battery is around 840g. Fujitsu says it is ideal for people working outdoors or without access to air conditioning, including many in the engineering and construction sectors. The rechargeable lithium-ion battery offers two-to-four hours of cooling and takes three hours to charge.

MPs urge swifter action on 'dangerous' cladding

Compulsory purchase buildings if work not started by end of 2020, says committee

MPs have urged the government to take legal action to recoup the cost of replacing dangerous cladding on more than 2,000 buildings.

The Housing, Communities and Local Government committee said 'it is not good enough' that thousands of residents continued to live in high-risk buildings three years after the Grenfell Tower disaster.

Unsafe cladding is still on 2,000 buildings

'We have challenged the government to finally commit to removing all dangerous cladding,' said committee chair Clive Betts, who added that the £1bn Building Safety Fund would not be sufficient. 'The fund should be increased so that it is enough to cover the amount of work that is actually needed, both to remove cladding and resolve wider fire-safety concerns.

'Compulsory purchase order powers should be used to take direct ownership of buildings where owners have failed to begin remedial work by December 2020. A piecemeal approach that will see homeowners facing many more years of stress and financial hardship... is not an option.'

The same ACM cladding used on Grenfell Tower has been identified on 457 high-rise residential or other publicly owned buildings, but has been removed from just 149 so far. Another 1,700 buildings are fitted with unsafe non-ACM cladding, the government believes – including certain types of laminate panels – and this also needs to be removed.

The MPs said the government should ensure all ACM cladding is removed by December 2021 and all other dangerous types by June 2022.

Call to widen combustible materials ban

The Construction Industry Council (CIC) wants the government to extend the ban on the use of combustible materials to a wider range of buildings, including care homes, halls of residence and, potentially, schools.

Its recommendation comes in response to a government consultation, published in January, that proposes changing the Building Regulations to ban the use of combustible materials in – and on – external walls, and in specified attachments to the external walls, on buildings such as hotels, hostels and boarding houses of 11m or above.

The CIC also wants a reduction in the 11m height for buildings where vulnerable people sleep, including care homes, which represent a higher risk. In its response, the council called for more research into the use of timber as structural material, and external shading to mitigate overheating.

UNIVERSITY PIONEERS PROJECT PARTNERSHIP MODEL

Sheffield Hallam University has appointed three partner suppliers to form the Hallam Alliance, a new procurement and delivery model.

The Alliance, the first of its kind in the UK for a university building programme, is made up of Sheffield Hallam, design consultants BDP and Arup, construction firm BAM and facilities manager CBRE.

It will deliver the first phase of the campus plan, and profits and losses will be shared.

CLC says industry must 'restart, reset and reinvent' post-Covid-19

Council's Roadmap to Recovery outlines three-stage approach to revitalise sector

Construction will have to reinvent itself over the next two years to deliver better value and collaboration, according to a strategy devised by the Construction Leadership Council (CLC).

The plan – designed to guide the sector's recovery from the Covid-19 crisis – includes a three-month 'restart' phase in which output grows, employment is maximised, and disruption to projects is minimised by the avoidance of disputes. This would lead on to a 'reset' period, where there is a fresh approach to compensate for loss of productivity created by the new safe-working practices, and supply chains are strengthened. The 'Roadmap to Recovery' culminates in a 12-month 'reinvent' period, during which the industry is transformed by greater adoption of digital and offsite manufacturing techniques, delivering better value, and working in long-term collaborative teams.

CLC's Covid-19 task force said the retention of key skills and minimising job losses were crucial. 'The unprecedented challenge of coronavirus calls for unprecedented solutions,' said CLC joint-chair Andy Mitchell. 'I am delighted by the way that the industry has collaborated at pace to develop this plan, targeting those interventions that will help the industry get back on its feet as quickly as possible.'

The Specialist Engineering Contractors' Group said fairer contractual and payment practices throughout the supply chain should underpin the recovery by supporting collaboration. Chairman Trevor Hursthouse said it was now vital to bring forward pipelines of work and get the cash flowing 'to all layers of the construction supply chain'.

Tough April but better May for sector

The construction industry shrank by more than 40% in April, before it started to show signs of recovery in May.

According to figures published by the Office for National Statistics (ONS), the value of construction was down by £5.1bn, at £7.6bn, compared with output of £12.7bn in March. New work fell by more than 41%, and repair and maintenance by 38%.

'All of these decreases were the largest monthly falls since records began in January 2010,' the ONS said.

The sector was down by 44% compared with April 2019. Housebuilding was the hardest hit, with public and private sector residential projects falling by more than 63% and 66% respectively compared with 12 months earlier. New infrastructure work was down by 20.7%.

In April, 42.5% of construction businesses reported no turnover at all. However, figures for May from information specialist Glenigan showed glimmers of a recovery, with the value of new work down by just 23% compared with last year.

Most sites are now open again and a survey by Build UK reported infrastructure sites achieving 89% of pre-crisis productivity levels, while general building sites are up to 78%.

IN BRIEF

Green boom could create one million jobs

The Local Government Association (LGA) believes that devolving skills development and investment to a local level will create a post-coronavirus jobs boom in the emerging 'green economy'.

It argues in a new report that more than one million jobs could be created through the introduction of a national skills programme, with government funding devolved to councils and combined authorities so they can work with businesses and education providers to address skills gaps through the training and retraining of workers of all ages.

Local green jobs – accelerating a sustainable economic recovery estimates the creation of more than 693,000 'low carbon jobs' by 2030.

Air-quality data must be made public

The vast majority of people in the UK believe air-quality data should be displayed publicly, according to research by air quality management company uHoo.

In a survey, 88% of respondents said this would be a good way of reassuring people that the local environment was being managed and was safe to enter. They want the information displayed on large screens inside offices, restaurants, hotels, and other public establishments.

uHoo said the coronavirus crisis had changed the emphasis away from energy efficiency and on to health in buildings.

Mace to make 300 redundant

Contractor Mace has announced that it is likely to make 300 staff redundant in the face of the economic slowdown caused by Covid-19.

It follows the redeployment of 150 staff into new roles in recent weeks.

Mark Reynolds, Mace chief executive officer, said: 'The coronavirus pandemic has had a significant impact on the markets that Mace operates in across the globe.

'Although we hope that many sectors will return to normal within months, activity in some industries – such as aviation – will be much lower for years to come.'

Net-zero transition can deliver £90bn boost

A report commissioned by WWF has predicted that the transition to a net-zero economy will give a £90bn annual boost to the UK in the wake of the coronavirus crisis.

It also says that investing in the country's net-zero carbon target will improve public health and create much-needed employment: at least 210,000 jobs by 2030 and 351,000 by 2050, in sectors including the built environment. Green buildings would require 85,000 new jobs by 2030, with the heating and cooling sectors set to expand by a further 7,000 skilled positions.

WWF has urged the government to make sure its spending and taxation regimes are aligned with the 2050 net-zero target, adding that this will lead to improved air quality and better-quality green spaces.

'Investing in a green recovery is the only way forward – the economic benefits will far outweigh the costs,' said WWF climate change specialist Isabella O'Dowd. 'The pandemic has shown we need to build resilience to future crises, and we need to prepare ourselves and our economy for the big climate challenges ahead.'

Britain goes coal free

Covid-19 lockdown partly explains the 13% fall in demand for electricity

The UK burned no coal to produce electricity for two months up to early June – the longest period since the Industrial Revolution, according to the National Grid.

This has partly been attributed to the coronavirus lockdown, with national demand almost 13% lower than normal, which allowed National Grid to switch off its four coal-fired power plants from 9 April.

Many experts now say the UK is close to dispensing with coal permanently.

'Yet another record-breaking coal-free run highlights... the fuel is simply not needed in a modern energy system,' said Energy and Climate Change Intelligence Unit analyst Jess Ralston.

'At the same time, the surge in renewable generation and extensive plans to expand the nation's fleet of cheap and clean energy sources show that there will only be one direction from here.'

Researchers from Carbon Brief said renewables have been responsible for 37% of electricity generated so far this year, compared with 35% from fossil fuels. Nuclear and imported energy accounted for the rest.

Flexible working key to retaining women engineers

CIBSE survey also finds sexism to be an issue in education

Flexible working and role models are important for retaining women in engineering, a CIBSE Inclusivity Panel survey has found.

Over a four-week period in 2019, 922 people – of which 75% were male and 25% were female – responded to the survey, which looked at education, careers and company policies, membership and chartership, career breaks, and retention.

The results showed that men were 11% more likely to see themselves staying in the engineering profession than women, 55% of whom thought the engineering sector did not retain women.

The top-three initiatives that participants thought would help encourage and retain women in engineering were flexible working, encouraging school children to study engineering, and having role models.

A third of the participants said they had experienced barriers while studying. The most common ones faced by women were sexism, lack of role models, time pressures, and inadequate careers advice. The most common barriers for men were finances, time pressures, irrelevant course content, and availability of courses in the local area.

Inclusivity Panel chair Alexandra Logan said: 'A common thread through the survey was the need for flexible working arrangements and role models. Businesses may want to consider how they can implement these initiatives into their companies.'

As well as producing the Inclusivity Guidelines – which can be found at **cibse.org/inclusivity** – the panel will look to: ensure a diverse range of speakers at events; build role-models' profiles; provide a 12-month technical update; and liaise with external groups. If you have comments or suggestions, contact **inclusivity@cibse.org**

Technical Symposium goes virtual

This year's CIBSE ASHRAE Technical Symposium will take place online during the week beginning 14 September. Originally scheduled for April at Glasgow's Strathclyde University, the event was moved to September, but will now happen 'virtually'.

Speakers are being asked to pre-record their presentations for the event, the theme of which is Engineering Buildings, Systems and Environments for Effective Operation.

Symposium chair Tim Dwyer said the organisers wanted to ensure the work that had already gone into preparing presentations was shared with the widest possible engineering community. 'We want to ensure a respectable and good-quality platform for your work, so we have decided that the best, and most certain, opportunity will be by holding a groundbreaking online CIBSE ASHRAE Technical Symposium built around pre-recorded presentations,' he said.

The presentations will each last for 18 minutes, and will take place in sessions across several days, with opportunities for live Q&As, a possible live, fast-track TED-type session for compendiary papers, and 'breakout' sessions, plus some live headline speakers.'We will be supporting the event with web and social media activity to maximise exposure,' said Dwyer.

Speakers and participants are asked to confirm their willingness to support the virtual event by emailing **tdwyer@cibse.org**

Panel calls for equality and inclusivity feedback

CIBSE's Inclusivity and Diversity panel is calling on black, Asian and minority ethnic (BAME) members of the building services community to make suggestions on how to improve the Institution and sector. The request comes amid the growing impact of the Black Lives Matter protest in America and around the world after the death of George Floyd in Minneapolis, the USA.

The panel issued a statement on how it is seeking to start a conversation to establish how to be more inclusive and promote equality for BAME members. It said: 'We want to make sure that everyone can be a part of, and feels welcome in, our community. We acknowledge we are at the beginning of a journey, with a goal of providing diverse and inclusive opportunities for BAME people in our community.'

To contact the panel with your experiences and ideas, email **inclusivity@cibse.org**

Cooling sector 'failing to innovate'

There has been 'little or no meaningful innovation' by air conditioning and refrigeration manufacturers in recent years, according to a new charity report.

UK-based not-for-profit CDP, which produces information about the environmental impact of major corporations, looked into the activities of 18 leading manufacturers, rating them for energy efficiency, emissions and low carbon innovation. It said an average of just 2.2% of revenues was spent on R&D and most were failing to take advantage of the best available technologies.

Playing it cool: which cooling companies are ready for the low carbon transition? claims that most innovations only produced 'incremental' gains, with 60% of patents simply covering tweaks to compressor design. There was also a 58% gap between minimum energy performance standards and best-available technologies for split air conditioners, for example.

Just four companies in the sector had set targets to reduce emissions throughout the value chain by 2050: Hitachi and Mitsubishi Electric (aiming for an 80% cut), and Daikin Industries and Electrolux (which are going for net zero).

Council to oversee £50bn heat-network funding

As much as £50bn will be invested in the heat network sector between now and 2050, creating 35,000 new jobs and delivering zero carbon heat networks, according to the newly created Heat Networks Industry Council (HNIC).

HNIC includes operators and energy firms responsible for providing heating to 500,000 customers. It aims to build zero carbon heat networks in most major cities by 2035, eventually delivering 18% of UK heat demand.

Minister for Energy and Clean Growth Kwasi Kwarteng said heat networks would play 'a vital role in a future net-zero economy by helping to decarbonise how we heat our buildings while creating new green jobs'.

New guidance on local exhaust ventilation

The Institute of Local Exhaust Ventilation Engineers (ILEVE), together with the Building Engineering Services Association (BESA), has published new guidance on local exhaust ventilation (LEV).

TR40 – *A guide to good practice for local exhaust ventilation*, is a comprehensive guide for all those who design, commission, operate and maintain LEV systems, including LEV commissioning engineers.

The guide has been produced to support the ILEVE aims of reducing ill health and death resulting from workplace exposure to hazardous substances, improve competence, and provide members and the wider public with first-class information and criteria for best practice.

TR40 includes information on the different roles and responsibilities, and associated legal and statutory duties, offering guidance on what to do and when to ensure the LEV process provides effective solutions to control exposure to hazardous substances.

It includes guidance on: identifying LEV competency skills, experience and knowledge; training (to be used in conjunction with the industry LEV Competency Matrix); the importance of keeping records; what to look for and what to ask when evaluating LEV tenders and quotations; and the installation and commissioning process through to handover.

'TR40 will help give the consistent approach we have all been working towards. The guide is designed to ensure we have bespoke systems being designed and installed, to protect the health of all those in the working environment,' said Dean Greer, chair of ILEVE.

The guidance supports the principles of the government's Helping Great Britain Work Well strategy by providing simple, accessible and relevant advice to facilitate proportionate, appropriate and effective risk management, encouraging all those in the system to take much greater ownership of health and safety.

TR40 is available for members to download from the CIBSE Knowledge Portal at **cibse.org/knowledge**; everyone else can purchase it from **www.thebesa.com**

New CIBSE strategy offers clear direction

Document sets out Institution's commitments to seek improvement in the built environment

CIBSE has set out its plans and commitments for the next five years, in a strategy document published in June.

The strategy aims to provide a clear direction for promoting members' expertise and the role they play in ensuring building occupiers can feel secure, healthy, safe and comfortable.

It has been developed through consultation with CIBSE Council and the regions, and focuses on the actions the Institution will take to meet objectives relating to five key areas:

Better building performance: CIBSE aims to deliver safe, healthy and affordable buildings that are fit for purpose and adaptable for the future

Growing membership: CIBSE aims to be the membership institution of choice for those working in areas linked to building performance

Sharing knowledge: CIBSE will continue to develop and grow the Knowledge Portal

Strengthening CIBSE's voice: CIBSE will represent the Institution, our values and the work of building services engineers with a purposeful voice

Increasing engagement: CIBSE will purposefully work with our members to develop a culture of engagement, offering opportunities for all to contribute to CIBSE and the broader industry.

Clear commitments are set out in the strategy to stimulate demand for better building performance, influence others to seek improvement in the built environment, and provide an authoritative hub for knowledge and innovation.

To meet these commitments, CIBSE has identified key actions, including:

- Define best practice metrics for built environment performance
- Demonstrate leadership in data sharing
- Provide clear guidance on delivery of safe net-zero carbon buildings
- Implement an online application process for membership
- Attract increasing numbers of talent from broader engineering backgrounds
- Proactively review CIBSE knowledge content and identify future focus
- Create feedback mechanisms and a discussion forum for knowledge area
- Refresh CIBSE brand
- Improve ways members and the wider community can engage with CIBSE and create volunteering opportunities.

● To read the CIBSE strategy in full, visit **cibse.org/strategy**

FM Group looks to expand

The CIBSE Facilities Management Group is seeking to expand its active membership and number of Committee positions. It is encouraging interest from colleagues of existing members of the group, and CIBSE Members from Regions, YEN and other sections.

The group is known for cross industry engagement, thought leadership, networking, events, information and formal documents such as CIBSE Guide M. The group has exciting plans for the coming years around building risk management and smart building technology. If you would like to join, please email **groups@cibse.org**, and if you would like potentially to become a committee member, please provide details of your specific areas of interest, current job role and activities you wish to offer the group.

Bob Bohannon champions a sustainable approach to lighting

Let's re-evaluate what is important, says SLL head

New president Bohannon highlights issues relating to building services and procurement following Grenfell

The Society of Light and Lighting (SLL) welcomed its new president, Bob Bohannon, at the AGM in May.

Taking over from immediate past president Jim Shove, whom he thanked, Bohannon outlined his desire to help the SLL deliver a safe, zero carbon, healthy, sustainable, comfortably lit and visually stimulating environment.

Bohannon, whose mother has been an environmentalist since the 1970s, has championed a sustainable approach throughout his career. He acknowledged the reduction in carbon emissions that has resulted from the introduction and dominance of LED lighting, but said the responsibility of the industry and lighting professionals does not end there.

Bohannon highlighted issues relating to construction, building services and procurement following the Grenfell Tower disaster and the publication of Dame Judith Hackitt's review. 'Much of the current industry design and build structure is predicated on short-term saving of capital cost, to deliver buildings that perform for as long as the warranty or retention period lasts,' he said, and called for lighting and related industries to refer to the importance, worth or usefulness of something, and to consider who this should benefit in the long term.

Bohannon stressed that safety, integrity and resilience need to be central to the professional practice of the lighting industry. In promoting the value of light, the SLL must also encourage diversity and inclusivity.

The SLL president's address was held online on 21 May. New president-elect Ruth Kelly Waskett was also inducted, and will serve her term from May 2021.

- **Watch the SLL president's address at bit.ly/CJJul20SLL**

IN BRIEF

Membership 1 August closing date

The next deadline to apply for the Associate and Member grades in the UK is 1 August. To find a list of what you'll need to submit and when, visit **cibse.org/closingdate**

CIBSE offers a wide range of support to help you with your application. Visit our Membership Development Support page – **cibse.org/briefings** – to find out more about our online workshop, briefing sessions, webinars and phone-surgery appointments with CIBSE interviewers.

If you have any questions, or need further information, contact us on **membership@cibse.org** or +44 (0)20 8772 3650. Based outside the UK? You can submit your application at any point throughout the year.

Death of Graham Smith

It was with sadness that CIBSE learned of the death of Graham Smith last month. Graham made a significant contribution to our understanding of controllability of hydronic systems. He wrote and presented the Energy Efficiency Best Practice programme GIR40 'Heating systems and their control', and GIR41 'Control of variable loads'. In 2012, Graham made a significant contribution to AM15 'Biomass heating'. He will be missed.

Geoffrey Brundrett obituary

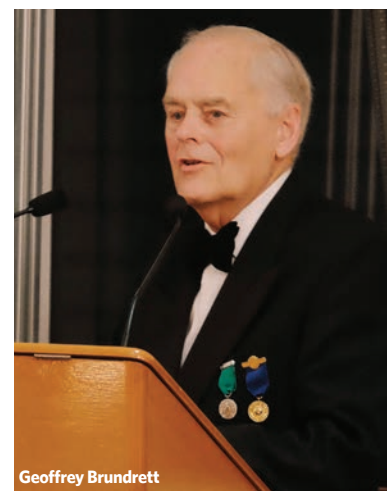
With deep sadness we report the death on 5 June of past President Geoffrey Brundrett BEng PhD CEng FIMechE FCIBSE HonFRSH after a long struggle with a serious lung condition. Geoff's involvement with building services goes back 60 years. After a BEng and apprenticeship at Leyland Motors, he completed a PhD at Liverpool University in 1961. He joined the Central Electricity Generating Board Marchwood Laboratories, moving in 1966 to the Electricity Council Research Centre at Capenhurst, where he worked for 26 years. He retired as head of the environment and buildings division to academic roles in Liverpool and the University of Wales.

Geoff served the regional committees of both the IHVE and IES prior to their merger to create the CIBS in 1976. He chaired the merged committee in 1979, serving on it until 2004.

Geoff was President of CIBSE in 1997, the centenary year, contributing to the historical book *The Quest for Comfort*. Geoff served CIBSE in many ways, chairing the electrical services group and panel responsible for TM13 *Legionella*, for many years. He wrote Guide A Chapter 8 on health, which became TM40 on health and wellbeing.

Geoff received two technical Bronze medals: the Walsh Weston in 1974 from the IES for a *Lighting Research & Technology* paper and the Carter in 1985 for a paper on legionella. He received the Silver Medal in 2004 and Gold Medal in 2017. He chaired the Council of the now Royal Society of Public Health in 1999-2000.

We offer sincere condolences and heartfelt sympathy to Janet, his wife of 60 years, and family.


Geoffrey Brundrett

MINUTES FOR CIBSE ANNUAL GENERAL MEETING

The Annual General Meeting (AGM) of CIBSE was held on 5 May 2020. In view of restrictions imposed to contain the ongoing coronavirus outbreak, the AGM was conducted as an online meeting in a webinar format. Lynne Jack, outgoing President, chaired the meeting. Chief executive Stephen Matthews read the notice convening the meeting.

The minutes of the 42nd AGM of CIBSE, held on 7 May 2019 and published in the July 2019 issue of *CIBSE Journal*, were accepted as a correct record, subject to noting that a question had been raised regarding the status of the Research Fund; conversations subsequent to the meeting had resolved the difference between the costs of research and the contribution from the Fund, and clarified the availability of the Fund for research expenditure.

ANNUAL REPORT AND FINANCIAL STATEMENTS

Lynne Jack introduced the Annual Report for 2019, drawing attention to the agreed CIBSE Values: to lead, to empower; to champion and to inspire. These would be important in the current challenging times. She referred to the Phase 1 report of the public inquiry into Grenfell Tower, which had sharpened the focus on building regulations and compliance. She noted the contribution to Dame Judith Hackitt's review by the technical team, the work of CIBSE members to find new ways of working to avoid such tragedies, and the publication of Guide E on fire safety. CIBSE was working to help meet the UK's 2050 net-zero carbon emissions target, had contributed to the review of Parts F and L of the Building Regulations, and was working on climate change issues and overheating in particular; attention was drawn to the CIBSE Climate Action Plan. The Building Performance Awards had been very successful, with excellent nominations, and Build to Perform Live had attracted more than 1,700 attendees, with 170 speakers. The Inclusivity Panel continued to deliver important work, with well-received Inclusivity Guidelines published during 2019.

She applauded the work of the CIBSE Young Engineers Network, having hosted its global conference, and referred to the Graduate of the Year awards, thanking employers for their support. It had been an honour and privilege to lead CIBSE, she said, and thanked everyone who had contributed, both volunteers and staff.

Richard Willis, audit partner of BDO LLP, then read the audit report, which confirmed that the Annual Report and Financial Statements gave a true and fair view of the state of the group and the parent charity's affairs, and of the income and expenditure for the year, and had been prepared in accordance with all relevant requirements. He further confirmed that there were no matters to which he would be required to draw attention by exception and no undisclosed material issues or inconsistencies between the Annual Report and the Financial Statements.

Honorary Treasurer Adrian Catchpole then reported in more detail on the Financial Statements, drawing attention to the breakdown of income sources and confirming that total income for the year had risen to £7.36m from £7.024m in the previous year.

He went on to present a detailed breakdown of the income sources of the commercial trading subsidiary CIBSE Services Ltd, highlighting the importance of income from Training in particular. The results of CIBSE Services Ltd had been affected during the year by the decision to transfer ownership of CIBSE Certification Ltd from CIBSE Services to CIBSE itself, and to commence certification trading through CIBSE Certification Ltd. This had removed certification activity from the CIBSE Services results for part of the year. Income sources other than certification had, however, increased by £29k in total for the year.

Group expenditure through subsidiaries had increased in line with income. Membership and Technical expenditure had both increased, but Regions, Special Interest Groups and Societies expenditure had reduced, and Research was at a similar level. Some extra costs had been incurred with the transfer of certification business, while membership costs had increased to improve support and improve membership recruitment and retention. Technical expenditure reflected increased consultations and work in respect of the Grenfell enquiries. The reduction in Regions, Groups and Societies expenditure arose from changes to the support structure and the application of overheads, and did not reflect a reduction in support for activities.

> "CIBSE was working to help meet the UK's 2050 net-zero carbon emissions target"

Overall, a surplus before investments of £71k had been achieved, with a positive investment result of £155k adding to a net movement in funds of £226k.

Regarding the balance sheet, property and equipment had reduced because of depreciation, investments had performed well, and stocks and debtors were at a similar level to the previous year. Cash balances were up because of prompt payment of membership subscriptions, which was also reflected in an increased creditors figure.

In summary, Adrian Catchpole noted the strong performance, and acknowledged the importance of new digital services to the work of the Institution. He acknowledged, however, that the recent coronavirus outbreak and the measures taken to contain it would have a significant impact; the trustees and executive were working closely together to evaluate this and would take all necessary steps to safeguard the financial position of the Institution. He thanked the staff for their support, in particular, director of finance Desiree Blamey.

In response to questions, Adrian Catchpole explained that, from next year, a detailed breakdown of performance would be provided for CIBSE Certification Ltd; this had not been undertaken for the current meeting,

as it had traded for only a few months in 2019. Regarding the increase in membership cost, which was up by more than membership income, this reflected a restructure to provide better support to the Regions, Groups and Societies, as well as investment to drive future membership growth and improve the membership journey; it was hoped that this would drive higher income levels in future. It was also explained that the Restricted Funds referred to the CIBSE Patrons Fund, which came from companies that wished to support the work of the Institution.

AUDITORS

Adrian Catchpole proposed that BDO LLP be appointed as the Institution's auditors for 2020, and that the Board be empowered to agree their remuneration. This was seconded by Kevin Kelly and approved by a substantial majority.

BOARD AND COUNCIL FOR 2020/2021

Stephen Matthews declared the following individuals appointed and elected to serve as Officers, Board Members and Council Members following the AGM 2020:

Officers:
President: Stuart MacPherson (takes office automatically)
President-elect: Kevin Kelly
Immediate past President: Lynne Jack (takes office automatically)

Vice-presidents: Ashley Bateson, Susan Hone-Brookes, Kevin Mitchell
Hon treasurer: Adrian Catchpole

Members of the Board:
Elected members: Vince Arnold, David Cooper
Continuing members: Les Copeland, Fiona Cousins, David Fitzpatrick

Members of Council:
Elected members: Scott Mason, Mike Smith, Becci Taylor

ANY OTHER BUSINESS There was no other business.


CIBSE's headquarters in Balham, London

Diversity is key to our recovery

A million jobs could be created if low carbon measures are at the heart of the post-Covid-19 economy – but will we be in a position to take advantage, asks CIBSE Patrons chair **Nick Mead**

Building services firms will have to recruit a far more diverse workforce if they are to play their part fully in the UK's post-coronavirus recovery.

According to a study commissioned by the Local Government Association, more than 693,000 low carbon jobs could be created by 2030. A further 488,000 positions will be added between 2030 and 2050.

WWF has also predicted that the transition to a net-zero economy will give the UK a welcome £90bn annual boost, and improve air quality and public health. Meanwhile, the Construction Leadership Council wants the government to back its two-year plan, which aims to 'restart, reset and reinvent' the sector through improved collaboration and better use of digital and modern delivery techniques. All very positive.

More immediately, however, the industry faces an employment crisis. We have to find innovative ways of keeping skilled people employed while expanding our skills base to achieve future aims – but our poor record on diversity could undermine everything.

Diversifying our workforce

It remains an astonishing and shameful fact that, today, only 12% of UK engineers are female and just 25% of girls aged 16-18 would consider a career in engineering, compared with more than 50% of boys, according to the latest statistics from EngineeringUK.

Last month's International Women in Engineering Day reminded us that many companies in our sector lack diversified workforces with the range of skills needed to deliver our rebuilding plans. Girls and women account for just 7.4% of engineering apprentices, and only 22% of students starting A level physics last year were female. Yet, studies show that young women outperform their male counterparts in all STEM A level subjects apart from chemistry. So why aren't we employing more – or, more pertinently, why does our industry not appeal to them?

Unless we recruit more female engineers, our firms will find it increasingly hard to deliver the social, economic and environmental challenges we all face. However, it is those very challenges that we can now use to appeal to women, young people and others in our communities, many of whom are looking – in the post-Covid world – to take up a profession where they can make a difference.

Patrons will be redoubling our commitment to financial and practical support for CIBSE's campaign to appeal to a much wider demographic that properly reflects the society we serve.

● For more about CIBSE Patrons email: **patrons@cibse.org**

Building to perform

In his Presidential address in May, Stuart MacPherson urged us not to return to business as usual as we emerge from the current crisis. Hywel Davies considers what that might mean for building safety

It takes something to displace the third anniversary of the Grenfell Tower fire from the headlines. But the SARS-CoV-2 pandemic did.

Covid-19 has driven change in ways we could not have imagined. We have learned to hold meetings online, and to work collaboratively and remotely on projects. It has been a radical and dramatic change.

As we reflect on the Grenfell Tower disaster and what we already know about that night, how can the current crisis inform the building safety programme[1,2] and review of building regulation?

Covid-19 has put the operational performance of our buildings into sharp focus. It has thrown a spotlight on the systems that supply essentials of life: air to breathe and water for sanitation. Suddenly, everyone wants to know that the plumbing and ventilation systems are safe. Not that, when installed a few years ago, they met building standards and a building inspector signed them off – or that there is a maintenance contract for them. They want to know that the building they are in, or being asked to return to, is safe to occupy now.

"What we deliver is built for a purpose – to provide a safe, healthy place to live, learn, work, be"

In lockdown, we have surely all shopped online. A critical element is the courier bringing the physical goods to our door. But they are only a means to deliver the goods we ordered to perform a function – to feed, clothe, educate or entertain us.

It is easy to lose sight of the reality that a sector employing about one in 10 of us – and delivering everything from our homes to the local supermarket, the transport links between them and the utility systems that serve them both – is a delivery service. But that is precisely what 'construction' is and does. We deliver the built environment in which we all live.

Good practice includes commissioning the building so that it works at handover. It might also include training the incoming building manager, but then we move on.

What we deliver is lived in, shopped in, taught in, travelled on, met in. It is built for a purpose and to perform a function – to provide a safe and healthy place in which to live, learn, work or be.

In engineering terms, the pandemic has brought a particular focus on ventilation and water systems in buildings. CIBSE guidance[3] on preparing buildings to reoccupy lists 11 engineering systems that must be checked before reopening.

Such is the concern about water systems that the HSE now has a specific website on the topic. And to reduce the risk of airborne transmission, CIBSE provides guidance on ventilation rates to dilute and disperse contamination and avoid transferring it within the building.

The emphasis is on performance of the building and the various systems within it. The question is, do they work now? Are they effective and delivering a safe environment today, and supporting our health in the future? That means asking whether they have been maintained and still operate as they should.

This is what CIBSE does. Everyone in the CIBSE family is involved in providing buildings that perform safely and effectively – whether that is how they are powered, lit or clad; how we move about them; how we wash our hands; how the air we breathe is provided; or how local contaminants are exhausted.

The current crisis has made people aware of the importance and the value of what we do. Do we really want to 'go back to normal'?

The pandemic also teaches us something about building safety. A safe building is not just a sound structure that will not burn down. It must be those things, but it also needs systems to detect fire, possibly to suppress or control fire, and certainly to enable escape. A safe building needs systems that deliver healthy air and clean water, and that maintain a comfortable temperature for all occupants.

As we look to implement the building safety programme in the aftermath of the Grenfell tragedy, it is vital that we deliver and maintain safe, healthy buildings for all.

Please note, the *CIBSE Journal* design style is to have an initial cap only for Covid-19, whereas the World Health Organization refers to it as COVID-19.

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

References:

1 A reformed building safety regulatory system: government response to the 'Building a Safer Future' consultation, **bit.ly/CJJul20HD1**
2 Letter from the Prime Minister to Sir Martin Moore-Bick **bit.ly/CJJul20HD2**
3 Emerging from lockdown, CIBSE advice pages, **bit.ly/CJJul20HD3**

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The road to recovery

As the lockdown eases, Julie Godefroy outlines some of the key policy activity focused on supporting the transition to a zero carbon economy

The Covid-19 pandemic hasn't diminished attention on carbon and environmental issues, with plenty of policy activity recently.

CIBSE has produced a 'green recovery' briefing to articulate our recommendations on the post-pandemic recovery plans, with priority areas being:

- Developing skills and competence to support a zero carbon economy, especially retrofit and low carbon heat
- Supporting retrofit, nature-based solutions, and clean energy and transport infrastructure, to benefit the climate and contribute to job creation and long-term economic benefits
- Making the most of the current period to prepare the low carbon transition – for example, training programmes, and implementing walking and cycling routes to pre-empt a rush to private cars as the economy restarts
- A review of financial incentives. Some are not aligned with carbon and environmental objectives, and – intentionally or not – support inefficiency and the continuing use of fossil fuels. Better long-term outcomes could be achieved with the same funds.

"We recommended a signifcant ramping up of retrofit policies"

We hosted a green recovery webinar, with speakers from Architects Declare, the Landscape Institute and the Royal Town Planning Institute presenting their ideas for how buildings and cities can contribute. This highlighted joint recommendations on health, green infrastructure, and planning for clean energy and transport. We intend to respond to a Department for Business, Energy and Industrial Strategy Select Committee inquiry on the issue. The deadline to contribute to the CIBSE response is 7 July.

Part L: any update?

Unfortunately, no update is available on the government's analysis of the responses to Part L and the Future Homes Standard, or on the upcoming consultations on non-domestic and existing buildings.

Retrofit

We contributed to an Environmental Audit Committee (EAC) inquiry on the energy efficiency of existing homes. EAC asked whether the government's current targets, policies and support measures are sufficient to improve existing homes and achieve the net-zero target. We recommended significant ramping up, including:

- Developing skills and competence
- Improving the regulatory framework, targeting all opportunity points (at the very least works subject to Building Regulations or planning, sales and new leases) with tighter requirements, a whole-house rather than elemental approach, and more attention to actual in-use performance
- Creating a system of monitoring, data gathering and analysis to improve technical solutions, regulations and supply chains
- The introduction of building passports, including a record of the building and its performance, a log of works carried out, a route to net-zero carbon (as a single package or step by step), and links to supply chain accreditation schemes
- More incentives and better alignment with energy and carbon goals. Examples include the discrepancy between the VAT rate applied to new build and retrofit, and permitted development rights for conversions of buildings into dwellings that are allowed minimum regulatory compliance and a fast-tracked planning process. Support should instead be provided to projects that most contribute to policy objectives.

The submission is not publicly available yet, but you can read our earlier briefing to the EAC for a summary on similar points.

Heat

CIBSE responded to a consultation on the regulation of the heat market. We were broadly supportive, as heat needs to be regulated for consumer protection. In addition, we recommended that support to heat networks should be conditional on energy and carbon performance, and that this should also apply to existing networks, to trigger real, robust transition plans away from fossil fuels.

We are also shortly due to respond to two consultations on the future support for low-carbon heat.

Net zero

We have created a web page summarising CIBSE recommendations towards operational net-zero carbon buildings, and how they relate to the Leti one-pager.

In 2019, we published our first Climate Action Plan, which summarises existing and planned actions in areas such as education, research, training, technical guidance and policy, as well as how we operate as an institution. A webinar is also available. The plan is due for its first annual update – send your suggestions by 10 July.

- Contact Julie Godefroy at **JGodefroy@cibse.org** to comment or contribute.

DR JULIE GODEFROY is technical manager at CIBSE

Rethinking space

Social distancing because of Covid-19 will result in lower office densities, but how might this affect occupant satisfaction, asks WMEboom's Roderic Bunn

As the Covid-19 outbreak begins to retreat in the rear-view mirror, the property industry will need to consider the implications for occupation of their buildings. New lines may be drawn for what working conditions employees are prepared to accept, particularly in office buildings, where people work closely together.

Some commentators are sounding the death knell for open-plan offices, suggesting a return to cellular accommodation and circulation designed to reduce close contact between co-workers. Much is being pinned on home and remote working becoming the new norm, to enable those who do visit the office to observe two-metre distancing rules. Remote working may not be the game-changer some believe, but greater diversification of office work is likely.

"No company will pay for space they can't justify"

Lower central office use may reduce the need for rented space significantly, leading to the renegotiation – if not termination – of leases. Landlords will, undoubtedly, try to retain tenants through various inducements, but this may only work in the short term. No company will pay for space it can't justify.

So, what is the right amount of office space? If the Covid-19 pandemic has done anything, it's alerted people to the health risks of being in forced proximity with others. Sometimes this can't be helped – public transport being an example – but in the office workplace, one has choices. A key choice is whether employers should continue to cram workers into tighter and tighter spaces, in ways they were doing before the pandemic.

Research by the British Council of Offices over the past decade reveals how severe this tendency has become. The chart shows how average office density has increased from one person/12.5m² in 2008 to one person/9.6m² in 2013. By 2018, 24% of floors surveyed by the BCO fell into the band of one person/8m² and below. Furthermore, densities for four large offices measured by your author longitudinally, over 10 years or more, have been overlain on the chart. While this data reinforces the BCO's findings, your author found some social and workstation densities were beyond the BCO's presumed limit of one person/6m².

Commitments to agile working and flexible use of offices tend to be applauded in wellbeing assessments. However, this is not necessarily the density safety valve that some believe, particularly where very small desks (say, 1.4m wide) have been installed in fixed workstation areas. In those instances, observed diversification may be less about 'agile' working and more about workers escaping density-induced discomfort. Clues can be found in occupant surveys, where respondents reveal why they escape to atriums and empty meeting rooms – or to home if they can; anywhere they can get some space and acoustic privacy.

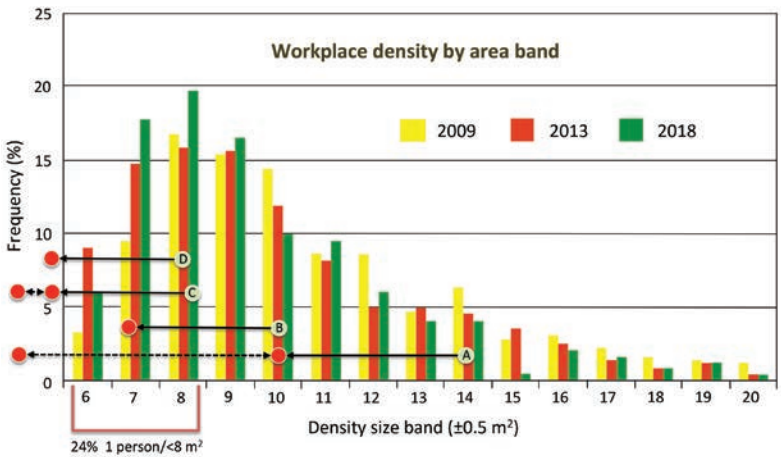
Some analysts want regulations that set a minimum area per person in offices, along with maximum occupancies for lifts and lobbies. That might be desirable, but we'll need robust proof of improved occupant satisfaction and health for employers to adopt those lower densities. Tantalising research evidence suggests that densities above one person/15m² may be more conducive to occupant satisfaction for a range of comfort variables – noise being a key one. The data is partial and unconvincing, however, largely because of a paucity of case-study offices operating at such densities.

Future case studies will need to capture the perceptions of occupants reliably, so we can be more certain of the relationship between density and comfort, health and productivity. More critically, we need to know where the discomfort thresholds lie if we are to define the components of a building's carrying capacity.

The disadvantages of diversified working will also need to be studied. Home working may have lifestyle benefits, but it could also stress the separation of work and home life in ways detrimental to overall wellbeing.

Improving what one might term the density carrying capacity of offices may be an unexpected upside of the pandemic, but we must keep an eye on the downsides, too.

DR RODERIC BUNN is an associate with consultant WMEboom, specialising in soft landings and building performance evaluation



Increases in UK office density 2009-2018, from the BCO report *Office Occupancy: Density and Utilisation*. The graph is overlain with longitudinal density data from academic research of four large office buildings (A-D) studied between 2007 and 2015. Dotted lines for two buildings indicate density below one person/6m² in specific zones.

Building a zero carbon nation

To achieve carbon reduction targets, **Chris Twinn** says the UK should be looking at large-scale offsite renewables and achievable building performance targets that are rigorously upheld

We are increasingly hearing the media and policy-makers demand that we start designing new buildings for zero carbon. When asked how, however, the answer comes back as the mantra that a net zero carbon building should generate as much renewable energy annually as it uses. As most design engineers will tell you, this is nonsense for vast swathes of buildings – particularly at urban densities.

This mantra is an out-of-date blunt instrument. We no longer need to assess buildings in isolation versus a coal-fired energy supply system. As a model, it has already demonstrated its impracticality for mainstream rollout. It is far more economic to generate renewable energy in bulk off site, rather than on our constrained building sites.

Then there is the myth of offsets to make up any onsite deficiencies. Come 2050, it seems more than likely that there will be little or no offsite offsetting available to UK buildings, as anyone with carbon sequestration will retain it for their own zero carbon obligations.

"Renewable generation is not a function of building energy demand, but a function of building footprint area"

In principle, the idea that a building is an isolated zero carbon island is a fallacy. They are part of a wider network of multiple energy generators, a whole spectrum of demands and a management system. We need to consider the whole system and think systemically, with the focus on the stated objective of a zero carbon nation, not buildings as islands.

So how do we come up with a practical definition of zero carbon that is applicable to all buildings? In essence, we can distil this down to a need to deliver sufficiently reduced energy demand to match the expected national availability of renewable energy supply.

To put some numbers to it, what would be a reasonable fair share of this 2050 available renewable energy? The 'Paris-proof' method is a way of assessing this.[1] The Paris reference relates to the UK needing to be, effectively, zero carbon to meet the UN Paris Agreement of limiting climate change to 1.5°C.

We already have a good idea of how much zero carbon energy the UK is expecting to generate by 2050.[2] This is against a backdrop of wind-

The University of Leicester's Centre for Medicine has Passivhaus certification

CHRIS TWINN
Specialist built environment adviser
Twinn Sustainability Innovation

power generation capital costs falling significantly as it moves from an innovative, low-volume technology into mass mainstream.

Divvying up this GWh of annual generation as proportions between buildings, transport and industry is done based on current energy use. Dividing the buildings' allowance across the overall national building floor areas for each main building type gives us the kWh·m^{-2} target to ensure we are contributing to that zero carbon future.

The targets in this table mean zero carbon changes from the exception to being something that is manageable and can be engineered for all buildings. These targets are, nonetheless, a challenge – but definitely achievable. Passivhaus has shown it can achieve this, although it is by no means the only method, with potential alternatives offering lower cost for achieving the same outcome.

Plainly, aspects of the above will take us beyond a design scope to consider unregulated energy use. Engagement with the client – for example, on their fitout choice of ICT systems – and, likewise, being more proactive with the architect on the building fabric performance required, will have to become the norm.

Designing to match a specific renewable energy availability is but only half the story. If the completed building fails to deliver on our predictions, the whole basis of Paris-proof zero carbon evaporates. Designers, constructors and operators will be judged on the actual performance of the building they are delivering. No hiding behind some code-compliant prediction with their performance gap.

This is where we learn from the likes of Nabers/Build for Performance initiative[4] and Passivhaus[5], where monitoring of the occupied building is standard. The results are remarkable; when designers and constructors are publicly judged by the performance of the building, it completely changes the mindset of all involved and is a real incentive to avoid compromising the label claims on the tin. This entirely accords with the principle of maintaining a golden thread of responsibility from design through construction into operation. Only then can we claim to have a building for delivering zero carbon.

We should be looking to develop planning and Building Regulations to deliver Paris-proof new buildings. Interestingly, it means there is no place for carbon targets or primary energy targets. It is a simple kWh·m^{-2} per year target, which are so much more readily understood by all the stakeholders involved in deliver and operation.

Onsite renewables are important, but are a separate policy requirement for harnessing the available roof-area resource as a community contribution to that renewable grid we will be drawing down on. This renewable generation is not a function of building energy demand, but a function of building footprint area.

Whole-building energy use	kWh·m^{-2}yr	Whole-building energy use	kWh·m^{-2}yr
Residential	35	Hospital*	100
Office	55	Healthcare daycare*	90
Primary education*	60	Healthcare with overnight stay*	80
Secondary education*	60	Medical group practice*	80
Colleges and universities*	70	Industrial/logistics with cooling*	80
Shop without cooling*	80	Industrial/logistics without cooling*	50
Large retail with cooling*	150		

Ref: Leti Climate Emergency Design Guide[3] and *Netherlands Green Building Council

Paris-proof zero carbon targets for a range of building types

Envelope thermal performance – 250mm mineral fibre
Window-to-wall ratio – 25%
ICT peak loads – 5W·m^{-2}
Office lighting load – 4W·m^{-2}
Installed heating capacity – 10W·m^{-2}
Shower heads – EWL rated 'A/Green' 6L·min^{-1}

Ref: Leti Climate Emergency Design Guide

Examples of selected typical building performance needed for 'Paris-proof' zero carbon

In the fullness of time, building peak-demand constraints will be added to the Paris-proof targets, to improve management of the grid with its real-time, finite renewable-energy generation and storage capacity. Until the metrics for this become clearer, however, Paris-proof zero carbon annual demand is the no-regrets action we can all take now.

To reinforce this, there should be a professional obligation imposed on each of us to offer the 'Paris-proof' zero carbon option to all our clients. This may be alongside what is current business as usual, but be assured, our clients are already being asked about long-term investment value for funders and how to appeal to the widest possible spectrum of potential occupants. Are you ready with your zero carbon offering?

References:

1 'Paris-proof', Dutch Green Building Council **bit.ly/CJJul20CT1**
2 Future Energy Scenarios, FES National Grid **bit.ly/CJJul20CT5**
3 Leti Climate Emergency Design Guide: **bit.ly/CJJul20CT2**
4 Design for Performance, Better Building Partnership **bit.ly/CJJul20CT3**
5 Passivhaus Trust: **bit.ly/CJJul20CT4**

NEW NORMALS

What is the impact of Covid-19 on the design of HVAC systems for future buildings? We asked four building services engineers how system specification might change as a result of recent guidance

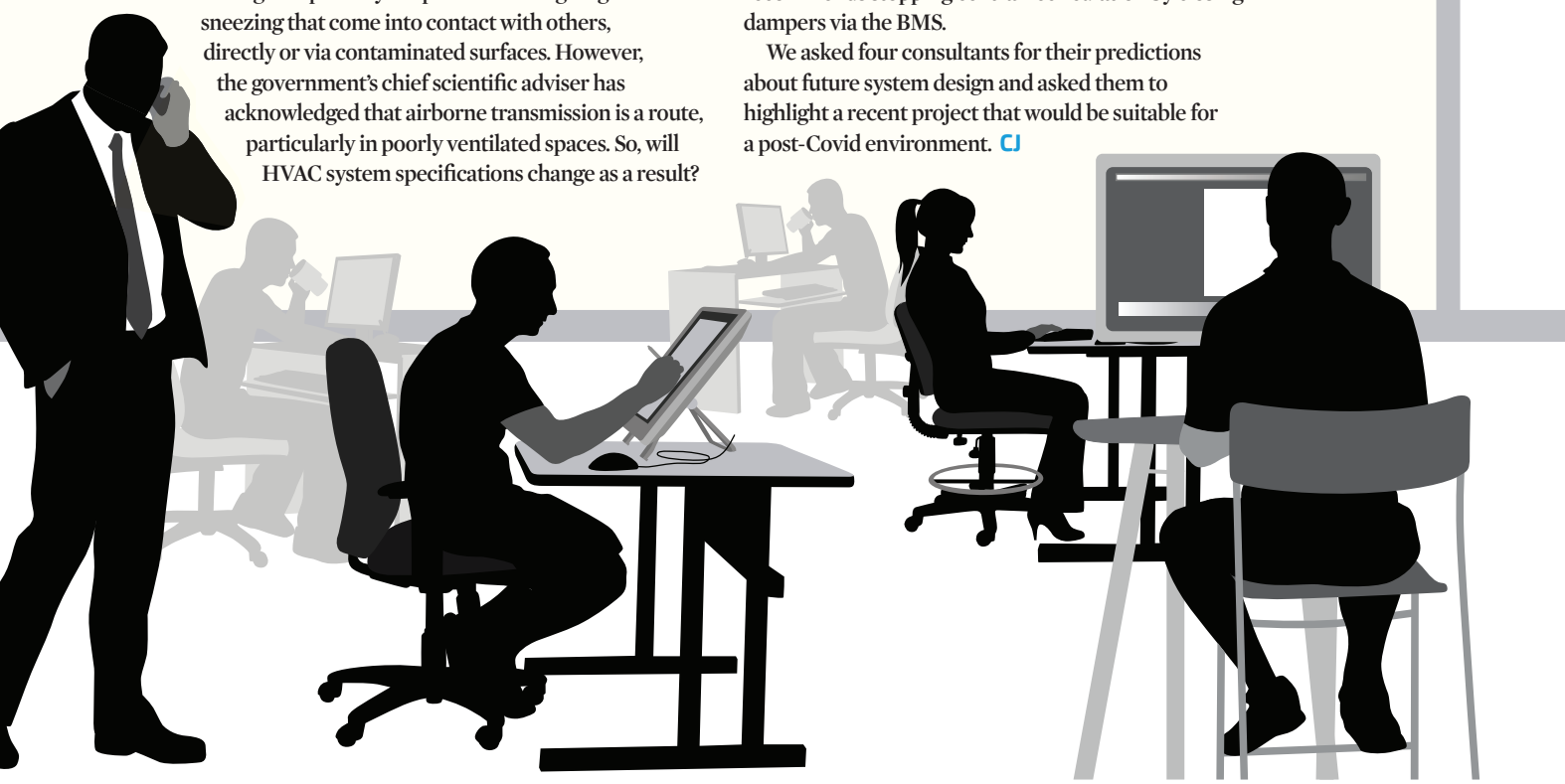
Lockdown restrictions are easing further around the world, and people are starting to return to workplaces, but there is no doubt that the way we interact with buildings is going to change.

Public Health England guidance states that Covid-19 is assumed to be primarily transmitted through respiratory droplets from coughing and sneezing that come into contact with others, directly or via contaminated surfaces. However, the government's chief scientific adviser has acknowledged that airborne transmission is a route, particularly in poorly ventilated spaces. So, will HVAC system specifications change as a result?

To ensure less recirculated air, experts say higher fresh-air rates and lower occupancy densities in offices will be key, as will designs with a greater number of naturally ventilated spaces.

It could also mean more interest in displacement ventilation, and a move away from traditional recirculation – during the pandemic CIBSE recommends stopping central recirculation by closing dampers via the BMS.

We asked four consultants for their predictions about future system design and asked them to highlight a recent project that would be suitable for a post-Covid environment. CJ



Edmund Vaughan, operations director, ChapmanBDSP

It is too early to see to which level public priorities will change away from the 'normal', as this will only come when people start returning to places of work on a permanent basis and cultural spaces reopen. Until then, we can only speculate as to the priorities of companies and clients on the balance between costs, Covid benefits and energy reduction.

The number of enquiries from clients regarding chilled beams, underfloor supply and all-air systems has risen steeply since the Covid-19 outbreak, but it is unlikely that these types of systems will be adopted in great numbers because of the known quality and flexibility of fan coil unit (FCU) systems.

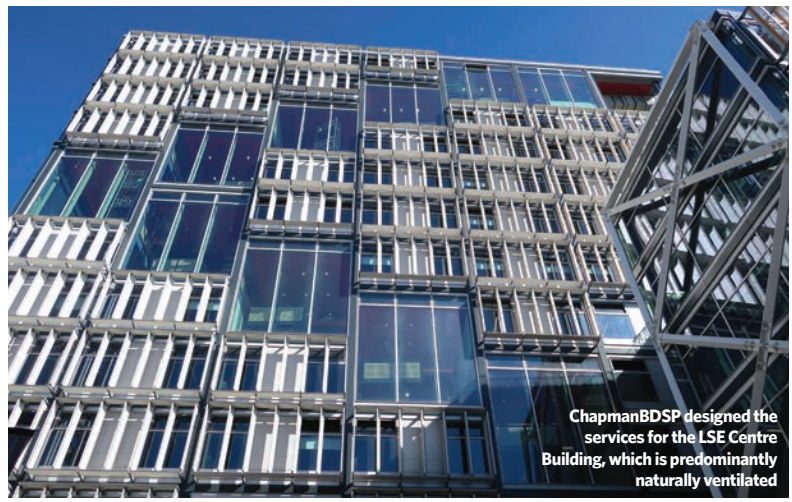
Despite FCUs being a recirculatory system, we believe it is more likely that improvements – such as higher specification of filters on the FCUs and humidification on fresh air systems – will be made to these types of systems to combat the easy spread of airborne diseases.

We are looking at higher fresh air rates and lower occupancy densities in offices, resulting in individuals experiencing less recirculated air. The general trend towards more naturally ventilated spaces has been accelerated by Covid-19, with all our current projects reviewing the provision of natural ventilation as both a purge method and a means to provide fresh air.

There are considerable concerns that post-Covid methods will harm the overall drive to energy efficiency. For example, the use of controls to purge the building once every 24 hours will, inevitably, mean that more energy will be needed to heat or cool the air to the temperature required. So, focus will be aimed at heat exchanger efficiencies to combat increased load.

The need to provide higher ventilation rates will also restrict the trend towards VAV CO_2 control, which will further affect energy reduction. However, thermal wheels are not being designed out, because they provide much higher energy efficiencies than alternatives – despite their potential for 1-2% recirculation – but the AHU controls will be enabled so they can be bypassed easily.

In summary, individual projects will be assessed to best enable a balance between energy efficiency and the needs of a post-Covid world.



ChapmanBDSP designed the services for the LSE Centre Building, which is predominantly naturally ventilated

Kavita Kumari, associate, Cundall

Establishing the mechanisms of transmission during this outbreak has been challenging, with much recent emerging research alluding to airborne aerosol, droplet, direct close contact and surface transmission as likely routes of infection. So, understanding key aspects of fresh air ventilation capacity and effectiveness, airflow patterns, and frequency of air change rates – as well as the building engineering controls strategy and environmental conditions – plays an important role in diluting airborne contaminants, protecting occupants, and reducing transmission risks in the built environment, while balancing and optimising energy consumption.

Feasibility of these should be considered alongside their corresponding impact on: plant or riser sizes; the risk of increased ductwork noise; increased operational energy; higher capital expenditure; reduced net area; increased energy bills; additional maintenance requirements; potential structural intervention; and worsening environmental footprint.

Increasing high-efficiency fresh air filtration could improve general supply air quality by reducing other external air pollutants, but has limited benefits as the outside air is not particularly virus-laden.

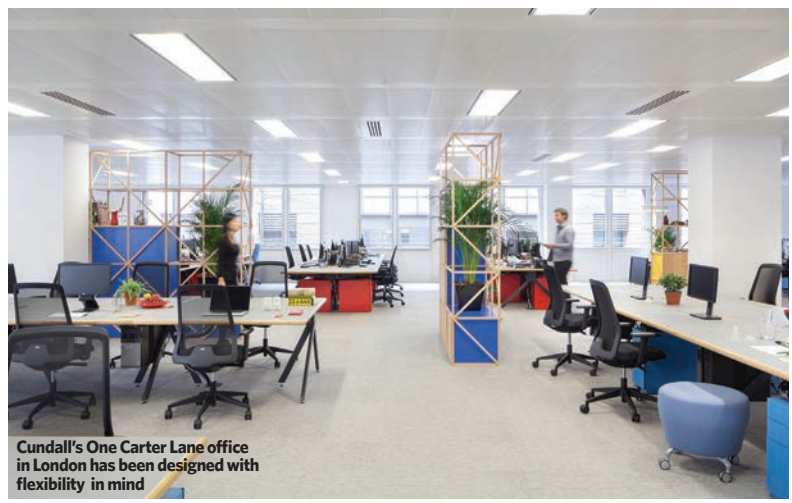
Inserting additional filtration into existing air handling plant will also make it longer and may require reconfiguration of plant areas with a very significant energy penalty. For recirculating systems, this would be much more beneficial.

Hepa filters will improve air quality. They are likely to remove some of the larger pathogen particles, particularly where attached to other particles, but they are unlikely to remove all of them. They will have a significant increase in energy, as they add a lot of resistance when air is passing through them.

The provision of high-intensity UVGI/UV-C light treatment can be considered; however, its technical effectiveness and safe use in indoor spaces is not yet proven scientifically, and requires further research and investigation.

There is strong evidence that keeping humidity between 40% and 60% will reduce most respiratory and viral transmission issues. In terms of virus transmission, humidity plays a key role in the lifetime of aerosols/respiratory droplets in the air and on surfaces, but also human sensitivity to infections.

»



Cundall's One Carter Lane office in London has been designed with flexibility in mind

» Richard Walder, science + tech UK sector lead, Buro Happold

It is inevitable that there will be nervousness about being inside public buildings for some time – at least until a vaccine is found, assuming that proves possible.

The guidance issued by industry bodies to date is comprehensive for existing buildings, but – in the short term – I expect new designs to consider different approaches. Longer term, it's too early to say whether there will be any fundamental design changes. Lower occupancy densities as people consider more home working may mean reduced cooling density and resulting increased fresh air rates per person, which will help.

I suspect we'll see more consideration of natural ventilation in many buildings, and the enhanced fresh air rates this can bring, although it's important that it is designed thoroughly, with properly considered controls. There may even be interest in creating more semi-outdoor work areas, although the UK climate poses challenges for this.

There is likely to be increased interest in displacement ventilation, potentially in conjunction with passive chilled beams. The fact that it can be full fresh air and gives unidirectional flow will be a significant attraction – and, of course, the supply temperatures are typically less demanding on energy than other systems. With higher primary air supply flowrates, however, consideration needs to be given to ensuring that plantrooms and ductwork distribution routes are sized sufficiently to keep pressure drops low.

Appropriate design of ventilation systems will avoid the need for significant additional filtration and the energy penalty this can bring; incoming viral load is generally minimal, so adding Hepa filters onto fresh-air systems will have negligible effect, and a move away from recirculating systems will mean that internal Hepa filtration is unnecessary.

As well as continuing to maintain low specific fan power, scrutiny of heat exchanger efficiency and avoiding leakage paths will become even more critical with higher fresh-air rates and increased operating hours.

Quadram Institute, Norwich, showing natural ventilation and no fan coils
Credit: Luke Hayes and NBBJ (architects)

Andrew Jackson, partner, Foster + Partners

It remains to be seen whether Covid-19 will have a fundamental impact on the design of buildings. When people return to their places of work, however, we can be certain they will be much more aware of how the buildings they occupy affect their health.

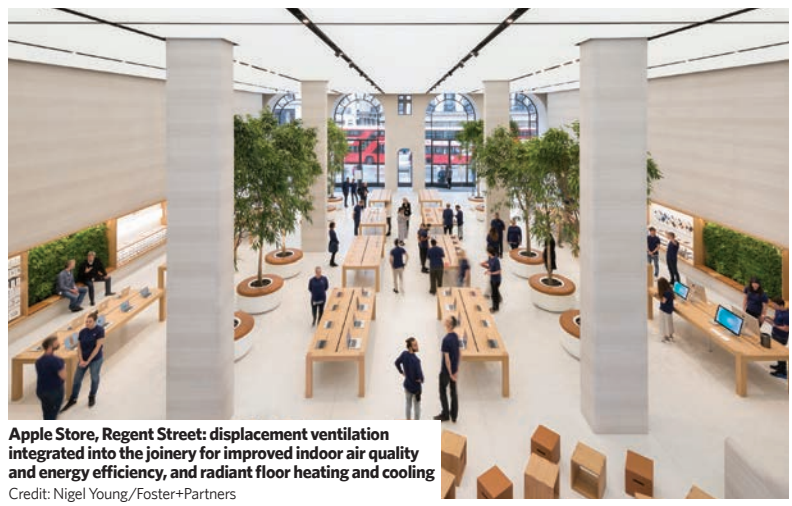
The existence of the airborne transmission mechanism is still being debated, so it's prudent to assume that it is possible, even if it is unlikely. Other coronaviruses, such as common cold and flu, have very well-documented airborne transmission mechanisms, so we may miss a trick if we base a design response specifically on the contagion characteristics of SARS-CoV-2, as the next viral outbreak may have different characteristics.

This may precipitate a move away from traditional recirculation and mixing HVAC systems, such as VAV and FCUs, towards ones incorporating radiant cooling and displacement ventilation, in which fresh air passes through a space once and contaminants are displaced upwards, away from occupants. Natural ventilation and mixed-mode will again come to the fore.

Research indicates that increased fresh-air rates and improved indoor air quality are associated with improved cognitive performance and reduced absenteeism. This can come at a cost, however, and there is often a tension between improving environmental quality and reducing energy consumption. Humidification in colder climates consumes water and energy, and enhanced filtration increases fan power. To counter this, we may need much smarter HVAC control systems and increased use of innovative filtration systems, such as UVGI, ionisation or electrostatic.

Increased fresh-air rates may be manageable in temperate climates, but the energy penalty is significant in more humid climates. Demand-controlled ventilation will become ubiquitous, which – coupled with a reduced occupant density – will help to mitigate the impact of this.

However, there is a clear need for innovative energy recovery systems, which prevent the transfer of contaminants between incoming and outgoing air streams, and novel dehumidification technologies – such as liquid desiccant – to reach maturity quickly. The challenge for built environment engineers and designers is about to get tougher. It's an exciting time to be in the industry.



Apple Store, Regent Street: displacement ventilation integrated into the joinery for improved indoor air quality and energy efficiency, and radiant floor heating and cooling
Credit: Nigel Young/Foster+Partners

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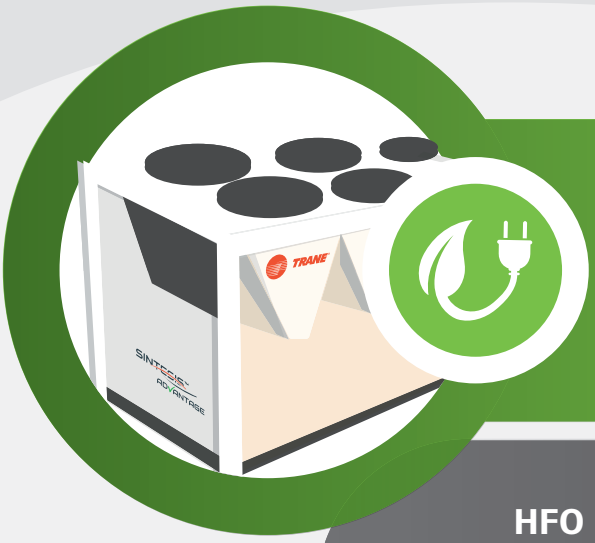

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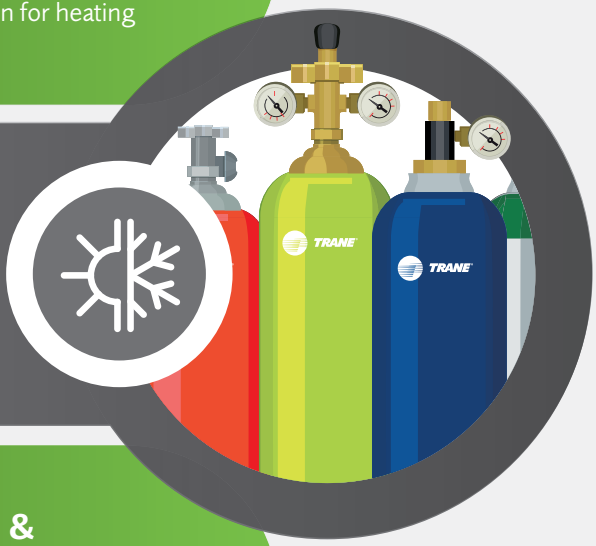

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CHAMBER MUSIC

To help maintain comfort conditions in Kent College's Great Hall, air is cooled using five giant, subterranean concrete chambers. **Andy Pearson** speaks to engineer Brinson Staniland Partnership about how the labyrinth ventilation system works

When James Staniland read about the use of an earth labyrinth at the University of Warwick's Digital Laboratory, in the April 2012 edition of *CIBSE Journal* (**bit.ly/CJApr12lab**), he recognised the potential of the system to pre-cool large quantities of outside air without the need for mechanical cooling.

Eight years on, the practice of which he is a partner, Brinson Staniland Partnership (BSP), is using an earth labyrinth-type natural ventilation solution to help maintain comfort conditions in the Great Hall, at Kent College, Canterbury.

The Great Hall has been designed by architect HMY, working with BSP, to provide the college with a professional-quality performance space for musical and theatrical performances, and a facility for college assemblies. The 11m-high hall can accommodate up to 600 people seated in the stalls and first-floor circle.

'The two big driving factors that make this assembly space conducive to natural ventilation with labyrinth cooling are its considerable height and the high internal heat gains from the audience and from stage lighting and dimmer racks, which totals about 63.5kW,' says Staniland.

Externally, the Great Hall's brick walls and pitched, grey, standing-seam roof give it an understated appearance. It's a theme that continues inside, with a relatively robust but aesthetic look derived from the exposed brick and timber finishes of the performance space. The hall is oriented on a north-south axis, with the stage to the south. Because it is a multi-purpose space, the envelope incorporates a significant glazed area, although the fenestration is concentrated mostly on the north and east elevations, where solar heat gains are less of an issue.

Earth ducts

The earth ducts are fundamental to the performance of the natural ventilation system to keep the hall comfortable in summer. Outside air enters the building from the south, through five giant, subterranean concrete chambers, each measuring up to 3.5m wide and 2m deep. The duct's cross-sectional area has been designed large enough to allow the air to pass practically unimpeded.

'With a natural ventilation system, you generally only have a maximum pressure of about 0.5Pa to play with,' Staniland says.

In summer, the relatively constant temperature of the ground, at about 12°C, will ensure the chambers' walls are maintained at a temperature close to that of the ground, to help cool the outdoor air entering the building. Dividing the intake into five separate ducts helps increase the area of duct in contact with the air, to maximise heat transfer, and helps with zoning the supply air. Each duct also incorporates a modulating

Kent College's Great Hall

There are five giant concrete chambers

motorised damper, to further control the quantity of outdoor air entering the space.

To maximise the rate of heat exchange with the chamber walls, the ducts have been sized so that the air flowing through them is moving just fast enough to enable it to turn from laminar to turbulent flow. 'The flow turns to turbulent once it surpasses an air velocity of 0.014m·s^{-1} in the labyrinth, which it will do most of the time that the dampers are open, to maximise heat transfer,' says Staniland.

The Great Hall stage, which features MMV units at high level and sidewall supply grilles at the front

The downside of ensuring a clear path for the air is that the concrete earth ducts present very little resistance to the passage of outside noise. Lining the concrete ducts with sound-absorbing material is one solution, but this would have limited significantly their ability to temper the outside air. Instead, the school has adopted the common-sense approach of ensuring its groundkeepers do not mow the lawns next to the air intakes when the hall is being used for performances.

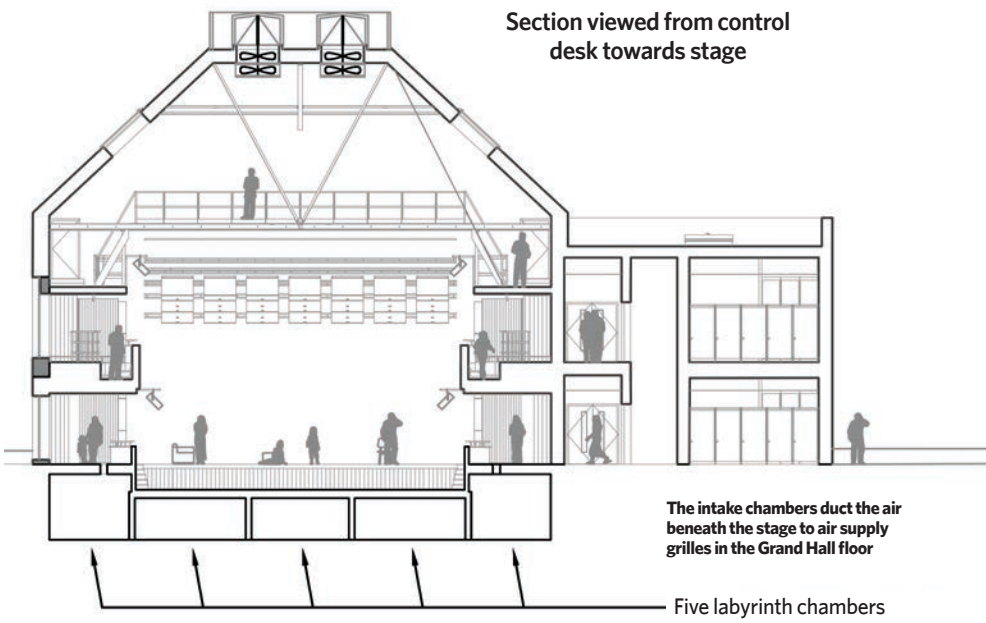
The five intake chambers duct the air beneath the performance stage to air supply grilles set into the hall floor and at low level in the auditorium walls. There is no high-level outdoor air supply, so – to keep the audience in the circle comfortable – its underside has been left open, and air can rise up and out through openings in the step risers beneath the rows of seats.

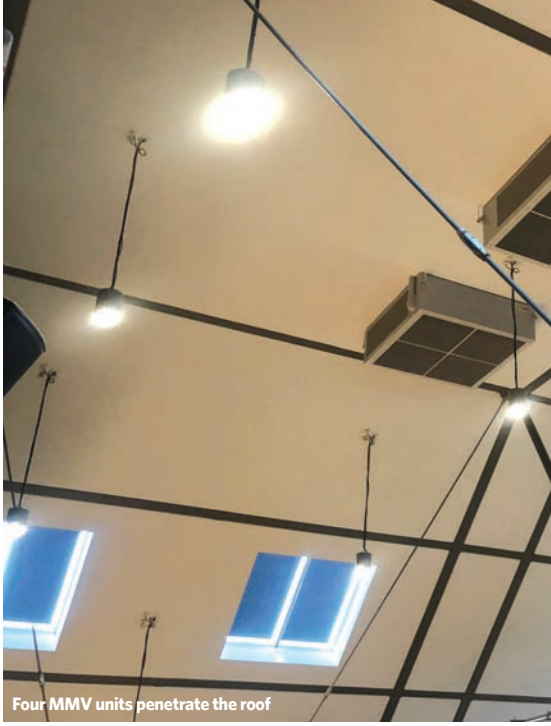
Buoyancy drives the vitiated air upwards to exit the hall through six roof-mounted ventilation units; these open up to act like chimneys when the building is in summer natural ventilation mode. 'At the end of a hot day, the air just beneath the hall's roof will be between 35°C and 40°C, making a significant contribution to the buoyancy forces,' says Staniland (see panel, 'Mixed-mode ventilation units'). »

> "The earth ducts are fundamental to the performance of the natural ventilation system to keep the hall comfortable in summer"

PROJECT TEAM

Client: Kent College, Canterbury
M&E Engineer: BSP
Architect: HMY
Structural engineer: CTP Consulting Engineers
Theatre specialist: Adrian James Acoustics
Project manager/QS: Fulkers Bailey Russell




Four MMV units penetrate the roof

» Modelling

BSP modelled the scheme using dynamic simulation based on a week in July, when the weather is warm and the school will use the hall for a performance every day. 'We decided that we would aim for a target dry-resultant temperature of 28°C at the back of the circle, which is the location of the highest audience seat,' says Gearoid Donnelly, associate at BSP. The system worked; modelling showed that the temperature in this location would peak at 26.5°C, even on the hottest day, which Staniland says the team were 'more than happy with' (see 'Performance week' graph, opposite).

The same earth duct/roof vent system is used to purge the building of heat overnight. In late evening, the dampers in the earth ducts and mixed-mode ventilation (MMV) units open fully. Cool night air, at about 18°C, will pass through the building, removing heat from the intake ducts' concrete walls and from the internal surfaces of the hall, including the exposed thermal mass of the hall's fair-faced brickwork walls.

On summer mornings, school assembly will take place in the cooled hall. At this time of day, the system will operate under control of CO_2 sensors, simultaneously modulating the dampers in the earth ducts and roof units to control the rate of airflow through the space. The system will operate in this mode throughout the day, remaining closed to keep the space cool and opening only when the auditorium is occupied and CO_2 levels rise. The performance of the system was modelled using computational fluid dynamics at RIBA Stage 4, to show the space-temperature distribution and prove the effectiveness of the design.

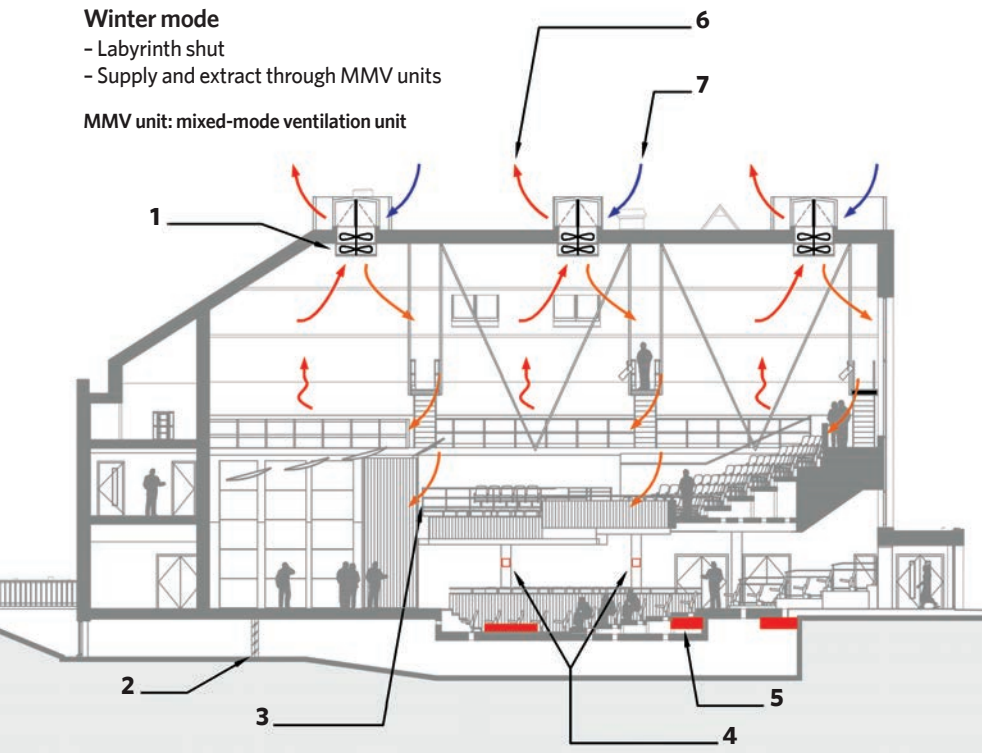
The earth ducts are not used in winter; instead, outdoor air is supplied to the space using the MMV units alone. In winter, the MMV units operate in one of two modes depending on the temperature of the outside air.

When it is relatively mild, with an outside air temperature of 12°C or above, the fans in the MMV units will remain off. One half of the split duct will continue to operate as a chimney to exhaust warm stale air from the hall, while the other half of the duct will act as an outdoor air supply duct.

On entering the hall, the denser, cooler outdoor air will sink towards the floor. As it does so, it will mix with the warmed room air at a temperature of 35°C or so, trapped beneath the hall's roof.

'Through natural mixing, you are entraining the hot air in with the supply air, which is sinking under the pull of gravity, so you are making use of heated air that would otherwise have been wasted heating the roof,' says Staniland.

'By the time the cool air has reached the neck of someone sitting in the gallery, it will have entrained a significant amount of the surrounding air, so that its temperature will



1 Mixing fans in the MMV unit mix intake air with hot air under roof, for delivery to space by gravity
2 Motorised damper – shut
3 Mixed air, cooler than the room air, falls by gravity. Entrained surrounding room air raises the supply air temperature to comfortable levels before it reaches audience
4 Temperature/CO_2 wall sensors
5 Heating by natural convectors concealed inside labyrinth
6 Exhaust air occurs through exhaust split duct in MMV unit
7 Cold outside air enters through inlet side of split duct in MMV unit

In winter, the earth ducts are not used, and outdoor air is supplied to the space using the MMV units alone


The modest boiler plant is evidence of significant fabric efficiency

A labyrinth chamber during construction. Natural convectors in the foreground, modulating damper in the background, sidewall grilles in the side, and floor grilles overhead

have increased to avoid causing discomfort,' he adds.

In the second winter mode, when the outside air temperature is below 12°C, the fans in the MMV units will operate to help pre-mix the colder air with the warmed internal air, to prevent it creating cold draughts, without the need for pre-heat from the hall's two small, wall-mounted, gas-fired boilers.

Heat is supplied to the hall in winter using a low-temperature hot-water system connected to finned natural convectors. These are concealed behind the same grilles that, in summer, are used to supply cooled air to the space; effectively the heating is hidden in the labyrinth supply air ducts.

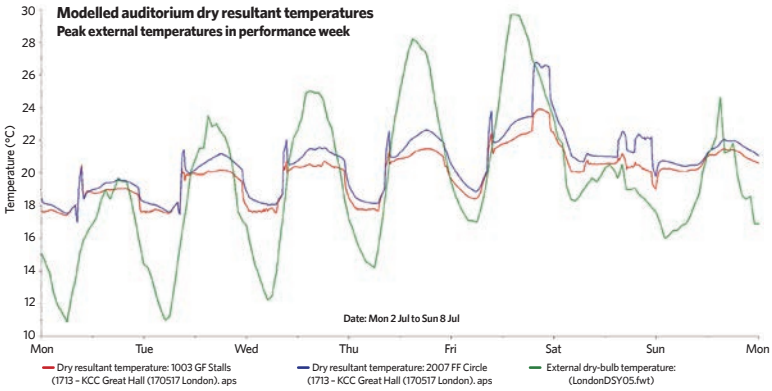
Seasonal commissioning has been used to optimise the performance of the various systems. BSP is also monitoring the system remotely, in conjunction with the school's facilities manager, to ensure it is operating effectively. Staniland says he would definitely do another earth-duct based scheme.

'A system like this does require a certain amount of tweaking initially,' he says, 'but, once it is up and running, there is not a lot that can go wrong, because we've designed it to be simple to operate.' CJ

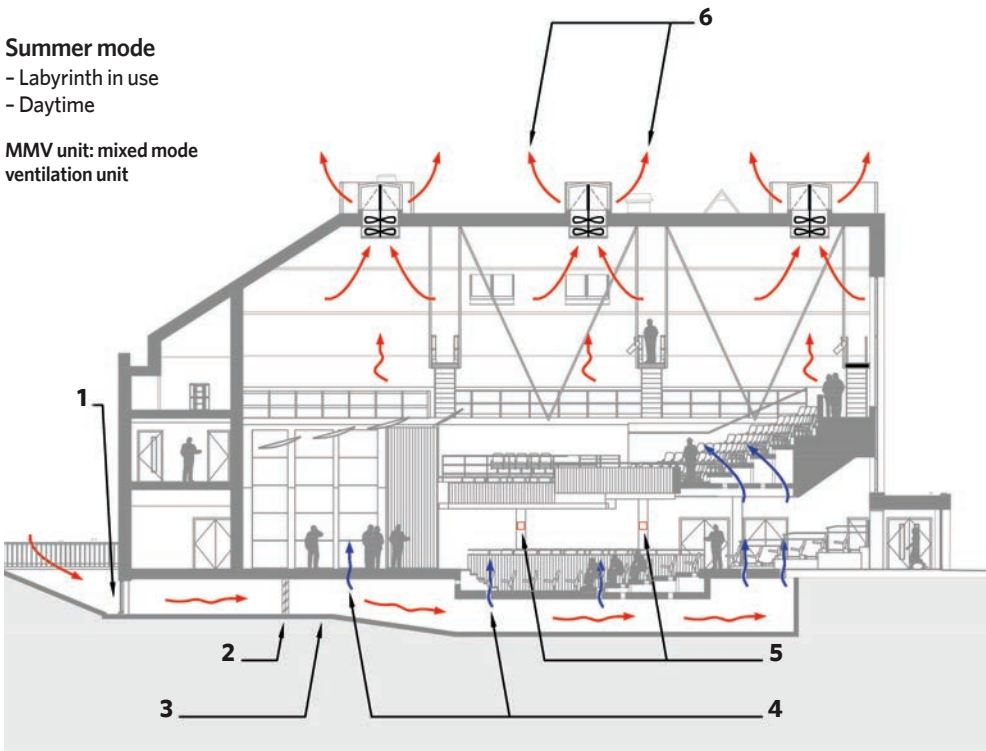
MIXED-MODE VENTILATION UNITS

Staniland refers to the ventilators as 'mixed-mode ventilation units', or MMVs. Produced for the project by Breathing Buildings, these units are based on a single duct divided into two, with one half containing a fan. Under normal summer conditions, the fans remain off.

The two halves of the duct act like a single chimney, ventilating the hall using the stack effect and drawing in large quantities of cooler air through the concrete earth ducts. 'The quantity of outside air used to cool the space can be several multiples of the quantity required for outdoor air when the hall is fully occupied,' says Staniland.



> "Once it is up and running, there is not a lot that can go wrong, because we've designed it to be simple to operate"



1 Intake louvers to chambers
2 Motorised damper – modulating
3 Concrete labyrinth with connection to earth
4 Supply air enters stalls through floor grilles and sidewall grilles
5 Temperature/CO_2 wall sensors
6 Air exhausts naturally through modulating dampers in MMV unites. Fans are off

In summer, the earth duct/roof vent system is used to purge the building of heat overnight.

Keep the British daylight standard with paper-based verification

A new European Standard measuring daylight in buildings is too complicated and should be suspended, according to Anglia Ruskin University academics Peter S Defoe and Andrew Thompson. A position not supported by one of the standard's authors (see right)

The new *BS EN 17037 Daylight in Buildings* includes methods of calculation for design parameters that differ from those in the former standard, *BS 8206-2: Lighting for buildings*. These include view out of windows and access to sunlight, and it adds glare as an issue to be considered.

BS 8206-2 was read in conjunction with *BRE BR 209 Site layout planning for daylight and sunlight* and *CIBSE LG10 Daylighting – A guide for designers* as guidance only, but BS EN 17037 no longer refers to these documents.

The transition to BS EN 17037 represents a fundamental shift in calculation methodology and threshold. It is no longer considered appropriate to calculate a vertical sky component at the window face and the average daylight factor within the room. The standard requires daylight to be assessed by a calculation method based on daylight factor and cumulative daylight availability data, or based on the direct prediction of illuminance levels using hourly climate data.

We believe there are a number of issues with BS EN 17037, including the requirement for specialist software and the shortage of underpinning research. We are calling for it to be returned to 'Draft for development' status and for BS 8206-2:2008 to be temporarily reinstated until the research, software and threshold target levels have been adequately investigated.

Both BS 8206-2 and BR 209 have weaknesses, in that their methodologies are based on historical research and simplified calculations. However, an advantage is that both are capable of being undertaken or checked using paper-based systems.

The new standard states that calculations based upon the methodologies described must be undertaken using software, which means the results can't be checked or validated without software and 3D modelling. We accept there is a need for a better methodology for assessing daylight before construction, but outputs should be capable of being understood by lay clients and of being verified independently. Paper verification is low-cost and an important safeguard in the planning system when assessing the environmental impact of new massing on adjacent properties.

The standard makes no reference to supporting material or any research to justify the assertions made regarding 'minimum' levels of illuminance. The authors pose the following questions:

- Where is the BRE concept design property – for example, an experimental control building where results can be verified through research triangulation?
- Which buildings aspired to the standard before implementation and was there post-occupancy evaluation?
- How was the impact of the change assessed on the nations' existing property?

The UK BSi committee has accepted that further research is required into how daylight is perceived by individuals. Surely this should have been done already?

Software providers representing the major systems used by daylight practitioners are currently unable to provide an application to implement the standard capable of cross-platform validation. So a software-to-software check is not possible for the full calculation range and it is impossible to verify results manually.

Minimum fitness appears not to have been considered in respect of the Homes (Fitness for Human Habitation) Act 2018, which came into effect on 20 March 2020. This creates a statutory requirement for properties to be fit for human habitation in relation to, among other things, natural lighting, ventilation and water supply. Where daylight provision is to be assessed, the official guidance, under the Housing Health & Safety Rating System, references BS 8206. In practice, any assessment based on the BS and compliance will, as a result, be a question of technical fact based on the levels stated in the new standard rather than what was appropriate at the time of construction.

This standard is unlikely to be useful in advising planning authorities on new housing design or impact. Adoption into planning policy might even lead to challenge and potential judicial review of decisions because of the lack of research to support the adoption.

Results are still presented in numerical form and/or colour contours, neither of which informs the stakeholders how the room will appear at various times of day throughout a year. Obviously, a methodology that shows graphically how the light penetrates a room will be an improvement, but it must be capable of being modelled for ease of understanding by lay people.

It is our opinion that, given current computing abilities – and with further research into actual requirements and into a wide selection of building typologies – it would be possible to produce models with accurate colour and reflectance rendering that would enable real-time visualisation of an internal environment.

However, it is recognised that the sheer number of calculations for complete analysis would be prohibitive. One solution could be to identify only those rooms with the least daylight and analyse those, along with a sample of others or those that the stakeholders require.

DR PETER DEFOE, FRICS is an honorary research fellow at Anglia Ruskin University
ANDREW THOMPSON, FRICS is a ARU senior lecturer

New thinking on daylight/sunlight links planning and performance

The new *BS EN 17037 Daylight in Buildings* has gained acceptance across Europe – planning, however, could use a radically simple approach, argues Loughborough University's John Mardaljevic

It is right that any building standard or guideline be subjected to scrutiny. However, the critique opposite is, I believe, founded on a crucial misunderstanding – which is that the target illumination values recommended in BS EN 17037:2018 are precisely that: recommendations. They are not normative. That is plain in the standard and should not need to be reiterated. Consequently, many of the issues raised opposite are illusory.

Furthermore, there cannot be any 'potential issues' with regard to legislation that, ultimately, may defer to BS EN 17037:2018 for the same reason. Is it perhaps that Dr Defoe and Mr Thompson (PD/AT) wish the standard were something that it isn't – primarily a guide for planners?

A horizontal illuminance of 300 lux was used as the basis for the performance recommendations because that value represented the best correlation to occupant preference for daylight sufficiency in a number of studies.[1] The recommendation is for a high provision that will not be possible to achieve in all settings - this is different from a 'least worst' approach. This has been welcomed by many practitioners.

PD/AT claim that 'paper verification' is an 'important safeguard', and that software providers 'are currently unable to provide an application to implement the standard capable of cross-platform validation'. The MBS web page proudly states that '99.8% of right-to-light consultancies' use their software.

The MBS Waldram Tools package includes climate-based daylight modelling (CBDM) functionality and the option to calculate spatial daylight autonomy using the 'European Standard – prEn17037' criteria. Additionally, a number of other packages are available, as are rigorously validated CBDM benchmarking tools. As was the case with CBDM and the Education Funding Agency daylight design guide in 2013, software developers quickly responded to new requirements.[2]

PD/AT suggest that, given current computing abilities, 'real-time visualisation of an internal [daylit] environment' could serve as the basis for verification of adequacy. Unfortunately, no validated research exists regarding virtual reality (VR) assessment of daylight. While humans are unreliable light meters with regard to pin-pointing values on a scale, we easily sense – and can make judgements in response to – absolute brightness levels, especially in daylit spaces where the range in experienced values is often great.

It is not possible, however, to reproduce the range in real-world luminances found in daylit spaces using available display/headset technology. Real-world luminances are, therefore, compressed and/or tone-mapped so that the manipulation of image contrast mimics scene visibility for display purposes. To quote Greg Ward, originator of Radiance and HDR imaging expert: 'There are scales for [comparing brightness], but they don't work very well. Matching contrast is not the same as matching brightness, at all.'

It is not possible, therefore, to make meaningful assessments about daylight using VR because the display technology cannot inveigle the eye/brain into responding as if it were in a daylit space.

EN 17037 has been well-received across Europe, and all CEN member states have withdrawn any conflicting national standards. The recommended performance goals have generally been welcomed by practitioners. With regards to planning, however, I found existing methodologies (including BR 209) to be unsatisfactory. I decided that what was needed was a back-to-basics re-evaluation of sunlight/daylight availability suitable for planning purposes.

A programme of personal research on this began in 2014, resulting in the formulation of a new schema for daylight/sunlight evaluation, which – in 2019 – I named 'aperture-based daylight modelling' (ABDM). Too late to be considered for 17037, unfortunately.

The ABDM metrics account for the size of the windows – not a factor in BR 209. Thus, ABDM gives an early indication of the potential for solar gain and, therefore, the risk of overheating. The skylight part gives the daylighting potential of the windows, while the view component gives a numerical measure of, say, the visual impact of an external obstruction – allowing the possibility for view to become a material consideration in planning.

ABDM offers the potential for a seamless workflow progression from outline planning to detailed building performance evaluation –such as refining the outline/planning 3D model and 'climatising' the ABDM evaluation to full CBDM and/or an energy/thermal simulation.

ABDM metrics are essentially geometrical in nature – therefore, not subject to the vagaries of the 'performance gap' and almost impossible to gameplay. This makes ABDM a reliable contender to form the basis of a daylight/sunlight evaluation method that, I believe, is ideally suited for planning purposes. A paper describing how ABDM might be applied in an urban setting has been accepted for the forthcoming CIBSE Technical Symposium.[3]

JOHN MARDALJEVIC, FSLL is professor of building daylight modelling at the School of Architecture, Building & Civil Engineering, Loughborough University

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1 J Mardaljevic and J Christoffersen, 'Climate connectivity' in the daylight factor basis of building standards, *Building and Environment*, 2017.
2 J Mardaljevic, 'Climate-based daylight modelling and its discontents', CIBSE Technical Symposium, London, UK, 16-17 April, 2015.
3 J Mardaljevic, 'ABDM: A new approach for daylight and sunlight planning' Technical Symposium, (accepted), 2020.

Cost model

Seawater source heat pumps have the advantage of a thermally stable water source, but the equipment needs protection from corrosion. Aecom weighs up what the cost would be for a 12.4MW energy centre in the Thames Estuary

Marine source heat pumps

The UK government is pushing the construction industry to decarbonise heating systems as part of the legal commitment to meet its 2050 net zero carbon target. This has led to a reduction in use of fossil fuels and an increase in the specification of centralised systems, with common-plant district heating systems and off-grid heat sources being specified far more widely.

Water source heat pumps are increasingly being considered as a reliable low carbon alternative to traditional heating systems. Ground source heat pumps (GSHPs) are well established and the groundwater heat source is far more stable than air in an air source heat pump. There is risk, however, that the temperature of the water and the adjacent strata could change over time.

Another option is marine source heat pumps, which use seawater as a heat source. With an annual temperature range of 11°C, seawater has thermal stability throughout the year. Tides also move the water around continuously, thereby diluting any thermal impact because of the sheer scale. Using saltwater as the heat source has its own challenges, though, including corrosion, geography and environment. Saltwater is an aggressive substance, so all of the primary pipework, pump sets, filters and plate heat exchangers need to be specified appropriately; this increases the cost over non-saltwater solutions.

From an environmental perspective, the primary loop is frequently an open-source loop, with risk of contamination of the source water from the system. The Environment Agency would be involved at all stages of the project to ensure that natural resources are safeguarded, pollution risks are minimised, and heat load does not impact the ecosystem adversely.

The design solution for a saltwater-based system is similar, typically, to a GSHP one. The primary difference is the need to minimise ingress of marine life into the system and to ensure mechanical separation of the open-loop saltwater system from the closed-loop glycol (or equivalent) system. This is achieved with grilles/screens, filtration and a plate heat exchanger. Incoming water is additionally filtered to protect the plate heat exchanger from unnecessary corrosion.

The cost model

The cost model looks at a large-scale urban development incorporating residential units, commercial office space, hotels and retail units – including extensive food and beverage offerings – using water-based heat pumps.

The scheme is located in the South East of England, along the Thames Estuary and within 50m of the water. It has 8MW of heat pumps and 4.4MW of water-cooled chillers. Costs are for energy source only and exclude inflation beyond first quarter 2020, main contractor's costs, design and other fees, and VAT.

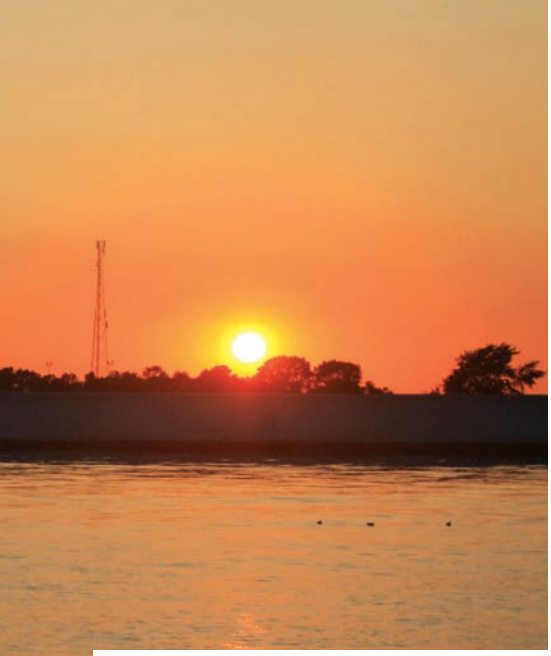
The cost model makes due allowance for an aggressive environment with highly saline water. So, the pipework is primarily stainless steel, and there are upgraded extraction pumps and plate heat exchangers to accommodate a harsher operating environment.

Only the services elements for the scheme are looked at in the cost model, which does not include any works associated with building or civil engineering. These elements are highly specialised and cover items such as coffer dams, dewatering and guided auger bores.

Additionally, the cost model excludes any works associated with the river wall, environmental protection measures – such as anti-scouring devices to protect the sea/river bed – fish bypass systems, and so on. It makes no allowance for extraction licences, river and environmental agency fees, and the like.

ABOUT THE AUTHOR

The engineering services cost management group of Aecom specialises in the cost estimating, procurement and cost management of building services installations. It is producing a series of cost models for *CIBSE Journal* in 2020 on areas such as data centres and London's commercial buildings.



Conclusion

Large-scale, mixed-use developments benefit from alternative energy strategies and technologies with a wider diversification applied to them than single-use schemes.

Advantages of large-scale heat pumps:

- Lower running costs in terms of consumables and energy
- Lower maintenance costs
- No impact on local air quality compared with gas-driven installations
- Meet the target of 35% reduction in carbon emissions
- The technology has the highest carbon savings using SAP10.

Disadvantages:

- Higher capital costs compared with traditional gas-led schemes
- Less efficient because of the low coefficient of performance of the heat pumps. **CJ**

Seawater has thermal stability throughout the year, but saltwater is an aggressive substance and corrosion is a challenge

Large-scale river-water cooling	Quantity		£	Total (£)
Primary filtration plant	12	Nr	15,000	£180,000
Polypropylene supply pipework distribution from primary filtration plant to river header pipes	120	m	750	£90,000
Motorised isolating valves, to above	4	Nr	5,000	£20,000
Stainless steel header pipes in river; 2m long	240	m	3,000	£720,000
Stainless steel supply pipework distribution from river headers to plantroom incoming header installed within concrete pipe ducts (pipe ducts by civil contractor); inclusive of pipe jacking	240	m	3,000	£720,000
Motorised isolating valves, to above	8	Nr	12,500	£100,000
Stainless steel header pipe, 10m long	1	Item	25,000	£25,000
Primary pump sets, valve arrangement and interconnecting pipework	6	Nr	100,000	£600,000
Polypropylene backwash pipework distribution from primary filtration plant to primary pump sets installed within concrete pipe ducts (pipe ducts by civil contractor) (12 No)	780	m	150	£117,000
Motorised isolating valves, to above	12	Nr	1,250	£15,000
Stainless steel header pipe, 15m long	1	Item	40,000	£40,000
Flow meter, including valves and interconnecting pipework	1	Nr	20,000	£20,000
Stainless steel supply pipework distribution from header to secondary filtration plant (3 No)	12	m	1,500	£18,000
Stainless steel supply pipework distribution from header to secondary filtration plant (1 No)	4	m	1,250	£5,000
Secondary filtration plant, including control panel and wiring, valuing arrangement	1	Item	100,000	£100,000
Stainless steel secondary filtration backwash drain pipework (2 No)	100	m	750	£75,000
Stainless steel secondary filtration backwash drain pipework (1 No)	50	m	600	£30,000
Stainless steel header pipe, 42m long	1	Item	100,000	£100,000
Plate heat exchangers	6	Nr	250,000	£1,500,000
Valve arrangements and interconnecting pipework to plate heat exchangers	6	Nr	30,000	£180,000
Stainless steel river water return pipework distribution	200	m	1,000	£200,000
Flow meter, including valves and interconnecting pipework	2	Nr	15,000	£30,000
Steel flow and return pipework distribution from condenser water connection to heat pump/chiller plant	40	m	200	£8,000
Heat pumps, 2MW each	4	Nr	500,000	£2,000,000
Valve arrangements and local interconnecting pipework	2	Nr	20,000	£40,000
Water-cooled chillers, 1.1MW each	4	Nr	200,000	£800,000
Valve arrangements and local interconnecting pipework	4	Nr	25,000	£100,000
175mm dia LTHW flow and return steel distribution pipework	160	m	200	£32,000
175mm dia CHW flow and return steel distribution pipework, including connection to existing distribution	160	m	200	£32,000
Connection to energy network distribution	1	Item	100,000	£100,000
Associated electrical works to pumps and the like	1	Item	250,000	£250,000
Associated controls installations to pumps and the like	1	Item	300,000	£300,000
Temporary electrical works associated with civils installation	1	Item	150,000	£150,000
Thermal installation	1	Item	250,000	£250,000
Trace heating	1	Item	100,000	£100,000
Testing and commissioning	3.00%			£272,010
Flushing and cleaning	2.00%			£186,780
Subcontractor preliminaries	15.00%			£1,428,869
BWiC	3.00%			£272,010
Total costs				**£11,226,669**

STREET WISE

Passivhaus standards of energy efficiency were delivered in two Cardiff homes by installing a sensor network that monitored room occupancy, temperature and air quality. Atamate's **David Miles**, **Dan Cash** and **Kat Kelly** explain

The UK government's Future Homes consultation paper makes an unambiguous commitment: by 2025, we will introduce a Future Homes Standard for new-build homes to be future-proofed with low carbon heating and world-leading levels of energy efficiency.[1]

At a time when domestic energy accounts for 29% of energy consumption[2] and 15% of greenhouse gas emissions[3] in the UK, reforms that would cut bills and carbon dioxide emissions are sorely needed.

A recent case study suggests that building energy management systems, long the preserve of teams managing large commercial buildings, have developed to the point where they can now play a major role in bringing down energy costs in the domestic sector.

The study was led by Kat Kelly, of Atamate, and Paola Sassi, of Oxford Brookes University, who analysed space-heating data from six domestic flats fitted with a domestic building control system.[4]

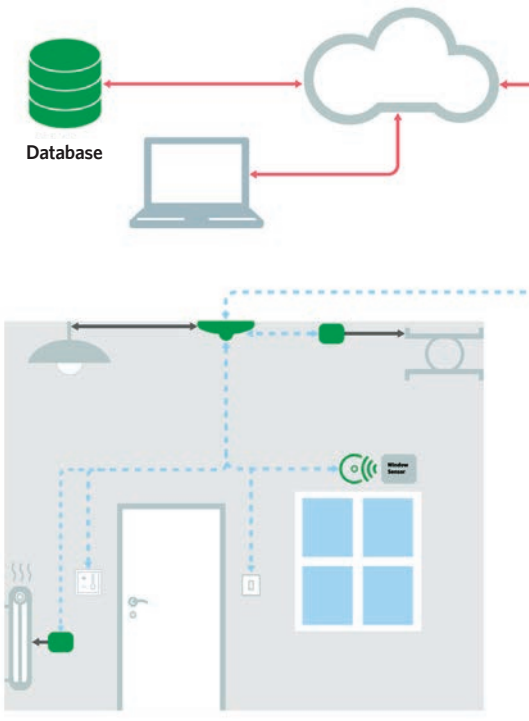
As a smart building technology designed for the domestic market,[5] Atamate can be tailored to the needs of any home and incorporated during the initial design, or retrofitted to an existing building. It runs in the background once its parameters are set, and users can operate the system in a number of ways, such as by setting parameters using a smartphone app or controlling services directly using switches.

The installation used for the analysis was in 14 and 16 Cogan Terrace, two houses in a Cardiff suburb built to modern standards of insulation and airtightness. Each house was divided into three flats rented to students and young professionals.

Post-occupancy evaluations often find that buildings consume more energy than predicted in the standard assessment procedure (SAP) model used to judge their efficiency. Kelly and Sassi aimed to test whether building controls can close that performance gap by evaluating energy use in a building occupied by tenants whose energy bills were included in their rent, giving them no strong incentive to limit their energy use.

The year they analysed ran from mid-September 2017 to mid-September 2018,

Schematic of the Atamate system



References:

1 Ministry of Housing, Communities and Local Government. The Future Homes Standard, 2019, p98
2 Department for Business, Energy and Industrial Strategy, Digest of United Kingdom energy statistics 2019, p182
3 Committee on Climate Change, Reducing UK emissions: 2018 progress report to government, June 2018, p267
4 Kelly K A, Sassi P and Miles J, In-use energy performance of automated smart homes, SDAR* *Journal of Sustainable Design & Applied Research*, 2019, Vol 7, p12
5 Atamate, How to improve the energy efficiency of new-build homes, Oxford: Atamate, 2019, p13
6 Committee on Climate Change, UK housing: fit for the future?, February 2019, p135
7 Siddall M and Grant, N, Claiming the Passivhaus Standard: Technical briefing document, London: Passivhaus Trust UK, 2015, p9
8 Sassi, P, A natural ventilation alternative to the Passivhaus Standard for a mild maritime climate, *Buildings*, 2013, Vol 3, pp61-78

which included the extreme weather events of the 'Beast from the East' cold snap of February-March 2018 and the heatwave of the following June and July.

Each of the Cogan Terrace buildings was made 'smart' by installing a sensor network that monitored room occupancy, temperature and air quality. A central hub processed the sensor data and used it to control building services such as heating and ventilation. The combination of services was selected partly because it was an energy-efficient way to keep the building comfortable, and because it involved a lower capital cost than alternative approaches, such as air source heat pumps or combi boilers.

The flats were heated with either panel convectors or infrared heaters powered by mains electricity that were switched on when someone was in a room in which the air temperature was below a set point of 21°C. Because the building fabric was well-insulated, the heaters could very quickly heat a room to the set point, so there was no need to waste energy heating empty rooms.

Figure 1 shows the temperature in one bedroom over two months, demonstrating the occupancy-based controls. As the tenant enters the room, the heating raises the temperature, but when the tenant was away over the Christmas holidays, the temperature was allowed to drop, so no energy was wasted on heating an empty room.

The ventilation system was designed around the principle that outdoor air would enter the flats through bedrooms and living rooms, where the air quality was usually good. It then passed through the flats to the kitchens and bathrooms, where water vapour and odours were most likely to be generated and ducted

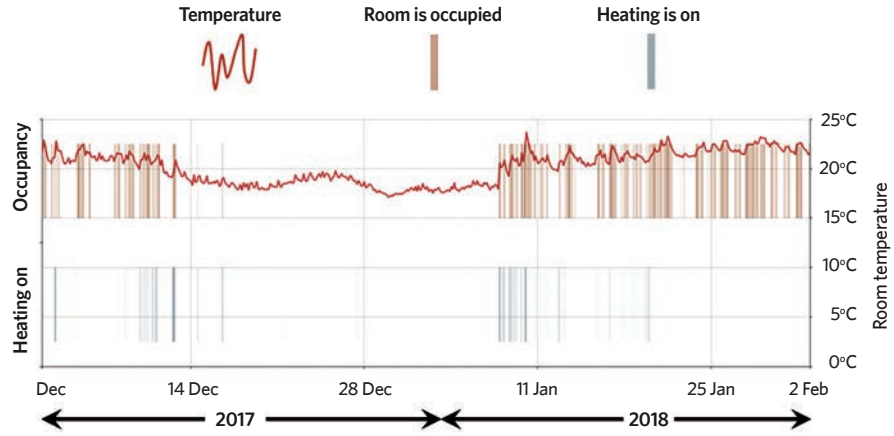


Figure 1: Temperature in one bedroom over two months. Occupancy-based control turned off the heating when the room was empty over the Christmas holidays

"The analysis shows a holistic system delivering the high levels of energy efficiency required by Future Homes by making low-cost technologies responsive"

out of the flats by an extractor fan. An exhaust air-to-water heat pump in the duct harvested heat energy from the extracted air and fed it into the domestic hot water.

A difference between the two buildings was that, in No 16, the inlets were uncontrolled trickle vents, while, in No 14, they were controlled by dampers. When the sensor network showed that the air quality was good, the hub closed the dampers to limit heat loss. When the kitchen or bathroom was in use, the extract fan was actuated and an outdoor air inlet in the room with the poorest air quality was opened to allow air to flow through the flats.

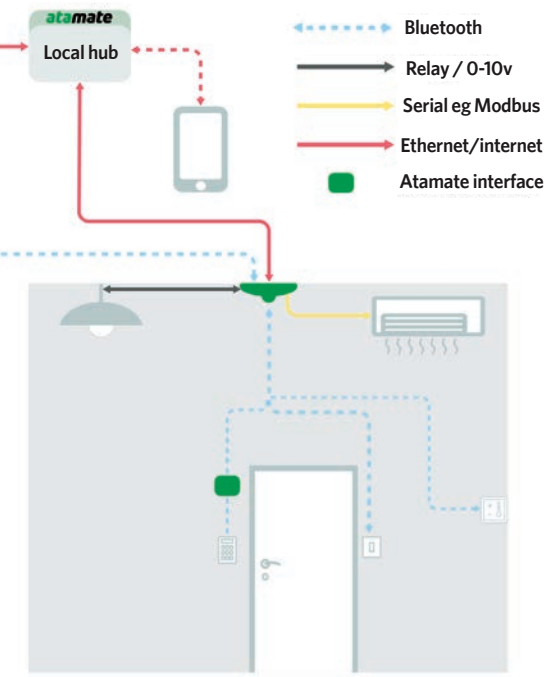
Figure 2 shows the operation of one of the dampers in a bedroom over a two-hour period and the air quality index to which it was responding, calculated from relative humidity, volatile organic compounds and carbon dioxide data. At around 8.20am, the sensors detected the air quality falling and the hub responded by opening the damper from 45% to 60%. At the same time, the extractor fan engaged to draw air through the building and out through the kitchen or bathroom, which was probably the source of whatever was affecting the air quality. The air quality recovered quickly but the tenant would not have been aware of either the fluctuations in air quality or the system's response to it.

Analysis of the year's data revealed that the dampers delivered a substantial improvement in heating energy efficiency. No 16, with its uncontrolled trickle vents, had a space heating energy consumption that fell 12% below that which was predicted by SAP, while the dampers in No 14 brought it down to 34% below SAP, with one of the three flats at more than 70% below SAP.

The average annual space heating requirements were 12.3kWh·m^{-2} with trickle vents and 11.8kWh·m^{-2} with damper valves, which met the recommendation that space heating consumption in homes should not exceed 15-20kWh·m^{-2} per year, given by the Committee for Climate Change's UK Housing document,[6] which is referenced extensively in the Future Homes consultation paper.

Both Cogan Terrace houses also met the Passivhaus standard of space heating annual demand[7] below 15kWh·m^{-2}, even though the fabric of the buildings did not meet the insulation and airtightness standards mandated by Passivhaus. The fabric did meet the standards that the Future Homes document recommends should replace the current, less stringent building regulation standards.

Another way in which Cogan Terrace differs from the Passivhaus standard is that Passivhaus recommends a mechanical ventilation with heat recovery (MVHR) system, which was not fitted to either of the Cogan Terrace houses. Sassi's previous research has shown that MVHR requires »



» a large difference between internal and external temperatures to be cost-efficient.[8] It may be suitable in some parts of Scotland and northern England, but not in the milder climate of the southern British Isles, which includes Cardiff.

The building control systems in the Cogan Terrace houses were able to deliver Passivhaus standards of energy efficiency without the expense of Passivhaus standards of construction. Kelly and Sassi's analysis demonstrates state-of-the-art building control system technology, which is affordable and flexible enough to deliver comfort and energy efficiency in the domestic setting.

The Future Homes consultation does not appear to recognise how far the technology has matured in recent years, stating that building controls 'would typically be installed in large commercial buildings, but not usually in dwellings'. Future Homes discusses some elements that might be incorporated into a building control system, such as thermostatic radiator valves that respond to the temperature in a given room rather than a central thermostat. However, it does not recognise the value in making a building 'smart' using building controls.

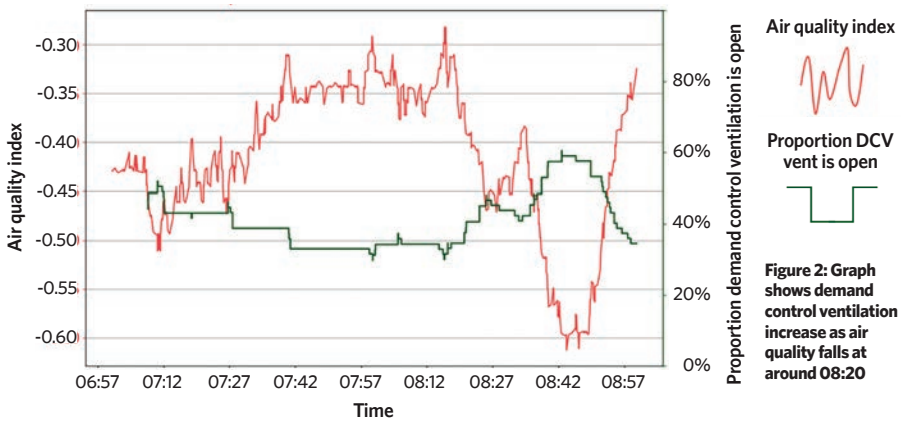


Figure 2: Graph shows demand control ventilation increase as air quality falls at around 08:20

The analysis shows a holistic system delivering the high levels of energy efficiency required by Future Homes by making low-cost technologies responsive, avoiding the capital costs involved in replacing them with more complex and expensive systems, such as heat pumps.

'The ubiquitous building control system... offers a user-friendly, room-specific, demand-controlled, energy-efficient solution that is cost-effective for new and existing builds,' says Sassi.

Building controls have a role to play in delivering the government's commitment to cut UK carbon emissions to net zero by 2050 and it is to be hoped that the final draft of the Future Homes policy enables the full use of their potential. **CJ**

DAVID MILES is content manager, **DAN CASH** is a director of consulting, and **KAT KELLY** is a senior data scientist, all at Atamate.

CLEAR COMPETENCE

New accreditation and certification schemes have been launched recently, to improve competency and compliance in the smoke-control sector. **Alex Smith** talks to Allan Hurdle about the industry's response to the Hackitt report

Allan Hurdle expects SDI 19 certification to rise as awareness increases

Dame Judith Hackitt's far-reaching proposals to improve the competency and compliance of those involved in the delivery of high-rise residential towers will have ramifications for nearly everyone working in construction.

The government has promised to implement Dame Judith's recommendations – laid out in her *Building a Safer Future* report –which means ensuring that those who work on high-risk buildings are certified as competent, whether they be a designer, installer or operator.

Life-safety equipment specified for these buildings will also have to be certified by an independent third party, to ensure they are safe and appropriate.

The smoke-control sector is one area currently undergoing reforms to ensure those working in the industry are competent. Allan Hurdle, the Smoke Control Association's (SCA's) technical consultant, is at the forefront of the changes being made to improve the competency of smoke-control engineers and the quality of equipment.

A former managing director at Fläkt Woods, Hurdle supports two working groups via the SCA looking at the competence and accreditation of smoke-control installers and products. He is also chair of a new BSI Working Group, FSH/025/0-/05, focused on the post-installation, service and maintenance of smoke fans.

'After the Grenfell Tower fire, there was a lot of focus on cladding and sprinklers, but 60% of fire deaths are caused by smoke. My brief was to ensure that smoke control was not forgotten,' says Hurdle.

The BSI Working Group will review motor specification, fan O&M manuals, and competence procedures for fan servicing and maintenance, with the intention of producing guidance. Hurdle says there is an acute need to introduce a scheme that ensures regular servicing.

'It's a concern that products are currently warranted for two years,' he says. 'There are some smoke fans out there that haven't been serviced for 25 years.'

Up until Grenfell, there was no competency scheme for designers and installers of smoke-control systems, but this was rectified with the introduction of the SDI 19 certification scheme in July 2018. This is designed to ensure that smoke control strategy verification, system design, installation and commissioning of smoke-control systems are in accordance with industry guidance documents and standards.

SDI 19 has now been made mandatory for SCA members involved in the design and installation of smoke control systems. The accreditation process for the scheme, which is UKAS certified, involves an inspection of procedures to verify the company is competent in this specialist area. 'In smoke control previously, there was no standard you could check to see if someone was competent to do the job,' says Hurdle. 'If you really believe in designing and installing systems properly, you will look to join the scheme.'

In a bid to improve the quality and integration of smoke-control systems, the SCA has also insisted that members only specify systems that have been tested in accordance with EN Standard 12101 suite of numbers, which covers the range of smoke control products. After Grenfell, it was discovered that smoke-control products were being supplied that had not been independently certified and tested.

'Products were often said to be tested "in accordance" with standards, but this did not mean they were tested and certified independently, which meant there was no confidence that products complied with the European standard,' says Hurdle.

The SCA is looking to encourage consultants and contractors to employ firms with IFC SDI 19 certification. Hurdle is currently hosting a number of webinars for consultants, contractors and building inspectors, and says 35 companies have applied or received SDI19 certification. He expects this to rise, however, as awareness increases.

'If you are installing life-safety equipment, you have to ask companies if they have the right certification,' he says. CJ

THE DETECTORISTS

Royal Papworth Hospital's fire alarm system has 1,900 fire detectors and more than 4,000 addressable devices. To ensure such a large system was integrated properly, fire specialists had to work with the designers at an early stage in the design, says Static Systems' **Chris Smith**

Hospitals are among the most complex buildings for which to design fire alarm and management systems, with designers having to take account of multiple fire-compartmentation zones, departmental boundaries, and building use by different groups of patients, staff and visitors.

The 1,900 fire detectors installed at the new Royal Papworth Hospital in Cambridge are evidence of the scale of the challenge faced by the project's design and installation team, which comprised fire alarm specialist Static Systems Group, building services engineer Troup Bywaters + Anders (TB+A), contractor Skanska, and the specialist suppliers of the BMS and ductwork.

As well as the detectors, the system has 15 networked fire alarm panels and, in total, more than 4,000 addressable devices. The size and complexity of the project meant it was important that the design team worked together at an early stage. The fire alarm system had to interface with dampers, air handling plant and smoke extractors to provide an integrated system that manages the airflow and smoke extraction, to direct smoke safely through the building.

At the preconstruction phase, Static Systems and suppliers engaged closely with Skanska and TB+A, who provided the brief. As a result, the design work was completed well before groundwork of the building had been finished.

Hospitals have their own bespoke cause and effect, which has to take account of the building design in terms of fire compartmentation (zones), departmental boundaries and building use. For Royal Papworth Hospital, the cause and effect design is one of phased evacuation, where zones adjacent to the one in alarm – both vertically and horizontally – sound an alert signal. Integral to the basic operation of the alarm devices and sounders and beacons is the need to control the supply and extract air intake system. This requires dampers to be programmed alongside the cause and effect, to ensure dampers function consistently with the fire alarm operation. The smoke dampers are designed to work automatically. However, there are specific areas – such as basements – where a manual extract override key switch allows the fire brigade to operate and control a cold smoke-extract system.


The disabled refuge system at Royal Papworth Hospital

It was important that detectors were placed away from air vents, and that clashes with lighting and sprinkler units and pipework were avoided. This was achieved through Skanska's integrated CAD models and associated coordinated ceiling plans, which also ensured the mounting of devices did not block access to other plant, such as fan coil units.

Royal Papworth's fire alarm system interfaces with other equipment, including the security and nurse-call systems, and sprinklers. Connecting with several systems where a simple 'on/off' control is required is achieved through volt-free contacts. The security system at Royal Papworth integrates with the fire alarm on a floor-by-floor basis, to release door locks and activate other devices. To maintain security integrity, certain more sensitive areas have different operations in the event of a fire condition. The connection to the nurse-call system is via an IP link, which allows more detailed information about the fire or alert to be sent to nurse-call indicators at the nursing stations.

Static Systems designed the fire system so that it would pick up signals from the sprinklers' flow switches and display them on a bespoke indicator. This also gives information on other plant that the sprinkler system monitors, including water and oil tanks. All alarms, alerts and other messages are directed to the onsite FM or fire-response team via indicators in locations such as security centres and the switchboard.

Evacuation planning was also a key consideration when designing the fire-engineered system for the new hospital. In the event of a fire, hospitals typically have a phased evacuation, whereby the affected zone is evacuated and adjacent areas are given an alert. At Royal Papworth, however, the Trust wanted to create a bespoke operation for ward areas. Each ward area goes across more than one of the fire zones for the building, so the Trust asked for an evacuation process based on ward areas rather than fire zones.

Static Systems also programmed and supplied a PC-based interactive data station for the fire alarm system. This enables maintenance teams to get an overview of the health of the system, obtain information on devices and, where required, isolate, add or relabel devices. **CJ**

CHRIS SMITH is head of project delivery at Static Systems

INTRODUCING THE NEW
Titon FireSafe™ Air Brick

The new Titon FireSafe™ Air Brick Range is a unique high flow terminal designed for powered ventilation systems offering low resistance to airflow, but high resistance to fire as set out in Approved Document B (fire safety) volume 1: Dwellings, 2019 edition. Constructed from sheet steel (A1) and polyester powder coated to classification A2-s1, d0. The Titon FireSafe™ Air Brick is designed to be built into external wall types during construction.

- Material 1.2mm electrogalvanized sheet steel, fire class A1 'no contribution to fire'
- Designed for both 204x60 & 220x90 ducting
- Bezelled version for use with exterior cladding instead of brickwork
- Extensive versatile range for different installation options
- Optional lengths available at request
- Polyester powder coating meeting EN13501-1 classification A2-s1,d0
- Performance tested to BS EN13141-2:2010
- Corrosion resistance - salt spray tested to BS EN ISO 9227:2012
- Special paint finishes available depending on quantity
- Compatible with thermal and rigid ducting

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ADAPTING TO STUDENT LIFE

The new Student Centre at University College London has reopened after lockdown, and its flexible design means numbers can increase as social-distancing guidelines change. BDP's **James Hepburn** describes the building

The new Student Centre forms part of a major transformation for University College London (UCL). The flagship building provides a progressive and flexible environment for students, supporting their needs and learning in the heart of the Bloomsbury campus.

BDP designed the building services engineering, including acoustics and lighting, working in conjunction with Nicholas Hare Architects and Mace Construction.

Two weeks ago, the Student Centre was reopened by UCL for the first time since the Covid-19 lockdown. Although the centre has capacity for 1,000 students, occupancy is currently limited to just 200 staff and postgraduate research students who are unable to work from home.

The reopening is part of a trial by the London-based university to reopen its buildings ahead of the September term, depending on the government guidelines.

UCL has incorporated a one-way system into the Student Centre's two large staircases, with staff and students directed down the striking central staircase.

Although the facility does feature fixed desks, it was designed to be flexible, and has clusters of chairs and tables that can be moved to ensure social distancing is practised between occupants. If distances are reduced by a change in government policy, increasing the building's occupancy will be straightforward.

PROJECT TEAM

Client: University College London (UCL Estates)
Architect: Nicholas Hare Architects
Building services, acoustics, lighting: BDP
Structural engineer: Curtins
Fire engineer: Arup
Project management: Arcadis
Cost planning: Aecom
Sustainability: Useful Simple Trust
Landscape architect: Colour UDL
Health & safety: Faithful & Gould
Planning consultant: Deloitte Real Estate
Contractor: Mace
M&E Subcontractor: Derry Building Services

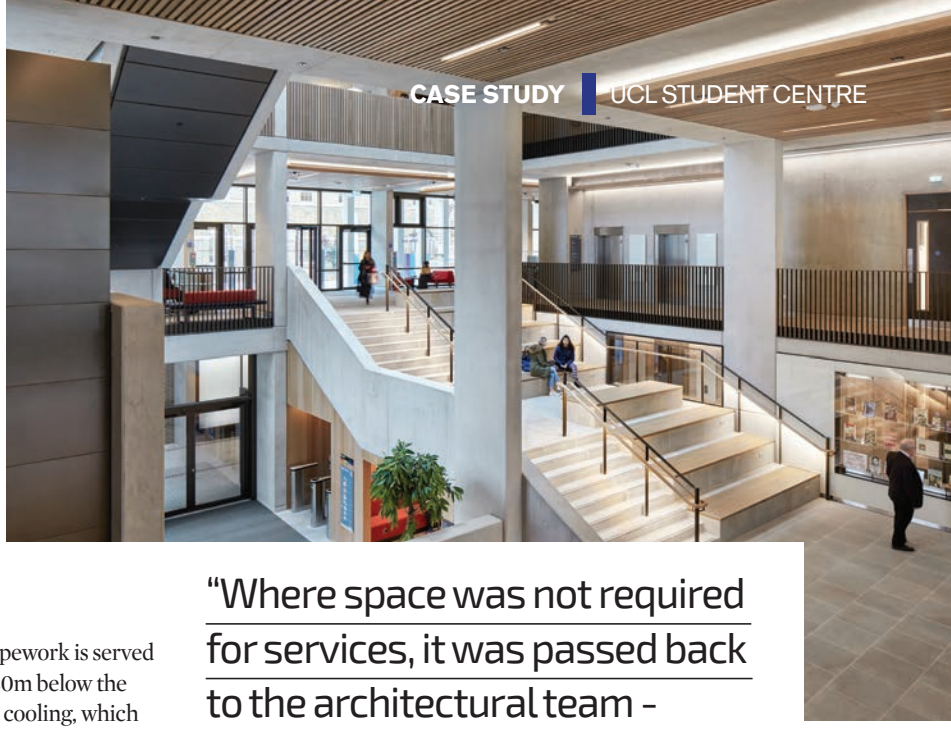
Low carbon strategies

The 5,300m² building employs innovative passive and active low carbon strategies, so that it can run in natural or mechanical ventilation mode, depending on internal conditions and ambient temperatures.

The mechanical ventilation is full fresh air with heat recovery, and is demand-controlled via variable air volume dampers linked to CO_2 and air-quality sensors. The control points can be adjusted to increase fresh air supply rates and windows can be opened by users if they desire.

The air handling units supply and extract air via the risers and the raised floor services zone. Generally, air enters the occupied spaces by floor swirl diffusers, and is extracted at roof level in the atrium.

The benefit of the thermally massive concrete soffits is boosted by



A one-way system has been implemented for the two large staircases as the Student Centre emerges from the Covid-19 lockdown

embedded cooling pipes cast into the concrete. This pipework is served by open-loop boreholes drilled down into an aquifer 120m below the building, abstracting aquifer water and using it for free cooling, which ensures year-round comfort for the building users.

The borehole water then runs through the tunnel network under the campus and discharges back to the aquifer via a third borehole located under the adjacent Wilkins Terrace. Heat pumps connected to the boreholes provide low-grade heating to the building, while high-grade heating for hot water is derived from a connection to UCL's existing district heating system.

The team delivered the project by using a BIM model. Working from the early stages, it ensured the services installations were space-efficient, risers were planned and populated, and – where space was not required – it was highlighted and passed back to the architectural team for reallocation. This was important on a building with such a compact footprint.

> "Where space was not required for services, it was passed back to the architectural team – important on a building with such a compact footprint"

The roofscape of the building was planning-sensitive, so plant and ductwork connections were modelled accurately from the early stage.

Part of the project involved the demolition of a plantroom serving an adjacent laboratory building. New primary ventilation plant was installed in the basement plantrooms of the Student Centre, and a sectional completion was achieved at the end of 2017, a year ahead of the main contract.

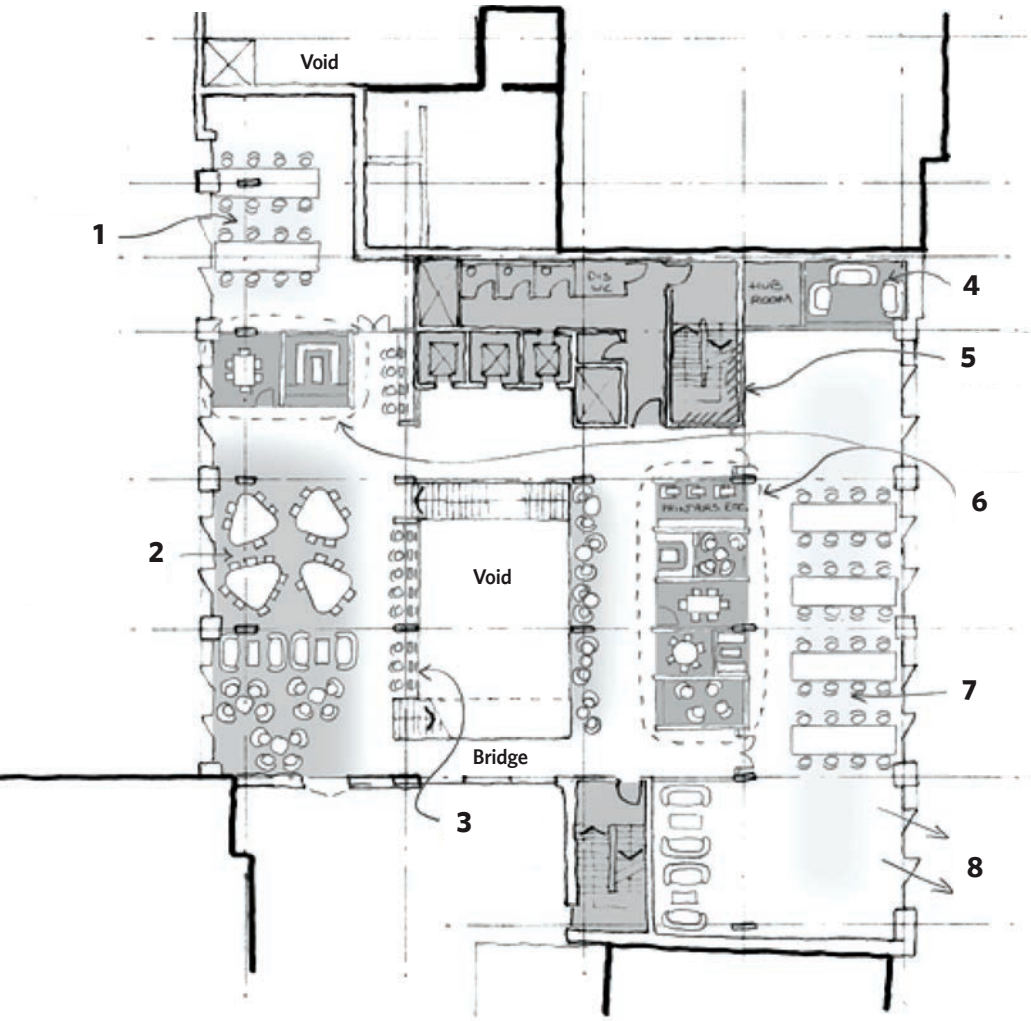
Building-integrated PV and an array on the flat roof of the adjacent building made the final contribution to allow the project to achieve an Energy Performance Certificate A rating and meet 35% carbon-reduction requirements in the London Plan. The scheme was also awarded a Breeam Outstanding rating.

Brick piers frame storey-high glazing that provides deep daylight penetration

Integrated lighting

The lighting scheme had to be high quality and energy efficient, yet flexible enough to support an agile space so that the furniture and partitions could be reconfigured at a later date. It had to respond to a variety of lit environments for different work settings, such as group working or quiet study.

Brick piers frame tall, storey-height glazing that provides deep daylight penetration on upper floors, but controlled, to avoid excessive solar gain. An adjacent projecting louvre facilitates natural ventilation and shade. A base level of 100lx was provided throughout the scheme, which allowed us to create 'islands of light' coordinated with the work areas, while keeping the energy consumption to a minimum. As recommended in the latest »



Sketch of floor plan

1 Quiet study room
2 Informal 'social' study space open to atrium
3 Drop-in computer stations
4 Cosy alcoves
5 Exposed brickwork to core walls
6 Timber cabins
- Open/glazed ends
- Meeting rooms
- Group work
- Resource area
7 Long room
- Quiet individual study space
- Simple table arrangement
8 Views out to Gordon Square

There is a variety of space that can be used for socially distanced working as the UCL Student Centre emerges from lockdown

» *BS 12464 – Lighting of indoor workplaces*, the lighting was further developed around the task areas and their immediate surroundings.

The lighting was coordinated with the architecture and integrated in the ceiling elements where possible, allowing the clean concrete ceilings to be visible and clutter-free. Lighting is concentrated on vertical surfaces to balance the daylight ingress. Photocells on the roof are linked to the lighting-control system to make use of available natural light.

Automatic scene setting scrolls through several scenarios throughout the day and into the evening, so that the building has a dynamic lit effect, appropriate for the time of day and season.

Study spaces are lit to a higher level, with furniture-integrated task lighting providing the facility to increase levels further when necessary, allowing the background to comfortably drop to a lower level. Livelier social spaces and flexible seating areas were lit to a higher level, while smaller group rooms enjoy decorative lighting from pendants, and feature, wall-mounted luminaires provide a cosy atmosphere.

The two basements have no access to natural light, so lighting levels are slightly higher here, with a pleasant warm-white colour temperature. Plenty of illumination at vertical eye level ensures there are no gloomy corners, while uplighting maximises the high ceilings where possible.

The Japanese Garden mirrors its twin, Wilkins Terrace, by integrating lighting in the steps and planters. Small spotlights highlight the vegetation, while discreet uplighters to the columns create a warm glow under the colonnade – a detail also reflected on the fourth-floor terrace.

There is a multitude of lit environments available for the students, all united as a single collective design. The colour temperature for the luminaires was chosen to complement the architectural finishes, and decorative luminaires break up the spaces and introduce colour.

Special areas – such as the 'quiet contemplation rooms' – are equipped with scene setting, allowing a high degree of flexibility to create a beautiful sensory lit experience within.

Sustainability workshops

Early sustainability workshops with the client and the design team guided the project towards a long-life, loose-fit building, able to respond to changing trends in education. Environmental strategies had to be adaptable and finishes are simple.

Careful consideration was given to the materiality of the fit-out, demonstrated by the timber-slat details that are prevalent across the building, providing the acoustic absorption to support the high density of occupation and the multifunctional use. This has been so successful that the entrance area has hosted a huge range of events without impacting on the 1,000 study spaces across the rest of the building.

The project also houses a Student Enquiries Centre, café and space for exhibitions, as well as a roof terrace overlooking the dome of UCL's Grade I-listed Wilkins Building. Once the building fully emerges from lockdown, it will again be the focal point for student events. **CJ**

About the author
JAMES HEPBURN is principal building services engineer London at BDP

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The control of legionella in wholesome hot-water systems

This module considers the challenges of combating increasing risks from legionella in domestic hot-water systems

Building operators have a specific responsibility to ensure the safety of building occupants in this period of the Covid-19 pandemic. However, the challenge is to maintain holistic control of all potential hazards that, without suitably applied knowledge and understanding, could create further – and significant – health issues. This includes the risks arising from legionella. This article will build on previous CPD articles – including modules 94 and 87 – and draw on recent publications to examine some of the challenges of combating increasing risks from legionella, with examples of mediation methods relating to wholesome hot water (or 'domestic hot water' (DHW)).

As discussed in CIBSE's comprehensive guide TM13,[1] many people are exposed to legionella , but their bodies' defence systems respond to prevent illness. Although previously healthy people may develop Legionnaires' disease (LD), there are several factors that have been shown to increase an individual's susceptibility, including: increasing age; being male; being a smoker; having an existing respiratory disease; and pre-existing illness, such as cancer, diabetes, kidney disease or alcoholism. In a particularly prescient review paper published in 2019, Bradley[2] *et al* note that 'lower respiratory infections remain one of the top global causes of death and the emergence of new diseases continues to be a concern. In the first two decades of the 21st century, we have borne witness to the emergence of newly recognised coronaviruses that have rapidly spread around the globe.... Although we perhaps most frequently think of viruses when discussing emerging respiratory infections, bacteria have not been left out of the mix, as we have witnessed an increase in the number of infections from Legionella'. European data reported[3] by Cunha *et al* suggests that LD is substantially under-diagnosed and under-reported. Comparing 2011 data of reported LD from the European Legionnaires' Disease Surveillance Network with that of a German multicentre study that employed active testing across a population indicates that possibly fewer than 5% of cases are being reported. If extrapolated, this would infer – based on 2018 EU data[4] – that, rather than the 20 reports of LD per million Europeans, there could be more than 400 cases per million. In the UK, there has been a steady rise in reported cases – in 2019 there were 516 confirmed cases in England and Wales[5] (approximately 8.5 per million), and this is likely to be significantly fewer than actual cases. As with all potentially fatal health problems, there are associated personal tragedies, as well as significant financial consequences[6,7] for the building operator if there is a failure to control the risk to occupants properly.

As described by AWT,[8] *Legionella pneumophila* was the first legionella species, named upon discovery in 1977 after the 1976 disease outbreak in Philadelphia. It was determined that neither the bacterium nor the disease was new, and that legionella bacteria have been around and causing disease for many years; it is found in the ground and groundwater. *Legionella pneumophila* is considered as the single species that is responsible for more than 80% of legionellosis cases. Outbreaks of LD have principally been associated with specific variations (or 'serotypes') collectively identified as *Legionella pneumophila* serogroup 1 – the most common legionella in environmental samples.

Legionellosis notably includes LD, a severe »

pneumonia infection, and Pontiac fever, an acute flu-like illness. Even though the colonisation of a water system by legionella may occur frequently, this alone is not enough to pose a high risk to humans, unless the bacteria population reaches high numbers and becomes dispersed through appropriate aerosolisation to impact susceptible people by inhalation.[5]

Legionella has evolved to exist and multiply in adverse conditions by being a parasite. (The boxout, 'Prozotoa and amoebae', provides some associated terminology.) Scheid[9] explains that the term 'free-living amoeba' (FLA) is applied to a mixed group of parasitic amoebae that are found in biofilms (which can visually manifest as slime), which are a complex layer of microorganisms that have attached and grown on a surface. Some FLAs have a resistant life stage, a cyst, which largely protects the organism from adverse environmental conditions – such as higher temperatures and chemical disinfectants – and, therefore, provides great tenacity. The FLA feed on algae, bacteria and fungi, as well as on smaller protozoa, and provide protected hosts for bacteria. The FLAs *Acanthamoeba* and *Vermamoeba vermiformis* are microscopic, free-living amoebae that exist in water and soil and are considered[10] suitable hosts for pathogenic microorganisms (bacteria that can cause disease). Work by Rowbotham[11] identified that these FLA can serve as hosts, reservoirs, vehicles and protectors for legionella (Figure 1). A recent systematic literature review[12] by Nisar *et al* shows that *Legionella pneumophila* combined with *Acanthamoeba* and *Vermamoeba* were extensively found in chlorinated and thermally treated water, which indicated the potential tolerance of *Legionella pneumophila* and its protozoan hosts to survive under a wide range of disinfection conditions. Not only does legionella acquire necessary nutrients from its host, but the host also protects legionella from toxic and unfavourable environmental conditions. AWT[1] notes that disinfection of a water source can lead to the eradication or reduction of legionella populations; however, the majority of legionella does not exist in an independent and solitary state (like a plankton). Instead, legionella more often resides inside a protozoan host and/or biofilm community. When legionella is released from a host, it is encapsulated within vesicles (small fluid-filled bladders) derived from the host's cell membrane. There can be more than a thousand legionella within a single vesicle, and legionella dispersed within these vesicles appears to be more virulent than legionella remaining parasitised in a protozoan host.

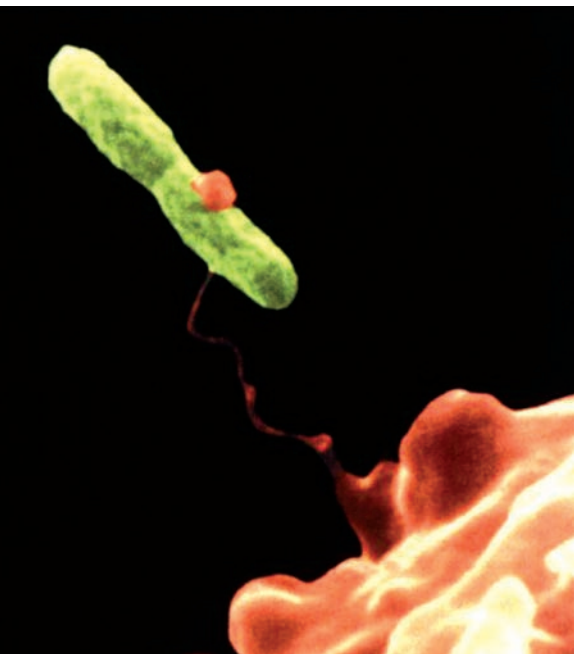

Figure 1: *Vermamoeba vermiformis*, orange, entraps *Legionella pneumophila* bacteria (≈2 to 20μm long), green (Source: pixnio.com/science/microscopy-images/hartmannella-vermiformis)

There are several authoritative guides to controlling and managing legionella risk in the built environment, including: CIBSE TM13:2013; the newly revised ASHRAE Guideline 12-2020; Health Technical Memorandum 04-01:2016; and the recently updated *BS 8580-1:2019 Water quality – Risk assessments for Legionella control – Code of practice*, which includes significant additions including an increased emphasis on risk assessment and management. These all provide further references to what is an increasingly well-documented topic.

The freely accessible Health and Safety Executive's (HSE's) approved code of practice, *Legionnaires' disease: The control of legionella bacteria in water systems (L8)*, 2013, contains practical guidance on how to manage and control the risks in building systems – see **www.hse.gov.uk/legionnaires**. Part 2 of the complementary technical guidance in HSG274 relates specifically to hot and cold water systems. Practically, temperature control is the traditional strategy for reducing the risk of legionella in hot and cold water systems, as temperatures between 20°C and 45°C have been identified as the optimal range for legionella growth. HSG274 specifically notes that, if hot water is stored, it should be at least at 60°C and distributed so that it reaches a temperature of 50°C (55°C in healthcare premises) within one minute at the outlets. The WRAS information leaflet *Preheated domestic hot water – Storage of preheated domestic hot water and possible growth of legionella bacteria* notes that legionella bacteria in concentrations of 100,000 colony forming units per litre (cfu·L^{-1}, a measure of viable bacterial cells) and higher are not uncommon at the base of conventional hot water storage vessels where temperatures of 20°C to 45°C are maintained. For comparison, HSG274 Part 2 recommends review of control measures (and possible disinfection) where legionella concentrations are in the range 100 to 1,000cfu·L^{-1}, and corrective action (followed by retesting every few days) where they exceed 1,000cfu·L^{-1}. An example of simple, practical, system design to reduce the risk of legionella accumulation is shown in Figure 2, where a direct-fired storage water heater installation includes a destratification pump that is automatically controlled to provide a daily legionella protection cycle, by circulating water from top to bottom in the cylinder of water at 60°C. Coincidentally, the main wholesome hot water (DHW) recirculation pump can be activated to provide a circulation of hot water around the distribution circuit. Although this should be undertaken at times when occupants will not be drawing hot water – as water at 60°C presents a scalding risk – local thermostatic mixing valves should be provided if this is considered an unacceptable risk. (TMVs will, themselves, present further requirements for legionella management.)

In the recent review paper[13] by Whiley, H *et al*, they reported that up to 25% of *Legionella pneumophila* cells can survive heat treatment of 70°C, but all of these were in a viable, but non-culturable, state. This could be significant in future assessments of legionella control, as being 'non-culturable' means it will not grow on the growth media that are used in culture methods currently employed to determine the efficacy of disinfection protocols.

In older, more complex buildings, it may be practically impossible to maintain the required temperatures. In the coverage[14] of legionella protection by the US Centers for Disease Control and Prevention (CDC), it highlights that 'a building *wholesome* water system with extensive dead-legs, low disinfectant residuals, tepid hot water temperatures, minimal water flow, and an established legionella biofilm might promote substantial legionella growth and dissemination in weeks or months'.

So, in addition to maintaining a temperature-control regimen, there may be occasions where additional, properly managed biocidal treatment is required for the effective control of legionella. HTM 04 notes that 'effective concentrations of some biocides are difficult to achieve in hot-water systems due to gassing off'. HTM 04 raises a further issue that has gained increasing focus during the control period for Covid-19, on how the use of antimicrobial hand-rubs might impact on the frequency of use of wash-hand basins and the volume of water being distributed, leading to the increased potential of stagnancy and low-water temperatures that supply wash-hand basins.

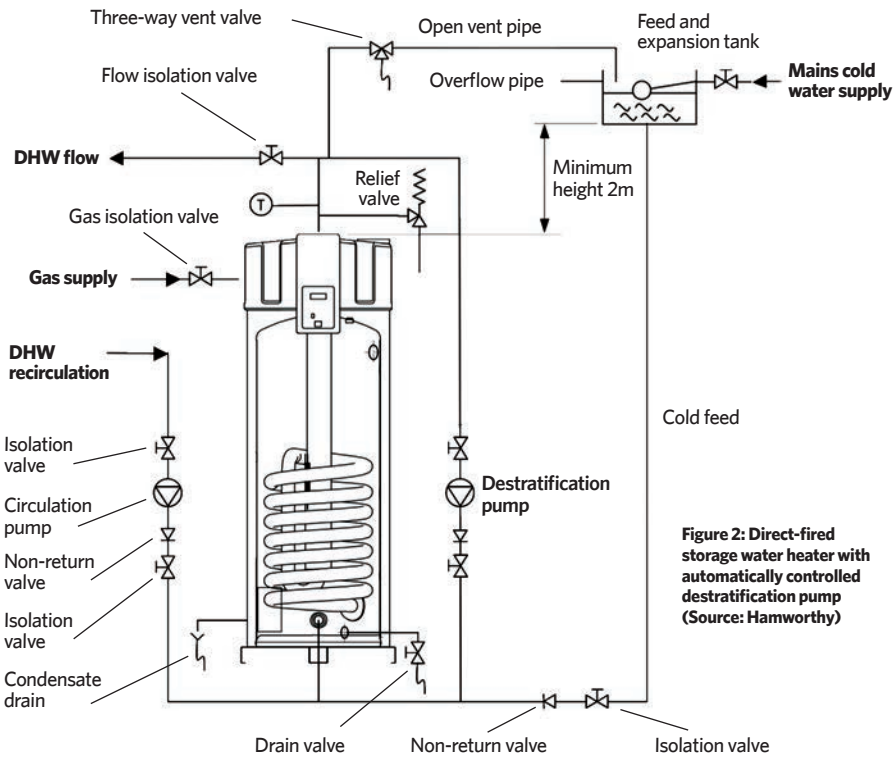

Figure 2: Direct-fired storage water heater with automatically controlled destratification pump (Source: Hamworthy)

PROTOZOA AND AMOEBAE

The term 'proto-zoa' literally means 'first animals', and originally connected as the basis of animal evolution. However, they were subsequently recognised as a discrete group on the basis of being a single-celled (unicellular) organism, and were assigned to the collective name of protozoa, although the taxonomy is still developing as research continues. Protozoa have a nucleus surrounded by a membrane (eukaryotic organisms), which exist as structurally and functionally independent individual cells, including those that form colonies. Protozoa have developed relatively complex subcellular features (membranes and special structures) that enable them to survive environmental rigours. Most protozoa are microscopic organisms – only a few grow to a size large enough to be visible to the naked eye. As unicellular eukaryotes, they move about to survive, feed and breed.

Amoebae are one of four main groups of protozoa, and use temporary, thread-like or balloon-like extensions of the cell membrane – known as pseudopodia ('false feet') – to creep or crawl over solid substrates.

■ Much of this boxout is based on abbreviated information from parasite.org.au/para-site/contents/protozoa-intoduction.html

RECOMMISSIONING HOT WATER SYSTEMS AFTER A PERIOD OF SHUTDOWN

The methods will be dependent on the particular application. The article 'Building closures could lead to legionella outbreak' in June's *CIBSE Journal* provides an overview of guidance for maintenance during the shutdown period. On the dedicated HSE web page,[18] 'Legionella risks during the coronavirus outbreak' recommends that if hot-water outlets have not been flushed at least weekly to prevent water stagnation, they should be inspected by a competent person and, as required, cleaned and disinfected before the building is occupied. The Legionella Control Association webpage[19] gives more detail of the precautions and processes that will be required, as does the US-based CDC '8 steps to minimise legionella risk before your business or building reopens'.[20]

Where biocides are used to control microbial growth in water systems, as with the temperature regimen, meticulous control and monitoring programmes should be in place if they are to be effective. The review[12] of studies undertaken by Nisar indicates that there was a failure of common disinfection procedures to achieve long-term elimination of *Legionella pneumophila* and protozoan hosts from potable (wholesome) water, and that disinfection procedures and protozoan hosts may facilitate the reproduction of viable *Legionella pneumophila* that have been shown to be highly resistant to many water disinfection protocols.

In an article[15] by Scherberger, he notes that biofilms are not simply removed as 'biofilm is produced to protect bacteria from harsh environments and disinfectants such as bleach, and antibiotics fall into the definition of a harsh environment'. Removal from water systems will probably require a carefully managed process with specialist advice, chemicals and appropriate personal protective equipment (PPE), so as not to adversely affect the operatives or the building occupants. Novel methods have been reported by Migliarina[16] that use hypochlorous acid, which reportedly provides a safe and effective method to remove biofilms in existing piped wholesome water systems.

Recently, Cloutman-Green *et al*[17] reported on a longitudinal study of a copper and silver ionisation system that, following a specific derogation of standing rules, was employed in a London clinical building with a wholesome hot-water system – both storage and supply network – operated nominally at 43°C, which obviated the risk of scalding in this healthcare setting. Over a six-year period, the systems were comprehensively sampled and, throughout that period, outlet temperatures varied between 37°C and 42°C, but there was no detection of any *Legionella pneumophila*. The copper and silver levels were maintained at target levels of >0.2mg·L^{-1} and >0.02mg·L^{-1}, respectively. The energy savings and reduction of carbon emissions were calculated to amount to 33% and 24%, respectively, compared with an equivalent temperature-controlled system. Such techniques require careful monitoring and control to ensure adequate dosing.

There are clearly practical measures that can be taken to reduce the risks from legionella in wholesome hot-water systems, but, as with other risks to building occupants, continuous assessment and management are the order of the day.

■ Turn to page 46 for references.

Module 165

July 2020

1. What proportion of cases of Legionnaires' disease were being formally reported according to the German study?

- ☐ A Fewer than 5%
- ☐ B 6% to 25%
- ☐ C 26% to 50%
- ☐ D 51% to 75%
- ☐ E More than 75%

2. Which amoeba was noted in the article as being a specific host for legionella?

- ☐ A *Acanthamoeba*
- ☐ B *Amoeba proteus*
- ☐ C *Chaos carolinense*
- ☐ D *Entamoeba histolytica*
- ☐ E *Gromiidea*

3. Which is the most recently updated standard/guidance to include an increased emphasis on risk assessment and management?

- ☐ A ASHRAE Guideline 12
- ☐ B BS 8580-1
- ☐ C CIBSE TM13
- ☐ D HSE L8
- ☐ E HTM 04-01

4. In a recent study, what proportion of *Legionella pneumophila* cells were found to survive heat treatment of 70°C?

- ☐ A Up to 10%
- ☐ B Up to 15%
- ☐ C Up to 20%
- ☐ D Up to 25%
- ☐ E Up to 30%

5. In the application of the copper and silver ionisation-protected system, at what approximate temperature was the water safely stored and circulated?

- ☐ A 20°C
- ☐ B 30°C
- ☐ C 40°C
- ☐ D 50°C
- ☐ E 60°C

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Edinburgh Printmakers starts a new chapter

A former rubber factory and brewery complex in Fountainbridge is now the home of Edinburgh Printmakers, a centre for printmaking and the visual arts.

Grundfos Pumps specified a range of ultra-efficient Grundfos MAGNA3 circulators that are ideal for a range of HVAC demands, to ensure the building's M&E infrastructure was ready to answer all that was asked of it.

Grundfos worked closely with M&E consultants Harley Haddow and contractors Emtec Building Services to come up with the right solution for this landmark project.

The heritage building has attracted much interest and attention, and has received many awards, both for the project itself and for its social impact.

Edinburgh Printmakers has established itself as an important hub for print and the visual arts, providing space for studios, classrooms, galleries, retail and hire.

As the print industry enters a new era, this building is proof that print is set to be intrinsically linked with our future.

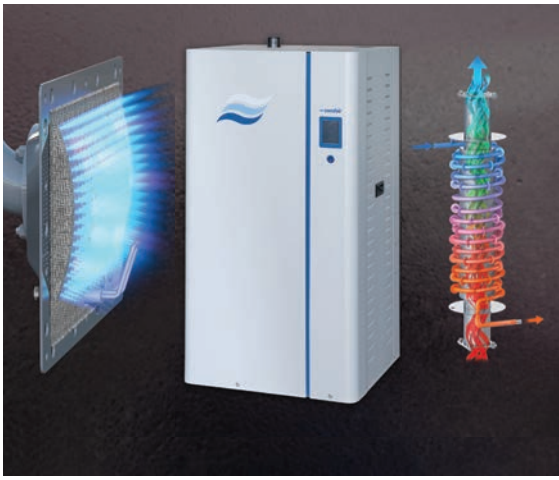
Visit www.grundfos.co.uk

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

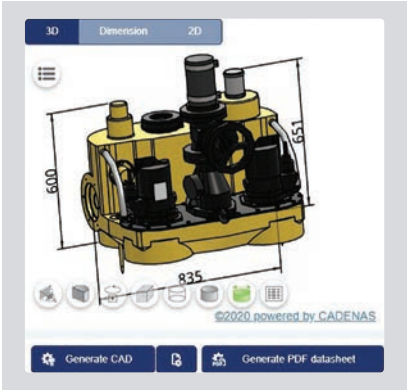


Condair backs petition calling for WHO indoor humidity review

Condair is supporting Dr Stephanie Taylor's petition to have the World Health Organization (WHO) review evidence related to indoor humidity and health, and set guidelines on a minimum lower limit for public buildings.

Head of sales at Condair Tim Scott said: 'We are delighted to see Dr Stephanie Taylor take the message directly to the World Health Organization that we need a minimum lower limit of indoor humidity. I've signed this petition and I encourage everyone else to do the same.'

Visit www.condair.co.uk or sign the petition at www.40to60RH.com



Jung Pumpen Compli now available as 3D BIM model

To help public health engineers specify floor-mounted sewage lifting stations more accurately, the Jung Pumpen Compli range is now available as a 3D BIM model.

The company will also be adding its DrainMajor floor-mounted wastewater lifting station range, which incorporates Jung Pumpen submersible U3, U6 pumps and its Hot Water 73/103HES pumps.

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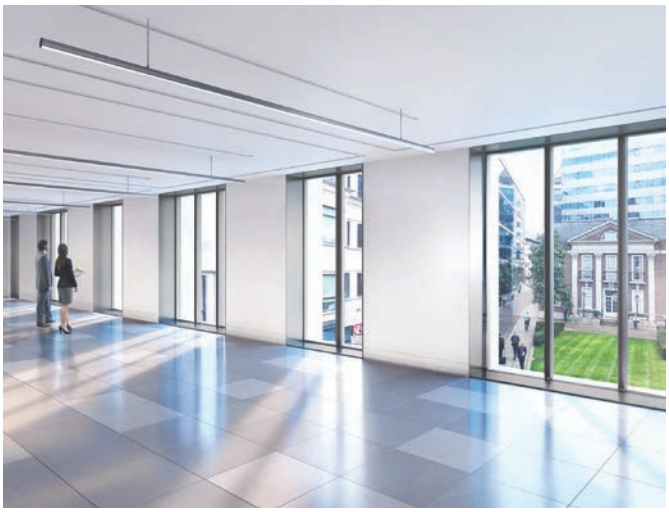

Underfloor air conditioning system from AET Flexible Space delivers outstanding design freedom

AET Flexible Space's underfloor air conditioning system offered an outstanding level of design freedom not possible with ceiling-based systems to the dramatic refurbishment of 77 Coleman Street. Designed by Buckley Gray Yeoman architects on behalf of Kajima Properties, the building offers stylish, high-quality office space in the heart of London.

As a result of hiding the air services within the existing 270mm floor void, key architectural design features – such as the unique terrazzo-patterned soffit – could be preserved and highlighted to full effect within the interior aesthetic.

The AET UfAC system has also been instrumental in gaining unusually high floor-to-ceiling heights, creating a far brighter, more open and inviting office environment. Finally, the modular design and installation of the AET system offers prospective tenants a truly adaptable and flexible air conditioning solution, reducing CAT-B fit-out timescales and costs significantly.

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Vexplate universal template can fit both twin and single electrical accessory boxes

Made from a rigid PVC intumescent compound, Vexplate can be fitted easily into new or existing, single or twin electrical accessory boxes. It is intended to be used where boxes are fitted back to back in the same compartment of a stud wall, to comply with part B of the Building Regulations – or where buildings, because of their type of use, would benefit from an enhanced level of fire protection. This includes schools, hospitals, hotels, and houses of multiple occupation.

Visit www.vexbox.com

British LED lighting with built-in antimicrobial surface protection

After many months of research and development, British company Coco Lighting has designed and launched a new range of antimicrobial LED lighting, proven to reduce surface levels of bacteria on the luminaire by more than 99%. With the ability to fight a wide variety of microbes, Bio-Luminaire's entire surface has been shown to be effective against MRSA and E. coli, and even at deactivating the influenza virus and feline coronavirus.

With lighting installed in hard-to-reach areas, routine maintenance can prove difficult and is often overlooked when working towards a cleaner environment. The Bio-Luminaire range of ceiling, wall-mounted, and pendant LED luminaires is protected with proven BioCote silver-ion technology, and tested to ISO 22196:2011 in an accredited UK laboratory.

Working around the clock, even when turned off, the Bio-Luminaire is an ideal solution for hospitals and healthcare environments where hygiene is of paramount importance, and is available in a wide range of bespoke trim colours.

Call +44(0)1376 331 515, email sales@cocolighting.com or visit www.cocolighting.com

Lochinvar appoints heat-pump specialist

Heating, hot water and renewables company Lochinvar has appointed James Cooper (above) to the new role of business development manager for heat-pump technology.

Cooper brings 20 years of engineering and technical sales experience to the role. He worked as a refrigeration and air conditioning engineer with detailed involvement in chillers, controls, process cooling and heating, before specialising in ground and air source heat pumps.

He has considerable hands-on experience of heat-pump technology, having being involved in a wide range of projects, including the largest UK installation to date, a major ground source system in Paris and one in London's Hyde Park. He has installed, commissioned, serviced and repaired heat pumps – as well as sold them.

Cooper's appointment is the next stage in Lochinvar's strategy to expand its heat pump sales after the launch of its 'Operation Heat Pumps' project in 2018. This has so far included an ambitious programme to extend its product range, with the introduction of higher-output models.

Visit www.lochinvar.ltd.uk

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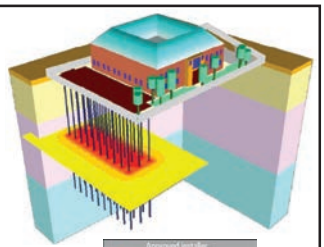
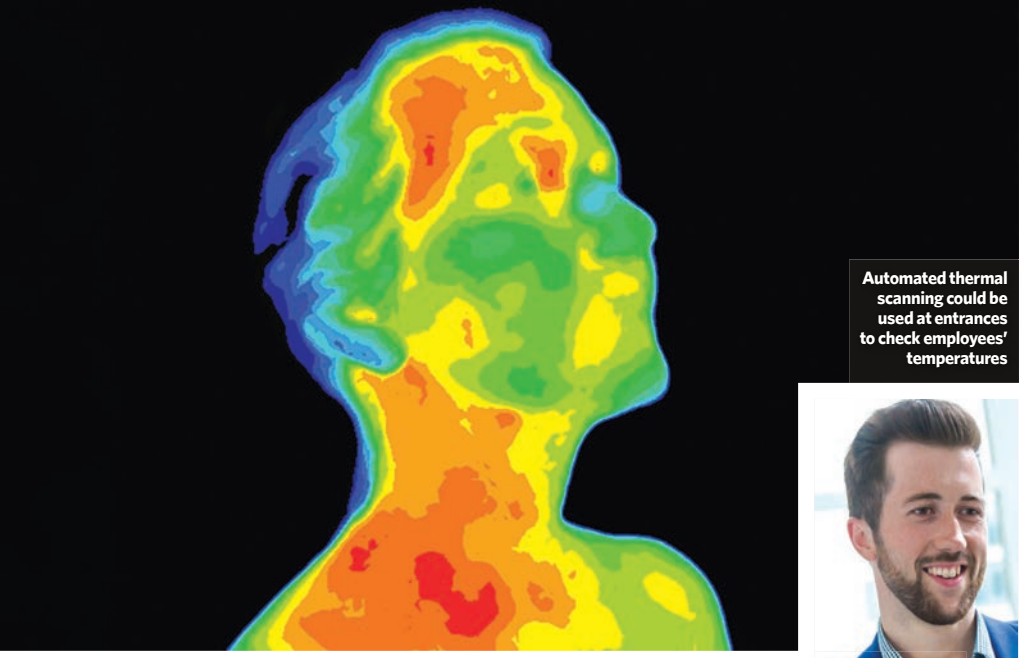
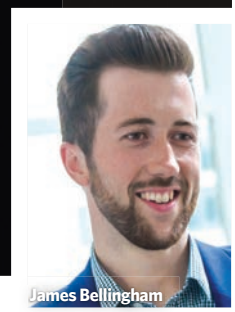




Automated thermal scanning could be used at entrances to check employees' temperatures



James Bellingham

Sensor timing

Smart tech can minimise the Covid-19 threat in workplaces by monitoring occupancy and enabling contactless control, says **James Bellingham**, of Siemens Smart Infrastructure

After lockdown, many people will be returning to workplace environments operating under very different conditions from the ones in place when they left, with the employers' priority being workforce health and safety, and minimising the threat from Covid-19.

As offices and workplaces adapt to the new paradigm of social distancing and more flexible working practices – affecting occupancy levels and the dynamics of the working space – smart office technology could help measure, monitor and control the building environment to maximise employee safety.

James Bellingham, head of digital buildings, Siemens Smart Infrastructure, UK and Ireland, believes that smart technology solutions offer a way to address the new demands of the post-lockdown workplace environment. Flexibility is key, he tells *CIBSE Journal*, with data, analytics, monitoring and controls offering more adaptability to improve conditions.

How can technology minimise the threat of Covid-19 in buildings?

Technologies such as workplace applications can help employers implement safety measures in a building – for example, through the booking of socially distanced desks, providing a list of people in the building to manage occupancy levels, and reassuring employees by making them aware of the guidelines and safety measures.

Using an app can also allow for contactless control of heating, lighting and blinds, as well as QR-code based work requests – such as the cleaning or emptying of personal protective equipment (PPE) stations.

By analysing data from occupancy sensors, or even Wi-Fi-based sensing, building managers can see live occupancy density for areas of the building, to ensure safe levels. With detailed occupancy sensing, high-traffic areas can be identified via a heat-map dashboard, and prioritised for cleaning.

For an extra level of protection, thermal-scanning solutions can be deployed at entrances to a building to indicate whether people have an elevated body temperature before they enter.

How will offices cope with peak activity?

It is clear that offices will need to run at a reduced capacity, phasing back to greater occupancy over time, so accurate occupancy data becomes important to ensure safe levels are not breached. Managing access to the office to reduce peak activity – perhaps in shifts or cohorts of people – may be necessary. So, moving to flexible desks and using a booking system to predict who will be coming to the office on a given day can be valuable.

If thermal scanning is in place for large employee populations, this can be automated and even linked into access-control gates or doors, to allow fast scanning of people and avoid bottlenecks at entrances.

How can you track people without infringing on privacy?

It is possible to get a good picture of occupancy density and traffic across areas of a building using PIR sensors [such as desk or ceiling IoT sensors] that cannot detect the identity of people, just presence and motion.

For enhanced safety, it is possible to carry out contact tracing within buildings using Bluetooth sensing, where employees would have Bluetooth-enabled tags. This would make it possible for businesses to track the employees that came into contact with an infected person and deep clean areas of the building they had visited. With the delay to the NHS UK-wide contact tracing app, this may be something employers will consider.

Businesses will need to consider the privacy implications of adopting tracing. It is possible to use Bluetooth tracking in an anonymised way by assigning a unique ID number to tags, instead of linking IDs to employee names.

Thermal scanning can also be anonymised, with temperature readings neither stored nor associated directly with individual employees.

Will occupant densities ever return to pre-Covid levels?

Digital transformation has, out of necessity, been accelerated during this period of the Covid-19 response, and this will probably drive lasting change in the role offices play in our working lives.

I believe we will return to pre-Covid occupancy levels in some offices, but working patterns will change. Offices will be used more flexibly, as hubs for employees who may work from home at other times. This may mean less office space is required and businesses may consolidate to fewer key sites.

The conversation around offices is focused more on employee experience and flexibility, and these topics are likely to be more important now.

EVENTS

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

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New live online training courses are now available. The training courses have been reformatted to work online, with a live trainer, so you can expect the same interaction and participation as you would in a classroom setting.

UPCOMING TRAINING COURSES:

Building services explained
1-3 July
Mechanical services explained
14-16 July
For details, visit **cibse.org/training**

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The CIBSE Membership department continues to support members wishing to progress their membership. They are hosting free webinars to support members with applications for the Associate and Member grades and registration with the Engineering Council at Incorporated Engineer and Chartered Engineer levels.

The series includes two separate webinars, with session 1 covering routes to membership and session 2 focusing on how to write the Engineering Practice Report. Each webinar features a presentation, followed by a Q&A.

Upcoming webinars:
7 and 14 July
For further details and to register, visit **bit.ly/CJJul20mem**

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24-25 November, London Olympia
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build2perform.co.uk

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CIBSE ASHRAE TECHNICAL SYMPOSIUM 2020 MOVES ONLINE

This September's CIBSE ASHRAE Technical Symposium is being redesigned completely, to provide an exciting, informative and absorbing online event. Originally due to take place at the University of Strathclyde, the symposium will now be delivered virtually, online, during the week beginning 14 September. It will include a variety of live and on-demand presentations, alongside live Q&A and discussion sessions.

It is expected that the programme will be based on the originally planned content, plus new material reflecting the swiftly changing demands in built environments, 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; design tools for lighting, and much more.

This event is open to all. Find out more and book your place at **cibse.org/symposium**

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CIBSE's free webinar series continues in July. Taking place every Thursday at 11am, the webinars are designed to support the CIBSE community in maintaining their CPD remotely.

Each webinar features a 20-45-minute presentation, ending with an interactive Q&A.

All previous webinars are available on the **#GrowYourKnowledge** GoToWebinar channel at **bit.ly/CJJul20GoTo**

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2 July
Near-zero energy buildings
9 July
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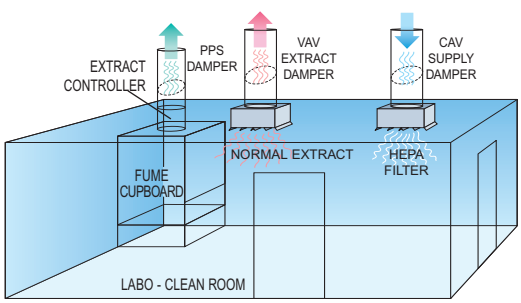

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