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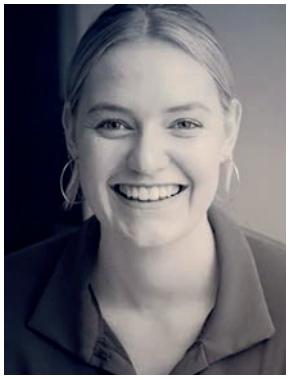
Creating a legacy



I am honoured to be appointed as YEN global chair this year, and equally as excited to be able to bring you this special edition of the *CIBSE Journal*.

September s issue has been curated using our Young Engineers Network and we re keen to share what our members and volunteers are doing in their regions and societies. We ll be showcasing events, projects, and career journeys, demonstrating our skills and ever growing knowledge, and highlighting what the dynamic and diverse YEN community has to offer.

The CIBSE President s theme of inspiring the next generation provides a platform and opportunity to create a legacy that will enable new engineers to evolve and grow into an industry that ñ using new technologies, ideas, processes, and pathways ñ will be able to respond to the challenges of climate change.

Inspiring the next generation is something that is at the heart of the Young Engineers Network ñ a growing community of engineers within the first 10 years of their career. We harness enthusiasm, share ideas, and engage with like minded professionals to support the evolution of the building services industry.

I hope this edition inspires you to get involved, provides thought provoking pieces that express new ways of thinking, or simply showcases the fantastic rising talent in this industry that gives confidence that its legacy is in safe hands. One such rising star is Raphael Amajuoyi, the former CIBSE ASHRAE Graduate Engineer of the Year, who is interviewed on page 26.

We can channel that energy to make a net zero world a reality by 2050.

A government led innovation to decarbonise school buildings using bolt on energy pods is a prime example of what can be done to improve building performance in a practical and creative way (page 28).

Building services is often a hidden discipline, but its profile has never been higher because of the climate crisis, rising energy bills and the focus on air quality post pandemic. Young people are more in tune with climate and their pester power will help engineer a sustainable future.

The YEN community spreads globally so please do use our map of YEN regional chairs on page 24 to contact your closest region. In October, we will also be hosting our first YEN Career Networking Day in central London, followed by our National Gala, which helps to celebrate and boost the careers of YEN members and inspires engineers to join this fresh and innovative industry.

We hope you find this issue of *CIBSE Journal* inspiring and that YEN will have the opportunity to guest edit again in the future.

GEMMA TAYLOR MCIBSE, YEN CHAIR

CONTRIBUTORS

Hywel Davies
The Building Safety Act will have long-lasting impacts on the industry for new and existing higher-risk buildings

Liv Stokes
How hybrid heat pump systems can help decarbonise heat in the short term in homes that are difficult to upgrade

Samreet Singh
How blockchain technology can be applied to radically improve BIM, energy grids and the circular economy

Tim Dwyer
This month's CPD looks at how guidance is helping the UK reach its net zero goals in the built environment

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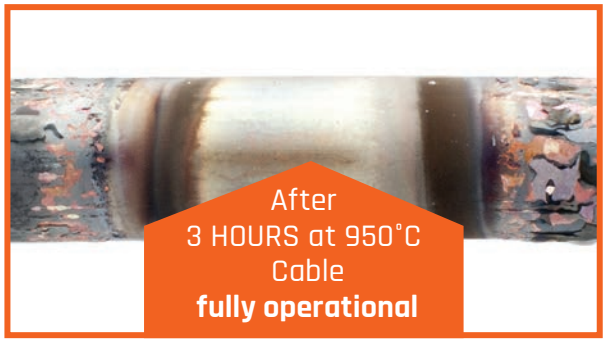
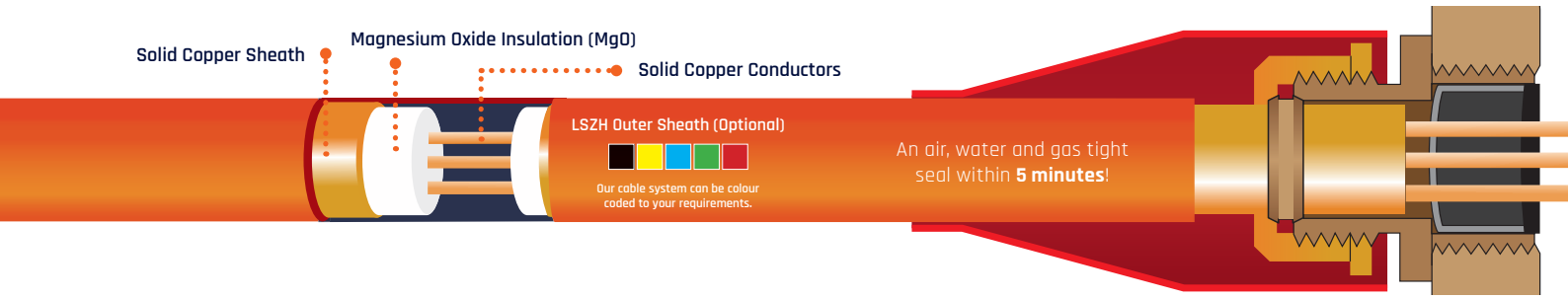


Wrexham Mineral Insulated Copper Cables



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Workers average 1.5 days in the office

UK office workers are only spending an average of a day and a half in their workplace even though social distancing regulations have been scrapped, according to a new survey.

Consultancy firm Advanced Workplace Associates (AWP) surveyed 43 offices in the UK with a total workforce of nearly 50,000 people during June and July.

The day the least number of staff attended the office was Friday when just 13% of workers turned up, followed by Mondays (19%).

AWP said that similar patterns in terms of office attendance, desk use and homeworking are being observed in other countries surveyed, suggesting that hybrid working appears to be here to stay .

A spokesperson said: Organisations may soon need to recognise that this is the post pandemic normal and evolve their working practices, processes and skills to support hybrid working models.

Offices in most sectors are under occupied which, if these trends continue, will result in excess space being repurposed or sub let.

Construction output shrinks for first time since October

Activity fell by 1.4% in June, following seven consecutive months' rise

Monthly construction output shrunk in June, the first fall the sector has suffered since last October, according to new official figures.

The Office for National Statistics' (ONS) most recent construction monthly data, released on 12 August, shows that the volume of the industry's output decreased by 1.4% in June.

This marked the first fall since October 2021 and follows seven consecutive months of growth. The figures show falls in both new work (2.0%) and repair and maintenance (0.2%).

The main sectoral contributors to the June 2022 decrease were private new housing and commercial work, which saw drops of 6.1% and 4.5%, respectively.

The ONS said that June's figures had been affected by the Diamond Jubilee weekend.

The release of the latest output figures follow the publication in July of a new survey showing that nearly half of small builders have seen their profit margins hit over the last quarter.

The most recent State of Trade Survey from the Federation of Master Builders (FMB) shows 49% of small builders have seen a negative impact on profit margins owing to the current economic climate.

Nearly all (98%) builders say they have experienced material cost increases, with 81% passing these on to customers. Further increases in material costs are expected by 95% of respondents in the third quarter of this year.

Meanwhile 71% of builders have had to delay jobs because of a lack of materials and 61% are putting off work because of a shortage of skilled tradespeople.

Brian Berry, chief executive of the FMB, said the survey made for grim reading.

'The industry appears to be at a turning point, and without any movement from a government stuck in paralysis, things will only get worse,' he said.

Home insulation must be a 'national mission'

Insulating homes must be priority, says Labour

The next Prime Minister should make home insulation a 'national mission' that could save households £11bn in three years, Labour's Ed Miliband has said.

The shadow secretary of state for climate and net zero has urged rival Tory leadership candidates Rishi Sunak and Liz Truss to embrace the Labour party's plan, announced by its leader, Sir Keir Starmer, on 15 August, to freeze the energy price cap.

This includes a fresh commitment to Labour's 10-year Warm Homes Plan to upgrade the energy efficiency of 19m homes.

Each household receiving an upgrade would save an average of £1,000, adding up to a total of £11.4bn in the first three years.

Meanwhile, as pressure builds on the government to cut bills, the National Grid Electricity System Operator was set to unveil plans, as *CIBSE Journal* went to press, to enable households to receive discounts on electricity bills if they cut use at peak times.

Rebates could be on offer for those who avoid high-power activities, such as using washing machines, during the early evening peak hours. The ESO hopes to secure approval from Ofgem for the scheme so that it can be launched by late October.

The Lowry in Salford will see its energy bill treble to more than £1m from 2022-23

Rocketing energy bills threaten UK business

The Federation of Small Businesses calls for government help as SMEs report more than five-fold increases in their energy bills

A survey of more than 1,300 firms for the Federation of Small Businesses' (FSBs) latest Small Business Index shows a record proportion (89%) saying their operating costs have increased over the past year.

There were also record-high numbers citing fuel (64%) and utilities (64%) as the primary drivers of increased costs. These figures outstrip the 43% that flagged up labour as a main contributor to higher outgoings.

The FSB has urged the government to provide help with energy bills for struggling small firms, to match the payouts due to be given to households over the winter.

Responding to this month's announcement that the consumer price index, the main measure of inflation, has increased to 10.1%, FSB national chair Martin McTague, said:

'Reports from members of four- or five-fold – or even higher – increases in their energy bills are coming in thick and fast, with relief on this front desperately needed.

'The new figures that small firms are being quoted for energy costs would be laughable if their potential effect on the business were not so serious – these are huge, unmanageable sums for businesses whose margins have been battered, and whose reserves have been depleted, by the disruption to trading caused by the pandemic.'

The FSB has issued its call for help as evidence mounts of the damage that spiralling power bills threaten to cause for non-domestic energy customers, such as businesses and public bodies.

The Guardian recently reported that The Lowry arts centre in Salford has seen its energy bills for 2022-23 increase more than three-fold, to £1m, which is more than the complex's annual Arts Council grant of £869,000.

No respite for households as energy bills set to top £4,200

The typical household's annual energy bill is forecast to top £4,200 by the beginning of next year, according to a new forecast.

Ofgem, the energy regulator,was expected to announce its October update of the price cap for default domestic tariffs on 26 August, after *CIBSE Journal* went to press this month.

However, consultancy Cornwall Insight, which uses Ofgem's published methodology to forecast future revisions to the cap, has estimated that it will rise to £3,582 from the current level of £1,971 in October. This is around £200 higher than Cornwall's previous forecast.

According to the consultancy, the cap will then climb to £4,266 in January, when the setting of the cap becomes a quarterly – rather than a six-monthly – exercise, before increasing again to £4,426 in April.

The escalating energy bill forecasts have prompted a pledge by leader of the opposition Sir Keir Starmer to freeze the current cap if Labour was in government.

IN BRIEF

Construction pay jumps by 6.3%

Pay rises in the construction sector outstripped those for the economy as a whole in the second quarter of this year, according to new official figures. The Office for National Statistics revealed that construction pay, including bonuses, grew by 6.3% from April to June. This was higher than growth in average total pay (including bonuses), which was 5.1% in the second quarter. Pay growth in construction was also higher than for the private sector as a whole (5.1%).

LABC announces training for building control

Local Authority Building Control (LABC) has launched a fully funded scheme to train 150 new building control professionals over a three year period. The programme is designed to create the additional capacity councils need to meet new responsibilities under the Building Safety Act 2022, and provide support for the new Building Safety Regulator. Trainees will be supported while they undertake studies for the Level 4 and Level 5 diplomas in building control, followed by funded Level 6 (degree level) learning once they are permanently employed by a local authority.

Ingleton Wood appoints director of sustainability

Property and construction consultancy Ingleton Wood has announced the appointment of Shawn Galliers as director of sustainability. Based at the practice s Oxford office, Galliers will lead the expansion of a new team of sustainability specialists. Galliers aims to support clients to ensure projects are delivered as sustainably as possible and ensure it is integrated across the company.

Galliers joined BSRIA early in his career. Qualifying as a surveyor, he has experience in the sustainable design, operation, and maintenance of buildings.

DROUGHT DIMS SHANGHAI S SPECTACULAR WATERFRONT

Shanghai's renowned Bund was not lit for this month in order to save electricity, officials say. The Shanghai Landscaping and City Appearance Administrative Bureau announced on August 21 that the waterfront area would not be lit for the following two nights.

A record-breaking heatwave and a severe drought has left China short of energy as demand for air conditioning has surged, while reduced river flows has cut the country's ability to generate hydro-electric power. The BBC has reported that factories in the country's Sichuan province have also been hit by power cuts.

Pressure to adapt buildings after heatwaves and drought

Building resilience must mitigate impacts of extreme heat, says UKGBC

Workplaces should consider improving ventilation and air conditioning to ensure the safety of employees in periods of extreme heat, the Health and Safety Executive (HSE) has said.

Following record UK temperatures, the HSE issued a statement saying that under the Workplace (Health, Safety and Welfare) Regulations, employers have to provide a reasonable temperature in the workplace. While there is no maximum temperature for workplaces, all workers are entitled to an environment where risks, such as extreme temperatures, are properly controlled, according to the HSE.

John Rowe, HSE's acting head of operational Strategy, said: 'We expect employers to take this recent weather event as the prompt to review how they assess the risk of high temperatures and identify now those changes that will future-proof them. There are low-cost adaptations to the structure of work, but things like improved ventilation and air conditioning should also be considered'.

Ensuring that the UK housing stock is adapted to high temperatures must be an 'urgent priority' for the new Prime Minister when they come into office on 5 September, according to the UKGBC.

It has called for a national rethink on how buildings can be adapted to mitigate the impact of heatwaves that are likely to become more frequent.

Alongside moves to improve energy efficiency and actively reduce water consumption, the government must take steps to ensure homes are liveable and safe in the face of future heatwaves, it said.

These measures include use of shutters to reduce solar glare, reflective paint, water-efficient fittings, and ensuring appropriate ventilation alongside external insulation.

Anastasia Mylona, head of research at CIBSE, said cooling solutions need to be prioritised. 'Control of solar gains through shading, maximising natural ventilation, and the use of insulation and thermal mass with sufficient night-time cooling have proven to be the most effective passive cooling techniques in hotter climates for centuries,' she said.

Mixed-mode solutions, featuring natural and mechanical ventilation, could be considered in areas with noise, security and air-quality restrictions, she added. Read more on cooling in extreme heat on page 75.

IN BRIEF

Government backs new Sizewell nuclear power station

Boris Johnson has given the go ahead to finance a government stake in a new nuclear power station planned at Sizewell, the *Sunday Times* has reported. According to the newspaper, the Prime Minister and Chancellor of the Exchequer Nadhim Zahawi have approved a final investment decision for a 20% share in the 3.2GW Sizewell C plant on the Suffolk coast.

Kwasi Kwarteng, Secretary of State for Business and Energy, granted EDF planning permission on 20 July for the project.

Inflation at highest rate for 40 years

The annual inflation rate increased to 10.1% in July, the first double digit price rise recorded in just over 40 years, according to the Office for National Statistics.

July s figures also mark the fourth month in a row that inflation has exceeded nine per cent and, with the energy price cap due to increase by around 80% from the current level of £1,971, economists at Citibank have predicted that the headline rate could rise as high as 18% next year.

Environment still big concern despite cost of living crisis

Concern has surged about the environment, pollution and climate change over the past month despite mounting concerns about the cost of living, according to Ipsos Mori.

The polling company s Issues Index for August shows that 37% named environment, pollution and climate change as a big issue facing the UK. This marked a 10% increase compared with the previous month, pushing the issue into third on the list of public concerns.

Inflation and prices remained in poll position in the list of issues of concern, named by 54% of respondents 9% up on the previous month.

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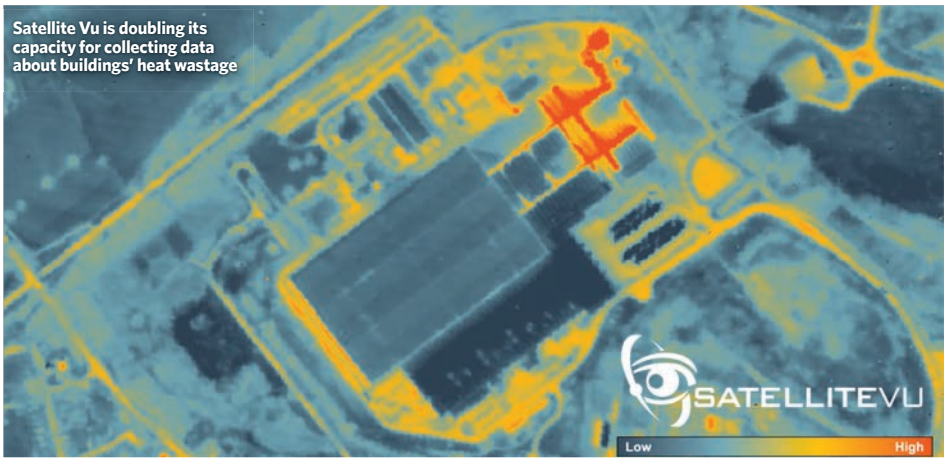

Satellite Vu is doubling its capacity for collecting data about buildings' heat wastage

British Earth observation start-up Satellite Vu has ordered a second thermal-imaging satellite to map the heat being generated by the world's buildings. The company's second satellite will enable it to double its capacity for collecting data about buildings' heat wastage using a new infrared camera. The constellation's operator, Surrey Satellite Technology, is due to launch its first satellite in the first quarter of 2023, on board SpaceX's Falcon 9 rocket

IN BRIEF

Entopia awarded EnerPHit Classic certification

Cambridge s Entopia Building has been awarded the Passive House Institute s EnerPHit Classic certification. The new headquarters of the University of Cambridge Institute for Sustainability Leadership is a conversion of a 1930s telephone exchange into offices. Its energy requirement is just 15% of the original building s, and the retrofit project saved more than 62,000kg CO_{2e} in construction materials. Only a handful of office buildings in the UK have been awarded the EnerPHit Classic certification, which is designed to recognise highly energy efficient retrofitted buildings.

Switched on council set for carbon negative microgrid

ABB has delivered an electrical distribution and control system for a 300kW future microgrid eco park being deployed by consultancy Tetra Tech for Oldham Council in Greater Manchester. The first phase of the eco park is due to be completed by spring 2023, and the council wants it to become a carbon negative microgrid that supplies excess electricity to the Grid. The eco park will integrate solar photovoltaic panels, a 500kVA Grid connection, electric vehicle charging points, and electricity demand from an office building, as well as heating from an air source heat pump.

Grid constraints holding up developments in West London

Requests for electricity connections from data centres creating a logjam

London mayor Sadiq Khan is set to meet the government in a bid to unlock the electricity Grid constraints that are threatening to hold back delivery of homes in the west of the capital.

At the end of July, SSEN, which owns and operates the distribution network in that area, told prospective developers there was insufficient electrical capacity for new connections, and that they may have to wait until 2035.

The constraints follow what a Greater London Authority (GLA) briefing note, seen by *CIBSE Journal*, describes as a 'rapid influx' of requests for new electricity connections from data-centre operators seeking to co-locate with fibre-optic cables passing through the west of London, along the M4 corridor, and across the Atlantic.

The current constraints are 'most acute' in the boroughs of Ealing and Hounslow, it says.

SSEN operates a queuing system for new connections, which works on a 'first come, first served basis', in line with its licence conditions set out by the energy regulator, Ofgem.

SSEN and the National Grid, which runs the electricity transmission network, are understood to be finding ways to maximise opportunities for new connections and resolve existing constraints. These include: improving queue management by reviewing customer connection needs and assessing whether existing capacity is available; better understanding of the phasing of already contracted parties' electrical requirements; measures to incentivise a more even spread of electricity demand throughout the day; and investigating a review of regulations to potentially enable additional Grid capacity in constrained areas.

A GLA spokesperson said a request for a meeting with the government, issued weeks ago, has now been accepted.

David O'Leary, director of policy at the Home Builders Federation, said the West London constraints offered a hint of the Grid-connection difficulties likely to arise when there was greater uptake of electric vehicles and heat pumps.

Greenpeace challenges gas field

Greenpeace has lodged a legal challenge over the granting of consent to develop a large North Sea gas field.

The Offshore Petroleum Regulator, on behalf of Secretary of State for business and energy Kwasi Kwarteng, gave the go-ahead in June for Shell to develop the Jackdaw field, which lies 150 miles east of Aberdeen.

Greenpeace has lodged an appeal against the decision, on the grounds that the government failed in its legal duty to check the project's environmental impacts by not considering the damage caused by burning the gas that will be extracted.

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Opposition builds to M&S demolition on Oxford Street

A Conservative MP and a key government adviser on the built environment have expressed their opposition to plans by Marks & Spencer to bulldoze its flagship Oxford Street store.

North Norfolk MP Duncan Baker and Nicholas Boys Smith, who chairs the government s Office for Place, have spoken out against the redevelopment, which has been called in for a public inquiry over concerns about embodied emissions.

Baker, a member of the environmental audit committee, said that for the built environment industry to meet government net zero targets meant doing things differently and encouraging innovation. Approving the scheme would mean no change and business as usual.

Boys Smith described the proposals as deeply flawed, and said it would waste oodles of embodied carbon.

In a technical statement to the upcoming inquiry, academic Dr Alice Moncaster said the energy used to create materials such as steel and concrete for new buildings is far more significant than previously thought.

Call for standard metrics for whole life carbon

UKGBC says lack of consistency inhibits uptake of efficient processes

A lack of agreed metrics on the carbon savings from retaining components in projects is an important gap in industry knowledge, according to a new report by the UK Green Building Council (UKGBC).

How circular economy principles can impact carbon and value says a more consistent approach to measuring how much carbon is saved by reusing materials when demolishing and rebuilding projects is urgently needed.

It found that as much as half of the life-cycle carbon emissions from buildings comes from embodied sources, such as the manufacturing of materials and construction processes. The report concludes that many circular economy principles are already in use, such as the reuse of steel and other building structures to save embodied carbon, and could be adopted more widely.

However, the research says measurement of whole life carbon is infrequent, inconsistent, and difficult because of the lack of a common set of metrics and methods. This 'knowledge gap' and a general failure to consistently measure whole life carbon and circularity inhibits uptake of more efficient processes, according to the report.

CIBSE published a methodology for calculating embodied energy last year because of the lack of environmental product declarations for HVAC products.

CIBSE TM65, *Embodied carbon in building services: a calculation methodology*, was subsequently used as the basis for another TM that investigates the embodied carbon impact of heating and hot-water equipment.

They are free to download for Members – go to **www.cibse.org/knowledgeportal**

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Call for abstracts for Technical Symposium on decarbonising buildings

Abstract submissions are being sought for the CIBSE Technical Symposium 2023. Its theme is *Delivering sustainable, safe and healthy buildings for a net zero future*, and will focus on the challenge of decarbonising our buildings and infrastructure, and delivering net zero over the next 25 years.

The symposium will present a range of peer reviewed papers and presentations, and showcase the latest guidance for building services engineers. It will also provide information on meeting the net zero carbon imperatives and on the latest building safety related reforms in the UK industry.

Short abstracts for research papers, posters, technical reviews, case studies and opinion presentations based on recent or current project work, research or application are being sought. Proposals that examine actual or potential impacts of our work on the built environment are also welcome.

For more information, visit **www.cibse.org/technicalsymposium**. The deadline for submissions is 3 October.

Manyonga wins Ken Dale Travel Bursary

Winning research project aims to improve access to lighting in rural Africa

Aluwaine Manyonga has won the Ken Dale Travel Bursary 2022 for his research on improving access to lighting in rural Southern Africa.

His project, *Assessing the impact of using off-grid, solar-powered DC LED lighting systems on improving reliability and access to lighting in Southern Africa's rural buildings (case study of schools and residential buildings)*, aims to assess the feasibility of implementing solar DC LED lighting systems in buildings within rural communities.

Manyonga's research will concentrate on countries in the Southern African Development Community, specifically Zambia, Malawi, the DRC, and Tanzania.

The University of Zimbabwe electrical engineering student plans to select a school and residential building to study the impact of the lighting systems.

Manyonga was named SLL Young Lighter 2020 for his project on off-grid solar lighting in Africa's education system.

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

- **For more information visit bit.ly/CJSep22CN1**

The Louvre Abu Dhabi was new-build façade of the year in 2018

International line up in Fa ade Awards shortlist

Young engineer and lifetime achievement categories added to accolades for 2022

Projects from across the world have been shortlisted for the Façade 2022 Design and Engineering Awards.

Seven buildings from the United Arab Emirates, Lithuania, Italy, the US, Turkey and the UK have been shortlisted in the New Build International Project of the Year category. A further 35 buildings and six engineers are on the shortlists for other awards.

There are eight categories in total, including Project and Product of the Year, and, for the first time, there is a Young Façade Engineer of the Year category and a Lifetime Achievement Award.

Notable projects making the shortlist include Thornton Tomasetti's The Shed, in New York (International Innovation and International New Build categories), which is an avant-garde arts centre featuring a movable outer shell on wheels that encloses a large, multifunctional open space, and wraps around the main building when not in use.

Also making the final is Arup's 1 Triton Square (Refurbishment and Sustainability categories), which required the removal, refurbishment and reinstallation of more than 3,000m^2 of façade, comprising more than 25,000 separate parts.

The winners will be announced at the Façade Awards night, at the Hilton Park Lane, London, on 3 November.

- **For the full shortlist and further details, visit www.sfecompetition.org**

Visual aid for new safety law

CIBSE has produced an infographic of key terms and components of the Building Safety Act.

It is designed to be an accessible entry point to understanding key elements and responsibilities of the act, and outlines: what is meant by the term higher-risk buildings; the role of the new Building Safety Regulator; the Golden Thread of information; and new dutyholder roles.

The act creates a Building Safety Regulator responsible for the regulation of all buildings, with new statutory roles for designers and contractors on all projects.

It also creates a new and more rigorous regime for the planning, design, construction and operation of prescribed classes of buildings. There will be new planning and building control gateways, accountable persons, safety cases, and a statutory Golden Thread of information, all linked to a formal certification of the building by the regulator for fitness to occupy.

The government has launched two consultations, as part of a series on regulations, providing technical proposals that support the law as set out in the Building Safety Act 2022.

Contributions to CIBSE's response need to be received by 1 October.

- **For further details and relevant links visit bit.ly/CJSep22CN2**

IN BRIEF

SLL Ready Steady Light annual event seeks teams

The Society of Light and Lighting s (SLL s) Ready Steady Light competition is looking for teams.

The annual event, in partnership with Rose Bruford College, challenges teams of lighting professionals to compete against each other to create an exterior light installation with limited kit, in only 180 minutes.

Taking place on 18 October at the college campus, the event is a celebration of the art and science of light. Teams of up to five people can enter, and each team must include at least one SLL member.

Rose Bruford College s BA lighting and design course students will be supporting the event, allowing them to see lighting professionals at work in this unique environment.

For more information and to enter, visit **bit.ly/CJSep22CN3**

Specialist volunteers wanted for Knowledge project

CIBSE Knowledge is seeking help from those with an interest in building physics to create guidance covering climate, thermal comfort, internal air quality, heat, moisture, light, and acoustics.

Specialists on all these topics have already been enlisted, but we require a project lead to pull it all together. Visit **bit.ly/3CJSep22CN5**

Shortlist revealed for UAE Awards

The shortlist has been announced for the annual UAE Awards, which will take place on 8 September at the Armani Hotel, Burj Khalifa, Dubai.

Six graduate engineers have been shortlisted in the MEP Graduate of the Year category, while the MEP Young Engineer of the Year category has eight shortlisted young engineers. The final two awards up for grabs are MEP Consultancy of the Year and MEP Manufacturer of the Year.

To view the shortlist ,visit: **bit.ly/CJSep22CN6**

New members, fellows and associates

FELLOWS

Duggan, James Joseph
Paulstown, Ireland

Atyab, Mohamed
Dubai, United Arab Emirates

Pais, Sujay
Dubai, United Arab Emirates

Herrick, George
London, United Kingdom

MEMBER

Abuziad, Qusai
Dubai, United Arab Emirates

Adaikkalasamy, Pal Stephen
Dubai, United Arab Emirates

Ali, Mohammed
Riyadh, Saudi Arabia

Aman, Mohd
Birmingham, United Kingdom

Ambrose, Bill John
Romford, United Kingdom

Andishehtadbir, Parham
Plymouth, United Kingdom

Au, Cheuk Wing
Hong Kong, Hong Kong

Au Yeung, Chi Wai
Kowloon, China

Bainbridge, Michael
South Shields, United Kingdom

Bake, Maitiniyazi
London, United Kingdom

Bateson, Conall
Magherafelt, United Kingdom

Bemister, Deborah
Southampton, United Kingdom

Bibby, Paul Alexander
Manchester, United Kingdom

Biggs, Colin
Caerphilly, United Kingdom

Bowman, James
Winchester, United Kingdom

Bradbury, Tom
London, United Kingdom

Bradbury, Johnathan
Plymouth, United Kingdom

Bradbury, David
Birmingham, United Kingdom

Bradley, Thomas
Weston Super Mare, United Kingdom

Brigham, Andrew
London, United Kingdom

Brookes, Daniel
Leeds, United Kingdom

Chan, Cho Wai Joe
Tin Shui Wai, Hong Kong

Chan, Lo
Hong Kong, Hong Kong

Chan, Ka Yiu
Tuen Mun, Hong Kong

Chan, Wing Ho Joe
Kennedy Town, Hong Kong

Chan, Siu Keung
Kowloon Bay, Hong Kong

Chen, Jingyi
London, United Kingdom

Cheng, Chun Ting
Hong Kong, Hong Kong

Cheng, Bik Nam
N.T., Hong Kong

Choi, Hiu Fung
Hong Kong, Hong Kong

Chowdhury, Eric
Caerphilly, United Kingdom

Clarke, Andrew
Carryduff, United Kingdom

Coey, Kelsey
Belfast, United Kingdom

Concannon, Paul
Prescot, United Kingdom

Cowie, Andrew
Waltham Abbey, United Kingdom

Coyne, Gavin
Maynooth, Ireland

Dady, Neil
Shrewsbury, United Kingdom

Davis, Katharine
Manchester, United Kingdom

Dawson, Ben
Leeds, United Kingdom

Dhaliwal, Jaswinder Singh
Maidenhead, United Kingdom

Duman, Tamer
London, United Kingdom

Dyment, Lewis Hadley
Tadley, United Kingdom

Elliott, Alex
Coulsdon, United Kingdom

Fan, Pat Piu
Kowloon, Hong Kong

Finn, Thomas Clive
Bristol, United Kingdom

Fung, King Tak
Wong Tai Sin, Hong Kong

Gavino, Norberto
Dubai, United Arab Emirates

Gay, Jack
Wigan, United Kingdom

Geis, Michael George
Exmouth, United Kingdom

Gillan, James
London, United Kingdom

Guest, Leslie Charles
Erith, United Kingdom

Hanna, Stephen
Hillsborough, United Kingdom

Hanson, Sophie Cathryn
Caldy, United Kingdom

Harrison, Daniel Richard
Bicester, United Kingdom

Haskell, Joshua
Penarth, United Kingdom

Hayath Mohamed, Mohamed Hinas
Fareej Abdul Aziz, Qatar

Headley, Luke
Stratford upon Avon, United Kingdom

Hemming, Ronald
Birmingham, United Kingdom

Hollywood, Thomas John
Birmingham, United Kingdom

Humphreys, Ian
Hamstreet, United Kingdom

Ismael, Islam Ramadan Abdelnaby
London, United Kingdom

Jaisi Bhattarai, Bed Prakash
Dartford, United Kingdom

Jones, Matthew
London, United Kingdom

Jucas, Tomas
Leeds, United Kingdom

Kelly, Aidan
London, United Kingdom

Kirby, James
Warwick, United Kingdom

Kotze, Willem
Dublin, Ireland

Kountouriotis, Antonios
London, United Kingdom

Kum, Ka Him
Hong Kong, Hong Kong

Kung, Wai Ming
Shatin, Hong Kong

Lau, Wai Lung
Lok Fu Kowloon, Hong Kong

Lau, Tsz Kin
Hong Kong, Hong Kong

Levett Lee, Ryan
Bexleyheath, United Kingdom

Li, Oscar Yi Lok
Hong Kong, Hong Kong

Lockie, Thomas
London, United Kingdom

Loney, Ryan
Dublin, Ireland

Loukas, Epameinondas
Birmingham, United Kingdom

Lovelady, Hope Victoria
Halifax, United Kingdom

MA, Chun Leung
Tin Shui Wai, Hong Kong

Makepeace, Matthew
Washington, United Kingdom

Mangar, Carlin Vivek
Rose Hill, Mauritius

Manuel, Richard
Tonbridge, United Kingdom

McFadden, Alan
London, United Kingdom

McKelvie, Laurie
Glasgow, United Kingdom

McKillop, Craig
London, United Kingdom

Merolla, Hugo
Queensland, Australia

Morgan, Richard
Bicester, United Kingdom

Ng, Woon Choon
Rotherham, United Kingdom

Ng, Shing Pan
Hong Kong, Hong Kong

Ng, Jonathan Chung Ho
London, United Kingdom

O Keeffe, Stephen
Rugeley, United Kingdom

O Sullivan, Johanna
Dublin, Ireland

Oatway, Lewis
Exeter, United Kingdom

Owen, James
Birmingham, United Kingdom

Painter, Michael
Bristol, United Kingdom

Pak, Kwan Yu
Tin Shui Wai, Hong Kong

Parrish, Craig
Stockton On Tees, United Kingdom

Paxton, Kate
Rickmansworth, United Kingdom

Pazdzior, Anna
London, United Kingdom

Peebles, Barry
Swindon, United Kingdom

Porter, Rachael
Downham Market, United Kingdom

Poultney, Anthony
London, United Kingdom

Punter, Amy Joan
London, United Kingdom

Qin, Jianbo
London, United Kingdom

Rawlinson, Steven John
Chorley, United Kingdom

Rigoni, Nicola
London, United Kingdom

Roden, Alexander Xarian
Reading, United Kingdom

Rossi, Giorgia
London, United Kingdom

Sachdeva, Benjamin James Kumar
Tower Hamlets, United Kingdom

Shah, Abdullah
Woking, United Kingdom

Shaik, Abdul Rahman
Abu Dhabi, United Arab Emirates

Shead, Neal
Leeds, United Kingdom

Shepherd, Hannah Jane
Bath, United Kingdom

Sheridan, Luke
London, United Kingdom

Shuttleworth, Samuel
Nottingham, United Kingdom

Sin, Kam Wa
Hong Kong, Hong Kong

Smith, Roger George Mepham
Surrey, United Kingdom

So, Hing Biu
Tuen Mun, Hong Kong

Southward, Paul
Manchester, United Kingdom

Spitere, Garry
Cork, Ireland

Stancliffe, Ed
Sydenham, United Kingdom

Standivan, John
Radstock, United Kingdom

Steed, Mark
York, United Kingdom

Stevens, Daniel
Newton Abbot, United Kingdom

Sumner, Jonathan Laurence
Chelmsford, United Kingdom

Szekely, Norbert Ferenc
Watford, United Kingdom

Tao, Martin Ming Lee
Kowloon, Hong Kong

Taylor, Stephen
Bishop s Stortford, United Kingdom

Taylor, James
Dublin, Ireland

Thomson, Kenneth Alexander
Blantyre, United Kingdom

Tolmatzian, Gkaro Anastas
London, United Kingdom

Tsang, Wai Bong
Sha Tin, Hong Kong

Tzinas, Nick
London, United Kingdom

Van Duivenbode, Ian Francis Anthony
Glasgow, United Kingdom

Veale, Martin
Edinburgh, United Kingdom

Waddington, Faye Alice
London, United Kingdom

Walsh, Ciaran
London, United Kingdom

Wan, Tsz Yan
Kowloon, Hong Kong

Watson, Daniel James
London, United Kingdom

Weatherall, David
Durham, United Kingdom

White, Charlotte
Oakington, United Kingdom

Wong, Tsz Tat
North Point, Hong Kong

Wong, Chiu Hung
Tai Po, Hong Kong

Wong, Wai Lam
Tseung Kwan , Hong Kong

Wong, Ka Wai
Hong Kong, Hong Kong

Wong, Wai Lok
Hong Kong, Hong Kong

Yeo, Mark
Wells, United Kingdom

ASSOCIATE

Alesbrook, Antony
Southam, United Kingdom

Bird, Dylan
Manchester, United Kingdom

Blood, Daniel
Hull, United Kingdom

Bradley, Steve
Liverpool, United Kingdom

Brown, Matthew
Walton on Thames, United Kingdom

Bruce Konuah, Adorkor
Plymouth, United Kingdom

Cox, Felix Oliver
London, United Kingdom

Croft, Arron
Birmingham, United Kingdom

Cunningham, Lance
Nottingham, United Kingdom

Dutton, John
Llantwit Major, United Kingdom

Gallimore, Chloe
Altrincham, United Kingdom

Kenny, Jack
Birmingham, United Kingdom

Kurmis, Danas
Dundonald, United Kingdom

Littler, Andrew John
Plymouth, United Kingdom

Lowes, Edward Ian Green
Darmstadt, Germany

Maxwell Swann, Jack
Nottingham, United Kingdom

Moore, Nick
Snodland, United Kingdom

Morgan, Emma
Edinburgh, United Kingdom

Morphew, Harriet
Southwater, United Kingdom

Onuma, Kalu
Manchester, United Kingdom

Parks, Ada
Chesterfield, United Kingdom

Poinoosawmy, Jason
London, United Kingdom

Szostak, Jonathan
Doncaster, United Kingdom

Tomlinson, Nathan
Warrington, United Kingdom

Williams, James Peter
Ashurst, United Kingdom

Wilson, Stephen
Essex, United Kingdom

Zhu, Yuting
Bath, United Kingdom

LICENTIATE

Boot, Nathan
Newark, United Kingdom

Cansian, Jessica
Wembley, United Kingdom

Dorey, Elliot
Southampton, United Kingdom

Fredericks, Connor
Staines Upon Thames, United Kingdom

Hayhoe, Aaron
Billericay, United Kingdom

Heffernan, Ryan
Solihull, United Kingdom

McQueen, Ben
Hadlow, United Kingdom

Moore, Mark
London, United Kingdom

Teambuild 2022 sets out to reinvent town centres

New professionals will be challenged to reimagine the town centre for a post-Covid world

This year's Teambuild challenge will be focused on town centres, with projects looking at how they might be adapted and reimagined to accommodate hybrid and remote working.

The construction industry event is due to take place from 18-20 November. It offers a unique challenge to young professionals, who must work collaboratively – and will have their abilities tested – as they solve problems with the skills that they have learned.

Key themes will include what a town centre should contain and look like in 2022 and into the future, when fixed-location working is no longer the standard. The competition will be based on a real, large-scale town centre development project.

The teams will be tasked with the design development and construction of this complex project, with intense activity and training condensed into a highly accelerated weekend. They will have to consider real-world constraints and develop ideas and solutions, and winning teams and individuals will be presented with prizes

To get involved, contact **admin@teambuilduk.com** or visit **www.teambuilduk.com**

#CIBSE125Challenges

There has been an incredible response to CIBSE President Kevin Mitchell's 125 Challenges on the themes of Celebrate, Inspire, Boost, Share and Engage.

The challenges are designed to raise the profile of building services engineers, and to be a vehicle for celebrating and demonstrating engineers' role in providing a healthy, safe and sustainable built environment. They were launched as part of CIBSE's 125 anniversary celebrations.

As well as shining a spotlight on icons within the industry, the challenges are designed to celebrate the day-to-day work of building services engineers.

See some of the contributions received from members so far at: **bit.ly/CJSep22CN4** Get involved by sharing your story on social media and tagging **@CIBSE #CIBSE125Challenges**

Why Building Safety Act will mean radical change

In April, the Building Safety Act 2022 gained Royal Assent. In July the government published two major consultations on the detailed implementation of two key parts of the act. Hywel Davies sets out what's in store as the act comes into effect

The Building Safety Act 2022 (the act) received Royal Assent in April. It creates a new regulatory regime and a new Building Safety Regulator for all building work of any kind on any building.

It also creates a more stringent regime for higher risk buildings (HRBs), [see panel Building Safety Act glossary], regulating these buildings throughout their operating life. It aims to deliver a regime that is fit for purpose and provides improved accountability, risk management and assurance of safety to those living in higher risk buildings.

The act amends the 1984 Building Act substantially, creating powers for the regulator to set new legal requirements for clients, designers and contractors when they procure, plan, manage and undertake building work ñ the dutyholders under the new regime.

They must be competent to undertake the work for which they are appointed and clients will have statutory duties to take reasonable steps to ensure that [those they appoint] are competent to perform their duties.

The act strengthens oversight and protections for residents in higher risk buildings and gives them a greater say in the management of their homes. It also introduces tougher sanctions ñ including imprisonment ñ against those who threaten their safety. The act adopts a risk based approach and requires owners of HRBs to manage their buildings better.

The Act is the enabling legislation for the biggest changes in building safety laws for at least a generation. Now we need the detailed secondary legislation ñ regulations ñ to implement the powers in the act.

These consultations address two distinct aspects of implementing the Act: design and construction of all buildings, and occupation of HRBs. The first sets out government plans to reform the building control system and procedures for all building work, and not just the more stringent regime for HRBs.

It makes significant proposals on professional competence and the new dutyholder regime, including requiring the client to appoint a principal designer and contractor. Client duties include allocation of sufficient

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

time and resource to deliver compliance with the building regulations , and appointing competent people to projects.

It describes the Gateways for design and construction of HRBs and requirements for provision of information about them in development, the Golden Thread. It sets out the system for control of building work by the new Regulator in existing HRBs undergoing refurbishment or any kind of notifiable work. This also covers work to create a higher risk building from an existing building that is not an HRB.

It is proposed that any person who, in the course or furtherance of a business, carries out any design work, or arranges for or instructs someone under their control to carry out design work, will be a designer . That is a broad scope and might be interpreted to include manufacturers who give advice on which products might be used on a project. It may be of interest to their insurers and lawyers.

The consultation on building control includes new proposals for lapsing of approvals, commencement of »

The act is the enabling legislation for the biggest changes in building safety laws for at least a generation

BUILDING SAFETY ACT GLOSSARY

Higher-risk building: Defined in section 31 of the act as a building in England at least 18m in height or at least seven storeys in height, and of a type prescribed in regulations. The current proposal is to prescribe any building with two or more dwellings in design, construction and operation and any hospital or care home in design and construction.

Building work is defined in Regulation 3 of the Building Regulations 2010 and includes the erection or extension of a building, installation, extension or material alteration of a controlled service or fitting, cavity insulation, underpinning and work relating to energy performance. Attentive readers will already be fully aware that the act applies to all building work that comes within the scope of Regulation 3.

Accountable Persons: Owners of HRBs are subject to specific obligations as Accountable Persons under the act, having an ongoing duty to assess building safety risks, specifically structural or fire-safety risks, and take all reasonable steps to prevent the occurrence or minimise the impact of a major incident.

works and transitional arrangements for moving to the new regime. Building control approval will apply to individual buildings and lapse after three years unless work is started.

Commencement will be defined in regulations and require more to be done on a building for it to be considered started, making it harder for new projects to be pushed through under the old system. Those tempted to rush ahead with an HRB before the start of the Gateways should read the second consultation.

Existing higher risk buildings

The second consultation is on the new requirements for operation and occupation of HRBs, including the new safety case regime. Anyone or an organisation that works in HRBs doing building work, design work or managing work needs to be conversant with this. Those managing higher risk buildings should be fully aware of the new regulatory regime: it will apply to them.

In particular, they should know that the new regime covers every single HRB in England, whenever built. Rushing a new HRB now may avoid the new Regulator during construction, but they may be all over the building when the owner seeks a certificate to occupy. If they do not think the building is fully compliant with the requirements, that certificate may not be forthcoming. A rush to build may prove a costly error.

The way in which all of these provisions are implemented in secondary legislation has the potential to shape the industry and the role of professionals and their professional bodies for many years to come. These regulations will have significant implications for professional practices and for contracting, manufacturing and those who own, operate, manage and maintain buildings.

It should now be glaringly obvious that significant change is coming. And for those who may say that they need more time to prepare, there is likely to be little sympathy: there has been more than five years of work since the Grenfell tragedy with a constant message that there must be serious change.

These consultations seek views on the current proposals. While the overall direction is set by the act, much detail is still being refined. This window of opportunity for constructive feedback to government to influence the new regime closes in early October. *Journal* readers are encouraged to contribute to the CIBSE response, view the consultations at **bit.ly/CJSep22HD** and send comments to **technical@cibse.org** by the end of September.

Why competency is key in fire safety

A focus on competency is essential to ensure the safe operation of smoke control systems, says **Richard Clark** of the National Fire Chiefs Council (NFCC), who is the Smoke Control Association s guest columnist this month

Where smoke control systems are specified, they play a key role in protecting the means of escape to allow occupants to evacuate and for firefighters to gain access.

Effective systems are reliant on correct specification at the design stage, proper installation, commissioning, and consistent ongoing testing and maintenance.

Central to these stages is the competence of individuals involved in the process, who need to understand the system's purpose and how it interacts with other fire safety measures.

The current system under the Regulatory Reform (Fire Safety) Order 2005 is reliant on self-compliance, with responsible persons being required to appoint competent people to maintain their systems.

However, this is where problems can arise. The probe into the New Providence Wharf building fire of May 2021 found there had been a failure to link the smoke control, fire detection, and fire door release systems correctly.

This is not the first time a fire has revealed the incorrect design or installation of the smoke control system, which was not identified either during commissioning, or by the testing and maintenance regime during occupation.

A report by Collaborative Reporting for Safer Structures UK on the *Testing of Smoke Control Systems* found that after testing systems in 50 buildings, an estimated 60-80% may have problems that prevent them from working correctly.

Following New Providence Wharf, NFCC wrote to high-rise building owners highlighting the need to test systems to confirm correct operation.

The competence of those working in this field is vital to ensure that systems are serviced and maintained correctly, and where they are found to not work, remedial measures and works are carried out to ensure the safety of occupants.

From January 2023, there will be a legal requirement for those responsible for high-rise residential buildings to check their smoke control systems monthly and report defects to fire and rescue services if they can't be rectified within 24 hours.

NFCC continues to support the Smoke Control Association (SCA) in its work to raise standards across the industry.

● **Richard Clark** is a senior fire engineer, protection policy and reform unit at the National Fire Chiefs Council

Time to accelerate net zero learning

Improving climate literacy among building services engineers is essential to meeting emissions targets, and new government short courses will help close the learning gap, says LSBU's Aaron Gillich

The target of creating a net zero world by 2050 is based on limiting climate change to 1.5 C of warming. To have any hope of achieving this, we must reduce global emissions by half in the next seven years.

The UK has laudable climate goals; however, a chorus of studies agree that we have nowhere near the level of green skills needed to make these goals a reality. This is particularly true for the built environment, where we have long struggled to deliver change quickly. Experts agree that we re likely to see the emergence of new green jobs , and a stronger infusion of climate literacy across all sectors, which should take place at every education and career level.

This presents two key challenges for the UK: scale and pace. How do we transform the way we teach and train nearly everyone ñ including those who have left formal education ñ at a pace that keeps alive the hope of a 1.5 C future?

How do we transform the way we train nearly everyone at a pace that keeps the hope of a 1.5 C future alive?

We are already seeing a range of actions and programmes that target new learners, focusing on continuing education for those already in employment. Among these is the recent announcement by the Department for Education (DfE) of a new mode of learning in higher education through Short Courses . This will be accompanied by a new student loan scheme, called a Lifelong Learning Entitlement, that people can dip into throughout their lives.

The programme aims to be nationwide by 2025, and the DfE has selected around 20 universities to run pilot courses, starting this academic year. London South Bank University (LSBU) will run four pilot courses from January to May 2023, under the theme of net zero buildings. It is recruiting the first cohorts now.

Each course consists of two standard LSBU undergraduate modules. Upon completion of these, students will be awarded a certificate, and can apply earned credits towards further study. The Short Courses make use of existing course content, which has been significantly updated to teach net zero buildings in a fresh way, informed by industry best practice.

The courses were created alongside industry partners, including the Building Services Research and Information Association (BSRIA), and the Climate Framework, both active members in the advancement of climate education in the built environment. LSBU worked with BSRIA and the Climate Framework to create a series of industry engagement workshops. Based on these workshops, four short courses were created to target urgent industry needs:

Designing net zero buildings: Many collaborators felt the demand for net zero buildings was beginning to exceed supply. This course is for people already familiar with buildings at a general level, and teaches the principles of forward looking designs that don t rely on fossil fuels.

Operating net zero buildings: It is not enough to simply design zero carbon buildings; they must be zero carbon throughout their lifetimes. This course is for facilities managers and similar roles that require an operational knowledge of buildings, with less formal education in building performance.

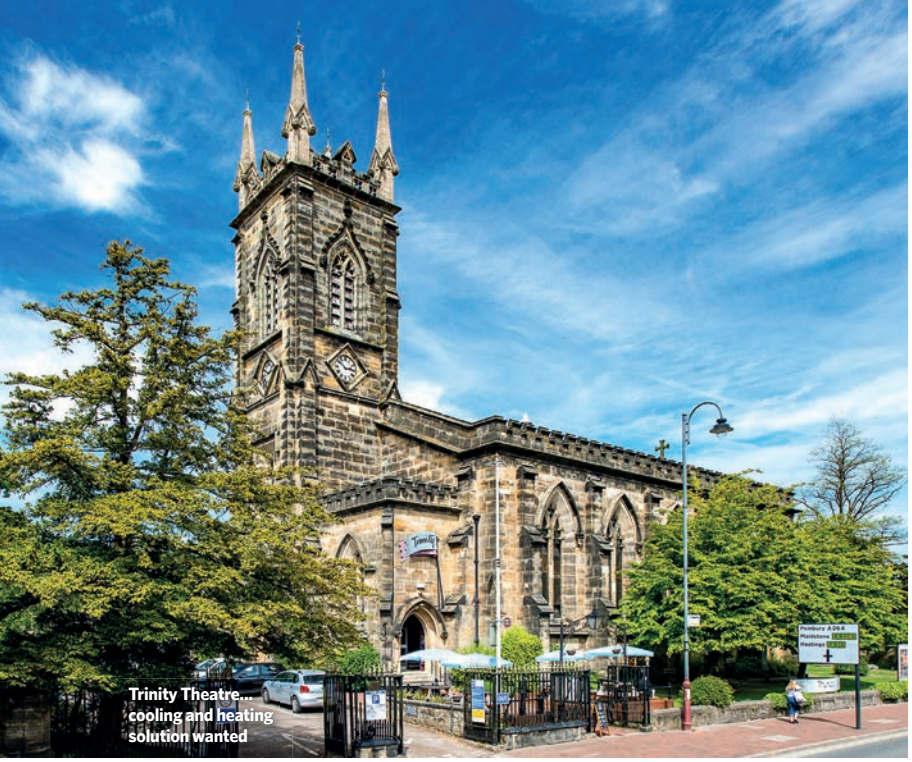
Procuring net zero buildings: This course is aimed at planners and sustainability officers, or similar, in councils or social housing. It aims to support those in decision making roles to procure and deliver more sustainable project portfolios.

Leadership and management in net zero buildings: Many industry collaborators were seeking ways to elevate promising employees to team leadership roles, with a focus on advancing net zero within their organisations. Designed to empower future leaders, this course equips learners to inspire others on their net zero journeys.

Each of these short courses has been structured to provide an optimal mix for today s net zero challenges, starting with the established fundamentals for which LSBU is renowned. The delivery mode will include in person teaching at LSBU s London campus, site visits, leading industry speakers, and flexible remote learning for parts of the semester.

LSBU is very excited for this new mode of learning to expand access to higher education, offer a flexible format for a wide range of learners, and help drive the scale and pace of the green skills developments that we need so vitally.

DR AARON GILLICH
is a professor of building decarbonisation and director of the BSRIA LSBU Net Zero Building Centre



Trinity Theatre... cooling and heating solution wanted

Building Safety Act and existing higher risk buildings, theatre appeal, and questions over heat pump rollout

Building safety for all

It is not clear (at least to me) whether the Building Safety Regime will apply to existing, residential, multi-occupancy properties. This has to be considered for central plant renewals where there are routine visits from maintenance people and consultants, such as myself. I find that access to, or escape from, plantrooms, rooftops, and so on is almost impossible.

It would be useful to know whether I, the landlord or the managing agents have any power of enforcement.
Robert Dwyer

Hywel Davies replies: The Building Safety Act establishes a new Building Safety Regulator (BSR) for England, which will oversee all building work and have responsibility for the building control profession.

The act makes the BSR the building control body for higher-risk buildings (HRBs), which are initially defined as being more than 18m in height, or seven storeys or more, with more than one residential unit, or a care home or hospital meeting the height criteria.

Part 4 of the act also establishes a new regulatory regime for higher-risk residential buildings, which the BSR will manage. So, all existing multi-residential buildings that meet the height threshold are within the scope of the act and of the new regime for HRBs in operation. Hospitals and care homes are not included in the in-use provisions of Part 4, as legislation under the Health and Social Care Act covers them.

To be clear, any building work undertaken in England falls within the remit of the new act. It will require that work be designed by a principal designer and undertaken by a principal contractor, and the client will be under a legal duty to assure themselves that those dutyholders are competent to undertake those roles. If work to a current building is classed as building work by Regulation 3 of the Building Regulations, then it comes within scope of the act. If it's in an HRB, then it also comes within scope of Part 4 of the act and the BSR is the building control body.

This is only a very brief summary of the scope and extent of coverage of the new act. CIBSE is holding a training course, *Introduction to the Building Act*, this autumn – see **bit.ly/CJSep22Let1.** Read more on the implications of the Building Safety Act on page 18.

Trinity Theatre appeal

Trinity Theatre in Tunbridge Wells is a social hub for local residents. Historically a church, it was to be demolished in the 1970s, but a strong community campaign was organised to save the 200-year old building designed by Decimus Burton. Consequently, in the 1980s, a decision was made to convert the building into a theatre, which is now run as a charity.

Unfortunately, the auditorium has no mechanical ventilation or comfort cooling, but has an antiquated heating system. The management is keen to have a new ventilation system with some form of cooling and heating, and invite interested consultants to offer a design concept for a system to suit this complex building.

We would welcome a rough estimate of the installation costs, with a quotation for the design fee. We anticipate that an M&E design engineer would want to visit the site. However, as funds are not available for this exercise, we could provide drawings of the building.

For more details call CEO Alex Green on 01892 500677 or myself on 078794 50661.
George Mercieca

A question of feasibility

The government is making the almost universal use of electric heat pumps a central part of its policy for the future of domestic heating in the UK. However, there are obstacles that this policy will struggle to overcome.

There will be a great deal of resistance from home owner-occupiers to the internal and external changes required to make homes suitable for heat pumps. Many will not tolerate the disruption or costs of such projects.

In areas of high-density housing, there is also the question of the noise that would be generated by multiple heat pumps in proximity to each other. Further, where is all this electricity coming from and how is it going to be fed into our homes?

Consequently, the greenhouse gas emissions that would result from the manufacturing and construction work required is likely to wipe out any overall saving.

The increasing use of more hydrogen blended into the existing gas network is an opportunity to make a real environmental saving at reasonable cost, with little or no disruption to people's lives.
Colin Sutherland

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GLOBAL AMBITION

Joining a CIBSE YEN Society or Region is the perfect way to network with fellow professionals and keep abreast of the latest rules and innovations. To get involved get in touch with one of the YEN chairs featured here, or contact YEN@cibse.org

Global YEN

Gemma Taylor, Global chair
Energy, carbon and performance lead, Department for Education
Why YEN? It gives my profession purpose. YEN gives me the courage to change how I want to see the world and be myself. It also enables me to pay forward the support I've received in my career.
LinkedIn:**bit.ly/CJYENGT**

Erato Vasileiou, Global vice-chair
Sustainability and net zero carbon consultant at Faithful+Gould
Why YEN? Networking, enhance my competencies, share knowledge, inspire and get inspired by great professionals.
LinkedIn: **bit.ly/CJYENEV**

Jake Lenahan, Global
Mechanical engineer at Stantec
Why YEN? Networking, expanding knowledge, and getting involved in STEM and supporting graduates
LinkedIn: **bit.ly/CJYENJL**

Immediate past chair: Rebecca Michaelsen
Patrons rep: Jennifer Cox
Educational outreach: Ruth Tatanga

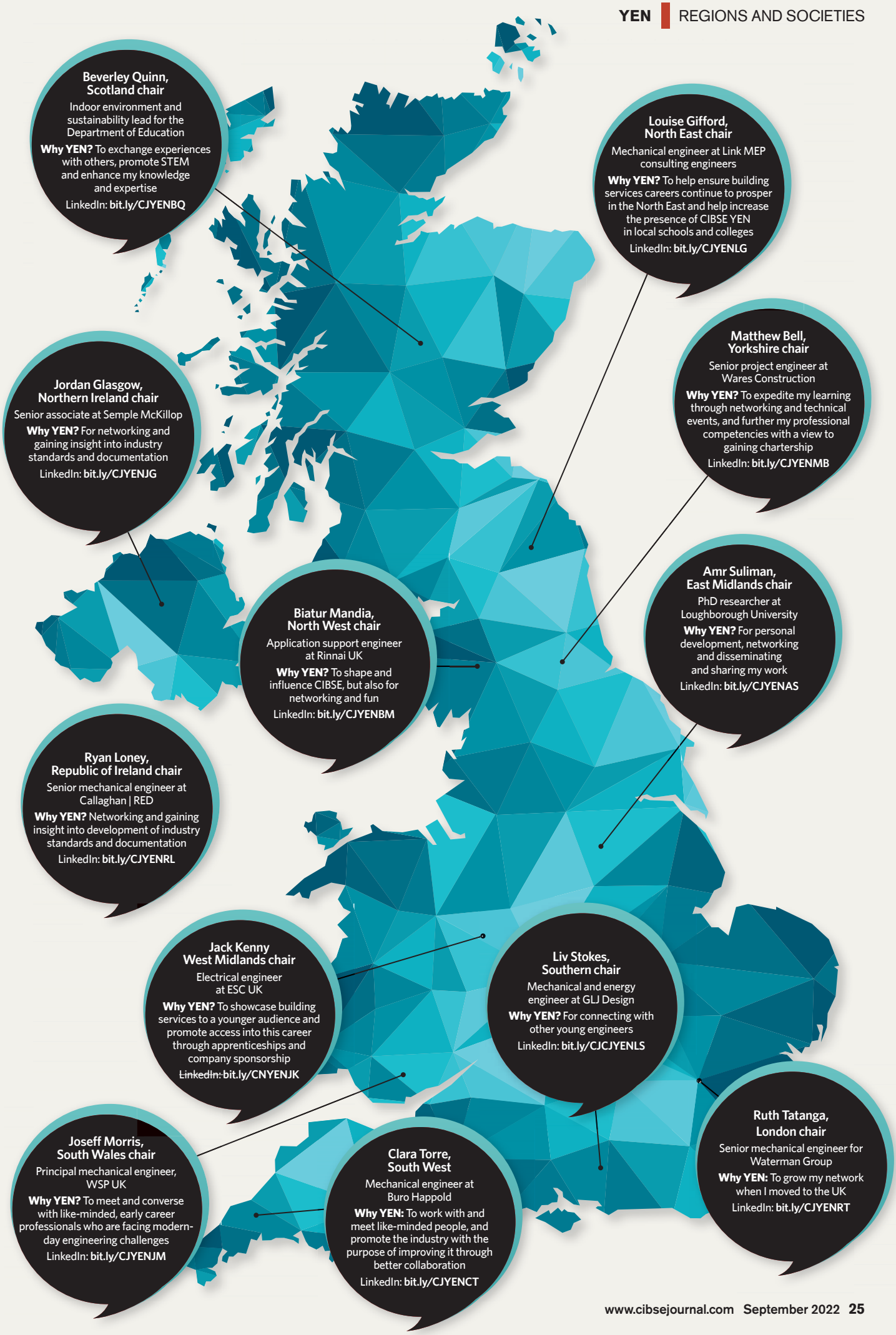
YEN Societies

YEN Society of Public Health Engineers (SoPHE)
Joe Russell, chair
Public health engineer for WSP UK
Why YEN? To further the knowledge of public health design among the YEN and higher education students.
LinkedIn: **bit.ly/CJYENJR**

YEPG – Young Energy Performance Group
Gavin Lane, YEPG chair
Energy performance consultant at Carbon Intelligence
Why YEN? To meet like-minded people, share best practice in sustainable design and building operation, and promote sustainability career paths in building services
LinkedIn: **bit.ly/CJYENGL**

YEN roles available

There are currently Global roles available for a secretary and social media coordinator as well as general roles in the regional and society committees


Beverley Quinn, Scotland chair
Indoor environment and sustainability lead for the Department of Education
Why YEN? To exchange experiences with others, promote STEM and enhance my knowledge and expertise
LinkedIn: bit.ly/CJYENBQ
Louise Gifford, North East chair
Mechanical engineer at Link MEP consulting engineers
Why YEN? To help ensure building services careers continue to prosper in the North East and help increase the presence of CIBSE YEN in local schools and colleges
LinkedIn: bit.ly/CJYENLG
Jordan Glasgow, Northern Ireland chair
Senior associate at Semple McKillop
Why YEN? For networking and gaining insight into industry standards and documentation
LinkedIn: bit.ly/CJYENJG
Matthew Bell, Yorkshire chair
Senior project engineer at Wares Construction
Why YEN? To expedite my learning through networking and technical events, and further my professional competencies with a view to gaining chartership
LinkedIn: bit.ly/CJYENMB
Biatur Mandia, North West chair
Application support engineer at Rinnai UK
Why YEN? To shape and influence CIBSE, but also for networking and fun
LinkedIn: bit.ly/CJYENBM
Amr Suliman, East Midlands chair
PhD researcher at Loughborough University
Why YEN? For personal development, networking and disseminating and sharing my work
LinkedIn: bit.ly/CJYENAS
Ryan Loney, Republic of Ireland chair
Senior mechanical engineer at Callaghan | RED
Why YEN? Networking and gaining insight into development of industry standards and documentation
LinkedIn: bit.ly/CJYENRL
Jack Kenny West Midlands chair
Electrical engineer at ESC UK
Why YEN? To showcase building services to a younger audience and promote access into this career through apprenticeships and company sponsorship
LinkedIn: bit.ly/CNYENJK
Liv Stokes, Southern chair
Mechanical and energy engineer at GLJ Design
Why YEN? For connecting with other young engineers
LinkedIn: bit.ly/CJCJYENLS
Joseff Morris, South Wales chair
Principal mechanical engineer, WSP UK
Why YEN? To meet and converse with like-minded, early career professionals who are facing modern-day engineering challenges
LinkedIn: bit.ly/CJYENJM
Clara Torre, South West
Mechanical engineer at Buro Happold
Why YEN: To work with and meet like-minded people, and promote the industry with the purpose of improving it through better collaboration
LinkedIn: bit.ly/CJYENCT
Ruth Tatanga, London chair
Senior mechanical engineer for Waterman Group
Why YEN: To grow my network when I moved to the UK
LinkedIn: bit.ly/CJYENRT

GET INVOLVED AND WORK HARD

The Presidential theme for CIBSE s 125th anniversary year is Inspire the next generation. **Erato Vasileiou** talks to CIBSE Young Engineer of the Year **Raphael Amajuoyi** about his role models, and the importance of networking and hard work in his burgeoning career

Erato Vasileiou

Where do you get your motivation to succeed? Have you had any role models?
My parents moved to the UK in the 1980s. Growing up as an immigrant child, I sometimes had to work harder than everyone else. This has been the key factor in my journey so far. It is not about being the best in your class, but about working as hard as you can. Pursuing the CIBSE Young Engineers Awards (YEA) and Ken Dale Travel Bursary, I would not have felt any less of myself if I hadn t won, because I had done the best I could.

Regarding role models, it has been a combination of my parents and the amazing people I ve worked with. Vitaliy Troyan, my line manager at Hurley Palmer Flatt (now HDR) was a big inspiration and gave me structure in my graduate role. I could ask any question without fear of being judged.

It s so important to find someone within the industry who inspires and pushes you to achieve your goals, especially in the early stages of your career. Is there anyone within CIBSE who guided you in your career?
Absolutely. Steven Matthews, the former chief executive at CIBSE ñ who I met in 2017, when I was in my undergraduate year, and who I am still in contact with ñ has been such an amazing figure.

There are many other people within the industry to whom I ve asked a very similar question: what would you advise me to do in the early stages of my career to succeed? The advice is always: Just go out there, try and experience it all, be willing to get involved with as much as possible. Some things you will enjoy, some things you won t, but you will never know if you don t try!

With regards to the CIBSE Young Engineers Network, another person who has been crucial in my journey is Ryan Rodrigues, who won CIBSE Graduate of the Year in 2015.

Was it difficult deciding whether to take part in CIBSE YEA?
Meeting Antoni Sapi a Grau, who had won the previous year s award, and discussing his journey was pivotal in my decision to apply. Realising how much work, time, dedication and determination went into it made this a challenge for me. I was working in an organisation that needs to make a profit, so I had to ensure I was still be able to deliver at work while finding extra time to prepare for the competition. I had some very long days, but it all worked out in the end.

Sounds like quite a challenge. What else did you gain from the experience?
First and foremost, the understanding that it takes hard work to achieve goals, and nothing is given for free. Whatever success may look like to you, you need to be willing to dedicate yourself to it and trust the process.

I was first to present [at the YEA] and was worried the judges may have forgotten me after the presentations that followed. However, I knew I had spent the time needed to perfect my content. I learnt that, if you put in the effort, you will reap the results at the end of the day.

I also got the opportunity to meet people within the industry. Building a professional network is one of the most important things you can do. You can be excellent at what you do, but without this network, you are limiting how you can apply yourself.

What would you advise someone who is thinking of entering the Young Engineers Awards?
Definitely go for it. We all have our strengths and weaknesses ñ try to understand and work on them in the best way possible. Some people are good presenters, and some get nervous, but that makes us who we are. It is not only about winning ñ the beauty of this experience is the journey itself.

You will pick up so many core skills to use professionally later, and the exposure to so many people in the industry ñ and the instant networking ñ is invaluable.

> Nothing is given for free. Whatever success may look like to you, you need to be willing to dedicate yourself to it and trust the process

What was it about the Ken Dale Travel Bursary that made it the next step for your career and development?
I didn t think I would apply for another competition until hearing about the Ken Dale Travel Bursary. It would give me the funds to travel and carry out research ñ too good to be true I thought!

I had noticed differences in how male and female colleagues were experiencing thermal comfort within the office. I had studied this before, but the award gave me the inspiration to research this topic further. I wanted to use the bursary to compare offices in the UK with offices around the world in different climates, and understand whether there was a similar phenomenon.

Winning the bursary was the best thing I have ever done. Being able to travel and study was an amazing experience that I will never forget.

What were the biggest challenges in organising this research, and how did you manage to overcome these?
The most obvious challenge was that I didn t know anyone in those cities, or where to start. Tackling this highlighted the importance of the people you meet. In San Fransisco, I got in touch with someone I had met at the ASHRAE Conference, and she helped me to find case studies there. With Brazil and Doha, I was able to do the same.

Another challenge was budgeting, booking flights and accommodation, and managing expenses. Thankfully, my employers gave me permission to work remotely, which was fundamental to completing my study abroad while continuing to manage work.

Do you have any top tips for keeping focused on your goals and not giving up on bad days?
One of the most important things I would say is keep knocking on the door of opportunity ñ and that applies to anyone. In 2015, I got involved in a competition to produce a report for *Property Week*. I wasn t 100% clued up on the topic and was disheartened, but it was a learning experience, and that helped me to win the CIBSE YEA a year later. With this mentality, you will figure out what it is that you enjoy doing and find out how best to apply your talents.

What are the next steps in your career?
My current role may sound far from building services, but it s not as far as you would think. My role focuses on making sure we invest our money responsibly within real estate.

That has to do with improving the performance of our assets as best we can. I m able to transfer my technical understanding of building services into the investment space. When developers start mentioning specific things to do with building services, I am able to contribute at a very high level.

The goal for my career trajectory would be to move further into responsible investment ñ an area closely linked to engineering. I think this is best suited to who I am as a person. CJ

Erato Vasileiou is sustainability and net zero carbon consultant at Faithful+Gould
The 2022 Young Engineers Awards will take place on 11 October **cibse.org/yea**

RAPHAEL AMAJUOYI'S CAREER HIGHLIGHTS

January 2022: ESG associate – UK & Ireland and Nordics, at AXA Investment Managers
2021-22: Senior sustainability consultant (associate) at Savills
2019 CIBSE Ken Dale Travel Bursary Award
2017 CIBSE ASHRAE Graduate of the Year
2015-21: Energy and sustainability development consultant
2014-15: MSc Low carbon building design and modelling, Loughborough University
2010-13: BSc architectural engineering and design management, Loughborough University

The Department for Education is exploring how it can apply platform construction principles to create an innovative retrofit solution that can decarbonise schools and colleges, and facilities in other sectors. **Andy Pearson** reports on the energy pod concept

BUNDLES OF ENERGY

With the education sector accounting for just shy of 40% of public sector emissions, the Department for Education (DfE) is keen to explore innovative ways to support the decarbonisation of the education estate.

The DfE school stock alone accounts for 25% of these emissions and is home to more than 22,000 schools that are made up of around 70,000 individual blocks, most of which are heated by gas fired boilers. Other schools not connected to the gas grid are heated using oil fired boilers, and even coal fired boilers.

One decarbonisation solution under consideration by the DfE is to develop a series of modular, off site manufactured, low or zero carbon packaged plantrooms, known as energy pods, which could be used to replace existing heating systems.

In November 2021, the then Education Secretary Nadhim Zahawi described the pods as low to zero carbon plug and play technical solutions which provide heating and hot water to existing schools .

Gemma Taylor, current YEN Global chair and engineering lead at DfE is heading up the project. She explains how the concept came about: We know from the BEIS led Public Sector Decarbonisation Scheme (launched in 2020) that the application of decarbonisation across the education sector is met with three core challenges: decarbonisation can feel daunting for a non technical audience; it is expensive; and is not the key priority for our end users.

As a government department, we are using our technical expertise in the built environment and construction to explore ways to unlock these challenges and make decarbonisation accessible for the sector.

She says the idea for energy pods came from the success of the DfE s MMC framework and builds on its GenZero research project, which looked at ultra low carbon standards for schools. If you can increase standardisation, you can aggregate and create a scale of economy, which allows you to start to reduce that price point.

The Energy Pod research and innovation project was launched at Education Estates in October 2021, and its first phase of work is under way to establish a set of concept proposals with key principles to underpin the future development of this work.

The team who have developed the thinking to date consists of Cundall s MEP team led by Ian Keeling, Mott Macdonald PM and QS team led by Rebecca Clarke, and Atkins Architectural and Structural team led by Raadiyah Rifath.

Arcadis, led by James Murphy with support from Arcadis Gen, was also appointed to develop a data analysis across the whole estate, using condition data collection (CDC) and display energy certificate (DEC) data to establish the range of loads across the portfolio. This informed the concept proposals.

Market engagement sessions are being run in October and

SCHOOL TYPES

- **Low scale intervention: a school with higher-than-average thermal loads; few energy efficiency interventions undertaken or planned.**
- **Medium scale intervention: a school with average thermal loads; some energy efficiency interventions undertaken or planned, but substantial improvements are still required.**
- **High-scale intervention: a school with lower-than-average thermal loads; significant energy efficiency interventions undertaken or planned.**

HEATING AND HEAT RECOVERY POD MODULES

- **Module A incorporates modular, low temperature hot water (LTHW) boiler as well as the primary circulating pumps. Incoming utilities, such as the gas service, will also be received in Module A.**
- **Module B incorporates primary LTHW buffer vessel as well as LTHW secondary circulating pumps, pressurisation equipment, expansion vessels, mechanical services control panel and LV distribution boards.**
- **Module C incorporates secondary LTHW buffer vessel, water source heat recovery heat pump (for low-grade internal heat gain recovery and all associated equipment such as chilled water (CHW) buffer vessel, CHW secondary circulating pumps, pressurisation equipment and expansion vessels.**

The energy pods concept provides the framework for decarbonisation, but still promotes action on energy use reduction measures

November to gather key intel from across the stakeholders, as well as identify a supplier to work alongside in developing a prototype by 2023.

To establish the pod concept, the project team used the data study to define three theoretical schools, covering three ranges of thermal loads from higher than average to lower than average. The three school types are low scale, medium scale and high scale intervention (see panel School types).

The team then set out to develop a standardised pod and plantroom concept that would work for all of these school types.

Each energy pod is assembled from a series of modules that allow plant space to be scaled as required for each school. So far, the basic module has been standardised at 3,600mm long x 2,400mm wide x 3,000mm high. This module dimension can accommodate a series of schools with varying load demands without ever being significantly oversized. The standard module is complemented by a smaller, secondary module of 2,400mm x 1,200mm x 3,000mm high ñ it would be used where the standardised module would be significantly oversized. Equipment that must remain open to the atmosphere, such as an air source heat pump (AHSP), is concealed behind pre fabricated louvre panel sections.

While the module size has been standardised, its skin has not, because the module s envelope will be selected to respond to the site context. The pod will not just be a module plonked on the school s playground, says Taylor.

We are exploring the wider benefits to society and how the pod could provide an opportunity for students to interact with it in order to educate what will be the future net zero workforce.

The team are also looking to see if the energy pods can be installed without the need for planning permission. We re looking at whether these can be installed under permitted development, says Taylor.

There are three distinct energy pod types: heating and heat recovery; domestic hot water; and electrical.

Heating and heat recovery pod

This will enable a school s existing boiler plant to be replaced with a combination of gas fired boilers and an air source heat pump. Each heating and heat recovery pod can be built from three module types (see panel Heating and heat recovery pod modules).

Ian Keeling, principal mechanical engineer at Cundall and lead MEP engineer on the project, explains: This approach allows energy pods specific to an application to be constructed from one or more of these standardised modules, with each module having a fixed function .

For example, Keeling notes that an energy pod designed for a low scale intervention school with a floor area of 1,250m² would require boilers in support of the ASHP, yet »

ELECTRICAL ENERGY PODS

- Module A incorporates the low-voltage panelboard and incoming utility supplies
- Module B is a derivative of Module A, which also incorporates photovoltaic inverters in addition to the LV panelboard.
- Module C incorporates battery storage

» would not require a system volume that would necessitate a second Low Temperature Hot Water (LTHW) buffer vessel, nor would it warrant the inclusion of a Water Source Heat Pump (WSHP) for internal heat gain recovery.

As such, the energy pod would be manufactured from Module A and Module C. In contrast, he says a high scale intervention school with a floor area of 10,000m² would not require boilers, but the higher system volumes needed would require a second LTHW buffer vessel and maybe the inclusion of a WSHP for internal heat gain recovery. This energy pod would be manufactured from Module B and Module C, says Keeling.

Domestic hot water pod

According to Keeling, there are areas in a school where a centralised domestic hot water system is required. These include kitchens and changing rooms. The centralised system is required because the modern approach of delivering hot water via local instantaneous electric systems in these areas would subject the LV network to excessive demand, says Keeling.

The standardised kitchen and changing room domestic hot water energy pod incorporates domestic hot water buffer vessels, each with an integral ASHP.

There is also a centralised domestic hot water energy pod, which incorporates LTHW buffer vessels and domestic plate heat exchangers, which feed from the LTHW system.

Electrical energy pod

Much like the heating and heat recovery energy pods, the electrical energy pods can be built from three standardised module types (see panel Electrical energy pods).

An electrical energy pod designed to deliver the low voltage supply to the school and support the inclusion of a photovoltaic array would be manufactured from Module A and Module B. Integrating battery storage capacity alongside these functions would require the inclusion of Module C.

Battery storage is not something you typically find in schools because they are not cheap bits of kit, says Keeling. However, he says their inclusion in abnormal circumstances may enable rural schools, not connected to the gas network and often heated by oil, to be decarbonised.

Where this is the case, the entire heating system must be replaced. It cannot be phased. As a consequence, the school s entire heat load will have to be delivered by the heat pump system from the outset.

It is unlikely that this school will have an incoming supply capable of delivering sufficient power, and, with it being a rural site, the chances are that upgrade costs will be substantial. The electrical design responds by allowing for an amount of electrical storage overnight, »

» he explains. This stored power could offset the cost of a low voltage supply upgrade. It could also be used to exploit cheaper overnight energy tariffs.

Using the pod and module system enables a bespoke energy pod solution to be assembled from a standardised set of components. For example, a particular school might need the heating and hot water pods but not the electrical; or the heating and electrical pods but not the hot water. There is an inherent flexibility in the design so that the energy pod can either stand alone or be integrated much like an energy centre, says Keeling.

Individual modules are designed so the plant arrangement and equipment zones within each module remain unchanged; it is only the capacity of the plant that will change depending on the loads required for a specific school. The plant too is modularised to provide a contractor with what Keeling describes as a kit of parts .

Connection between the new energy pods and existing systems will be via a plate heat exchanger. This hydraulically separates the operation of old and new systems and, most importantly, protects an expensive new plant from the sometimes contaminated contents of the existing system.

Impressively, there is a decarbonisation mechanism built into the energy pod concept.

What we ve done with the design is enable heat in the high efficiency school to be generated by an ASHP alone from day one, says Keeling. The more inefficient schools will have an ASHP sized to the net zero load, with the supporting boiler sized to the school s actual peak load .

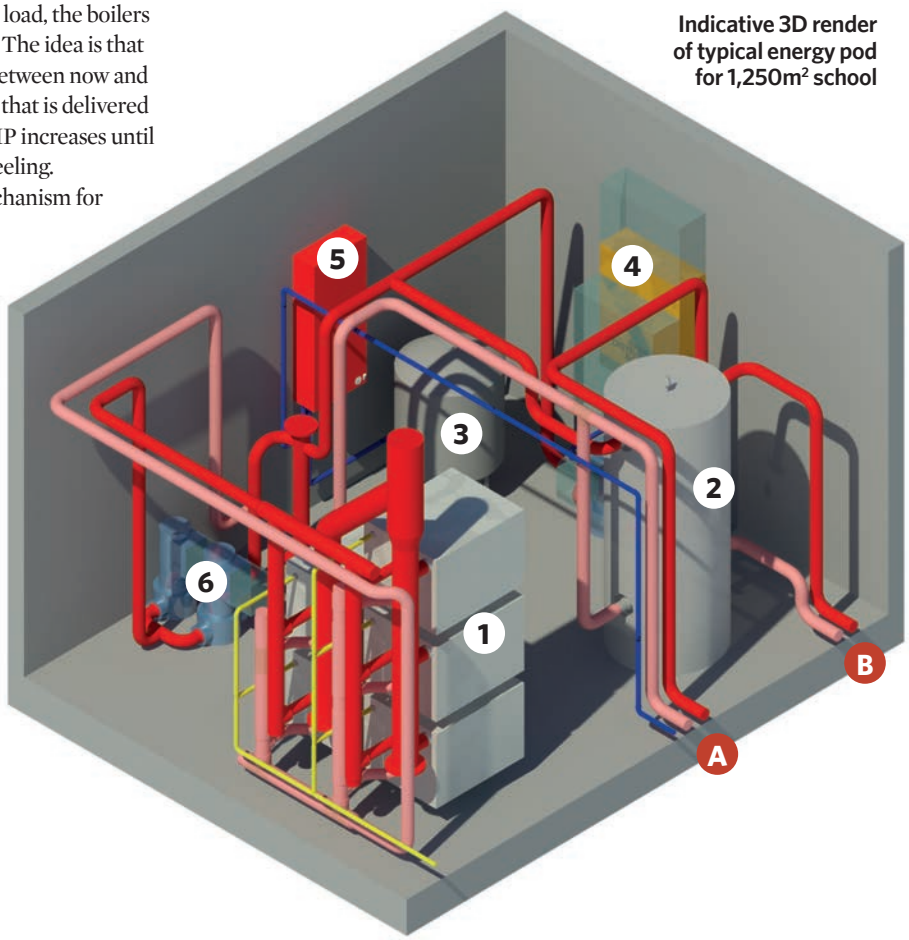
The boilers are designed to operate alone during the colder winter months. As outside temperatures increase, however, the school s heating load begins to drop. As soon as the building load is below the net zero load, the boilers turn off and the ASHP kicks into action. The idea is that as the school s energy demand reduces between now and 2050, the proportion of the heating year that is delivered purely through the operation of the ASHP increases until the boilers are no longer needed, says Keeling.

Ultimately, the aim is to provide a mechanism for schools to decarbonise without the need for any structural changes to the energy pod themselves. The schools will have to undertake energy efficiency interventions, however, such as replacing windows, as well as improving fabric efficiency and airtightness. The energy pods approach provides the framework for decarbonisation, but still promotes action on energy use reduction measures.

The conclusion of the first phase of the project will be the construction of a non working prototype pod next spring. We want lots of critical friends to tell us what needs to change and what doesn t, says the DfE s Gemma Taylor.

Once any changes have been incorporated, the aim under the next phase of the project will be to install prototypes in around five schools. Between now and 2025, we re looking to build a non working prototype, then working prototypes and ultimately to roll out this initiative across the estate as and when funding becomes available, says Taylor.

We are taking a standardised approach to ensure that the energy pod can be adapted beyond school stock if there is the appetite for other sectors to follow, says Taylor. CJ



Indicative 3D render of typical energy pod for 1,250m² school

KEY

A Incoming cold water as well as incoming/ outgoing LTHW flow and return from building

B Incoming/outgoing LTHW flow and return from air source heat pump compound

1 Boiler stack
2 Low temperature hot water buffer vessel
3 Expansion vessel
4 Control panel
5 Pressurisation unit
6 Primary circulating pumps

Large red duct rising from boiler stack is the flue

Dark red pipework is LTHW flow

Pale red pipework is LTHW return
Blue pipework is cold water feed

Yellow pipework is gas

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THE VALUE CHAIN

Blockchain is fuelling the digitisation of the built environment by providing a secure method of data exchange. IN2 Engineering s **Samreet Singh** explores how it could revolutionise the use of BIM, energy microgrids and the circular economy

Digital technology is forging ahead in various aspects of the built environment. Drones are used to map sites, digital models are creating virtual environments before the first ground is even broken, and data analytics is shaping how we design buildings for the future.

Each new technology or iteration presents vast data opportunities, so how can we ensure a secure and accessible platform by which to collate this digital revolution? The solution lies in a system known as blockchain paired currencies.

What is blockchain?

Blockchain is a shared digital ledger that records transactions. It enables the tracking and trading of virtually anything of value, as well as storing transaction related data. As new entries are made onto this digital ledger, a number of transactions are grouped together and become known as blocks. Newly formed blocks are then chained to older ones ñ hence the term blockchain.

Blockchain has been transformative in the financial sector, but it lacks the same presence in the built environment. Its implementation can bring positive developments, however, to enhance the already rapidly developing digital mediums in this sector. Some of the changes it can bring are in building information modelling (BIM), internet of things (IoT) devices, the circular economy, smart contracts, and energy microgrids.

BIM with blockchain

With the increasing use of BIM, blockchain presents opportunities to further accelerate the digital evolution in the built environment. Linking digital entities in BIM to their physical real world counterparts through blockchain has more advantages over traditional radio frequency identification (RFID) tracking.

RFID tracking can, generally, do what is possible with blockchain, but the control of data is usually by a single part and not open. Blockchain does the opposite, tracking vastly more data publicly while providing a more secure tracking base.

With blockchain, a component s life cycle can be tracked from its manufacture to installation on site. This allows the precise measurement of quantities needed, preventing needless waste from overproduction. It also enables live progress tracking for project management, to minimise delays and plan efficiently.

Plus, with blockchain, each change to the project model can be recorded with corresponding data, such as time stamps and a party responsible for the change.

When discussing BIM models, issues of intellectual property and ownership can possibly be foreseen. As multiple disciplines work on digital models, contributions will be made from each party involved. Building services engineers may contribute with air handling unit models, for example, while structural or civil engineers will have their equivalent contributions. Having blockchain tied to these BIM elements means there is undisputed ownership and unauthorised use of intellectual property is prevented. If required, ownership of such intellectual property can still be transferred.

A good example of this is **Bimchain.io** ñ it implements accountability and incentive mechanisms in BIM workflows that, according to the company, puts the BIM model at the centre of the contractual and

Nokia has enabled data and algorithms to be shared globally at more than 240 data-centre locations

legal process making stakeholders legally bound to what they publish, and limiting their liability .

It increases project efficiencies by boosting trust and transparency in the collaboration process. Bimchain has already been used on bridge projects in France.

Energy microgrids

As renewable energy production becomes more prevalent, there are scenarios where this production goes unused, known as curtailment. This can be directed back to the Grid, but what if the surplus could be sold to other nearby consumers? Energy microgrids linked with blockchain would be a good solution to this.

Linking microgrids to blockchain can open opportunities for producers to allow spot purchases of their electricity production by nearby consumers

Microgrids work as localised distribution networks for electricity, used by producers and consumers. Linking this to blockchain can open opportunities for local producers to allow spot purchases of their electricity production by nearby consumers.

For example, Brooklyn Microgrid, by LO3 Energy, is a network of New York City residents and business owners who support local solar energy production. The participants can sell excess solar energy on the mobile app marketplace and people can choose to buy local solar energy credits. After its trial phase, more than 300 local households and businesses expressed interest in the full launch, and there were already 50 generation locations, primarily using solar. Not only does it support the local economy, but it incentivises people to optimise loads for times when solar production is high, making full use of green energy and reducing emissions. A system such as this can work brilliantly in denser spaces, such as large retail centres or central districts.

The introduction of microgrids will also work well in the EU s Positive Energy Blocks (PEBs) project. A PEB is a mix of local developments that collate energy use to be net producers of energy. One of the best known implementations of this initiative is Hikari, in Lyon, France, a 12,300m² mixed use development containing apartments, shops and offices. It has local generation through solar and geothermal to provide electricity, heating and cooling. Through the use of energy optimisation and concise planning, the Hikari PEB achieved a net positive generation of 2kWh·m ² per year in the first 18 months of activity.

Using blockchain linked microgrids in such PEBs encourages better optimisation of energy use, provides the opportunity for consumers to use local renewable production, and incentivises investments in generation such as solar.

Circular economy/supply chain

As the importance of sustainability and environmental impacts grows, the circular economy is becoming increasingly prominent. The main premise of the circular economy is to prevent the one time only use of products. It encourages the recycling and reuse of materials and products, from production, manufacturing, and post initial consumption. For the circular economy to function efficiently, there needs to be a platform for all parties »

» involved to access relevant data through the internet. Linking blockchain to materials or products allows reliable, effective and transparent tracking of the entity throughout its life cycle.

Engineers can view data related to the life cycle of a product, and have better information about a building s life cycle analysis, carbon footprint, and use of newly obtained raw materials.

The concept of buildings as material banks (BAMB) is a circular one. The BAMB project, funded by the European Union, emphasises this, and instead of materials used in buildings being directed as waste after its life cycle, BAMB encourages reuse of these resources. This reduction in waste leads to fewer virgin resources being used, lowering the environmental costs and, in the current situation, alleviating risks of resource scarcity.

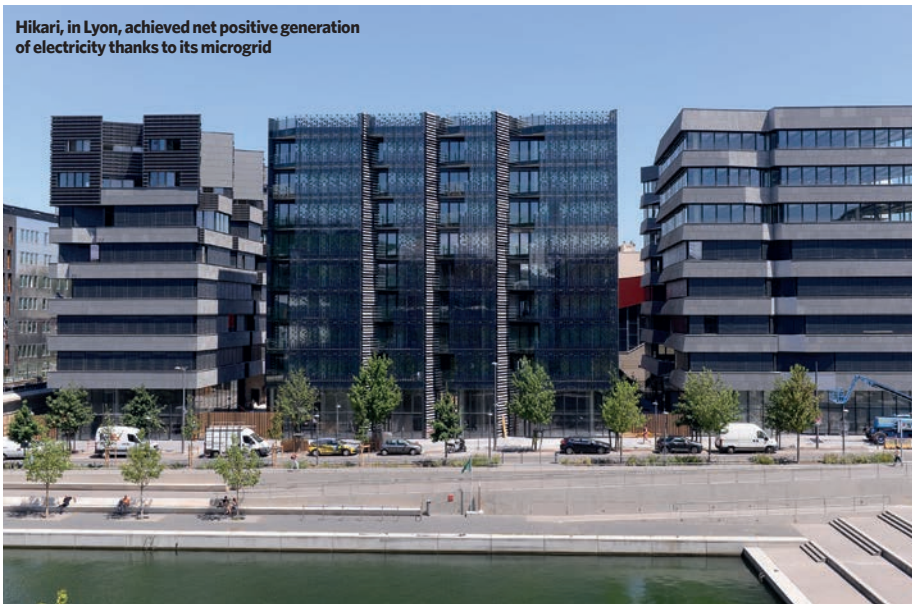
Having blockchain as a base platform enables BAMB to function properly. Material lifespans can be viewed to see how long something has been in operation; its production source can be looked at to see the ethics of its manufacture, and previous refurbishments examined to gauge its integrity and physical condition ñ plus an array of other data.

The IoT and blockchain

The IoT generally refers to the network of devices that can connect to a wider network, such as the internet, and exchange data. With IoT devices becoming popular, they can allow significant performance enhancements in the built environment, from smart buildings to city wide infrastructure management.

On a smaller scale, IoT devices integrated with blockchain can enable things such as a fixed track record of parts or systems in the building. Blockchain data can be viewed by relevant parties, and may contain data on the expected remaining operation lifespan of components.

On a larger scale, IoT and blockchain can transform the way we interact and manage city infrastructures. Transportation, water resources, energy and residents can all benefit from IoT. Commuters can pay for public transportation with smart devices rather than with cards or cash; and public infrastructure can be maintained or



Hikari, in Lyon, achieved net positive generation of electricity thanks to its microgrid

newly built with fully transparent data for anyone to look at, ensuring no misused funds. There are many uses of blockchain and IoT that can assist towards an evolving digital future.

Nokia delved into this sector by launching the Nokia Data Marketplace in 2021. This sets out to provide a blockchain framework to enable secure and trusted exchanges of data.

According to Nokia, the data marketplace has been used with Equinix data centres to allow organisations to securely share data and algorithms globally at more than 240 locations. This provided insight that even large data producers and consumers, such as artificial intelligence or machine learning devices, can use blockchain.

Nokia describes the platform as being used for predictive maintenance of equipment, supply chain automation, predictive traffic management, data exchange between government agencies, and environmental data monetisation in agriculture.

While blockchain may be nascent in the construction industry, it clearly has many applications, with some pioneering companies already taking advantage of the technology.

If you have seen examples of blockchain in building services, please let *CIBSE Journal* know at **editor@cibsejournal.com**. CJ

SAMREET SINGH is an environmental engineer at IN2 Engineering

Step in the right direction

With 23 million homes still using gas boilers, Liv Stokes argues that hybrid systems featuring heat pumps and top-up gas boilers could provide a stepping stone for the decarbonisation of heat

The route to the decarbonisation of heat remains uncertain. The Future Homes Standard, which will ban gas boilers in new builds from 2025, is looming.

Many developers are looking to heat networks and heat pumps to replace gas, but what should be done about the 23 million where gas boilers are still being used? Hydrogen is currently being trialled but its feasibility and relevance in decarbonising heat won t be known for years.

Hybrid heat pump systems may enable existing homes to decarbonise in the short term. These systems have an air or ground source heat pump working with another heating source such as a gas or LPG boiler or immersion. Heat pumps are installed to work alongside the existing heat source, or both systems can be installed simultaneously.

Hybrids typically use the heat pump at higher ambient temperatures and the boiler below a certain ambient temperature, optimising efficiency and minimising energy cost. Domestic hybrids don t require a hot water cylinder, as the gas boiler will usually provide hot water. However, if a cylinder is included with an appropriately sized coil, it enables the heat pump to contribute to delivery of hot water.

Hybrids are included in the National Grid s Future Energy Scenarios 2022 (ASHP + Hydrogen boiler), and were in the Renewable Heat Incentive, but are not in the recently introduced Boiler Upgrade Scheme. This suggests the government does not consider hybrids to be a low carbon heating technology and it is uncertain what support will be given in the future.

The electricity Grid upgrades needed for widespread deployment of heat pumps poses a challenge. However, hybrids have smaller heat pump units with lower peak power demands than standalone heat pumps and could be rolled out without major Grid upgrades.

If used with smart controls, hybrid systems could help the National Grid balance supply and demand by using renewable electricity when available.

Hybrids are not the only option for flexibility. Standalone heat pumps ñ for example, ground source with thermal storage ñ coupled with smart controls, remote grid balancing, and time of use tariffs may also assist the National Grid by turning on when there is excess generation and turning off when the Grid is under strain.

UK desperately needs a national retrofit strategy that addresses poor insulation and widespread use of fossil fuels

Currently, hybrids don t present a long term solution for decarbonisation because of the carbon emissions from the gas boiler. However, if the UK had contributions from hydrogen, hybrids have long term potential.

Compared with standalone heat pumps, hybrids are easier to install. They avoid the cost and disruption of changing radiators or improving building fabric through insulation or window upgrades if these are undesired or challenging. Hybrids work with or without a hot water cylinder, offering additional convenience and choice to homeowners.

Poorly insulated homes have greater heat loads, requiring higher operating temperatures meaning the heat pump runs less efficiently. Considering the urgency of the climate emergency, efficiency is arguably less crucial if utilising renewable electricity.

However, given the UK s poor levels of insulation, adopting hybrids shouldn t be at the expense of improving the energy efficiency of homes. More insulation will drive down heating demand, cut the size and cost of equipment, optimise system efficiency, and minimise the gas needed on cold days. .

The future costs for installing a hybrid in individual dwellings are uncertain, as they are not currently included in the Boiler Upgrade Scheme. However, hybrids (GSHP + electric; ASHP + electric; GSHP + gas; or ASHP + gas) ñ if used with carbon offset payments ñ could be the most cost effective option for decarbonising heat networks, compared to standalone heat pumps[1].

Hybrids need additional maintenance expertise and yearly service regimes. Renting a heating system, as opposed to purchasing ñ for example, through BeWarm s rent a boiler scheme ñ could make hybrids more accessible and affordable, with maintenance and service costs factored into customers bills.

Hybrids aren t a perfect solution but, with correct support, they could quickly contribute to the decarbonisation of the 23 million homes currently on gas.

Regardless of what the decarbonisation of heat entails, the UK desperately needs a national retrofit strategy addressing poor insulation and widespread use of fossil fuels in existing buildings to meet 2050 net zero carbon targets.

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LIV STOKES
Mechanical and sustainability engineer at GLJ Design Services

CIBSE Journal editor Alex Smith (centre), with (from left) Dr Liora Malki-Epshtein; Ted Pilbeam, Hern Yau, James Morris, Alasdair Donn and Neil Pennell

VENTILATING FOR NET ZERO

In the post pandemic environment, balancing effective ventilation and energy efficiency is a prime challenge for engineers. At the latest *CIBSE Journal* roundtable, industry experts aired their opinions on how best to optimise design to achieve comfort and net zero carbon building emissions. **Amanda Birch** reports

As the UK sweltered in July's record breaking heatwave, it was an appropriate time to discuss the challenges of ventilating buildings in a post pandemic world. At a *CIBSE Journal* roundtable, sponsored by Mitsubishi Electric, contractors, consultants, housebuilders and academics discussed how energy efficient, effective ventilation strategies could be achieved.

The participants looked at the impact of the recent changes to the Building Regulations, covering energy performance (Part L), ventilation (Part F) and overheating (the new Part O). They also explored how designs are changing to comply with the Future Homes Standard regulations on the path to net zero 2025.

Those around the table all agreed that the recent changes to the regulations were not far reaching enough and that many in the industry were already working towards more ambitious targets.

Part L hasn't pushed far enough in the right direction, said Alasdair Donn, head of building performance at Willmott Dixon. The fear of introducing regulations that make MVHR [mechanical ventilation with heat recovery], particularly in homes, the right thing to do is a shame. The better solution would be to incentivise MVHR and make sure it's applied in a good, high quality way.

James Morris, project principal at Mott MacDonald, agreed that the regulations could have gone further to reward people who apply MVHR systems in buildings. He added that there was a disconnect between Part L and Part F. Part L asks for airtight buildings, while Part F asks for windows to have trickle vents.

Morris suggested that the next step in the regulations should be to close this loophole and promote the heat recovery route, which should provide continuous fresh air in winter and reduce heat loss.

Being cognisant of the Building Regulations is a given, said Neil Pennell, head of design, innovation, and property solutions at Landsec. We set our own targets with regards to positioning ourselves, as a business, to be net zero carbon by 2030, he said. That's challenging us to think beyond the Building Regulations and how we assess the designs of our buildings going forward.

For Landsec, Pennell added, it was more of a priority to improve the performance of existing properties. We have established a fund of £135m to reinvest into that existing property portfolio, to help it move towards meeting the

goal of net zero carbon, he said, adding that sophisticated analysis around operational performance is becoming more important. He predicted that there will be a greater focus on facilities management and a need to maintain a building s performance throughout its life.

Ted Pilbeam, building services and sustainability director at Volker Fitzpatrick, agreed that there is too much focus on specification and delivery at the front end of a project. Many overlook the fact that 70% of the cost and energy is expended through the life cycle of a building.

He said that the newly updated *Commissioning Code M*, a CIBSE guidance document in which he was involved as chair of the steering group, is an important step towards ensuring buildings operate as intended. The Code emphasises the need for post occupancy evaluation and regular checks and tweaks of systems, to ensure that buildings perform better than originally intended. Pilbeam added that he is disappointed that the updated Part F doesn t consider buildings in use.

Ventilation is very much the forgotten art of building services, he said. However, one positive outcome of Covid 19 is that it has raised its profile.

Covid highlighted people s lack of understanding around ventilation and the need for better education on the topic, said Pilbeam. Examples were cited during the pandemic of poor management and energy inefficiency in schools, where windows were opened during winter to ventilate classrooms while, at the same time, rooms were being heated. The recently updated Part F could have addressed some of the challenges of winter ventilation, said Morris.

Pennell added that, for existing buildings to perform more efficiently, ventilation products in buildings should be more visible and incorporate better controls.

Hern Yau, product manager for ventilation at Mitsubishi Electric, said that the company looks five years ahead when designing products and always strives to make them as energy efficient as possible.

Mitsubishi Electric is currently developing a cloud based platform that will monitor a building s HVAC systems. Sensors could record the indoor air quality, pre empting any changes in operation and providing the occupant with a snapshot of the ventilation system s performance.

Pennell said this new system sounded useful, but stressed that, from a ventilation perspective, it is critical that the system in a building is designed to work effectively and is maintained in that condition throughout its life. »

TESTING VENTILATION SCENARIOS

UCL's new Dagenham research facility will have two ventilation systems, according to Ted Pilbeam, whose company is building the test centre. This will allow UCL's Dr Liora Malki-Epshtein the flexibility to build whatever she wants to test indoor air quality and recreate whatever external environment is required via a second ventilation system.

'In an experimental space such as this, we will have control, and can test different scenarios that come up often or that are already identified as a problem,' said Malki-Epshtein. 'We can then use that data to validate energy and thermal models and, because of the 9m tall space, we can look at buoyancy-driven flows. The facility will be available for hire by industry to test specific solutions.'

"The starting point should always be to get the ventilation system engineered correctly first; good ventilation systems should help dilute any contamination in the air
Liora Malki Epshtein, UCL

» If the controls are providing all this data, and it s indicating that it s not very good, there s nothing that can be done about it, said Pennell. But the data may allow energy to be saved by cutting back ventilation where it s not needed, as long as the control points are responsive enough to allow for this.

Donn thought the Mitsubishi Electric cloud based system would have a real benefit for residential performance where the indoor air quality is important, especially now that more people are working from home.

Having feedback from the equipment is really valuable, because that currently doesn t exist in homes, he said, adding that it was especially important because heat pump and ventilation systems had to ensure there is an optimal balance between good ventilation, comfort and energy efficiency. We must make sure they work well. Given that the kit is more sophisticated, it is very important that we get it right.

Dr Liora Malki Epshtein, associate professor of urban fluid mechanics and air quality at University College London (UCL), summarised her area of research and explained that, over the past two years, during the pandemic, she has been carrying out government funded CO_2 monitoring.

Her team monitored up to 70 live events in 10 venues, including the O2, Wembley Stadium and Ascot racecourse. They found that understanding how users occupied the spaces was key, because people come and go, each live event having its own rhythm.

When designing a space, it s important to understand the peak times of crowding in a certain area, Malki Epshtein added. This will influence when the ventilation system comes into play, or when the room should be evacuated and flushed out.

These findings were communicated weekly to the Scientific Advisory Group for Emergencies (Sage). Part of Malki Epshtein s remit is to develop design guidelines and have discussions with CIBSE, and other groups, based on their results.

To research overheating and air quality, indoors and outdoors, can be very time consuming, she said, which is why UCL is building a large experimental space at its Dagenham outpost campus (see panel Testing ventilation scenarios .)

The participants agreed that, when the experimental facility is complete, it will be a great asset, enabling engineers and others to test and fully understand how to get ventilation right. Malki Epshtein confirmed that it could possibly be used to test air cleaning technologies. However, even though air cleaning devices are often discussed for use in buildings, particularly offices, they are often seen as a sticking plaster solution, and the participants considered that they would benefit from further research.

Ventilation is the forgotten art of building services. However, one positive outcome of Covid 19 is that it has raised its profile Ted Pilbeam, Volker Fitzpatrick

The starting point should always be to get the »

Part L hasn t pushed far enough in the right direction" – Alasdair Donn, Willmott Dixon

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» ventilation system engineered correctly first; good ventilation systems should help remove any contamination in the air, said Malki Epshtein.

Malki Epshtein s research revealed hotspots in buildings where CO_2 accumulated. Ideally, in those situations, the amount of ventilation required would be quickly calculated and more air would be provided to that space, she added.

If you re wanting to achieve energy efficient buildings that provide comfort and wellbeing with better ventilation, there is a paucity of modelling tools that can tell you, in the commissioning stage, what the impact of those decisions will be.

Morris said that modellers can help, because the models are increasingly integrated into building design. Every building and space is used differently, and you need to make sure, at the design stage, that a system is adaptable. However, a lot of buildings haven t been built to be adaptable, he added.

Hospitals are a good example of this, where a lot of strain is put on systems and money is wasted. But there is now guidance relating to hospitals that moves towards an adaptable system that enables delivery of a fit out in a more cost effective way.

The discussion then returned to the issue of overheating and the new Part O. Malki Epshtein maintained that, in urban environments, overheating will only get worse, leading to an increase in air conditioning systems and high energy use.

Donn said the effect of Part O on new residential buildings is important, because it has brought in good practice on preventing overheating in homes in an otherwise unregulated area.

But the challenge will be in urban high rise flats, where the right balance of ventilation, energy consumption and cost of ownership will have to be achieved, he added. Manufacturers are looking at solutions here, but sometimes at the cost of more sophisticated equipment, he added.

Part of the challenge is that homeowners don t yet have the confidence to look after their complicated kit, or know who to call if something goes wrong, said Yau. The goal is reliability and awareness. When people buy a house or flat, they generally want to know how many bedrooms it has, not whether it has MVHR.

> When people buy a house, they generally want to know how many bedrooms it has, not whether it has MVHR
> Hern Yau, Mitsubishi Electric

There was agreement among the participants that there is a need to re educate and train skilled professionals to help resolve current challenges. Building Regulations are important, but can t be relied upon. There s some unbelievable expertise in this country, but we need to get this out quickly and in good form, said Pilbeam.

This is where building services engineers must come to the fore, because the profession embodies much of what is going on. CJ

> Every building and space is used differently, and you need to make sure, at the design stage, that a system is adaptable
> James Morris, Mott MacDonald

> "We have established a fund of £135m to reinvest in that existing property portfolio to help it move towards meeting the goal of net zero carbon
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Healthy outlook

Healthy indoor environments are a key feature of the new generation of post-pandemic offices being designed to entice employees back to the workplace.

After Covid, we all understand the risks of working in poor quality environments and, as a result, the once-niche Well Building Standard is now becoming a standard requirement among clients.

In our health and wellbeing special, we feature two new offices with Well certification: the shell and core Bloom Clerkenwell, and a fit-out project in Edinburgh for Pinsent Masons. The legal firm is already benefiting from its new offices and says occupancy has risen 10-15%. As a result, it is likely to go for Well Certification in any UK office to which it relocates.

Technology can play an important part in creating healthy spaces. Research by Dr Elizabeth Cooper and Dr Yan Wang has suggested integrating automated windows with home air purifiers to ensure a consistent healthy environment. The study also looked at the impact of poor air quality on health and found that by implementing smart air cleaning technology life expectancy could potentially be increased by six months.

Alex Smith, editor of *CIBSE Journal*

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Lighting up the workplace

I'm sure you will agree that unless you are a gardener or a marine biologist, most time during our week is spent indoors. Therefore, buildings need to play a vital role in keeping us healthy.

The workplace wellbeing agenda is growing. When you consider how the pandemic has dramatically changed the working landscape, from WFH to hybrid working, businesses have been left with little choice but to adapt.

Encouraging figures from the International Well Building Institute (IWBI) suggest firms are responding, with more than 4bn ft^2 of spaces using the Well standard around the world.

The IWBI figures highlight the extent to which business leaders have embraced healthy building design to create positive environments that support the health and wellbeing of those who use them.

Take the modern office for example. It now needs to be attractive, comfortable, and adaptive for a more demanding workforce. The power of lighting is becoming more and more evident, with some surveys suggesting that up to 80% of employees believe good lighting is one of the most important aspects in the workspace.

With increased value being placed on workplace wellbeing and sustainability, is now the time to recognise the importance of lighting when starting a building design?

DEBBIE-SUE FARRELL, head of wellbeing and manager of marketing at Tamlite Lighting

Elta partners with Airthings to offer remote monitoring

Ventilation company Elta Group is to offer air monitoring solutions following a partnership agreement with sensor technology company Airthings.

Elta says the collaboration will allow customers to monitor air quality and identify what ventilation strategies are necessary to ensure a healthy indoor environment.

Airthings sensors can measure radon, CO_2, relative humidity, and PM2.5, and send all data via a central hub to the cloud, after which a detailed dashboard is created.

As a result of the partnership, Elta intends to take a more advisory role in the monitoring of air quality and consequent ventilation strategies.

It said the business recently received one of the UK's first Reset Air Certificates at its head office in the Midlands. In achieving the accreditation, the company decreased its peak CO_2 levels by 33%.

Reset Air Certification requires that air quality is continuously monitored throughout the lifetime of the project.

Vent Axia launches mechanical extract ventilation

Vent-Axia has launched the Lo-Carbon NBR dMEV C, a decentralised mechanical extract ventilation (dMEV) unit that is designed to meet Building Regulations and provide improved air quality efficiently.

The system has been tested to the new SAP 10 performance requirement and is listed in the Product Characteristics Database with specific fan power (SFP) values as low as 0.08 w/l/s, sound tested as low as 7.4 dB (a whisper is around 30dB).

Vent-Axia says low SFP and sound power levels are achieved through an air pathway design that promotes turbulent airflow, allowing for a predictable performance curve. It says high pressure development and the silent mixed flow impeller allows the Lo-Carbon dMEV C to meet the requirements of many domestic installations without the need to use a centrifugal fan.

STRICT COVID RULES IMPROVED AIR QUALITY, STUDY SHOWS

Cities with more stringent Covid-19 restrictions were more likely to have better air quality during the pandemic, according to a new study.

The research was led by Heresh Amini, a fellow of the Cyprus Harvard Endowment Programme for the Environment and Public Health. Researchers analysed 1,851 cities in 149 countries and found that NO_2 levels decreased by 5% in cities that implemented the strictest Covid-19 containment policies.

Pollution did not change significantly in cities with moderate Covid-19 policies.

Last opportunity to enter 2023 CIBSE awards

New categories created for products and innovations this year

Entries for the 2023 CIBSE Building Performance Awards held in March close on 14 September.

Entries are invited for products or innovations introduced or launched from 1 September 2019 to 31 August 2022.

There are three categories associated with health and wellbeing: thermal comfort, wellbeing, and air quality.

The 2022 winners were: Knauf Insulation & Knauf Energy Solutions for thermal comfort; Water Kinetics – Eco-Duo for wellbeing; and Signify UV-C Upper Air Disinfection Luminaires for air quality (see page 56).

There are also new categories introduced this year, for Building Safety and two for Embodied Carbon.

The winners will be announced at Park Plaza Westminster Bridge, London, on Wednesday, 1 March 2023.

CIBSE-accredited CPD courses cover UV-C and biophilic design

Lighting company Signify has announced five new CIBSE-accredited CPD courses.

They include a training webinar on UV-C for disinfection, which looks at how managers and installers can ensure safe use of the technology. It also focuses on how it works, the research conducted to date, the benefits, and applications to help keep air and surfaces free from viruses and bacteria.

Another new webinar is by Harvard Professor Edward Nardell on why UV air disinfection is essential from a medical perspective.

There is also a course on biophilic design, which incorporates natural light indoors. The CPD course also covers the core principles and 14 patterns of biophilic design.

All courses last an hour and are available on the Signify Lighting Academy. The other two CPDs are on Connected Lighting and an introduction to LiFi called Trulifi by Signify.

Shades of grey

Claims that lighting contributes to improved wellbeing should be treated with caution, says Dr Peter Boyce, as non-visual factors can affect mood

It is frequently claimed that appropriate lighting can improve the wellbeing of people and change their mood. These claims should be treated with caution ñ not because such effects do not occur, but because such effects are matters of probability rather than certainty.

Three factors contribute to the uncertainty. The first is simply a matter of definition. The *Oxford Dictionary* defines wellbeing as being healthy, happy or prosperous. This definition is so wide as to be useless for the identification of lighting effects. There is hardly any aspect of life that cannot contribute to an individual's wellbeing, positively or negatively.

With such a capacious definition, it would be a miracle if the visual environment could not be shown to affect wellbeing, so something more specific is required to be sure of any claimed effect. Mood is somewhat more closely defined as the way you are feeling at a particular time. This implies mood is a transient state of human emotion. Lighting can certainly influence mood.

The definition of wellbeing is so wide as to be useless for the identification of lighting effects

The second factor is the possibility of interference from aspects of life other than the visual environment. For example, a restaurant that is attractively lit for a romantic evening will not contribute to a positive mood if the couple cannot hear each other's endearments. And it is not just the physical environment that matters; there is also the influence of human interaction.

Entering a room filled with people one dislikes is likely to darken one's mood, regardless of the way the room is lit. Mood is inherently easily altered. About the only situation when lighting can reliably change mood is when it causes visual discomfort. Then the salience of lighting increases and the probability of a negative effect on mood increases.

However, very few lighting designers set out to cause visual discomfort. Claims of lighting's beneficial effects on mood are generally framed in positive terms and it is these positive effects that are subject to interference.

The third factor is the duration of the effect. The positive impact of lighting on mood is likely to be greatest for people unfamiliar with the installation ñ but for how long will that effect be sustained? Familiarity is likely to reduce the impact of the lighting on mood without any interference from other factors.

Therefore, when considering claims of lighting enhancing wellbeing and mood, it is necessary to ask a number of questions. What is meant by wellbeing? What facets of mood are desired? Was mood only affected by the lighting in closely controlled laboratory conditions? How likely are these to occur in the real world? How will the lit space be used? Will people be familiar with the space? And so on.

The further the outcome is from the operation of the visual system, the more likely it is that other non visual factors will interfere ñ or, to paraphrase the poet John Clare, the closer to the fountain, the purer runs the stream.

This article first appeared in *Lighting, Research and Technology* journal, published by SLL, on 18 January 2022, bit.ly/CJSep22PB

DR PETER BOYCE is an independent higher education professional

The peak of health

To tempt workers back to the office, developers have to deliver healthy workplaces that score highly on sustainability and smart technology. Andy Pearson looks at post pandemic office design at Bloom Clerkenwell

As far as building certifications go, Bloom Clerkenwell has pretty much got the lot. This brand new office was certified Well Platinum (shell & core) in June 2022, Breeam Outstanding in May 2022, and WiredScore Platinum in 2019. According to its developer, HB Reavis, it is the first commercial building in the UK to achieve the top level in all three certifications.

Bloom Clerkenwell's accreditations appear to exemplify what the post-pandemic office building is about: workspaces that prioritise wellbeing; high levels of sustainability; and enhanced user experience through technology and services.

The building set out to meet these targets from the start, which is an impressive achievement and one that shows acute foresight on the part of the developer, particularly given that the building was designed before the pandemic.

'The client had bought into those targets when we were first involved with the project in 2018, and they had a significant influence on the approach and criteria for our MEP design,' says Lee Hargreaves, associate director at Buro Happold, the project's MEP and structural engineer.

The seven-storey, 18,000m^2 building is mostly offices, with some retail at ground level. Designed by John Robertson Architects, its façades feature a regular grid of rectangular glazing, which is given added impact on its Cowcross Street elevation by a bright-red, four-storey projection.

Above the projection, floors four, six and seven have private terraces, providing external workspaces. There is also a communal terrace, accessible to all, on level seven. Below ground, the single-storey basement features a gym, cycle storage, and changing and shower facilities. The basement also incorporates some plant and tank space, although space is limited because the building sits directly over London's Farringdon Elizabeth Line station.

In response to its over-station location, the building has been designed with a relatively light structure of steel columns supporting castellated beams, through which the building services had to be threaded.

'We made extensive use of BIM throughout this project, which facilitated precise coordination across the project teams – it has a generous floor-to-floor height, helped by the integration of services within the structural zone,' Hargreaves explains.

Occupants enter the building through a ground-floor entrance; the first floor is split into two fully fitted-out Category B offices, while floors two to seven have a Category A, shell and core fit-out.

'The most challenging Well requirement was to deliver the circa 30% enhanced fresh air rate, because that required additional coordination, more space for the


The basement-level fitness room

ductwork and larger air supply equipment,' says Hargreaves.

Six roof-mounted air handling units (AHUs) supply the enhanced air volume to, and extract air from, all the office floors through a series of six dedicated vertical risers located around the building's central concrete core. The AHUs incorporate heating and cooling coils and a heat-recovery system; they also have enhanced filtration to comply with Well, but do not include a mixing box because Well requires full fresh-air ventilation.

'Arranging the ducts around the core allows maximum flexibility in terms of duct and air distribution, because we were constrained by a maximum ductwork height [to enable ducts to pass through openings in the castellated beams],' explains Piotr Korwin-Piotrowski, associate director at Buro Happold. Duct branches to each floor are equipped with a variable air volume (VAV) box and attenuator to enable demand-controlled fresh air based on a CO_2 sensor on the return duct intake.

Unusually, the Category A fit-out includes ceiling-mounted air distribution ductwork, to ensure the fresh air distribution is effective, along with four-pipe fan coil units (FCUs). To keep fan loads to a minimum, and to provide tenants with maximum flexibility in terms of the location of meeting rooms and spaces, the fresh air distribution ductwork is deliberately large. This has the added benefit of keeping duct-generated noise to a minimum.

The FCUs provide heating and cooling to the office floors. Units are positioned to line up with façade modules to enable tenants to easily subdivide the floor plate into cellular offices should they wish to do so. The fresh-air supply ducts terminate at a series of diffusers across the floor plates rather than at the rear of the FCUs.

'Mid-season, this arrangement allows us to switch off the fan coil units to save energy, while still being able to distribute fresh air,' Korwin-Piotrowski explains. 'The system was fully modelled in IES to confirm its performance throughout the »

> The building set out to meet these targets from the start, which is an impressive achievement and one that shows acute foresight

SITE SUPERVISION DURING THE PANDEMIC

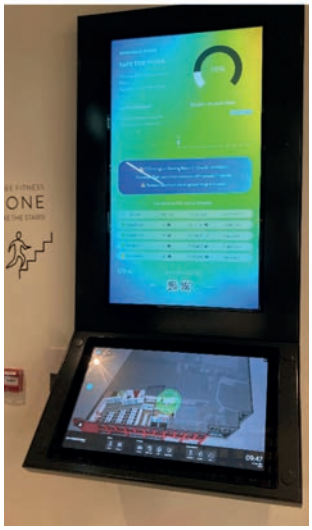
The strict travel restrictions during the coronavirus pandemic made it difficult for Buro Happold's engineers to keep up to date with daily progress on site. The solution on Bloom was remote site monitoring facilitated by the Matterport software platform, which turns physical spaces into immersive digital twins.

The software creates accurate 3D models of any space and allows engineers to go on virtual walk-throughs to see progress and spot issues.

For Piotr Korwin-Piotrowski, associate director building environments in Warsaw, remote site monitoring enabled him to keep up to speed with progress on site in London.

'Remote site monitoring is a better option than 2D pictures via email; when combined with in-person inspections, it definitely helped us do our job effectively,' he says.

Korwin-Piotrowski hopes that remote site monitoring will become standard on all jobs, to save time and money.




The building's Cowcross Street elevation with its bright-red, four-storey projection

year,' he adds. Alongside system modelling, the team undertook a comprehensive analysis of the glazing at the design stage. As a result, it has been specified with four different G-values, depending on its location and orientation, the amount of daylight it is required to admit, and the heat gains it was beneficial to allow or prevent.

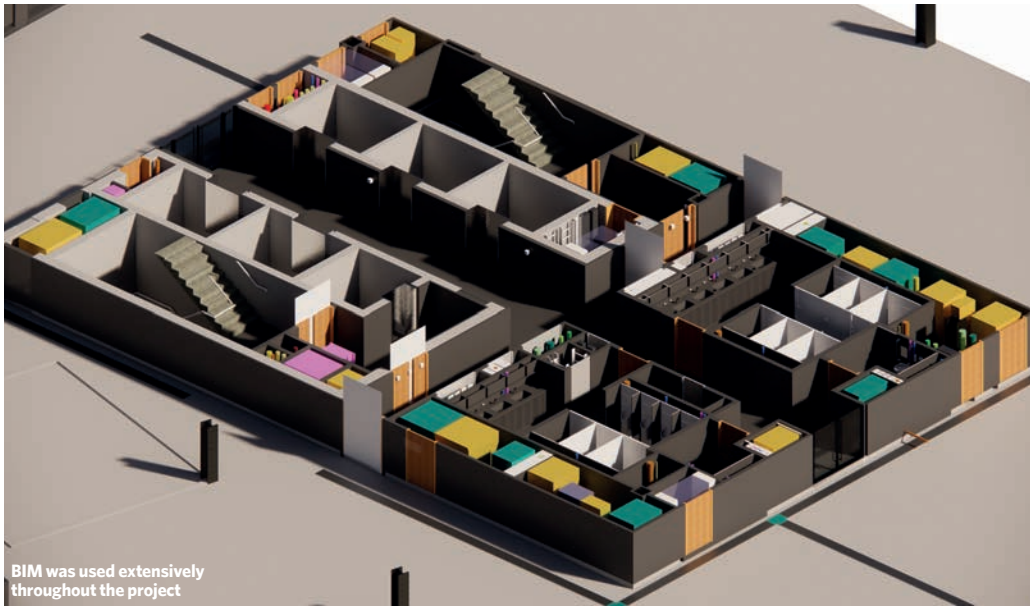
The glazing contributed to the façades' impressive thermal performance, which, when combined with the increased volume of air supplied to the floor plates, meant there was no need for additional heating or cooling at the floors' perimeter.

There is no fossil fuel heating plant in the building. Instead, heating, cooling and heat for domestic hot water is supplied from the adjacent E.On Citigen energy centre (see *CIBSE Journal*, April 2022). Connection to the energy centre was a condition of planning, but it also had benefits for the developer.

'Because heating and cooling is from Citigen, you don't need fossil fuel equipment in the building; all we need is space for heat exchangers in the basement,' says Hargreaves.

In addition to the Category A fit-out floors, Buro Happold was responsible for the design of the services to the Category B fit-out offices on Level 1. In these ready-to-work office spaces, the office community is supported by HB Reavis' smart workspace technology, as part of the building app. The technology empowers occupiers to manage their indoor working environment, with access to real-time data, such as indoor air quality and space utilisation. The app also facilitates a touch-free arrival and concierge services.

Occupants can be confident in their ability to exploit the building's smart office functions because it is certified WiredScore Platinum for telecoms, fibre, internet and digital connectivity.



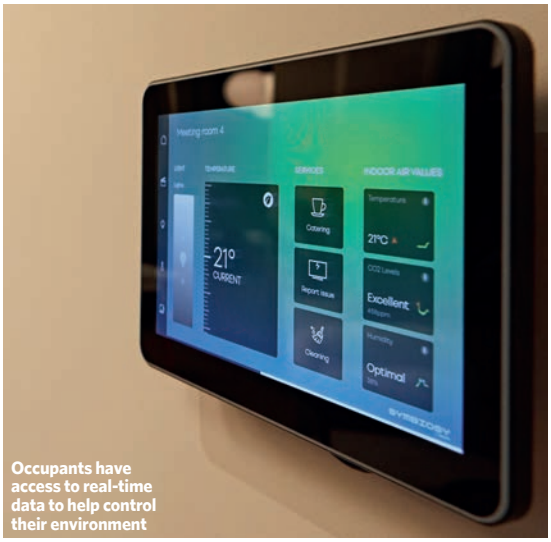
BIM was used extensively throughout the project

The smart technology empowers occupiers to manage their indoor working environment with access to real time data

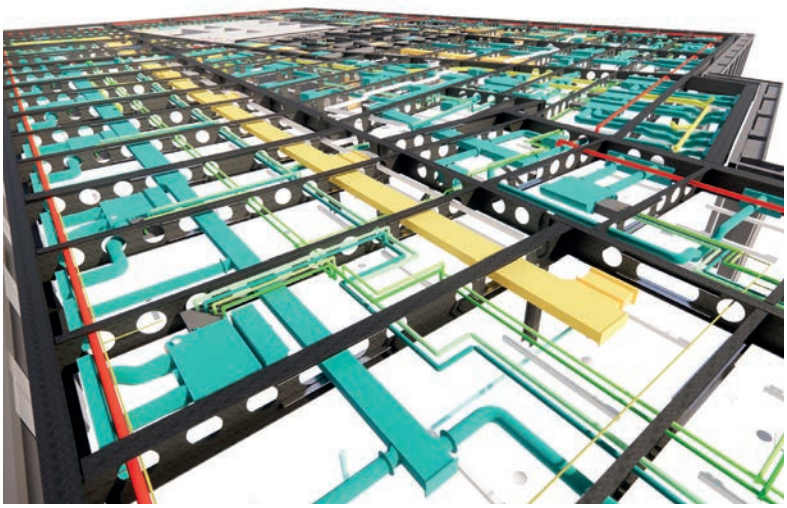
Hargreaves says Buro Happold is seeing more businesses wanting digital connectivity and smart capabilities rating as part of the remit for their building, because they see it as being 'an optimised smart building, providing resilient, reliable connectivity'.

He adds that occupants will be in little doubt that this is a smart building because the air quality is 'displayed visually as CO_2 in parts per million' on each floor plate, with a traffic light warning system if it gets too high.

Post-pandemic, Hargreaves believes Well is gaining significant traction as a new default assessment methodology, given the wider understanding that the buildings in which we live, work, learn and relax profoundly impact our health, wellbeing and productivity. 'It just so happens that, on this project, the Well standard was in the brief from the outset.' **CJ**



Occupants have access to real-time data to help control their environment



The building services had to be threaded through castellated beams

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Fit for purpose

Pinsent Masons people centric approach to its workplace environment meant aiming for Well certification at the fit out of its new Edinburgh office. Andy Pearson finds out how the ventilation system was upgraded to turn a good building into an ultra healthy one

Post pandemic, multinational professional services firm Pinsent Masons wanted its new 2,300m^2 Edinburgh office to encourage its employees to return to the office. The business was planning to relocate from its existing premises to the newly developed Capital Square, so it took advantage of the move to create a new flexible office environment to support hybrid, agile working and to promote staff wellbeing.

Designed and Well certified by engineers Cundall, working with architects Form Design, the firm's new office has less focus on formal workstations and more spaces to encourage social interaction, collaboration and meetings, including a café and social hub designed for multifunctional use.

To accommodate people's different working styles and needs, the new office also includes small meeting rooms and even individual work pods to enable more focused work.

According to Luke Richards, Pinsent Masons' head of facilities UK&I, the decision to target Well certification for this office was made pre-pandemic in late 2018. 'Our approach to workplace design was always people-centric; this was an opportunity to see how we could up the ante and deliver a workplace that enhances wellbeing and productivity,' he says.

The decision proved to be long-sighted. 'Although it was important at the beginning for us to deliver a workplace with a true focus on health and wellness, it became even more vital for the post-pandemic world,' he adds.

Home to 200-plus lawyers and operations staff, the new offices are located over two floors of the Capital Square building in the centre of Edinburgh. Recently constructed, the building had a shell and core fit-out achieving BREEAM Excellent and an 'A' rating EPC.

'The good thing about this building was that it was brand new, completed in May 2020, and it was built to a high standard so it already had a lot of amenities that align with Well criteria – for example cycle racks and good-quality glazing to allow daylight onto the floor plates,' says Kavita Kumari, associate director at Cundall and a Well Accredited Professional. She says Well Gold was a 'pragmatic' target for the fit-out.

Cundall was appointed to the project as MEP engineers with responsibility for Well certification at RIBA Stage 2, before detailed design had started. The architect had established the interior layout so Cundall worked with the project team to implement Well criteria. 'We sat down with the design

team and we went through what they can expect from a Well-certified building,' explains Kumari.

Cundall then followed this up with a series of individual workshops with each member of the design team, including Pinsent Masons' HR team, to talk about putting greater focus on healthy nutrition and making organic and sustainable products available in the office cafe and introducing yoga classes, for example.

A biophilic approach to office design was used with natural and sustainable materials employed in the fit-out wherever possible.

Occupiers and developers have been trying to create spaces that are different... clean and healthy... so people want to come into the office

Fortunately for Cundall, design of the office ventilation system was simplified by the fresh air supply, which was already fitted with a MERV 13 filter. 'Because the building is new, the level of filtration on the landlord's supply was already to an acceptable standard for Well; all we did was advise the landlord of the maintenance strategy required under Well for filter cleaning/replacement,' explains Kumari.

The offices are full fresh air in line with the Well standard. However, because the quantity of filtered air coming from from the landlord supply was insufficient to meet the Well standard for the occupancy levels proposed, Kumari says Cundall added 'additional supply heat recovery units to supplement the fresh air loads'.

Fresh air is ducted to the different workspaces via VAV units; flowrates are demand-controlled using CO_2 sensors in the return air ducts. Kumari describes it as 'a flexible strategy, with fresh air moved to where it is needed'.

In addition, a kitchen ventilation system was installed, consisting of a supply fan installed in the ceiling void on the third floor and an external, roof-mounted kitchen extract fan. The supply fan incorporates a G4 filter and ducted electric heater battery to condition the fresh air. Space heating and cooling is from a four-pipe fan coil system connected to the landlord supply.

Floor-to-ceiling glazing meant that many of the spaces could be naturally lit. 'We did have to put in blinds to give occupants at the perimeter of the floors the ability to control glare,' says Kumari.

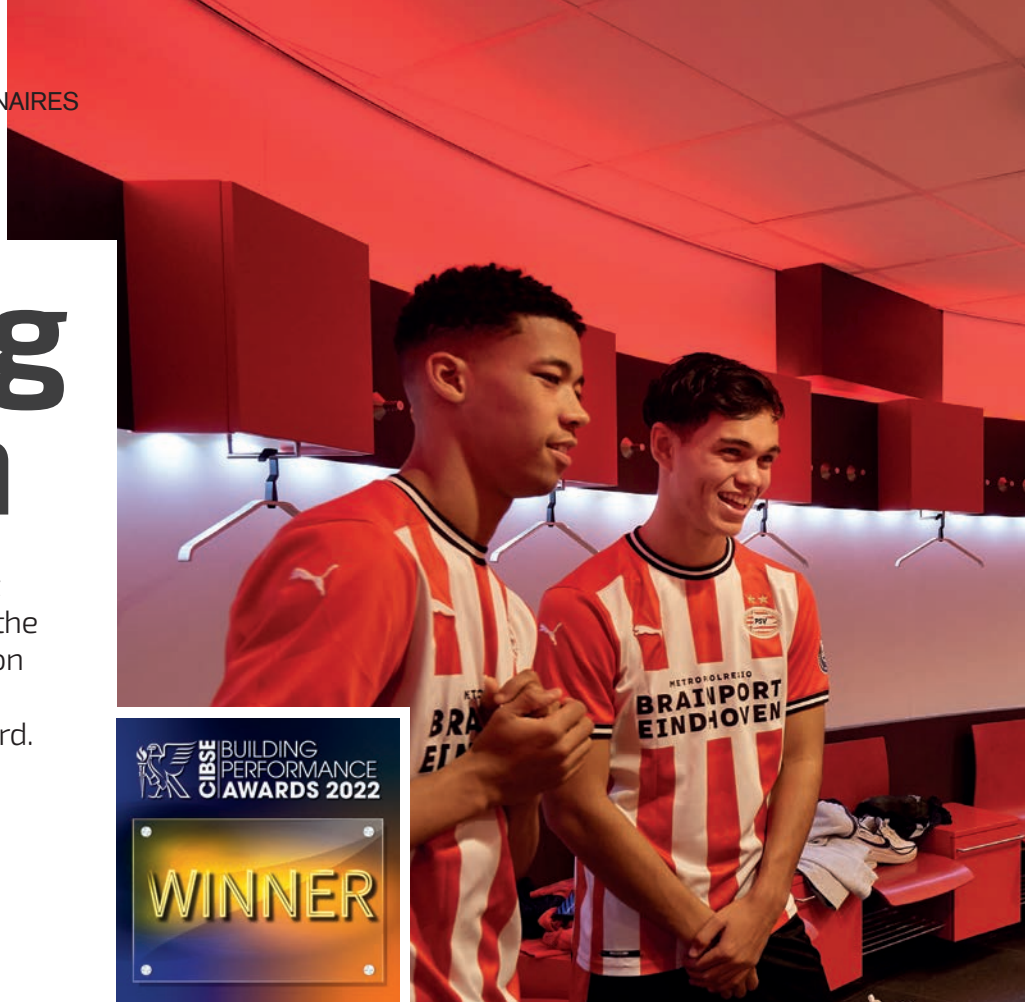
Daylight is supplemented by an LED circadian lighting system. This is programmed to change colour throughout the day to work in harmony with the occupants' internal body clocks to amplify occupant comfort and productivity. It delivers a cooler bluer light during the day, transitioning to warmer colours in the morning and evenings. 'Lighting can be controlled from a colour temperature of 2700K to 6500K to enable it to transition from yellow to blue,' explains Kumari.

The office opened in January 2022 and, according to Pinsent Masons, the response from its employees to the Well Gold-certified space has been overwhelmingly positive. 'Importantly, feedback from our people has been amazing and we have seen a sustained positive uplift of around 10-15% in office occupancy, which we call "the Well effect",' enthuses Pinsent Masons' Richards. 'It's very likely that we will go for Well Certification with our other UK offices that we're looking to relocate to in the next few years,' he adds.

Kumari expects many more employers to follow Pinsent Masons' example. She says that Well appears to be becoming the default standard for office ventilation post pandemic. 'Since the pandemic, occupiers and developers have been trying to create spaces that are different and that give employees a sense of security so that they know it is clean and healthy so they want to come into the office'. CJ

Keeping it clean

The germicidal effects of UV light were discovered in 1877. Now, in the shadow of Covid 19, an application of UV C is winning plaudits and a CIBSE Building Performance Award. **Phil Lattimore** reports



'The aggressive spike in Covid-19, was the catalyst for the launch of our UV-C lighting portfolio and business stream,' says Clark Morrow, UK&I marketing manager at Signify. That, and the fact the lighting company had also been working on lighting propositions that aligned with the overall market trend for 'health and wellbeing'.

Launched in late-2020, Signify's UV-C upper air disinfection luminaires were the winner of Product or Innovation – Air Quality at the CIBSE Building Performance Awards 2022. Judges praised the technological solution, which effectively and safely eliminates airborne viruses and bacteria – including the SARS-CoV-2 virus responsible for Covid-19. Ultraviolet (UV-C) radiation is used as 'a thoroughly thought-through and researched product that addresses the current need to disinfect indoor air'.

The UV-C upper air disinfection luminaires are part of Signify's portfolio of professional UV-C products and solutions that cover air, surfaces and water disinfection applications.

The BPA judges commended its novel application of existing technologies to address the threat from Covid-19. They also highlighted the level of research and development documented in the award entry, the use of independent studies to verify safety and efficacy, and the provision of information on actual in-use performance.

Threat

Airborne viruses and bacteria contaminate the air trapped indoors, posing a threat to the health of people. Upper air UV-C systems – which use the highest energy portion of the UV radiation spectrum, between 200 nanometers (nm) and 280nm – can disinfect air circulating in a room, with the UV-C radiation breaking the nucleobases of DNA and RNA of bacteria and viruses.

Signify's entry for the CIBSE award cited several independent studies to establish the effectiveness and safety of its solutions. For example, a laboratory test conducted by Innovative Bioanalysis found that the luminaires inactivated 99.99% of SARS-CoV-2 in the air of a room within 10 minutes; at 20 minutes, the virus was below detectable levels. In addition, all other bacteria and pathogens tested have responded to the UV-C solution. Signify says its upper air luminaires can provide the equivalent of up to 30 air changes per hour and estimates that achieving this with a traditional HVAC strategy would cost 10 times more.

Ceiling and wall mounted options

The luminaires come in two standard forms, with ceiling- and wall-mounted units supported by various brackets and suspension kits. The system can be installed with basic on/off control, or it can be linked to timers to manage its operational periods. Luminaires are designed to be mounted above 2.4m to ensure that UV-C safety limits and exposure levels do not exceed the relevant standards, with the omnidirectional units creating an effective UV-C zone safely above head height.

Careful design and implementation of the systems are essential to ensure they are effective and safe, as UV-C overexposure is harmful. 'All our installations are designed and implemented to strict European standards [ISO 15858],' says Morrow. Specialist lighting design software calculates performance and efficiency, as well as safety levels, and these parameters are verified during commissioning.

According to ISO 15858 and ASHRAE guidelines, human exposure to UV-C (at 254nm) should not exceed 6.0 for an eight-hour day, 40-hour working week. So, detailed designs for the installation of the luminaires must calculate the maximum

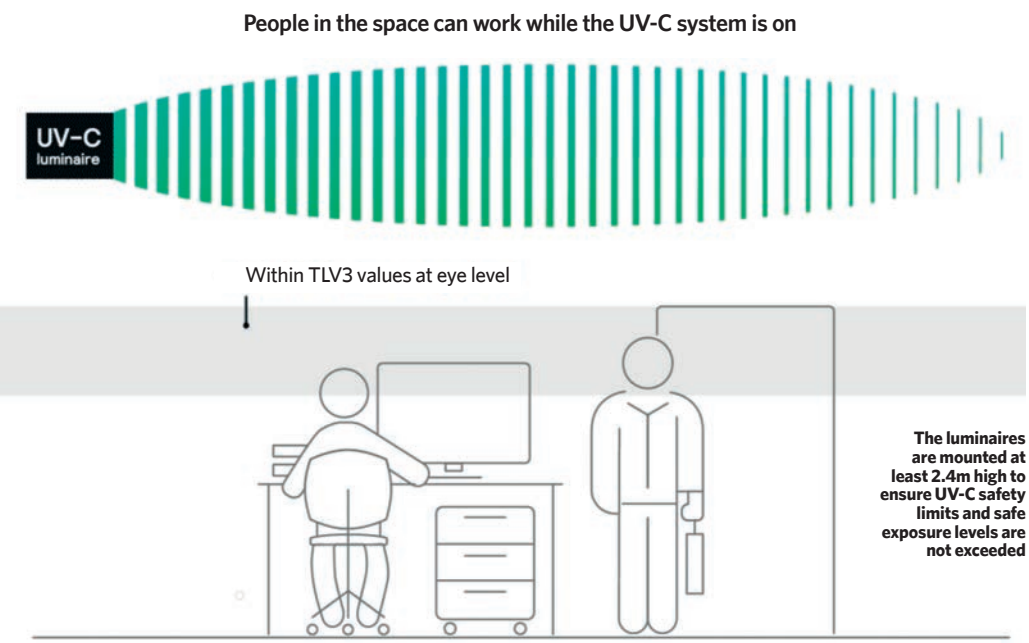
A laboratory test by Innovative Bioanalysis found that the luminaires inactivated 99.99% of SARS CoV 2 in the air of a room

One of Signify's ceiling-mounted UV-C upper air disinfection luminaires in the changing rooms of Dutch football team PSV Eindhoven

irradiance at eye level (based on the space usage) and extrapolate this over the worst-case exposure time, to determine the UV-C dosage.

Installation must be carried out by competent persons trained to use UV-C, and the designed luminaire locations and heights must be followed to accurate tolerances. Once energised, the project must be commissioned to certify the scheme as safe. The luminaires must be maintained and serviced regularly to ensure ongoing effectiveness and safety.

UV-C luminaire systems can be used as part of a hybrid or dual air-disinfection strategy, alongside HVAC-based solutions. However, Morrow says: 'To date, most of the installations of our UV-C upper air units have been single, standalone solutions, to specifically help combat harmful viruses. Some clients are also considering placing UV-C into their HVAC systems, to ensure clean air is supplied into the indoor spaces, but this does not help with in-room transmissions and is only effective if you have high air change rates, which most existing HVAC systems do not.'



The luminaires are mounted at least 2.4m high to ensure UV-C safety limits and safe exposure levels are not exceeded

Signify's wall-mounted UV-C unit

Building trust

While the germicidal effects of ultraviolet light were discovered 145 years ago, the potential for UV-C technology is still not fully appreciated, suggests Morrow. Since launching the upper air unit, penetration into the market has been 'fairly slow', he says. 'There is still a general lack of knowledge, understanding and trust in UV-C, and this – coupled with the lack of UK government legislation and standards around air quality – has meant that the decision to implement such UV-C disinfection solutions is often down to an individual's personal view on risk.'

He cites the example of public transport operator Abellio, which wanted to minimise the risk of transmission and improve the air quality for its employees. 'They installed UV-C upper air units, along with active air units, into a London bus depot – including offices and training rooms – and have been very pleased with the results,' he says.

Signify is also keen to highlight the sustainability credentials of its UV-C luminaires; it is accredited with sustainability bodies and is on the Dow Jones Sustainability Index. It also claims to use 100% renewable energy to power its operations and says it is 100% carbon neutral in all its operations (as of 2020).

Looking ahead

Having won the CIBSE Building Performance Award, Signify will continue to promote the technology and increase awareness of UV-C in the UK as an effective way to enhance the health and wellbeing of building occupants.

'A second-generation unit is being launched at the end of 2022,' Morrow says. 'We are also looking at embedding an occupancy sensor into the unit, and a smart power supply unit [PSU] so that units can be monitored and controlled via the cloud.'

With the increased focus on indoor air quality and wellbeing in buildings, the future of UV-C is getting brighter, Morrow suggests, adding that 'the introduction of new legislation and standards for air quality and ventilation in buildings will be the key enabler for the mass adoption of UV-C solutions'. CJ

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Lighting for
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Life enhancing

Exposure to indoor particulate pollution can significantly affect health over a lifetime. Research by **Dr Elizabeth Cooper** and **Dr Yan Wang** suggests that the smart integration of automated windows and home air purifiers could improve average life expectancy by six months

People in the UK, as in most of the Global North, spend about 65% of their time at home, where pollutant concentrations can be much higher than in outdoor air.

A pollutant of particular concern is particulate matter less than 2.5μm in diameter (PM2.5). Exposure to this contributes to many serious health issues, including lung cancer, stroke, heart disease, and asthma.

PM2.5 is readily filtered with portable home air purifiers (HAPs) equipped with high efficiency particulate air (Hepa) filters. One potential way of improving air quality is by using smart building control systems to maintain a healthy indoor environment through automated windows and HAPs.

Researchers at the University College London Institute for Environmental Design and Engineering carried out a study that assessed the impact on health of using automated systems.

Occupants' operation of windows exerts a substantial impact on indoor air quality and building energy consumption, but it also has the potential to conflict with air filtration strategies in buildings. Bearing this in mind, the study aimed to develop a novel building control framework that optimises the operation of windows and portable HAPs to improved energy efficiency and health.

Building control systems play a central role in building operations and performance. The overall goals of such systems are to satisfy occupants' comfort and minimise building energy consumption and carbon emissions.

Building control systems, in general, share a common structure: sensor to controller to controlled device. The sensor measures an environmental parameter (for example, temperature and CO_2 concentration) and sends collected data to the controller, which then processes the data with pre-programmed logic to determine the direction of change.

Window-control systems have become a hot research topic in recent years, as has the study of HAPs. However, an integrated system, which controls both window operations and HAPs, has not been explored.

Methods

The proposed control framework takes into account seasonality. For the non-heating period, the control framework has HAP and window controls running in parallel.

In contrast, for the heating period, the window is set to be closed, while the mechanical ventilation with heat recovery (MVHR) system operates continuously to provide background ventilation, with the HAP control enabled.

Schematic diagrams of the logic for HAP and window controls can be found in Figures 1 and 2. The HAP is set to run when the indoor PM2.5 concentration reaches the defined 'HAP on' threshold (15μg/m^3) and stops working once the concentration falls below the defined 'HAP off' threshold (5μg/m^3).

To maintain security, the window is set to be closed at midnight and when

Health modelling was included to predict the potential scale of the impact of changes because of the framework

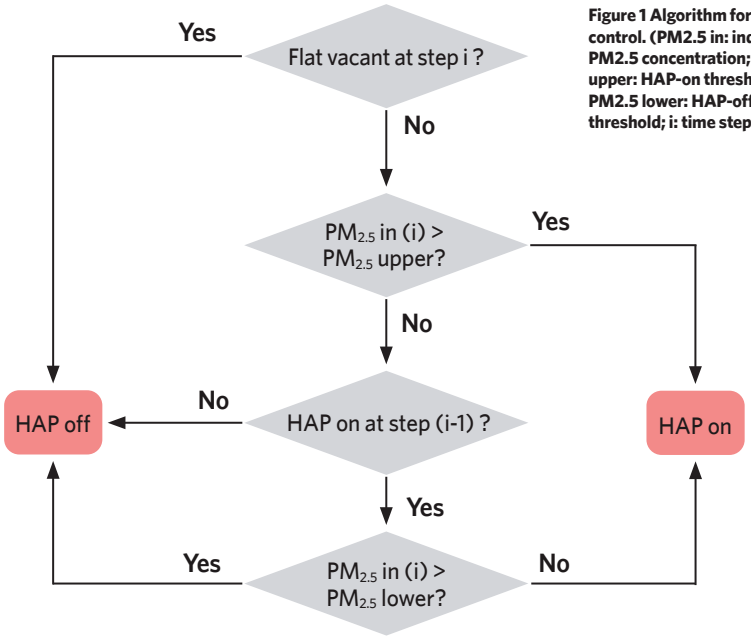

Figure 1 Algorithm for HAP control. (PM2.5 in: indoor PM2.5 concentration; PM2.5 upper: HAP-on threshold; PM2.5 lower: HAP-off threshold; i: time step).

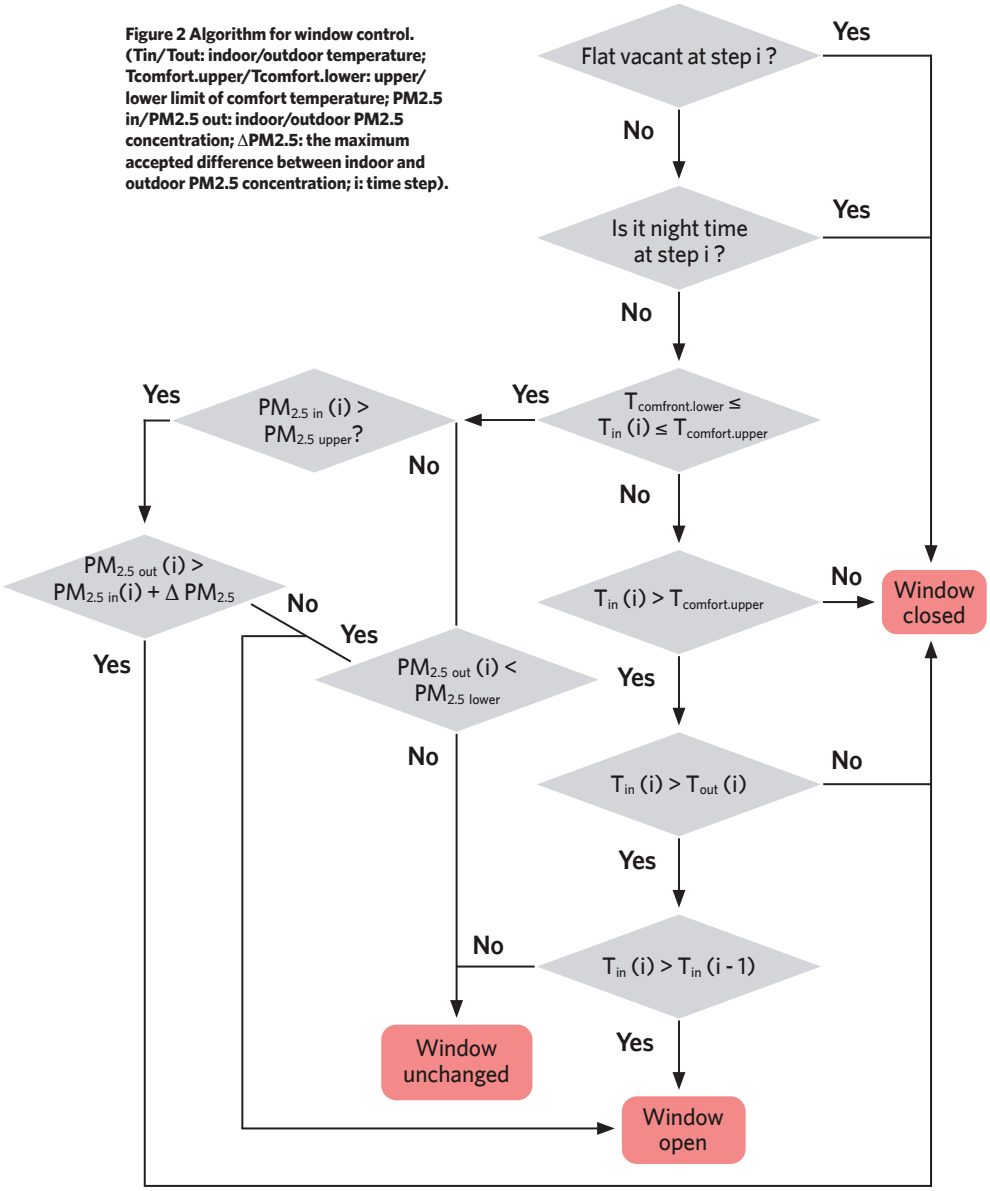

Figure 2 Algorithm for window control. (Tin/Tout: indoor/outdoor temperature; Tcomfort.upper/Tcomfort.lower: upper/lower limit of comfort temperature; PM2.5 in/PM2.5 out: indoor/outdoor PM2.5 concentration; ΔPM2.5: the maximum accepted difference between indoor and outdoor PM2.5 concentration; i: time step).

the residence is unoccupied; otherwise, the default state of the window is fully open to enable natural ventilation. The window is set to fully close when the indoor temperature falls outside the limits of EN 16798-1 Category II adaptive comfort temperature. Moreover, if the outdoor PM2.5 concentration is higher than that indoors, and the indoor temperature is within the comfort zone, the window will be fully closed to reduce the HAP working load.

Health modelling was included to predict the potential scale of the impact of changes because of the implementation of the control framework.

Quantitative health impact assessments are used to estimate future rates of mortality and morbidity from different interventions compared with what is predicted without such changes.

In the work presented here, life-table models were used to quantify the impacts on mortality of reductions in indoor PM2.5 concentrations.

The life-table method is based on age- and sex-specific mortality rates, which are used to calculate probabilities of survival by year of age and calendar year. An impact assessment is performed using the underlying mortality rates, which are adjusted to reflect changes in mortality risk from changes in exposure by applying relative risks calculated using available epidemiological evidence.

Individual single-year survival probabilities are multiplied together to calculate cumulative probabilities of survival over multiple years.

These cumulative survival probabilities are applied to a population, allowing the calculation of life years lived by the population (where one life year is a full year of life lived by one person), which, in turn, can be used to estimate the average remaining life expectancy per person by age.

Results

The proposed hybrid control framework – along with either HAP or auto-window control alone, for comparison – was tested in building simulations for a one-bedroom apartment. The simulation results for a summer week are presented below.

As seen in Figure 3, for the baseline scenario without any control measures, there were morning and evening peaks of indoor PM2.5 concentration; the daily mean of indoor PM2.5 concentration exceeded the World Health Organization (WHO) 24-hour limit (15μg/m^3) for most of the week, while the indoor temperature

» stayed within the comfort range all the time.

For the auto-window control mode, the peaks of indoor PM2.5 concentration declined significantly with use of the auto-window control, reducing the number of days exceeding the WHO limit of PM2.5 concentration by two from the baseline. Meanwhile, occupant thermal comfort was satisfied. Yet, the results indicated that relying on window controls alone may be insufficient for cases of both high indoor and outdoor pollution levels.

In the HAP control mode, the peaks of indoor PM2.5 concentrations were significantly reduced. However, there were still two days when the daily mean concentration of indoor PM2.5 was above the WHO limit, even with the use of HAPs. The reason was that outdoor PM2.5 levels were considerably higher on those days and, therefore, leaving the window open worsened indoor conditions.

As shown in Figure 4, for the hybrid control mode – which represents the proposed control method – the indoor PM2.5 concentration decreased substantially, with no days exceeding the WHO daily limit, while indoor temperature remained within the comfort range.

The major advantage of the joint control of HAPs and windows was that the window could be shut when outdoor pollution was high without an accumulation of PM2.5. In this way, the HAP operation was minimised, and the indoor PM2.5 concentration was lowered. Meanwhile, the control algorithm was directed to look for opportunities, when the outdoor air was good, to open the window for natural ventilation.

Based on the modelled indoor PM2.5 concentrations of the case-study flat, the mean years of life gained (YLG) for all males in the UK across the modelled period (97 years) were approximately 6.5 million, 15 million, and 18 million for the automatic window/MVHR, HAP, and hybrid modes respectively. The mean YLG for females over the same modelled period were approximately 6 million, 14 million, and 16 million for these three intervention scenarios, respectively (Table 1).

The reduction in exposure to PM2.5 from the implementation of the hybrid mode added a mean of nearly six months of life.

Key messages

The work presented here highlights the importance of building designers and engineers recognising health impacts, as well as energy efficiency and environmental impacts, related to occupant-centric building design and operation. The implementation of smart building control systems has the potential to reduce people's exposure to PM2.5 indoors, which could have substantial health benefits.

This research adds technical evidence for policy-makers, to help prioritise health in the building sector. It also shows how smart and connected building control systems could improve indoor environments for better health of the occupants. CJ

DR ELIZABETH COOPER Lecturer MSc Health, Wellbeing & Sustainable Buildings, UCL
DR YAN WANG PhD student at UCL

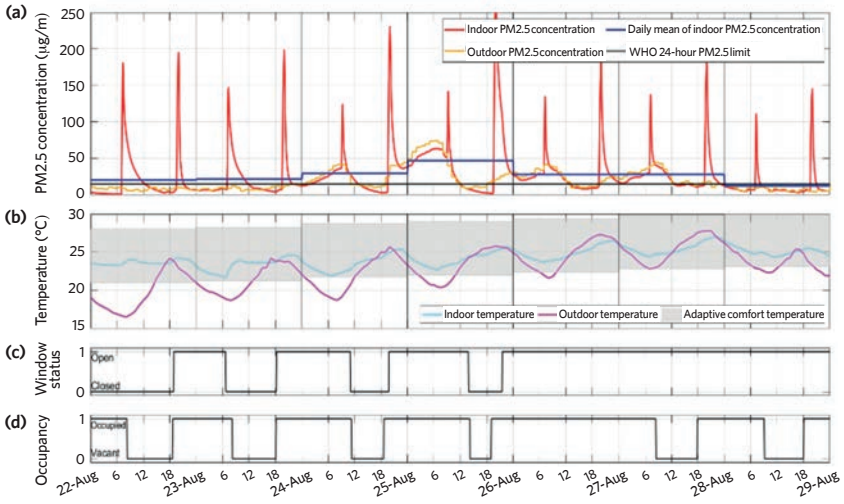

Figure 3 Summer week: Baseline. (a) Indoor and outdoor PM2.5 concentrations with the daily mean of indoor PM2.5 concentration compared with the WHO guideline; (b) indoor, outdoor and adaptive comfort temperatures; (c) window state schedule; (d) occupancy schedule

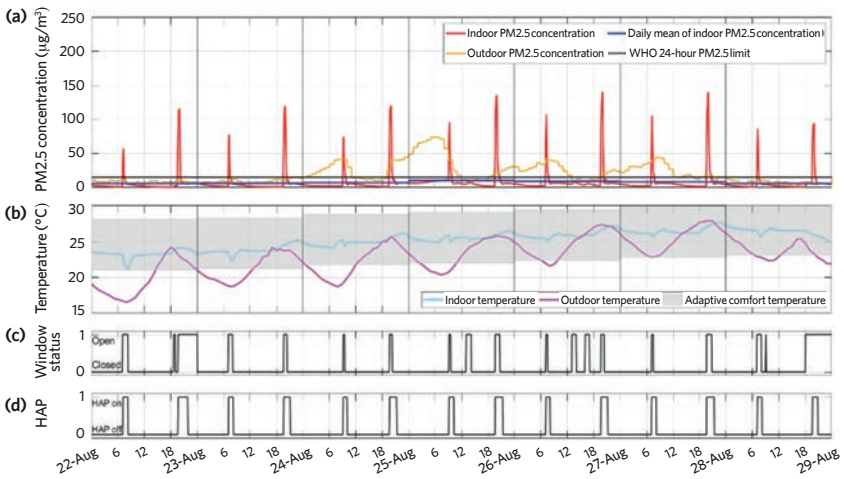

Figure 4 Summer week: Hybrid mode. (a) Indoor and outdoor PM2.5 concentrations with the daily mean of indoor PM2.5 concentration compared with the WHO guideline; (b) indoor, outdoor and adaptive comfort temperatures; (c) window state schedule; (d) HAP operation schedule

Control mode	Males		Females	
	YLG mean	Mean days gained	YLG mean	Mean days gained
Auto-window/ MVHR	6,557,926	73	5,948,462	64
HAP	15,209,453	6,557,926	13,739,074	148
Hybrid	17,940,660	199	16,188,821	175

Table 1: Summary of life-table model estimates of changes in mortality from different environmental control strategies based on modelled PM2.5 concentrations in case-study flat

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Development of mechanical ventilation concepts for occupied spaces

This module looks at key factors around the assessment and development of mechanical ventilation requirements for individual rooms in commercial and institutional buildings

The provision of ventilation air is fundamental to the health and wellbeing of building users. This CPD will consider some of the key parameters that drive the assessment and development of the mechanical ventilation needs for individual rooms, particularly those in occupied commercial and institutional buildings.

Traditionally, buildings in temperate climates, such as the UK and much of Europe, have used natural means of providing outdoor 'fresh' air to occupied spaces. However, despite the progress in passive ventilation systems, mechanical ventilation is likely to be required in larger, and possibly urban, residential, commercial and industrial applications in order to overcome challenges such as deep and obstructed floor plans, high occupant density, internal equipment loads and emissions, and poor outdoor air quality. There are good reasons to ensure that the volume flow and distribution method for the air are optimised to suit the application, not least to minimise operational expense, but also to reduce environmental impacts.

When assessing the mechanical ventilation requirements for occupied buildings, the key criteria are health, safety, wellbeing, specific application requirements (such as air humidity) and care of the building structure. These will, in turn, impact the performance of building occupants, the energy consumption in the building, and the building economy in general. As with any system development, it is important that the problem is properly defined before attempting to work towards a solution, with each application and subsequent installation benefiting from individual assessment. That is not to infer that every mechanical ventilation design is unique in concept and function, but for effective and efficient building operation, the solution must be led by the specific needs of the application.

To determine whether natural ventilation, mechanical ventilation (with/without cooling/heating/humidification) or a hybrid (air-water or air-refrigerant) system is likely to be most suitable requires an initial assessment of: the building shape, structure, occupants and surroundings; the heating and cooling loads; and the particular environmental control needs. CIBSE Applications Manual AM10 *Natural ventilation in non-domestic buildings* (Figure 2.8) provides a useful flowchart to assist in this process. The system selection process is iterative, and it is only through considering the detailed requirements of the individual spaces in conjunction with building-level aspects that an overall system concept will emerge.

If, as a result of an initial analysis, a mechanical ventilation system is required – which might be part of a hybrid system – then an outline ventilation system design process ensues, which might usefully follow the path suggested in the outline of the ventilation design process (Figure 2.1) from CIBSE Guide B2,[1] which goes from identifying the requirements through to completing the calculations, drawings, schedules, and specifications. To develop a system that delivers appropriate ventilation in the »

individual rooms will require a room-by-room analysis. The creation of 'room data sheets' or equivalent will identify the design parameters that are required for each space.

If natural ventilation is not feasible, suitable or sufficient, a mechanical supply of outdoor air will be needed for ventilation purposes. Outdoor air may provide the total airflow (in a 'full fresh air' system), but is more likely to be a fraction of the total airflow. The total maximum amount of air that will be needed by the room as a mass flow, m kg·s^{-1}, will typically be determined from the larger of the ventilation air requirement or the design (maximum) room sensible cooling load, q_s kW. To determine the load-based flowrate, the room-supply air temperature differential, $\Delta\theta = \theta r - \theta s$ K, will be needed. This will be intrinsically linked with the system type and so may present an iterative stage in the early design process.

Often, hybrid systems are considered that can provide tempered (and possibly humidity-controlled) air to satisfy the ventilation requirement and, additionally, employ integrated or separate cooling and/or heating elements, which use water or a volatile refrigerant, to meet the remainder of the room load. For buildings with several environment-controlled rooms, there can be significant benefits in using hybrid systems that may include reduced services distribution space, improved controllability, and reduced operational costs. Water- and refrigerant-based distribution systems are well placed to maximise opportunities from applying heat pump 'heat recovery', as well as benefiting from significantly smaller conduits and reduced distribution power compared with air systems to provide cooling and heating (see boxout, 'Moving energy around a building'). Taking an example of a 10kW cooling load supplied through a 25m duct compared with a 50m (flow and return) pipe, with a conservative electricity price of £0.35 per kWh, over an eight-hour working day, five days a week, over 52 weeks a year, and assuming that the efficiency of the pump/fan is 70%, would provide a simple comparative pump/fan energy cost, as illustrated in Figure 1. In this greatly simplified example, the cost to distribute waterborne energy is less than 7% compared with using air. This excludes any allowance for fittings, controls and terminal devices – these must be considered in any complete analysis. In terms of systems, this could lead to the air-water arrangement illustrated in the lower part of Figure 2 that can be compared with the all-air system shown above it.

The all-air system may be more appropriate for spaces with large ventilation loads, such as conference rooms, whereas the lower air-water system may be more appropriate, for example, in a modular office or hotel room. In this hybrid system, the air handling unit (AHU) and ducts are sized to meet the maximum ventilation requirement, while the main cooling (and heating) is managed in a piped water system.

A significant benefit of the air-water system is that there are smaller/fewer AHUs, as well as the ducts being smaller. Additionally, the chilled water to the room units will normally be distributed at a higher temperature than the temperature required to cool the air in the AHU, which can provide savings in cooling costs. However, the lower air flowrate through the ducted system will reduce the opportunity for employing air-based 'free cooling'.

The room unit may be one of several types – such as fan coil, active chilled beam, passive chilled beam, chilled ceiling panel, or the relatively recent reinvention of an induction unit incorporated into a ceiling diffuser, as illustrated in Figure 3. Such new-style induction units operate at a lower pressure compared with the noisier old-type induction units, with the supply air creating a low static pressure zone, so drawing room air across the water coil, to mix with the ducted supply air that is then delivered into the room. For each volume of ducted ventilation supply air (that would be tempered and potentially humidity controlled) the induction diffuser will deliver that volume of air mixed with the induced recirculated room air. This provides the efficiencies of an air-water system without the additional hardware of a fan coil or the bulk of a chilled beam, while ensuring good mixing with the room air and no risk of draughts from cold treated air. The proportion of recirculated room air drawn through the heat exchanger is typically about three to five times the proportion of primary

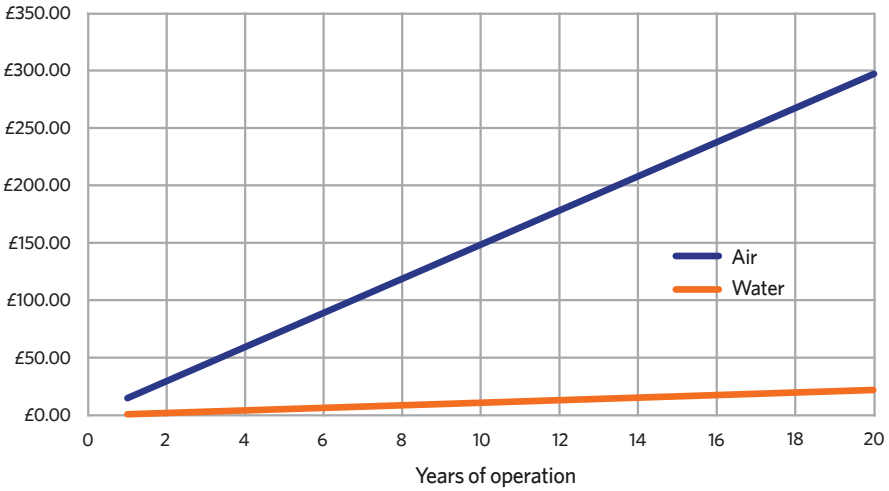


Figure 1: Simple cumulative pump/fan energy cost of air system vs water system to deliver 10kW in simplified part system (25m duct, 50m pipe)

MOVING ENERGY AROUND A BUILDING

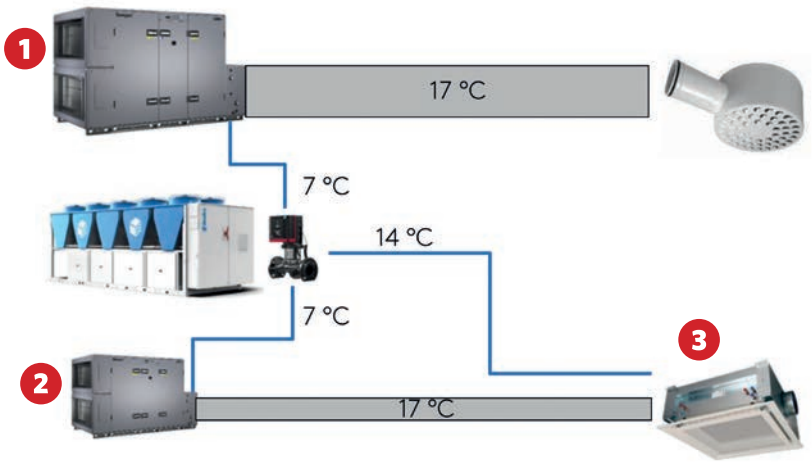
To determine the mass flowrate, m kg·s^{-1}, of a heating/cooling fluid to provide a load of q_s kW
q_s = m Cp $\Delta\theta$ where Cp (kJ·kg^{-1}·K^{-1}) is the specific heat capacity for the fluid.
The fluid volume flow, m^3·s^{-1} is given by m/ρ where ρ kg·m^{-3} is fluid density.
Comparing using water and air to move 1kW cooling to the room.
For air with ρ = 1.2kg·m^{-3}; Cp = 1.02kJ·kg^{-1}·K^{-1} with a nominal $\Delta\theta$ (room – air supply) of 10K, air mass flowrate = 1kW/1.02 x 10 = 0.0980kg·s^{-1} and volume flowrate ≈ (0.0980/1.2)m^3·s^{-1} = 0.0817m^3·s^{-1}

For water ρ = 1,000kg·m^{-3}; Cp = 4.2kJ·kg^{-1}·K^{-1} with a nominal $\Delta\theta$ (water return – flow) of 8K water mass flowrate = 1kW/4.2 x 8 = 0.0298kg·s^{-1} and as a volume flowrate ≈ (0.0298/1000) m^3·s^{-1} = 0.00003m^3·s^{-1}

Pump or fan power (W) to move water or air through a pipe or duct =
volume flow (m^3·s^{-1}) x pressure drop (Pa)

Considering 1m pipe (with nominal pressure drop of 100Pa·m^{-1}) or duct (with nominal pressure drop of 1Pa·m^{-1})

Air power = 0.082m^3·s^{-1} x (1m x 1 Pa·m^{-1}) = 0.082W for each kW for each 1m duct
Water power = 0.00003m^3·s^{-1} x (1m x 100 Pa·m^{-1}) = 0.003W for each kW for each 1m pipe



1 Provides ventilation, temperature (and humidity) control. Simple, typically cheaper installation. Larger volumes of air. Simple to use free cooling
2 Provides tempered ventilation air (and humidity control) with smaller or fewer AHUs and potentially smaller plantroom
3 Provides ventilation, temperature (and max humidity) control. Reduced space required for ductwork, but requires distributed cooling services. Opportunity for lower operational cost

Figure 2: A graphical comparison of an all-air system compared with an air-water system employing chilled water (Source: Swegon[2])

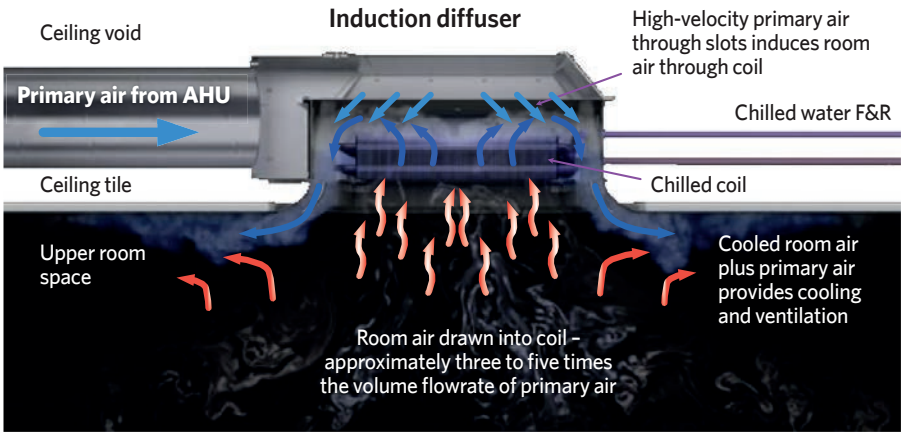
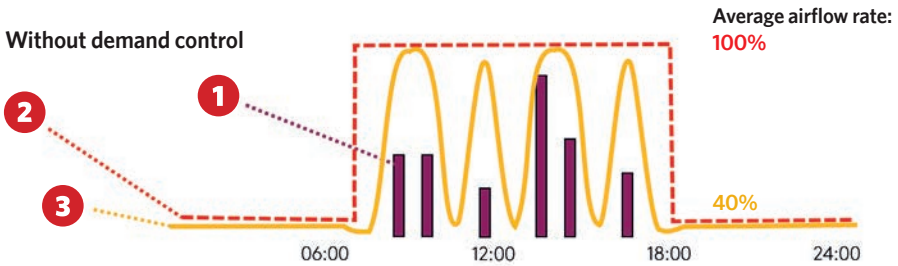
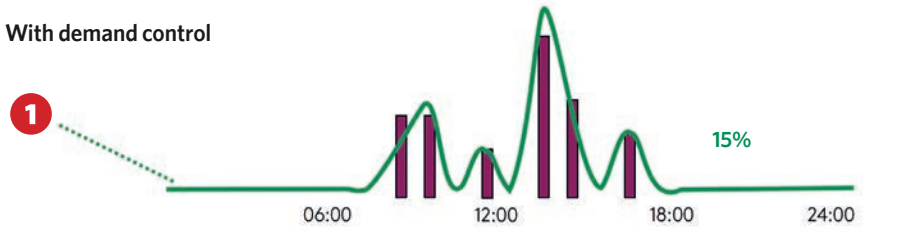


Figure 3: Ceiling-mounted induction diffuser (Background image source: Swegon[2])



1 Number of people in the room **2** Constant airflow 07:00 - 18:00
3 Constant airflow with manual boost functionality



1 Airflow automatically adapted to the number of people

Figure 4: Comparison of notional intermittently occupied room ventilation rate without and with demand-controlled ventilation based on occupancy (using, for example, CO_2 sensors) (Source: Swegon[2])

air – so, for example, if 20L·s^{-1} supply air comes from the air handling unit, then approximately 60-100L·s^{-1} room air will pass through the exchanger and be tempered. Whichever mode and type of environmental system is employed in intermittently occupied spaces, there can be significant operational benefit in employing demand-controlled ventilation (DCV). This adapts the flowrate of the ventilation air to satisfy the number of occupants.

As illustrated in Figure 4, an example room with variable occupancy could be ventilated with a constant volume flowrate system, which would deliver the volume flow indicated by the red dotted line, so providing a reference average for comparison of 100% full flow. This system is often improved by an intermittent boost facility (such as one that could potentially be manually activated by a café owner when it is noticed that the number of customers increases); this can provide a significant reduction in flowrate, as indicated by the yellow line and equating, in this example, to an average flowrate of 30% full flow. Where even closer control is required (for example, to meet low energy, green or healthy building certifications), a fully automatic DCV system may be employed, potentially actuated with feedback from CO_2 sensors (to detect occupancy) or VOC sensors (that can detect occupants by proxy, as well as other pollutants); this particular example would show an average supply ventilation air flowrate of approximately 15% full flow.

The same concept might be applied where there is a varying casual source of contaminant that is possible to sense in real time, such as cooking processes, copying/printing machines, or other emissions, such as from painting, gluing, 3D printing and surface preparation (for example, sanding). To use DCV means reduced airflow, which, in turn, means lower energy consumption for the fans, and a reduced need for adding heating/cooling. It is usually also possible to reduce the size of the indoor climate system as a whole (from AHU to ductwork), saving space, embodied carbon and investment costs. (For further discussion and application of DCV, see *CIBSE Journal* June 2019, CPD Module 148 'Demand-controlled ventilation for comfort, wellbeing and resource efficiency'.)

Defining the key areas and divergently exploring the problem are just the first steps in developing a suitable ventilation system for a specific application – a future CPD will build on the considerations covered in this article to explore room air distribution and system types.

Turn to page 68 for references.

Module 202

September 2022

» **1. Which of these was not listed as a key criterion for mechanical ventilation requirements?**

- ☐ A Care of the building structure
- ☐ B Prior experience of a specific system design
- ☐ C Safety
- ☐ D Specific application requirements
- ☐ E Wellbeing

2. In the simple example of moving heat around a building, what was the approximate cost multiple of using air instead of water?

- ☐ A 0.4 x the cost of pumping water
- ☐ B 4 x the cost of pumping water
- ☐ C 10 x the cost of pumping water
- ☐ D 14 x the cost of pumping water
- ☐ E 18 x the cost of pumping water

3. Which of these is unlikely to be an attribute of employing a hybrid system compared with an all air system?

- ☐ A Maximises free cooling
- ☐ B Provides maximum humidity control
- ☐ C Provides temperature control
- ☐ D Provides ventilation
- ☐ E Reduces ductwork sizes

4. For the illustrated induction diffuser, what is the maximum total air volume flowrate that could be delivered by the diffuser?

- ☐ A Twice the primary air volume flowrate
- ☐ B 3 times the primary air volume flowrate
- ☐ C 4 times the primary air volume flowrate
- ☐ D 5 times the primary air volume flowrate
- ☐ E 6 times the primary air volume flowrate

5. In the example of demand controlled ventilation, what was the average flowrate for the system that employed a manual boost facility?

- ☐ A 15% full flow
- ☐ B 30% full flow
- ☐ C 40% full flow
- ☐ D 50% full flow
- ☐ E 75% full flow

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References:

1 CIBSE Guide B2 *Ventilation and ductwork*, CIBSE 2016.
2 *Technical Training (Room Units)*, Swegon, 2022.

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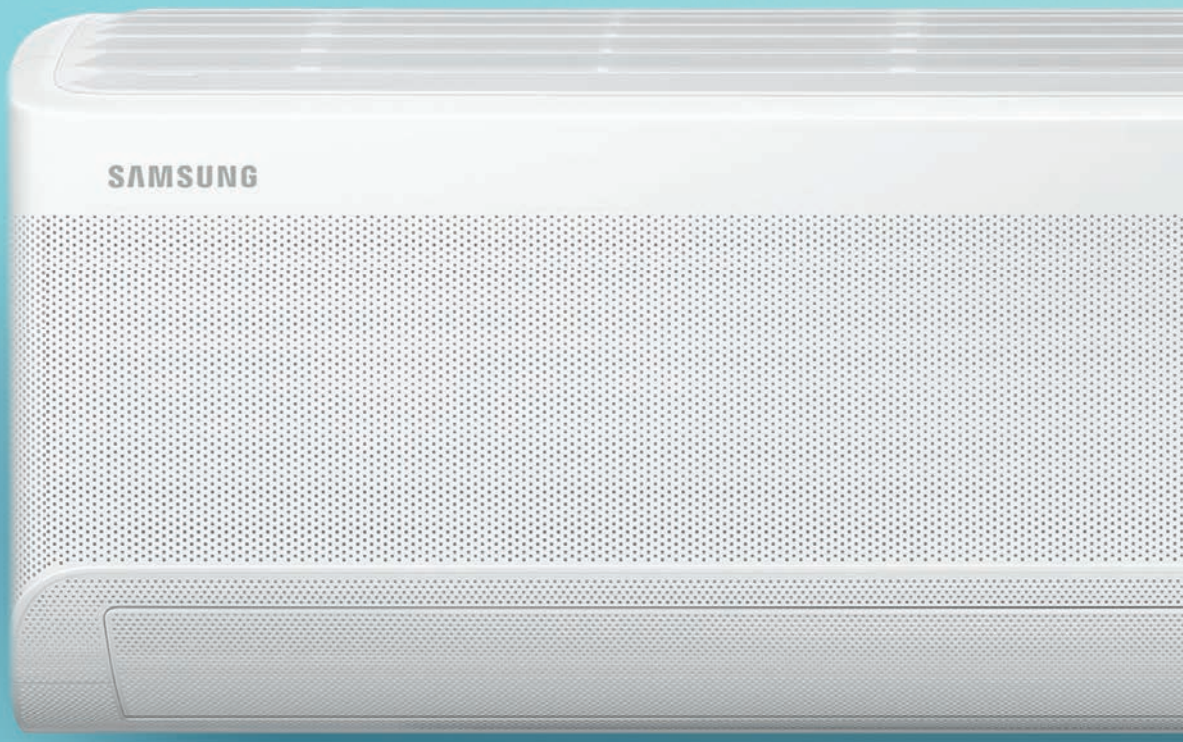

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Energy crisis sees laws tightening up in Europe

Shops to be fined if doors left open while air conditioning is running

Tougher laws on air conditioning are being proposed in France and Spain in response to the extreme summer weather and global energy crisis.

In France, the Minister of ecological transition, Agnes Pannier-Runacher, has proposed introducing fines for shops that leave their doors open while the air conditioning is on.

She said that leaving the doors open led to a 20% increase in energy consumption. Fines of up to €750 will be given to shops that fail to comply with the new regulations.

Similar rules have previously been put in place in some French cities. In Paris, an order requires stores using air conditioning to keep their doors closed or face fines of up to €150. A similar ban was announced in Lyon, Bourg-en-Bresse and Besançon.

In Spain the government said commercial buildings would not be able to run air conditioning below 27°C until November 2023.

The policy matches one in place for public buildings but kindergartens, hospitals, schools and universities, gyms, hair salons and laundries are exempt.

The new rules also state lights must be turned off after 10pm, and monuments will no longer be illuminated at night.

Similar rules have been in place in New York for many years and business can be fined up to US$1,000 for repeated offences.

Illegal HFC trade jeopardises EU climate objectives

Calls have been made for an investigation into the illegal trade of hydrofluorocarbons (HFCs) in the EU. Comparing data reported under the EU F-Gas Regulation with trade data, the Environmental Investigation Agency (EIA) estimated that the volume of illegal HFCs smuggled into the EU currently amounts to between 20–30% of the legal trade.

To phase down the use of HFCs, the EU introduced a quota system via its F-Gas Regulation to limit the volume of these greenhouse gases on the market.

The 2018 supply cut of 37% sparked a reactive skyrocket in black market sales for the greenhouse gases across Europe.

Romania has become a major illegal entry point into the EU. However, failure of the country's authorities to act has compelled the EIA to urge the European Public Prosecutor's Office to conduct an official investigation into the crime.

Air conditioning upgrade for Buckingham Palace Road landmark

After year-long preparations, a new air conditioning system has been installed in a major refurbishment of London's iconic office space, 111 Buckingham Palace Road. The project was logistically challenging, involving tight space limitations.

The chiller lift, requiring a 450-tonne crane, took place over a weekend, with London's busy Buckingham Palace Road closed for less than a day.

Two Carrier AquaForce 30XBE air-cooled chillers have been included to deliver a combined total of 2.4MW of cooling. The chillers are equipped with variable-speed fan motors, minimising noise and maximising energy savings, with a seasonal energy efficiency ratio (SEER) for cooling of up to 4.6.

Connected to the building management system, the chillers will provide high-level control and monitoring, enabling optimisation of performance.

The project involved reconciling existing systems with the newly installed chillers.

Cooling down the Tube

Transport for London (TfL) has begun trialling a state-of-the-art cooling panel on a disused platform at Holborn underground station, to test its suitability for reducing temperatures on the wider network.

The trial is part of the government's TIES Living Lab programme, and the panels work by circulating cold water around metal pipework to chill it. Air is then circulated, using an industrial-sized fan, through gaps in the panel.

The test will assess whether the panels could provide a cooling solution for platforms on the deep Tube, which comprises the Bakerloo, Central, Jubilee, Northern, Piccadilly, Victoria and Waterloo and City lines.

SHIP SHAPE

To preserve the timbers of the Golden Hinde, a ventilation system with heat recovery had to be designed that could be squeezed into the compact, curved spaces of the replica 16th century ship. **Molly Tooher Rudd** finds out how they did it

The Golden Hinde is a full size reconstruction of the English galleon captained by Sir Francis Drake on his circumnavigation of the globe in the 16th century. Launched in 1973, the ship sailed more than 140,000 miles before being retired and docked at London s South Bank in 2003. Suffering from rotting timbers, the Golden Hinde is undergoing a major refit, using traditional materials and classical methods. .

Poor levels of ventilation can lead to increased levels of condensation, which, over time, can cause significant damage. If not managed, the rot caused by these conditions can impact the strength of the structural timber, which poses a danger for visitors to the ship.

The design processes

The Golden Hinde s lead shipwright, Toby Millinder, worked with National Ventilation to create an effective, practical system that would achieve a good level of ventilation. Millinder has detailed knowledge of the build and functions of the ship, so his collaboration was crucial to ensure the design was appropriate for the ship s structure.

Two site visits were conducted to make sure the ventilation system would function once it was in situ. Finding space in the ship to install kit that would achieve the number of air changes per hour necessary for a safe environment for the public was a challenge. With careful consideration, however, the final design exceeded expected changes by 25%.

> Finding space in the ship to install kit that would achieve the necessary number of air changes per hour was a challenge

Heat recovery

During the design process, National Ventilation specified heat recovery ventilation to recover waste heat.

Using the project drawings, specialist knowledge of the equipment from engineers at National Ventilation, and software programs, a correctly sized ventilation unit ñ and the correct type and lengths of ducting ñ were specified.

Because of the space restrictions, it was necessary to specify two Monsoon HRU/ ECO150EC mechanical ventilation with heat recovery (MVHR) units and two inline heaters ñ one for each MVHR unit ñwhich will provide comfort heating for visitors. National Ventilation commissioned and balanced the system.

The project presented a number of challenges for the ventilation team. Ductwork is generally run in straight lines, but the hull of a ship is curved, so a compact solution was needed that could accommodate the bends of the ship.

Radial ducting was specified, which, in its simplest form, consists of a central plenum that feeds a network of radially arranged branch ducts. This was the perfect solution, as the flexibility of this type of ducting allowed for unforeseen circumstances during installation, while its smaller diameter means it is crush resistant and sturdier than alternatives.

National Ventilation s Monsoon 75mm radial ducting was used, and could be pulled through the small spaces of the ship without tearing. It is all hidden from view, because it runs between the ceiling planking (on the inside of the hull) and the hull planking.

The MVHR units provide good air comfort levels while minimising heat wastage, as heat

captured and transferred to the fresh air being drawn inside can be distributed throughout the interior of the ship.

In this way, the heat recovery system contributes to energy conservation and can help the Golden Hinde s management reduce its space heating bills significantly.

The ventilation unit runs continuously at low speed, only boosting to high speed when required. Installation is simplified thanks to the unit s multi spigot arrangement and an in duct humidistat can be included to automatically boost the units to high speed, further reducing installation time, as well as cost.

The radial ducting system is said to be 60% quicker to install than traditional ducting, thanks to its unique click system, which removes any need for sealant and tape, simplifying and speeding up the process. Radial ducting also assists in the reduction of noise transfer between rooms, which is often a problem with traditional ducting.

Removing stale, polluted indoor air helps control humidity and condensation levels, and removes odours, resulting in improved indoor air quality, and a healthier, more comfortable environment. The system also has an antimicrobial coating, for further health benefits.

Retaining the authenticity of the Golden Hinde was an integral part of the project, so the outlets for the ventilation grilles had to be adjusted to fit with the aesthetics. To allow for this, eight 70mm holes were made on each side of the ship as air outlets. These holes resemble scuppers ñ small openings in the side of a vessel that allow water to drain away ñ so they fitted with the overall look of the ship.

Now a floating museum, the Golden Hinde is used for educational purposes, as well as for events and even weddings ñ and the new ventilation system will ensure that these can take place for years to come. CJ

Radial ductwork is hidden from view between hull and ceiling planking

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Tim Mitchell, sales director at Klima-Therm

Adopt a 'fabric first' approach to building design, maximising the performance of the components and materials that make up the building itself, before considering the use of mechanical or electrical building services.

Part of this involves designing buildings to be low energy in the first place: well-insulated and sealed to reduce winter energy demands, but avoiding the danger of over-insulating that creates summer overheating problems.

If possible, use exposed slabs to absorb heat and create height in the space. This allows warm air to rise and be removed from the space. Exposed slabs also allow for overnight purging of the building to store 'coolth' in the slab.

Use 'smart building' principles to share energy between local users. For example, cooling means heat rejection – what can you do with that heat? You might, for instance, place data centres and offices near leisure centres, hospitals, and residential hot-water and heating demands.

Next, choose high-efficiency central plant – there is no better way to get a return on investment, not only for owners and tenants paying the bills, but also for landlords. Their asset is worth more, as it can be let for more to tenants, who tend to stay longer – and if renters do move on, an efficient building can be let more quickly.

Efficiency comes in many guises. Best-in-class equipment is one way to go, but another is to use energy storage and recovery, which can allow one energy input to do two jobs.

A good example of this is the hybrid four-pipe Rhoss EXP/HT heat pump, which can produce independent cooling and heating, but – when cooling – the heating can be free essentially, because of heat recovery, and vice versa.

Susan Hone-Brookes, director of sustainability at ChapmanBDSP

We are all familiar with the worrying stats on increasingly extreme high summer temperatures. The cost-of-living crisis and focus on reducing carbon emissions during the winter months pushes building design down the route of a well-insulated, thermal box, which then struggles to perform well in high temperatures.

Our tortuous 'fenestration dance' between wellbeing daylight levels and limiting solar gain is one that we perform daily.

Many clients are constructing residential apartments in urban settings where cooling is not the norm. Mechanical cooling, generally direct expansion, fixes the immediate issue, but with the payback being increased energy consumption costs and carbon emissions. It can also exacerbate the urban heat island effect, which can increase external summer temperatures by up to 7°C in London.

The ability to carefully select fabric elements and fenestration design has, over time, 'hit the buffers', with a maxing-out of what can be considered commercially viable today. Furthermore, we still operate within an industry that shies away from technology input, so suggestions of phase change materials and PV-plated windows are still considered whimsical, and dismissed quite early in the design process.

We believe we are now at the very edge of what we can do passively with residential tower blocks in urban settings without a wholesale change to the design, look and feel of the architecture.

That means a holistic rethink on inception design solutions, and adaptation strategies for existing buildings. This needs to encompass new technologies, mass/form, and so on, but also how occupants inhabit the building.

»

Martin Fahey, head of sustainability, Mitsubishi Electric

Most UK buildings simply aren't prepared for the high temperatures we have seen this summer, but there are a number of things that building operators can do to keep occupants and critical infrastructure safe and cool, without ramping up energy use.

The first and simplest thing is to turn up the thermostat. Air conditioning in the UK is often set at 21°C or lower, and the temptation when it's hot outside is to turn the thermostat down even further. If it is 35°C+ outside, however, an internal temperature of 23°C, 24°C or higher will still feel much cooler – and, more importantly, it will consume less energy, giving you occupant comfort without increasing bills.

Effective maintenance is another easy and highly beneficial way of maximising comfort and minimising energy use. Ensuring that filters are clean and outdoor units are not blocked will allow them to work efficiently.

Many modern commercial air conditioning systems also offer the ability to maximise heat recovery. This means that heat energy recovered from cooling spaces for occupant comfort can be transferred to a hot-water supply, or moved to parts of a building that may still need heating. Of course, this can work all year round, with essential cooling for critical IT infrastructure producing energy that can be used to heat other parts of the building.

With modern mixed-use buildings in our towns and cities, this approach can be used to enable heat energy from cooling gyms, offices and retail outlets to be used to provide hot water for the apartments above. In addition, clever use of natural ventilation and mechanical ventilation with heat recovery can help lower peak temperatures inside buildings, reducing the initial requirement for cooling systems – along with energy use.

With these levels of summer temperatures likely in future, we need to look at designing urban spaces to stop them becoming heat spots in the first place, with solar shading, natural ventilation and other physical attributes such as trees and green walls to provide cooling and ventilation.

Anastasia Mylona, head of CIBSE research

Passive cooling solutions need to be prioritised. Control of solar gains (through shading), maximising natural ventilation (by ensuring cross-ventilation), and the use of insulation and thermal mass with sufficient night-time cooling have proven to be the most effective passive cooling techniques in hotter climates for centuries.

Orientation and proximity to green and blue areas are additional, well-established cooling techniques – for example, reducing glazing in the south/west/east, introducing internal atria with overhangs and water features, and green roofs and walls can all contribute to keeping buildings cool in the summer.

Buildings in dense urban environments tend to suffer most from overheating, and face noise, security and air-quality restrictions. Although the same passive principles apply, natural ventilation might not always be appropriate or safe.

Mixed-mode solutions, such as a combination of natural and mechanical ventilation options, could be considered in such buildings. Noise, pollution and security concerns could be reduced by careful consideration of the placement of larger windows.

Ultimately, keeping our buildings cool is an urban planning issue. If we succeed in keeping our cities cool, the buildings will always have access to natural ventilation and, as such, to natural cooling. This can be achieved by introducing more green spaces and urban shading, green walls and roofs, cool building material and water features, and less air polluted by maximising wind patterns, reducing car traffic and increasing sustainable travel.

Based on future climate projections, if we continue expanding and building our cities the way we are, they will most likely become uninhabitable over the summer by the end of the century.

Mark Beaumont, head of strategic accounts UK, building products, Siemens Smart Infrastructure

Higher temperatures are here to stay for the foreseeable future, so we need to start looking at how we mitigate the impact on our journey to zero carbon through energy management and green credentials – reducing our water usage, among other things.

We should, of course, be looking to capitalise on the longer hours of sunshine and the higher, more sustained wind speeds, which are related to temperature change. Research by a team at Princeton University shows that the average wind turbine produced 17% more power in 2017 than in 2010. If current trends continue, by 2024 wind turbines could generate 37% more power than they do today. If your site can support solar or wind generation, it may be more viable now than ever before. You might also consider water collection and planting for shading.

Managing the efficiency of your HVAC system can mean that you do not use as much energy and water, even when it is hotter. Avoiding having the cooling running at maximum while you have the windows and doors open on a hot day may sound like common sense, but it happens a lot more than you might think.

It is also frequently the case that the HVAC target temperature is set too low on a hot day, or that the thermostat is not responsive enough. Most people are comfortable at around 18°C to 22°C. At 17°C or less, they will be looking to wrap up for warmth or to let in some outside heat. It really is important to keep your HVAC system serviced and to have a good building management system running things.

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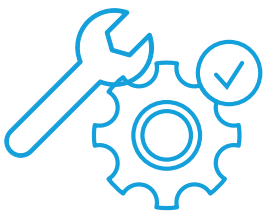

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When spaces are cooled to uncomfortable temperatures, negative impacts are seen on people s health and the environment. **Tim Dwyer** looks at a new paper that attempts to measure the extent of the issue

SENSIBLE COOLING

Space cooling is a signi cant energy end use within buildings, responsible for roughly 20% of the energy consumed in buildings globally, and contributing to 8% of total energy demand carbon emissions.

Population growth and an increasing number of buildings ñ together with the availability and affordability of space cooling systems ñ make this the largest consumer of energy in warm climates, but also the fastest growing.

A recent paper ñ *The comfort and energy impact of overcooled buildings in warm climates*, by Abdulla Alnuaimi, Sukumar Natarajan and Tristan Kershaw, of the University of Bath ñ reports that the majority of built environment growth will occur in warmer climates. Although the global trend in power generation carbon intensity is decreasing, the signi cant future increase in cooling energy demand is estimated to triple.

Current carbon emissions from cooling energy annual demand is expected to rise from about 2,000TWh currently to 6,000TWh by 2050, because of increased air conditioning use, urbanisation, population growth, and a warming climate.

The authors of the paper note that it is remarkable that a proportion of this projected growth in cooling energy demand is being driven not by an increase in the overall installations of air conditioning, but through the unnecessary expenditure of energy, or overcooling , that produces uncomfortably cool thermal conditions. The extent to which overcooling is de ned and quanti ed, in terms of thermal comfort, has not been systematically studied.

Unmanaged, overcooling will not only lead to signi cant unnecessary energy consumption within a rapidly expanding building stock ñ resulting in increased cooling energy demand and carbon emissions ñ but also to persistent occupant discomfort, leading to negative health effects.

Overcooling has also attracted media attention, with anecdotal reports from a range of buildings, including of ces and shopping centres, commonly featuring terms such as summer freeze and freezing . Overcooled spaces in public buildings are reported as being too cold inside, while it is nice and warm outside.

In East Asia, the term air conditioningitis is used to describe the negative health effects arising from the large differences in indoor and outdoor temperatures caused by low setpoints in air conditioned buildings.

The sensation of being overcooled causes occupants to resort to unsustainable strategies: opening windows to dump the coolth, which can unwittingly admit more heat; increasing clothing during the hot season; and, in some instances, simply avoiding overcooled spaces.

The analysis revealed that, within comparable air temperature ranges, occurrences of warmer climate overcooling outweigh those of cold climates. Within both climates, differing perceptions of thermal discomfort are indicated, suggesting a cultural link to thermal comfort.

> Unmanaged, overcooling will not only lead to significant unnecessary energy consumption, but also to persistent occupant discomfort, leading to negative health effects

A proliferation of air conditioning units on the sides of buildings in Singapore

A signi cant gender disparity in cold discomfort has been observed, with females three times more likely to experience it than males.

A global implementation of thermal comfort, as in the predictive mean vote (PMV) across varying climates, assumes that comfort is homogeneous within all climates, cultures and genders. However, more frequently, the application of an international comfort standard yields contrasting results in climates that differ from the climate originally intended.

To estimate the carbon penalty of overcooling, a countrywide energy model is needed that accurately re ects the varying building typologies in terms of their quantities and size, as well as their operation. Additionally, power generation carbon intensities for electrical grids will be needed for periods of air conditioning use at all the studied locations. As much of this data is currently unavailable, a general assumption of the global cooling trend has been applied instead.

Based on International Energy Agency reports, it is speculated that the overall carbon emission volumes will remain signi cant, as reductions in grid carbon emission factors will be offset by the mass use of air conditioning.

By examining studies of global thermal comfort where cold discomfort, during the warm season, exceeds warm discomfort, they estimated an average of 17% were classed as overcooled, all occurring in warm climates.

The 2,000TWh of global energy use annually employed for cooling equates to around 8% of global carbon emissions.

At the simplest level, if it is assumed that 17% of expended energy is wasted in overcooling, it can be estimated that 1.3% of current global carbon is being emitted unnecessarily because of overcooling. Not all buildings in the world are likely to experience overcooling, so this is probably an overestimate of the impact of overcooling on global carbon.

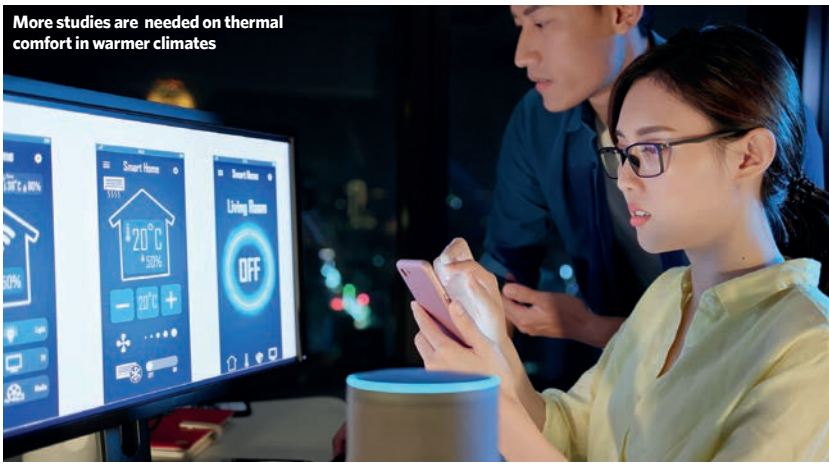
It is notable that the majority of future space cooling will come from the Global South, where demand can be considered to be largely unsaturated. Hence, the estimated tripling of space cooling demand, to 6,000TWh by 2050, will be driven largely by the Global South, which is unlikely to decarbonise electricity grids at the same rate as the industrialised parts of the world.

If a 1:3 split is assumed for space cooling demand from non domestic to domestic buildings, overcooling to occur only in non domestic buildings, and a linear growth business as usual scenario, then 6,800TWh of delivered space cooling over the 30 year period of 2020 to 2050 can be estimated to be because of overcooling.

If the world halves its present carbon intensity for electricity by 2050, this equates to 1.6 billion tonnes carbon equivalent by 2050, which is 0.7% of the available carbon budget for a 67% chance of limiting global temperature rise to 1.5K.

While the assumption of all non domestic buildings to be overcooled is likely to result in an overestimate, this may be »

Women are more likely than men to feel cold discomfort



More studies are needed on thermal comfort in warmer climates

The majority of future space cooling will come from the Global South

» balanced in future by the overall warming trend, and the fact that many residential buildings ñ especially those controlled centrally ñmay be wastefully cooled.

It is instructive that the simple behavioural change of adjusting of thermostats to eliminate overcooling will have a significant impact on the planet s total carbon budget for the next 30 years.

It is not merely the impact on energy demand or carbon, however. Overcooling causes thermal discomfort that will have knock on effects for health and wellbeing. These can result in increased absenteeism and loss of productivity, contributing to staff costs, which account for 90% of a typical institution or business costs.

The researchers believe there is a shortage of studies that have the necessary thermal comfort parameters to obtain a fuller understanding of thermal comfort in warmer climates. As a result, further research on space cooling culture in these geographies and climates is required, as current urbanisation trends within developing warmer climate regions are expected to exacerbate the issue of overcooling significantly.

> By examining studies of global thermal comfort where cold discomfort, during the warm season, exceeds warm discomfort, they estimated an average of 17% were classed as overcooled, all occurring in warm climates

It was discovered that the opportunity cost for mitigating this waste is low ñ for example, through the use of a more climate and culture speci c de nition of thermal comfort.

The researchers estimate that an upward adjustment of setpoint temperatures by, on average, 1.5K would likely reduce cooling energy demand more than most good practice passive design measures ñ such as better heat loss parameters and shading ñ now and in the future.

This is not to say that passive design measures are not needed ñ quite the opposite ñ but rather that the impact of poorly speci ed indoor environments is of a greater scale than is often appreciated.

So, a departure from a universal interpretation of thermal comfort towards a climate and culture speci c application would serve to not only avoid the waste of energy and carbon, but also improve health and wellbeing. **CJ**

■ To read the paper visit: **doi.org/10.1016/j.enbuild.2022.111938**

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HOW TO BE SMART WITH MONITORING

The increasing affordability of sensors means real time monitoring of indoor environmental quality is within reach of many buildings. CIBSE s new TM68 guide offers advice on using sensors and data analysis to optimise building performance. **Eleonora Brembilla** reports

TM68 summarises the basic knowledge behind indoor environment measurement and relates it to practical experience

In the past few years, more and more people have come to realise the importance of well ventilated restaurants, air conditioned shops, well lit schools, and soundproofed home offices. Recent events brought up issues with our buildings that we all had to tolerate until major events ñ think Covid 19 or heatwaves ñ forced us to face the consequences of bad design decisions.

The thing is, indoor environmental quality (IEQ) is often hard to assess by just relying on our perception. The effects of poor air quality, or of discomfort glare, can manifest hours later with seemingly unrelated symptoms, such as headaches and eye strain.

We start to complain about indoor discomfort only when something is really wrong with it ñ and we do (eg fund) research on IEQ only when everything is wrong with it. So it was that the few guidelines we had on how to measure IEQ in existing buildings were all about targeted campaigns to solve well known indoor environmental problems.

Meanwhile, the technology behind measuring instruments has made a giant leap forward, bringing us ever so tiny sensors that are able to retain the accuracy needed for meaningful assessments. The cost of this new technology is becoming incredibly affordable and new wireless connection protocols can guarantee reliable communications between devices.

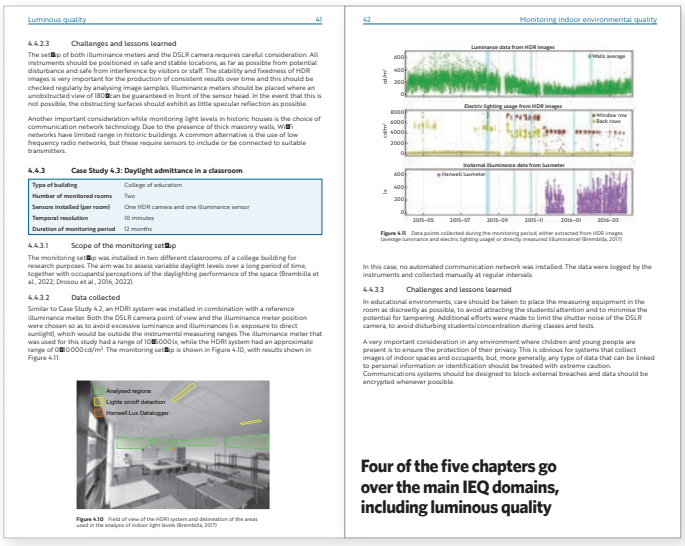
Such innovations mean measuring devices can now be placed permanently in a space for monitoring purposes, and can collect data on long term periods, giving us a wealth of information about our indoor spaces and whether they represent comfortable, or uncomfortable, conditions.

But with power comes responsibility, and the responsibility of installing such sensor networks ñ and making sense of their data ñ is well within the realm of a building services engineer.

TM68 was conceived to bring some clarity to the subject of IEQ sensors and data for professionals and researchers approaching this field for the first time. Too often, the hype around topics such as the internet of things (IoT) and smart buildings detracts from the actual data being collected, and from their relationship to more traditional building performance knowledge.

So, we decided to approach continuous IEQ monitoring by summarising the basic knowledge behind indoor environment measurement and relating it to practical experience of monitoring existing, in use buildings.

Four of the five parts that compose this new TM68 (chapters 2 5) go over the main IEQ domains: thermal comfort, air quality, luminous quality, and acoustic quality. Each of these sections gives a general overview of basic quantities and units, and instruments and sensors used for measurements, including their calibration, as well as practical recommendations about sampling strategies for successful monitoring campaigns. At the end of each section, case studies illustrate how IEQ monitoring was performed in existing buildings, how data was collected and analysed, and the lessons learned from these research and commercial activities.



Luminous quality 41

4.4.2.3 Challenges and lessons learned

The set□p of both illuminance meters and the DSLR camera requires careful consideration. All instruments should be positioned in safe and stable locations, as far as possible from potential disturbance and safe from interference by visitors or staff. The stability and fixedness of HDR images is very important for the production of consistent results over time and this should be checked regularly by analysing image samples. Illuminance meters should be placed where an unobstructed view of 180□can be guaranteed in front of the sensor head. In the event that this is not possible, the obstructing surfaces should exhibit as little specular reflection as possible.

Another important consideration while monitoring light levels in historic houses is the choice of communication network technology. Due to the presence of thick masonry walls, Wi□i networks have limited range in historic buildings. A common alternative is the use of low frequency radio networks, but these require sensors to include or be connected to suitable transmitters.

4.4.3 Case Study 4.3: Daylight admittance in a classroom

Type of building	College of education
Number of monitored rooms	Two
Sensors installed (per room)	One HDR camera and one illuminance sensor
Temporal resolution	10 minutes
Duration of monitoring period	12 months

4.4.3.1 Scope of the monitoring set□p

The monitoring set□p was installed in two different classrooms of a college building for research purposes. The aim was to assess variable daylight levels over a long period of time, together with occupanti perceptions of the daylighting performance of the space (Brembilla et al., 2022; Drosou et al., 2016, 2022).

4.4.3.2 Data collected

Similar to Case Study 4.2, an HDRI system was installed in combination with a reference illuminance meter. Both the DSLR camera point of view and the illuminance meter position were chosen so as to avoid excessive luminance and illuminances (i.e. exposure to direct sunlight), which would be outside the instrumental measuring ranges. The illuminance meter that was used for this study had a range of 10□2000 lx, while the HDRI system had an approximate range of 0□10 000 cd/m². The monitoring set□p is shown in Figure 4.10, with results shown in Figure 4.11.

Figure 4.10 Field of view of the HDRI system and delineation of the areas used in the analysis of indoor light levels (Brembilla, 2017)

42 Monitoring indoor environmental quality

Figure 4.11 Data points collected during the monitoring period, either extracted from HDR images (average luminance and electric lighting usage) or directly measured (illuminance) (Brembilla, 2017)

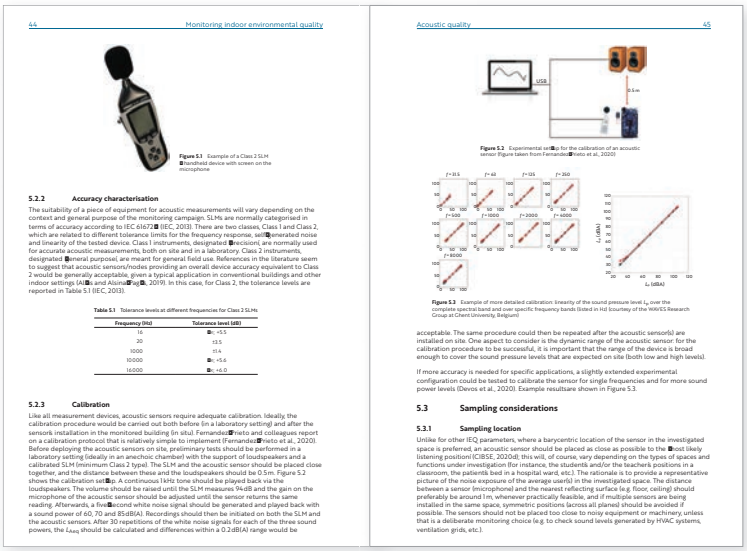
In this case, no automated communication network was installed. The data were logged by the instruments and collected manually at regular intervals.

4.4.3.3 Challenges and lessons learned

In educational environments, care should be taken to place the measuring equipment in the room as discreetly as possible, to avoid attracting the studentsl attention and to minimise the potential for tampering. Additional efforts were made to limit the shutter noise of the DSLR camera, to avoid disturbing studentsl concentration during classes and tests.

A very important consideration in any environment where children and young people are present is to ensure the protection of their privacy. This is obvious for systems that collect images of indoor spaces and occupants, but, more generally, any type of data that can be linked to personal information or identification should be treated with extreme caution. Communications systems should be designed to block external breaches and data should be encrypted whenever possible.

Four of the five chapters go over the main IEQ domains, including luminous quality



The combination of basic theory and practical examples is designed to aid the reader and answer their questions

Data about indoor environment could provide early warnings about the need for maintenance or replacement of systems

The fifth part of TM68 (chapter 6) focuses on how to manage these new sensor networks and the continuous stream of data they collect. It provides a broad, but technical, primer for those of us less familiar with the hardware and software required for an efficient and unintrusive environmental monitoring system.

This is where all the knowledge summarised in the previous sections comes together to provide an integrated IEQ assessment, and where it combines with concepts of electrical and software engineering.

Importantly, it also highlights delicate ethical questions, such as respect of building occupants' privacy, the protection of data and networks from external intrusions, and the responsible (re)use of sensors and other electronic components, which are full of rare earth elements.

Throughout TM68, the combination of basic theory and practical examples is meant to help the reader, answering questions such as: where can I place my temperature sensor so that it is not in the way of building occupants, but its measurements are still valuable; how often should I measure noise levels; do the specs of my illuminance sensor meet the minimum requirements for my analysis; should I store data locally or on the cloud – plus many more typical questions that need to be answered before embarking on a monitoring campaign. While, previously, you had to search and read a number of disparate documents, we tried to collect these answers into a single technical manual that can steer readers in the right direction and offer them useful suggestions and references.

The possibility of looking at indoor environmental conditions during the life of a building is welcome news for both research and commercial purposes. From a research perspective, the collection and comparison of these data from a multiplicity of buildings could reveal performance patterns, and their combination with survey data collected from occupants could reveal more about human–building interaction mechanisms.

From a commercial perspective, data about the indoor environment could give early warnings about the need for maintenance or replacement of installed systems, as well as an opportunity to establish more regular relationships with clients and provide updated advice on refurbishment and energy improvement strategies.

In the long run, these same IEQ monitoring data could serve as the basis for digital twin applications, where live data feed a digital replica of the entire building system, which is used to detect potential malfunctioning in the real building or even predict and optimise near future performance.

With the increase in distributed renewable sources and flexible grid solutions, we might also see a rise in such predictive control strategies – and we always need to keep IEQ in mind, side by side with energy efficiency, if we want to see these new frameworks work.

It is expected that a growing number of new and existing buildings will soon install monitoring systems with the capability of assessing IEQ conditions. The reasons outlined above, and an increased tendency of green building certification schemes to require measurements during the operation phase, seem to push in this direction. So, while it was not always easy to find appropriate case studies for this first version of TM68, we expect new case studies to be included in future versions.

New sensor technologies and research findings on occupants' preferences will contribute to a renewed understanding of monitoring data, which, in turn, will provide us with more evidence on IEQ.

If we treat all these data cleverly and responsibly, and share them with each other whenever possible, we will be able to build a collective database from which to draw new conclusions and design new solutions, to improve indoor health and wellbeing for all. CJ

DR ELEONORA BREMBILLA, is an assistant professor at Delft University of Technology and chair of the TM68 committee

TM68 is available on the CIBSE Knowledge Portal at **cibse.org/knowledge**

TARGETING THE BREATHING ZONE

Traditional methods of measuring ventilation effectiveness depend on well mixed spaces that don t often occur in reality, says **Tim Dwyer**, who introduces a new metric developed by **Dr Kishor Khankari** that targets the critically important breathing zone and enables engineers to accurately model ventilation designs

The unenviable position as the very last slot in the ASHRAE Conference in Toronto in July 2022 was occupied by AnSight s Dr Kishor Khankari. There was a sense of saving the best till last, as his paper on evaluating ventilation effectiveness could have a lasting impact on the way we design for healthy indoor spaces.

Ventilation effectiveness is a description of an air distribution system s ability to dilute and remove internally generated pollutants from a building, zone or space compared with a perfect air mixing condition.

In his presentation, *A computational fluid dynamics (CFD) approach for evaluation of ventilation effectiveness*, Dr Kishor Khankari explained that it provides a measure of how a clean air supply meets the ventilation goals of the space, with the aim of keeping occupants healthy, comfortable and productive in occupied space by concentrating on the breathing zone.

He emphasised that the supply air should move through the space with minimum recirculation and stagnation, which otherwise can promote zones with high contaminant concentrations. He also noted that the precious resource of clean air should not short circuit without doing its work ñ it should reach the breathing zone, sweep up the contaminant, and not leave the space without removing the contaminants.

However, the air always takes the path of least resistance, but that path is not intuitive and is difficult to imagine ñ it is important to understand that path.

The breathing zone is the critical zone. Sensors are often mounted in the return ducts ñ and this should not be confused with a monitor for ventilation effectiveness, as the key zone is the breathing zone, which is typically 1.2m to 1.8m off the floor. Khankari reflected that, generally, designers are seeking a simple number that can represent ventilation effectiveness. However, he emphasised that there are quantitative and qualitative aspects, and a single number is not going to serve the purpose.

He employed the widely used contaminant rise and decay curve (Figure 1) to illustrate the concentration of contaminants in a space. The contaminant

source starts at time zero ñ for example, an infected individual entering the room and exhaling contaminants. The concentration builds up, and reaches a steady state as the dilution and removal of contaminants by the ventilation system practically balances those being emitted. Then, when the source is taken away ñ for example, the infected individual leaves the room ñ the contaminant gradually depletes.

Khankari noted that there are limited real world applications where this decay curve is practically useful as in most cases occupants are not present during the decay phase of contaminants.

Examples might be a laboratory when there is an accidental spill, or in isolation rooms, where the patient leaves the room and the room air needs to clean sufficiently for the next patient. However, he was of the opinion that practically all the ventilation effectiveness theories are developed using the decay curve, as well as the most popular ventilation test methods, the tracer gas method, that employs the decay curve.

These are based on well mixed spaces, but, in reality, this never happens. It is not your coffee cup, where you add creamer and stir, and suddenly you get a homogeneous coffee ñ ventilation is not like that, Khankari says.

His contention is that current, popular theories are effectively measuring how well mixed the room is but that does not mean the room is clean and does not mean the breathing zone is at an acceptable level of concentration. It only measures how well the room and supply air are mixing, and how fast the concentration is reducing. Without proper qualitative and quantitative investigation before the installation of the systems, there is a risk that the systems will need expensive reconfiguration after installation.

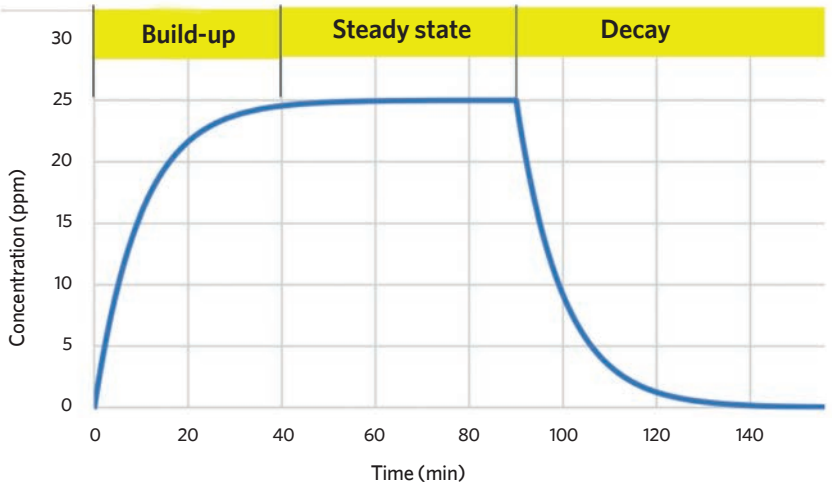


Figure 1: The classic decay curve representation of intermittent contaminant concentration in a ventilated space based on well-mix theories. (Courtesy of AnSight, Ann Arbor, MI, USA)

Khankari introduced a new approach to ventilation effectiveness ñ the Spread Index, SI_{TC}. This defines the extent of room volume occupied by a certain concentration, where SI = Volume of the room above TC/Volume of room, where TC is target concentration that, for example, could be 25ppm. And Ventilation Effectiveness, Ev = 1 ñ SI_{TC}, with the goal to minimise SI and maximise Ev. The time taken to reduce SI from its maximum value to zero is known as the Purge Time (PT) ñ another metric of ventilation effectiveness introduced by Khankari.

He demonstrated how CFD modelling can be employed to readily estimate the Spread Index. The red blob in Figure 2 is a dirty zone in a space above the acceptable level of contaminant concentration ñ possibly caused by an accidental spill release. Using CFD, the volume of the red blob can be established, and dividing the volume of that blob by the volume of the space gives the proportion of the space that is above the acceptable level of concentration. The image on the »

> The supply air should move through the space with minimum recirculation and stagnation, which otherwise can promote zones with high contaminant concentrations

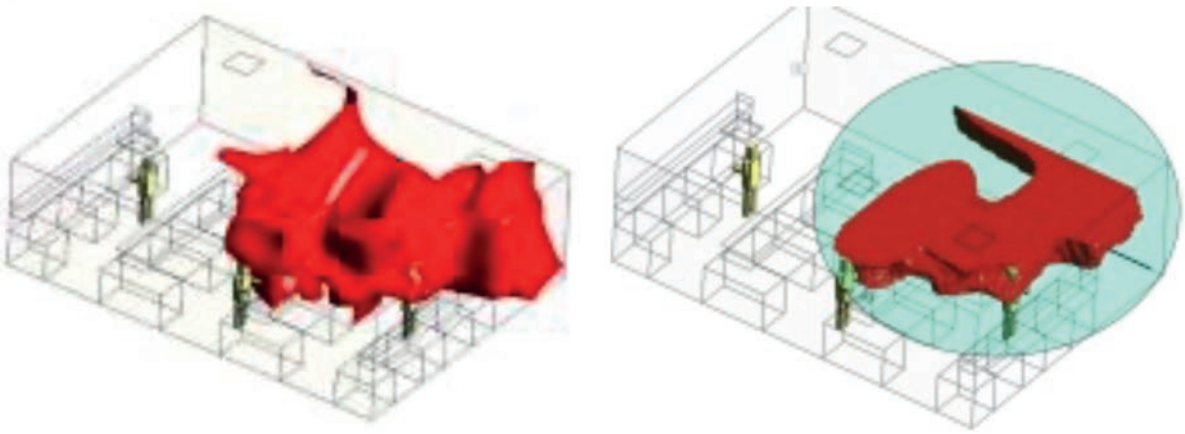


Figure 2: Spread in the room and in the breathing zone because of accidental spill in a laboratory. (Courtesy of AnSight, Ann Arbor, MI, USA)

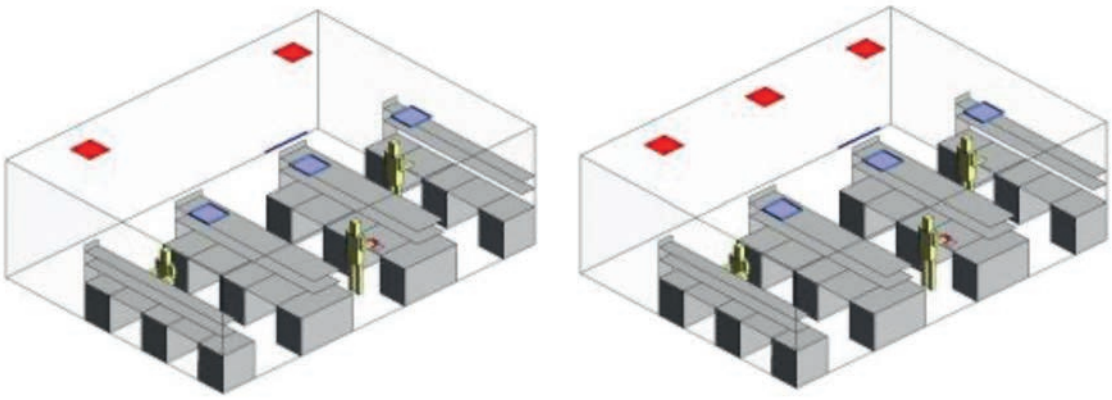


Figure 3: The example laboratory where the first case has two extract grilles and the second has three. (Courtesy of AnSight, Ann Arbor, MI, USA). Exactly the same lab, exactly the same air changes of six per hour, just adding one more extract grille.

» left visualises the volume of the entire space, whereas the figure on the right is a slice that relates just to the breathing zone.

The Spread Index can be calculated for the entire space or just for a critical zone and so can be developed at the breathing level by taking the volume of the dirty blob in the breathing zone and dividing it by the volume of the breathing zone. The Spread Index can be calculated for the entire space or just for a critical zone. The goal of a ventilation systems is not only to reduce the spread of contaminants, but also to reduce the concentration to an acceptable level as quickly as possible.

The associated metric is the Purge Time, which is how long it will take that red blob to disappear from the space. Once the contaminants are released, the goal is to minimise the Spread Index to zero as fast as possible. Khankari provided a practical example of how this can assist in the ventilation system design for a laboratory by considering two cases. In one case it has two exhaust grilles, and in the other, three ñ as shown in Figure 3.

Figure 4 shows the visualisation at the breathing level while maintaining the same air change rate. With three extract grilles, that red dirty zone has reduced

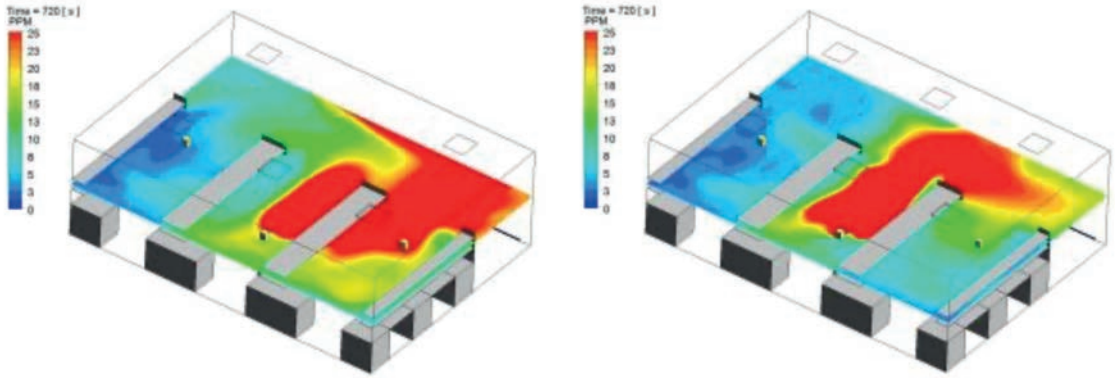


Figure 4: CFD visualisation of contaminant concentration after 720 seconds with two extract grilles on the left and three on the right, while maintaining the same air change rate. (Courtesy of AnSight, Ann Arbor, MI, USA)

and has been contained at the source of contaminant ñ the accidental spill release. With two extract grilles, the volume of the red blob indicates about 27% of the lab volume is at an unacceptable level. By adding one more exhaust grille, it brings it to 16%.

Thus, the Spread Index is providing qualitative and quantitative aspects of ventilation effectiveness.

Khankari illustrated a further simulation, this time applied to a shared office with six occupants, as shown in Figure 5, to assess the Spread Index with various configurations of supply diffusers and extract grilles, while maintaining the same three air changes per hour.

This showed a stark difference in the performance of the ventilation, while maintaining the three air changes per hour, that would potentially impact cross infection between occupants, as shown in Figure 6.

More air into the space will not change the ventilation effectiveness of HVAC components, however, CFD can be readily applied to optimise the arrangement with the best Spread Index, that provides a method to compare various mitigation strategies and optimise the ventilation effectiveness.

Dilution is important, because all those studies are based on dilution ñ the more air dumped into the space, the more diluted it becomes, so correcting the contaminant levels. That s a brute force approach: a lazy approach.

Better results come from properly distributing the clean supply air without the need for so many air changes ñ achieving the same result at lower air changes. So, it begs the question, why are ventilation effectiveness theories evolving around dilution all the time when it s not necessarily the dilution that is the solution for all pollution? **CJ**

> Mixing air does not really address ventilation effectiveness, it only provides a space that is well mixed

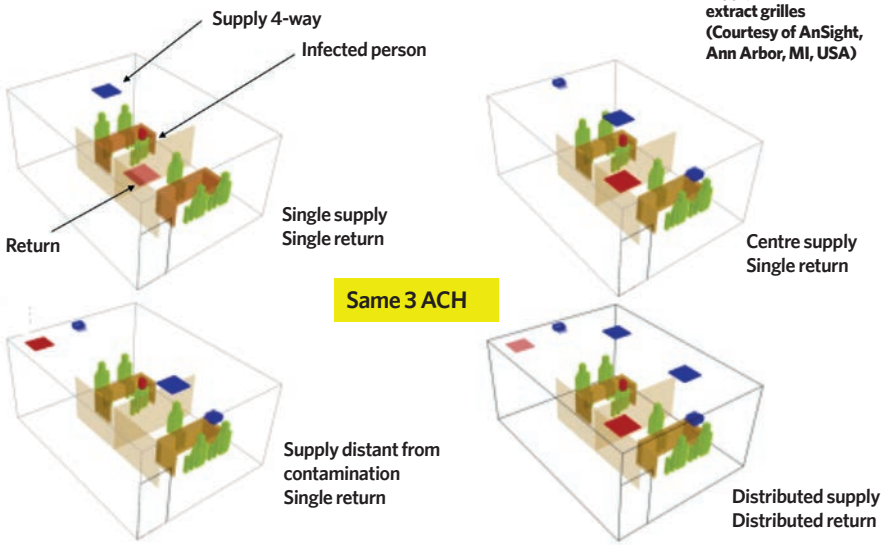


Figure 5 – shared office with five occupants with four different configurations of supply diffusers and extract grilles (Courtesy of AnSight, Ann Arbor, MI, USA)

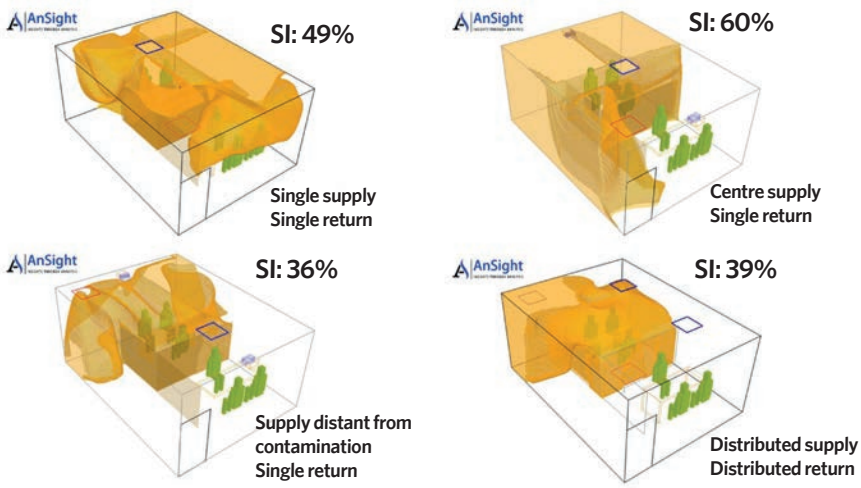


Figure 6: Spread Index for four different configurations of supply and return grilles

TOSHIBA

SHRM
SUPER HEAT RECOVERY MULTI
ADVANCE

[illegible]

[illegible]

- C[illegible] b[illegible] u+[illegible] [illegible]83%
- SEER[illegible] [illegible] u[illegible] 8.9
- R32[illegible] [illegible]W P[illegible] r[illegible] [illegible]
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Seeking net zero in the built environment

This module considers recent and forthcoming guidance aimed at helping the UK to achieve net zero in the built environment

The recent, unprecedented, high outdoor temperatures and widespread flooding around the world have provided a stark reminder that climate change and global heating is not pausing as the world looks towards a 2050 deadline for carbon neutrality. The built environment in the UK and around the world is increasingly committing to achieve net zero buildings. This CPD will consider recent and forthcoming guidance from a collection of concerned professionals and institutions in the UK that is aimed at improving understanding of metrics, methods and validation, in order to move from good intentions towards realistic, effective action.

Most countries and many corporations are already grappling with mitigation measures, and seeking long term solutions to avert the climate crisis, while also maintaining a handle on pandemic control.[1] The built environment is responsible for much of the world s energy use and carbon emissions, and many nations ñ including those of the UK ñ have set what appear to be challenging targets on the path to limit climate change. However, it may be that the route is paved with good intentions, misunderstanding or, potentially, meaningful obfuscations, and the recent Intergovernmental Panel on Climate Change (IPCC) working group 3 report *Mitigation of Climate Change*[2] did little to inspire confidence in progress so far.

To keep global warming to no more than 1.5K ñ as called for in the Paris Agreement[3] ñ emissions need to be reduced by 45% by 2030 and reach net zero by 2050.[4] The UN puts it simply: Net zero means cutting greenhouse gas (GHG) emissions to as close to zero as possible, with any remaining emissions re absorbed from the atmosphere, by oceans and forests, for instance.[5] The provision of energy ñ including electricity ñ transport, manufacturing, buildings, fugitive emissions and other fossil fuels is most significant, accounting for 75% of global emissions in 2018.[6] The building and construction sector, an inveterate user of energy, accounted for 36% of global final energy consumption and 37% of energy related CO_2 emissions in 2020.[7] Although the UN encapsulates the task ahead in those few words, a quick Google search will uncover hundreds, if not thousands, of interpretations of how this translates in terms of the built environment, and what is needed to move towards a net zero existence for our buildings in a timely manner.

The publication of five short briefing documents[8] by LETI (see panel, LETI), in conjunction with the UK Green Building Council, Better Buildings Partnership, Good Homes Alliance, the Royal Institute of British Architects and CIBSE, sets out the foundation of contemporary UK knowledge and thinking.

The documents described in the boxout provide a base on which to develop a better understanding of the issues and mechanisms involved in the development of net zero built environments. The reformational proposals in these documents ñ and the ensuing industry consultation, reviews and questions raised on the facts, assertions, developments and interpretations ñ have stimulated the publication of answers to a set of 27 frequently asked questions (FAQs). These have been evolved from a survey undertaken by CIBSE and LETI in late 2021, specifically »

» oriented towards the definitions, which sought to determine the level of agreement with the definitions and their interpretation, and attracted 198 responses. More than 75% of respondents self identified as expert or having medium expertise , with the majority of responses from sustainability consultants, building services engineers and architects. The resulting FAQs still do not profess to provide the definitive answer to what net zero means, for all building types, but [provide] a step on the road and point towards a direction of approach .

The FAQs and answers ñ together with all the other documents referred to here ñ are freely downloadable through the links given at the end of the article. As examples of the content, here are some of the notable discussions that have been drawn, in an edited form, from the answers to the FAQs.

Example FAQs

The fundamental FAQ 1 asks: Why does a building need to meet energy targets? The response notes that buildings cannot be considered in isolation and need to have low energy use to enable the most effective (financial/embodied carbon/ resources) development of a zero carbon Grid. It is contested that a building that is completely off Grid should also be subject to energy targets, because that building will use embodied carbon resources for its onsite energy supplies and, by employing energy efficient design, will maximise the opportunity to generate surplus energy, which could be used (exported) elsewhere. In terms of the type of energy target, the comments attached to FAQ 4 outlines that it should meet an energy use target such as an energy use intensity (EUI) or energy rating. Additionally, it recommends that appropriate heating/cooling design targets be set as a precursor to meeting those energy targets.

As operational energy will play such a significant part in the lifetime impact, FAQ 10, Will the Net Zero Carbon ñ Operational Energy definition be valid until 2050, or will it evolve? , is particularly important. The response notes that, although this is currently based on reducing annual energy use and employing energy from a renewable energy source, this may evolve to respond to a changing context ñ such as meeting the needs of demand management to optimise, for example, peak demand and storage provision. The focus on annual energy use and renewable energy generation could also potentially evolve.

Much of the success of a low carbon future is pinned on the decarbonising of the UK electricity Grid (and potentially the gas Grid).

LETI

Established in 2017, the London Energy Transformation Initiative (LETI) is now a UK network of more than 1,000 built environment professionals who are working together to put the UK on the path to a zero carbon future. The voluntary group is made up of developers, engineers, housing associations, architects, planners, academics, sustainability professionals, contractors and facilities managers. The group has been the catalyst for the production of several advisory documents, including the five summarised below, that, together, form a basis of current UK thinking on the definitions and processes employed in the development of net zero built environments.

Net zero (one-pager) – Published in 2019, as the widespread support for an acceleration to net zero carbon took hold. It provides: high-level benchmarks for total energy use intensity (EUI) for many building types; suggested frequency of validation audits for buildings; and the carbon auditing required to establish that a building achieves a net carbon balance. This provides a simple scene-setter for the subsequent short publications released in 2020 and 2021.

Whole life carbon (Emissions) (one-pager) – This describes how whole life carbon is the sum total of all building assets-related GHG emissions and removals, both operational and embodied, over the building's life-cycle, including disposal. It provides a succinct commentary on methods applicable to 'asset' life-cycle stages (as defined by BS EN 15978:2011[9]), which includes phases (or 'modules'): 'upfront' – product creation and construction; 'embodied carbon' – in-use and end-of-life stages; 'operation carbon' – in terms of energy and water; and, possibly the most difficult to quantify, 'circular economy', which incorporates reuse, recovery and recycling, and the potential future carbon benefit of a design decision made today.

Embodied carbon (Emissions) (one-pager) – Describing the GHG emissions and removals associated with materials and construction processes throughout the whole life-cycle of an asset. This is explained in terms of the BS EN 15978 life-cycle stages by: 'cradle to gate' – the product stages; 'cradle to practical completion'; and 'cradle to grave', which includes all stages except the operational carbon. A hierarchical set of 'elemental reduction strategies' provides suggestions for methods that may be employed to reduce embodied carbon.

Embodied carbon target alignment – This explains the need for consistent methods of measurement to produce standardised benchmarks, targets and performance metrics that are appropriate to the particular building types and applications. It explains that there is a need for embodied carbon reporting on all projects, requiring a rating system that may be contextually applied and accessible – which, it suggests, should be based on a simple A-F scale. It includes examples of embodied carbon targets that have been developed for office, high-rise residential, education and retail sectors, noting the need for transparency in reporting to ensure validity.

Carbon definitions for the built environment, buildings and infrastructure – This aims to provide some consistency in basic definitions related to carbon and net zero carbon terminologies. This lexicon includes a useful base set of interpretations relating to definitions of 'carbon', 'infrastructure', 'net zero', and the terminology associated with offsetting, or compensating for, emissions. It includes a useful table that summarises tasks that would relate to achieving net zero carbon at each project stage.

FAQ 9 asks if there is a point where renewable energy procurement will no longer be required, and the response is clear that all energy use should be met by on or offsite renewable energy sources. Although the UK electricity Grid is continuing to decarbonise and is predicted as being net zero (or near) well before 2050, buildings must meet their needs through onsite or procured renewable energy generation (at the time of handover to the building operator). For a building that is supplied by green gas ñ for example, created from anaerobic digestion ñ the reply for FAQ 22 highlights that, if the anaerobic digestion happens on site, the green gas is deemed renewable and the building can qualify as net zero (if it meets the other requirements of the definition). The building must run 100% on green gas, or another renewable, so a net balance of exported green gas and imported natural gas is not acceptable. An important caveat is that, if it is employing forestry based products for anaerobic digestion, they must be sustainably certified ñ which effectively means they should be replaced.

One of the most contentious areas in the reliability of net zero claims is the role that offsets play. The reply to FAQ 13 clarifies that offsets are not allowed to cover

carbon emissions from energy use, as, ultimately, all buildings will need all energy use to be met by zero carbon sources. Offsets are only for unavoidable emissions, particularly in a transition period while all parts of the economy decarbonise. This may be to offset embodied carbon emissions, while still meeting local upfront and embodied carbon targets; (selected) upstream emissions from energy generation and distribution; and GHG emissions arising from water supply and wastewater treatment, while still meeting local water use targets. Upstream emissions are extensively explained in FAQ 21, where they are referred to as well to tank emissions from the production, processing and delivery of a fuel. This applies to: biomass, such as in the processing and transport of pellets; natural gas, including extraction and processing; and electricity if, for example, it is generated using biomass, oil or gas. Several worked examples are included.

It may seem anomalous that building mounted solar photovoltaic (PV) panels are excluded from the LETI embodied carbon targets. The notes on FAQ 25 explain that the rationale is that PVs are part of the wider energy system, helping to decarbonise electricity. The embodied carbon of that wider infrastructure is not included in buildings embodied carbon targets, so including PVs would not provide a fair comparison and could disincentivise their installation. The commentary accepts that the boundary is not always clear ñ for example, when PVs are integrated as a fa ade element, as these elements are included in embodied carbon targets. Solar thermal systems are included in the calculations for embodied carbon targets, as these systems only connect to the building, not to a wider network/infrastructure.

The increasing cachet of delivering a more environmentally responsible built environment undoubtedly contributed to the inclusion of FAQ 15, which asks whether achievements towards delivering operational energy aspects of net zero carbon can be acknowledged at the various stages of project delivery. It is noted that net zero in progress (NZiP) status can be claimed at different project stages ñ such as for a building that is being designed, or has been completed ñ to meet energy use targets that can be evidenced with design stage predictive energy modelling calculations. Manufacturers of environmental plant are responding to the demand to reduce operational impact with product developments such as the example illustrated in Figure 1. A building could then be handed over to the occupier to follow on with compliant operation to meet net zero. The response to FAQ 16 adds that the designation of NZiP can also apply to existing buildings that do not burn fossil fuels and have a net zero retrofit plan in place to meet the energy targets with on or offsite renewable energy for all energy use, with any offsets clearly established for upstream emissions.

Figure 1: Example of recently developed external unit for variable refrigerant flow (VRF) system, operating with a R-32 twin-rotary compressor with liquid injection, split heat exchanger, sub-cooling plate heat exchanger, a high-performance fan motor, and novel control features, all contributing to providing a SEER up to 8.9 and SCOP up to 4.67

These FAQs add significantly to existing resources from CIBSE and LETI, such as the 2020 LETI *Climate emergency design guide* and 2021 CIBSE TM65 *Embodied carbon in building services: A calculation methodology*. The authors conclude that work is needed, and is being planned, in collaboration with other industry bodies to develop further clarity and consensus on net zero.

There is, undoubtedly, scope for further directed guidance and action to deliver changes in the way that buildings are constructed and used to reduce environmental impact. In recent months, a group of UK organisations and professional institutions, including CIBSE, have come together to form a technical steering[10] group with the aim of developing the UK Net Zero Carbon Buildings Standard . This group will establish task groups of technical and sector specific experts to determine realistic sector specific embodied and operational benchmarks for what is currently possible and for what is likely to be possible in the future. This will be founded on robust carbon accounting methodologies, assessed and agreed as part of this project, and will include proposals of the requirements for credible validation.

A recent UK court case indicates[11] that government is still seeking the detail of how the current net zero policies will reach targets, making it all the more important that the industry swiftly develops clarity of purpose and ñ more importantly ñ practical metrics, applications and solutions. The work discussed in this article is but a step on the critical path towards net zero.

Turn to page 92 for references.

Module 201

September 2022

» **1. What is the reduction in emissions by 2030 that is considered necessary on the path to limit global warming to no more than 1.5K?**

- ☐ A 15%
- ☐ B 30%
- ☐ C 45%
- ☐ D 60%
- ☐ E 75%

2. Which British Standard includes life cycle stages referred to in the FAQs?

- ☐ A BS 8001
- ☐ B BS EN 15942
- ☐ C BS EN 15978
- ☐ D BS EN ISO 14001
- ☐ E BS ISO 20400

3. This article provides a commentary on 10 of the FAQs how many are in the full CIBSE/LETI document?

- ☐ A 10
- ☐ B 12
- ☐ C 17
- ☐ D 27
- ☐ E 37

4. Which FAQ attempts to clarify what might be considered one of the most contentious areas?

- ☐ A FAQ 1
- ☐ B FAQ 9
- ☐ C FAQ 13
- ☐ D FAQ 15
- ☐ E FAQ 22

5. What is the manufacturer s claimed SEER and SCOP for the illustrated external VRF unit?

- ☐ A SEER up to 5.9 and SCOP up to 6.67
- ☐ B SEER up to 6.9 and SCOP up to 5.67
- ☐ C SEER up to 7.9 and SCOP up to 7.67
- ☐ D SEER up to 8.9 and SCOP up to 4.67
- ☐ E SEER up to 9.9 and SCOP up to 8.67

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CIBSE

Products of the month

Hot water audits tackle cost of living squeeze

Rinnai is offering a free audit of hot water system energy costs on all sites, which may lead to customer fuel savings of up to 30%

Free audits of total energy costs related to hot-water systems on all sites are being offered by Rinnai. Specifically aimed at maximising hot-water delivery efficiencies, the audits will contribute to significant savings on fuel costs to the end-users.

Maximising efficiencies on site could result in fuel cost savings of up to 30% on current energy prices. Rinnai says its continuous flow technology means that hot water is heated only when required. It says benefits are seen because energy costs stop immediately once the tap is not in manual use.

The total capital expenditure and carbon savings are to be included in the audit for the final whole life calculation. The audit measures all data from both individual and multiple sites concerning hot-water use, and presents a full and detailed report.

'This is our response to the tightening squeeze on costs that all businesses, commercial sites and homes are currently facing. We have a range of products, which includes gas-fired solutions, hydrogen-20% blends ready, BioLPG and solar to electric heat pumps, as part of our H3 initiative of hydrogen, hybrid and heat pumps,' says Tony Gittings, managing director at Rinnai UK.

Recently, the company announced a global first, with the development of 100% hydrogen hot-water heating technology. Current UK Rinnai product ranges – both domestic and commercial – are 'hydrogen blends ready'. This means that units will accept the proposed 20% hydrogen/natural gas blend.

Rinnai UK is one of the first manufacturers to be able to display the I2HY20 gas category certificate for all its products.

The company has also announced that it will help in reducing the carbon footprints of all sites and applications with the introduction of its Carbon Cost Comparison Form. This can be completed online; however, hard copies of the form are available on request.

The form offers a free appraisal of a site's current hot-water delivery system, along with recommendations for how customers can go about reducing the carbon load.

To access the advice, the user simply visits the Rinnai website, completes the form and hits the 'Submit' prompt. Following this, Rinnai will complete a thorough analysis, which is then returned. The Rinnai Carbon Cost Comparison Form is part of the Rinnai suite of innovative digital touchpoints. Easy to use, the pages are designed to make customer decision-making fluid and specific.

'Continuous flow hot water heating units and systems deliver proven reductions on working costs and quantifiable improvements in energy efficiency, as well as providing temperature-controlled end-product whenever the need arises,' says Gittings.

'The user pays only for fuel used to heat the water at point of use – not when on standby, as in stored tank holding systems, creating cost-effective and carbon-reducing solutions for systems on the gas grid.

'Our carbon calculation service, however, will compare our complete H3 array of hydrogen blend ready water heaters, hybrid solar and heat pump systems, and stand-alone heat pump solutions, providing our customers with market-leading, low carbon solutions.

All of Rinnai's units are UKCA certified, with A-rated water efficiency, and can be accessed through multiple fuel options.

Audits of total energy costs by hot-water systems can be booked by calling 0300 373 0660 or visiting **www.rinnai-uk/contact-us/request**

The Carbon Cost Comparison Form is available FREE of charge from: www.rinnai uk.co.uk/contact us/carbon cost comparison form

Products of the month

Toshiba launches new generation R 32 VRF system

Ultra efficient SHRM Advance is designed to help decarbonise commercial buildings and cut running costs

Launched in July, the latest generation of Toshiba's variable refrigerant flow (VRF) system, SHRM Advance, operates on lower global warming potential (GWP) R-32 refrigerant. The combination of R-32's lower GWP and reduced refrigerant charge enables it to deliver a significant reduction of up to 80% in equivalent carbon emissions.

This all-new VRF system gives end-users an ultra-efficient, high-quality cooling and heating solution, enabling establishments to achieve best-in-class sustainability credentials, while reducing running costs.

Technical innovations have been incorporated that help enhance performance and energy efficiency. These include the ability to select either three-pipe heat recovery or two-pipe heat pump operation, a new twin-rotary compressor with liquid injection,

split heat exchanger, sub-cooling plate heat exchanger, a new high-performance fan motor, and a unique thermodynamic circuit, all contributing to a seasonal energy efficiency ratio of up to 8.9 and seasonal coefficient of performance of up to 4.67.

For system designers, a new generation of innovative flow selectors with up to 12 ports gives enhanced flexibility and optimises the ability of SHRM Advance to deliver simultaneous cooling and heating. Controlled automatically, this enables seamless energy transfers between areas of the building requiring heating and cooling.

An advanced heat-recovery function provides heat to the indoor unit with minimal input from the condensing unit, further improving energy efficiency and helping to minimise carbon footprint.

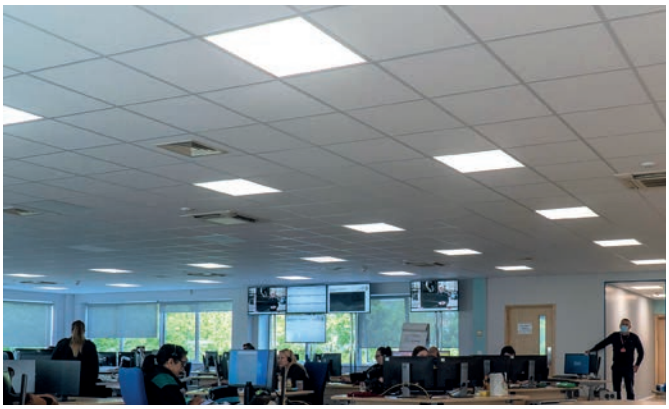
If required, SHRM Advance can also be customised to operate as a two-pipe heat pump system.

SHRM Advance is available in 8HP to 24H capacity units, giving the flexibility to meet the needs of any commercial building project.

As well as conventional indoor units, SHRM Advance is available with a fresh air ventilation duct and a medium temperature water module. For enhanced levels of indoor air quality, Toshiba's one-way and four-way cassettes offer plasma/ioniser air purification, while the high-wall unit has an ultra-pure filter.

Safe operation is a key design priority and is ensured by an advanced integrated leak-detection and shut-off valve system.

For more information call 01372 220240 or email marketing.uk@toshiba ac.com



Luceco relights call centre for ambulance service

The relighting of facilities at Horizon Place, for East Midlands Ambulance Service NHS Trust, was recently carried out by Luceco. Work included lighting of the Incoming Calls Centre, an open-plan space that required eight separately controlled zones, providing various levels of illumination.

Recessed LuxPanel Extra luminaires were used throughout the installation, controlled by Luceco's wireless lighting control system, Platform. Platform makes planning, configuration and commissioning of wireless lighting controls accessible to many applications, from large open- plan environments and warehouses to conference rooms and smaller offices.

Existing and new installations are transformed into a flexible wireless-controlled infrastructure. Platform sensors were used to provide occupancy and daylight dimming facilities, with switches pre-set with scenes for different lux levels depending on the time of day and staff shift arrangements.

For more information contact Zoe Newland Hodges: zoe.nh@luceco.com, telephone 07890 3201.

ELCO supplies hybrid heat system for secondary academy

Funding from a public sector decarbonisation scheme has supported the replacement of a new, sustainable heating plant at a secondary academy in Derbyshire. The project is contributing to a combined estimated carbon saving of 134 tonnes per year.

Carried out by ELCO heating solutions, two poor-efficiency coal-fired 'Robin Hood' boilers were replaced by two 48kW Aerotop M commercial heat pumps, with two 120kW Thision L ECO wall-mounted condensing gas boilers.

The commercial heat pumps provide the bulk of the heating and hot water throughout the year for maximum efficiency, energy savings and minimal emissions.

The new Aerotop M reversible heat pumps are available in outputs from 24kW to 48kW. All models are supplied with flow and return manifolds for arrangements of up to four heat pumps, while 16 units can be managed by a cascade controller.

For more information visit www.elco.co.uk or email enquiries@elco.co.uk

Aquatech announces new Spillpress pressurisation units ›

The pressure rise in commercial buildings must be minimised. Aquatech Pressmain has designed its Spillpress pressurisation units to maintain the water pressure in heating and chilled water systems in such buildings.

The Spillpress has a far lower pressure hot-system increase than a traditional sealed system. Using near-atmospheric diaphragm spill vessels, the system deals with temperatures of 3°C to 120°C, at fill pressures from 0.8 bar to 8.0 bar, and system contents of up to 87,000 litres.

■ **Contact sales@aqpm.co.uk or visit www.aquatechpressmain.co.uk**

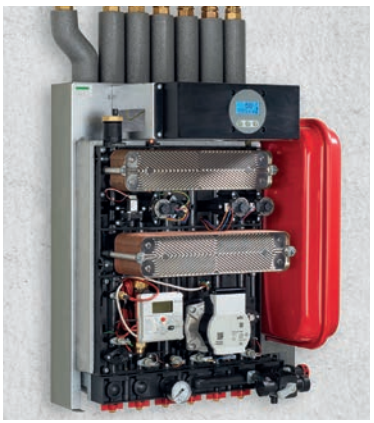
Jung Pumpen collecting tanks recommended for commercial buildings ›

When pumping large-capacity wastewater and sewage from commercial buildings, public health engineers may find it beneficial to specify a floor-mounted lifting station over a traditional below-ground pump.

Units such as the Jung Compli 1500/2500 have large-capacity collecting tanks that can be linked together for greater volume.

Being floor- and externally mounted, the tanks are easier to install, and inspection and maintenance is faster and more cost-effective.

■ **Contact Pump Technology on 0118 9821 555 or visit www.jung pumps.co.uk**



‹ Modutherm s MTA Plus performs well on BESA tests

Modutherm's MTA Plus has been confirmed as the best-performing heat interface unit (HIU) on the market, following test results from BESA.

The unit registers the lowest volume-weight average return temperature in both the high- and low-temperature tests, with values of 26°C (high) and 24°C (low) respectively. This makes the MTA Plus HIU perfect for use in 4th-generation low-temperature heat networks that use heat pumps or boilers. Visit the Modutherm website for more information on the MTA Plus heat interface unit, or Modutherm's full range of units.

■ **Visit www.modutherm.co.uk**

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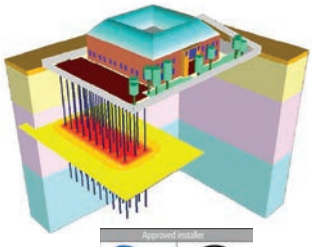

Certificate Number MCS 1201
Heat Pumps

Fire Protection

Jake demonstrating building services to would-be engineers

Jake Lenahan

Travelling to work

CIBSE's youth network has played a part in helping mechanical engineer Jake Lenahan realise his long-held ambition of moving abroad for work

Jake Lenahan, from Manchester, recently took up the opportunity to work at engineering consultancy Stantec, based in Melbourne, Australia. The mechanical engineer is currently a member of the Global Committee of CIBSE s Young Engineers Network (YEN), sitting as the CIBSE YEN/YEA [Young Engineers of ASHRAE] liaison.

He graduated from the University of Nottingham with a first class Master s in engineering in 2016, and his previous roles have included two and half years at Hoare Lea, a 16 month spell at Atkins, and two and a half years at Crookes Walker Consulting. Here, he tells us how CIBSE and YEN have helped further his career and given him opportunities to connect with engineers all over the world.

Why did you first get involved with CIBSE?

I was initially convinced by one of my colleagues to join the CIBSE North West committee as a graduate, under the premise of networking with other people in the industry. I didn t really know what to expect, but my first impressions were great ñ the people were lovely, the discourse was engaging, and I found it really interesting to be a part of discussions regarding professional events within the North West.

Moving onto the YEN committee as a vice chair, at the start of 2018, opened up further opportunities to engage with engineers in the region, with a focus mainly on those at the start of their careers. CIBSE pointed me in the direction of STEM resources and training, so I could teach at schools and careers events. It also helped me organise technical CPDs and social events, and arranged travel so I could attend national events for the CIBSE YEN Global Committee.

What made you want to work overseas?

I have never been one for standing still and have always had the ambition to further my knowledge ñ so the opportunity to design in a whole new environment was really appealing to me. I may also have been influenced, in part, by my dad, who was an engineer and worked in many different countries. It was something I always wanted to do, so when I graduated, I actively looked at avenues of opportunity to facilitate international working.

These were limited at my first engineering consultancy, as the vast majority of the company s projects were UK based. I was, however, fortunate to have the opportunity to work in Qatar for two weeks while I was there, and this experience furthered my desire to pursue something more permanent. Moves to other consultancies didn t yield the international work opportunities that I d hoped for, and with the pandemic compounding the inability to move abroad, I was itching to take an opportunity if it came my way.

How did the CIBSE YEN help?

My other, and most successful, avenue for foreign travel was via CIBSE. As well as the national events I attended, there were opportunities to travel internationally. In 2019, I was lucky enough to attend the CIBSE YEN Global Conference in Malaysia, with those on the Global Committee.

It was a wonderful experience. Aside from the networking opportunities, there were some real highlights, such as a trip to see the plantroom of the Petronas Towers, the awe inspiring Gardens by the Bay in Singapore, and a presentation for a commercial development located on the site of an old prison in Kuala Lumpur. My utmost thanks go to the then CIBSE President, Lynne Jack, for curating such a memorable trip.

Was YEN instrumental in getting your job in Australia?

Not directly. However, coming into contact with other engineers from various backgrounds, and talking with them about their own experiences, broadened my horizons. Those encounters really shaped me as an individual and, ultimately, influenced me to explore different options.

What does your current role for CIBSE in Australia involve?

I m sitting as the CIBSE YEN/YEA liaison, which provides a formal link between the two institutions and facilitates activities, both professional and social, to help younger engineers at the start of their careers.

CIBSE has been a cornerstone of my ability to network, travel and, ultimately, experience the world of building services. The profession can be a bit overwhelming when you start as a graduate, so it was important to me to provide a platform for those coming into the industry.

EVENTS

NATIONAL EVENTS AND CONFERENCES

The Building Safety Act: The consultation period and the Golden Thread
14 September, London
CIBSE and the Society of Digital Engineering (SDE) have launched a new event focusing on the new Building Safety Act and the Golden Thread – the information that allows you to understand a building and the steps needed to keep both the building and people safe. This event will convey and debate how the right people have the right information at the right time to ensure buildings are safe and building safety risks are managed throughout the building cycle.
www.cibse.org/goldenthread

Young Engineers Awards
11 October, London
Encompassing Apprentice, Graduate and Employer of the Year, the awards recognise the best new talent entering the building services industry, as well as businesses that go the extra mile to support and nurture them. The 2022 Awards will be held at RIBA, London. Enter now: **www.cibse.org/yea**

Fa ade Design and Engineering Awards 2022
3 November, London
The shortlist has been announced for these awards, which recognise and reward excellence and achievements in façade engineering and raising the profile of the importance of this discipline. Join the industry on the night to celebrate and see who takes home the trophies.
www.cibse.org/facadeawards

Build2Perform Live
29-30 November, London
The flagship event returns to face-to-face for 2022, at London Excel. The two days will feature a carefully curated CPD programme with more than 60 speakers and 70 exhibitors. Register your interest to be kept up to date with the latest news at **www.build2perform.co.uk**

CIBSE REGIONS AND GROUP EVENTS

Check the website for up-to-date information on regions and groups meetings, webinars and podcasts. Visit **www.cibse.org/events**

Intelligent Building Group: What is artificial intelligence when it comes to architecture?
14 September
Webinar looking at the ways AI is creeping into or acting as the architecture of our cities, towns, districts and homes.

HVAC Group: Embodied Carbon
14 September
A panel of guest speakers will discuss embodied carbon and the future of how the modelling is completed, and give advice on best practice. In-person and online, visit the group's LinkedIn or CIBSE page to register.

South West: St Sidwell Point Passivhaus Leisure Centre Tour
19 and 20 September
Held over two days, this CIBSE/RIBA joint event will explore the design and construction of one of the UK's more groundbreaking projects – the first Passivhaus leisure centre in the world.

CIBSE YEN Gala and Careers Networking Day
13 October
A career day for up to 450 student, apprentice and graduate engineers to meet employers. The day is followed by the YEN Gala, bringing together young engineers to celebrate their hard work and make lasting connections in the industry.

CIBSE JOURNAL WEBINARS

Watch the latest *CIBSE Journal* webinar, *Lighting the path to easily comply with the new Building Regulations*, sponsored by Lutron, along with all previous webinars on demand at **www.cibsejournal.com/cpd/webinars**

SLL Ready Steady Light 2022
18 October
The annual SLL event, in partnership with Rose Bruford College, where teams are challenged to create an exterior light installation with a limited range of kit.

LIVE ONLINE TRAINING COURSES

CIBSE training courses have been reformatted to work online, with a live trainer, meaning you can expect the same interaction and participation as you would in a classroom setting. Upcoming courses:

Building services explained
6-8 September

Energy strategy reports
7 September

Design of heating and chilled water pipe systems
8 September

Energy surveys
13 September

Electrical services explained
13-15 September

Below ground building drainage
14 September

The importance of energy efficient buildings
20 September

Introduction to the Building Safety Act
20 September

Introduction to the Building Safety Act
22 September

Energy Savings Opportunity Scheme
27 September

ONLINE LEARNING

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

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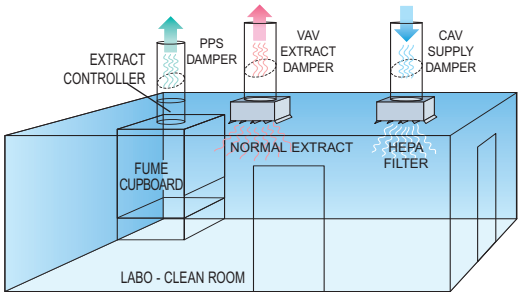

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