cibse Journal

June 2025
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The magazine of the Chartered Institution of Building Services Engineers

Thinking outside the box

Cathedral Hill sets benchmark for net zero industrial estates

The future for DC microgrids

Dementia and indoor air quality

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Better living

Many of us know someone living with dementia – a challenging condition that can lead to moments of confusion, anxiety or frustration that can be difficult for the person affected and their carers.

At the CIBSE IBPSA-England Technical Symposium in April, Professor Neveen Hamza, of Newcastle University, presented an important paper that asked whether indoor environmental conditions affect behaviours of people living with dementia. While previous studies have looked at whether there are links between indoor temperature and humidity, and dementia behaviours, Hamza's team compared incidents of agitation with the quality of indoor air.

In a real care-home setting, they found that as CO_2 levels rose (even at low levels) more incidents were logged by researchers, suggesting that more ventilation could lessen episodes of anxiety and aggression, and reduce the need for medical interventions (page 26).

Research is ongoing, but it is hoped that the setting of optimal environmental conditions for people living with dementia in care homes and domestic settings will soon offer relief for patients and caregivers.

Another paper that piqued interest at the symposium was one by Jacobs' Adam Selvey – 'We will not achieve our net zero future without applying the principles of net zero carbon power' – which argued that UK buildings should transition to direct current (DC) and microgrids. Selvey says this approach would allow renewables, battery energy storage and electric vehicles – all of which use DC – to be integrated without the 10–20% energy losses typically incurred when converting DC to an alternating current (AC) network.

Our cover feature on Cathedral Hill, in Guildford, is a blueprint for the decarbonsiation of the type of industrial estates found in every town and built-up area of the UK. The scheme won Project of the Year – Portfolio Estates at the CIBSE Building Performance Awards with its combination of fabric energy efficiency upgrades, renewable installations and close attention to embodied carbon. The units all achieved Energy Performance Certificate uplifts to A or A+, ensuring compliance with the future Minimum Energy Efficiency Standard, and – just as importantly for the owner – improving rental values markedly.

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Editorial

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1 Cambridge Technopark, Newmarket Road, Cambridge CB5 8PB.

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

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CIBSE BUILDING PERFORMANCE AWARDS 2026

ENTRIES OPEN

The CIBSE Building Performance Awards are back for their 20th year with over 20 categories to recognise and celebrate engineering excellence in the built environment.

These awards, reward the people, products and projects that demonstrate engineering excellence in the built environment.

Entries close: 5 September 2025

View all BPA categories

@CIBSEAwards
#BPA2026

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The official magazine of the Chartered Institution of Building Services Engineers

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***CIBSE Journal* newsletter**

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 ISSN 1759–846X

Subscription enquiries
If you are not a CIBSE member but would like to receive *CIBSE Journal*, subscribe now! Costs are £80 (UK) and £100 (international). For subscription enquiries, and any change of address information, please contact Nicola Hurley at **nhurley@cibse.org** or telephone **+44 (0)208 772 3697**. Individual copies are also available at a cost of £7 per copy, plus postage.

CIBSE Journal, ISSN 1759–846X (USPS 4070) is published by CPL One, 1 Cambridge Technopark, Newmarket Road, Cambridge CB5 8PB, UK.

Subscription records are maintained at CIBSE, 91–94 Saffron Hill, London, EC1N 8QP, UK.

ISSN 1759–846X (print)
ISSN 2756–1895 (online)

Credits
P35 Qvantum Solution Design

ABC audited circulation: 19,220 January to December 2024
Printed by: Warners Midlands PLC

Heat networks could supply 60% of all heat

Author of heat network technical standards says new regulation will enable the mass rollout of good-quality networks

Heat networks have the potential to supply 60% of the UK's heat demand, according to the lead author of new industry technical standards.

The UK government aims to supply 20% of heat from heat networks by 2050, up from 2–3% currently. However, Gareth Jones, managing director at FairHeat, told the FairHeat Annual conference last month that the industry could supply 60% of heat over the same timeframe.

'For medium- to high-density housing, heat networks with large-scale heat pumps will be the best route to supply heat,' said Jones, who added that heat networks offer the benefit of capturing waste heat, and can be deployed with smart thermal stores to help balance the Grid.

In the past 10 years, heat networks have improved vastly, Jones continued. In 2015, a study of 30 heat networks by FairHeat revealed losses of 500W per dwelling. Now, with structured quality control processes in place, losses of less than 70W are possible – the equivalent of the losses in one hot-water cylinder.

Jones is the lead technical author of the new Heat Network Technical Assurance Scheme and Heat Network Technical Standard, which are being developed to support a new regulatory regime for heat networks, due out next year.

At the conference Dave Newton, policy manager at the Department for Energy Security and Net Zero (DESNZ), said the 'sky was the limit' for heat networks 'as long as we get the regulatory framework right'.

Arran Mornin, head of heat network zoning policy at DESNZ, added that the aim is to build on policy that has been enacted in mature heat-network markets such as Denmark. 'Large district networks built in the right location can provide significant cost savings compared with individual heating solutions,' he said.

Gatwick to depart from gas

Gatwick Airport has agreed a five-year contract to eliminate the use of natural gas from across its entire site.

London's second-biggest airport has partnered with specialist renewable energy provider Vital Energi on a £250m decarbonisation programme, which is designed to reduce Gatwick's Scope 1 and 2 emissions to net zero by 2030.

It includes the airport generating its own energy and eliminating reliance on gas in 50 buildings, including the North and South terminals, engineering facilities and office space.

Under the contract, Vital will support Gatwick to improve the energy efficiency of its buildings and deliver zero carbon heat solutions, such as heat pumps, across the airport.

The collaboration will focus on enhancing not only the airport's sustainability, but also its operational resilience.

Mike Cooke, managing director of Vital Energi, said the company's in-house team of more than 100 design engineers will support the airport to achieve its 'ambitious' 2030 net zero target.

University of York celebrates £35m PSDS grant

The University of York has been awarded £35m for a geothermal project to heat its campus buildings. It is part of the latest tranche of projects to receive funding through the Public Sector Decarbonisation Scheme (PSDS).

The Department for Energy Security and Net Zero has announced £630m worth of awards from the PSDS to retrofit public buildings across England, including £5m for the National Portrait Gallery to switch to heat pumps.

In addition, the government has announced an extra £102m from the Green Heat Network Fund. This includes £21m for the replacement and extension of an ageing heat network spanning a large part of central London.

Cooling demand to rise 85% with 4°C warming

DESNZ official predicts huge rise if global warming hits 4°C

Increases in cooling demand in residential property could increase by 85% if the climate warms by 4°C, Roger Littlewood, from the Department for Energy Security and Net Zero (DESNZ), has warned.

Speaking at last month's CIBSE Decarbonisation of Heating and Cooling conference, Littlewood said cooling was 'no longer a luxury, but a necessity'.

With UK temperatures having already exceeded 40°C for the first time, climate adaptation needed to be addressed urgently, he added.

Climate Change Committee senior analyst Olivia Shears highlighted that more than 20% of homes in England already experience summertime overheating, and warned: 'Without intervention, this could rise to more than 50% by mid-century. People know the risks; our focus now must be on the actions.'

CIBSE research manager Zoe De Grussa said CIBSE's upcoming weather file updates, due out this month, will support better design decisions to mitigate overheating.

The afternoon sessions focused on heat pumps and heat networks, with experts stressing the need for greater collaboration and training to boost uptake. CIBSE technical consultant Colin Goodwin previewed CIBSE's upcoming AM17.1, which will focus on retrofitting heat pumps in non-domestic buildings .

To read more about the conference, turn to page 35.

Protect heat pump customers from eviction, says CA

The government should prevent heat network customers from being evicted if they run up big debts, says Citizens Advice (CA).

In a new discussion paper on improving protections for heat network customers, it says they are four times more likely to pay for heating and hot water through their rent or service charges than other energy consumers. They are also more likely to be on low incomes and in social housing.

The bundling of charges leaves tenants more open than other energy consumers to the threat of eviction if they fall behind on payments. If needed, legislation should be introduced to enable unbundling, says CA, which acts as the statutory consumer advocate for energy customers.

Standards delays cost households £5bn in energy bills

Households living in new-build homes have paid an extra £5bn in energy bills since 2017 because of successive governments' delays to new-build standards, according to analysis by the Energy & Climate Intelligence Unit. The thinktank has calculated that around 1.35 million new homes in England were built to lower standards of insulation between the previous government's decision to scrap the Zero Carbon Homes standard in 2016 and 2024. These homes have faced a cumulative extra £5bn in energy bills because of lower insulation requirements and a lack of heat pumps and solar panels.

Heatropolis at King's Cross to explore flexible power

King's Cross is being used as a test bed for how heat and electricity networks can be optimised to work together. Heatropolis, at the central London regeneration zone, is one of three UK Power Networks projects to secure support from Ofgem's Strategic Innovation Fund, which the energy regulator is managing in partnership with Innovate UK. The London and South East distribution network's four-year project is exploring how heat distribution systems can be designed to optimise the ways heat and electricity networks work together.

University of Bristol IT systems serve heat network

Vattenfall is connecting a University of Bristol building to the city's heat network, enabling excess heat from its computer servers and cooling system to be reused. The Swedish company is connecting the university's Temple Quarter Enterprise Campus Academic Building to its city-scale heat network. It means the building will be able to provide heating and hot water for homes and businesses in the local area, as well as to the university's campus.

Seaside rendezvous

A department store in Great Yarmouth has been transformed into a new library and learning hub after a retrofit that replaced gas boilers with electric heating and cooling. A DX air conditioning system is linked to air handling unit ventilation, and the primary mode of heating and cooling is through a variable refrigerant flow system. Morgan Sindall carried out the £17m refurbishment of the five-storey, former Palmers department store. Facilities include classrooms, IT labs, and a simulation training hospital. It will be used as an education centre by East Coast College and the University of Suffolk.

'Poor quality' applications blamed for building delays

Safety regulator says 70% of Gateway 2 applications for higher-risk buildings don't meet legal requirements

A 'significant number' of 'poor quality' applications has contributed to delays in the Building Safety Regulator (BSR) vetting planning applications for higher-risk buildings (HRBs), a minister has said.

Long waits to secure Gateway 2 approval from the BSR have been identified by the National House Building Council as the main factor behind a 38% drop in home registrations in London, where apartments make up a bigger share of new-build properties.

In a written answer to a parliamentary question, issued on 7 May, building safety minister Alex Norris said: 'A significant number of poor-quality applications that do not meet the regulatory standard are contributing to overall processing times, resulting in delays.' The Ministry of Housing, Communities and Local Government (MHCLG) recognises that recently introduced changes to building safety approval are 'still bedding in', he added, but 'the sector must also take responsibility for the projects it delivers'.

The BSR is rejecting around 70% of applications because they don't meet the legal requirements and 44% are turned down at the validation stage, often because of the absence of 'basic' information. In a video on the BSR website, chief inspector of building safety Philip White said the BSR is having to reject applications for 'fundamental failures' and 'significant life safety matters', such as buildings not being tied together properly and corridors not being wide enough to enable evacuation to take place.

Norris told Shadow Secretary of State for housing Kevin Hollinrake that the MHCLG and BSR are prioritising improvements in the rate of applications so they can progress through the system 'first time, lessening the rate of invalidated and rejected applications'.

The MHCLG is also exploring 'all possible options' with the BSR to ensure it is equipped for the high volume of applications it is receiving, he added.

The Nottingham North MP said the benefits of additional funding for building control caseworkers and in-house technical specialists at the BSR should scale up' in the coming months.

Norris hosted a roundtable with the BSR and developers on 28 April, to discuss industry's concerns, and the regulator meets weekly with the Construction Leadership Council to resolve issues with Gateway processes.

More domestic electric heating eligible for grants

DESNZ reveals Boiler Upgrade Scheme proposals

The government has unveiled proposals to widen the Boiler Upgrade Scheme (BUS) to technologies beyond air and ground source heat pumps.

Under the changes, published for consultation by the Department for Energy Security and Net Zero (DESNZ), the £7,500 BUS grants will be available for air-to-air heat pumps and electric heating technologies, such as heat batteries.

The consultation proposes retaining certain restrictions and requirements to exclude hot water-only heat pumps from grant funding, because this would leave the property owner reliant on another heating appliance for space heating.

Fossil fuel 'hybrid' appliances and systems also remain excluded from the scheme, while eligible heat pumps must have sufficient capacity to meet a property's entire space heating demand.

In addition, the consultation paper includes proposals to mitigate the relatively high upfront costs of buying heat pumps with new rental and hire-purchase arrangements.

These new purchase and ownership models could enable households to spread the cost of a heat pump over several years, or provide opportunities to lease one for a monthly fee instead, it says.

Schools positive on heat pump retrofits

Nearly all (93%) school estates managers would consider installing a hybrid heat pump system, according to a new poll by manufacturer Baxi.

More than 200 school estate managers, consultant engineers and M&E contractors were surveyed, and 90% of the school estates managers agreed that net zero is a priority.

Virtually all (99%) reported having a net zero plan, and 97% of school estate managers viewed the performance and operating costs of heat pumps favourably.

However, more than a third (36%) identified technical difficulty as a barrier to installing a low carbon heating system, with 39% of consultant engineers and contractors agreeing.

cibse news

CIBSE and International Code Council agree closer working ties

Memorandum of understanding aims to promote engineering best practice

CIBSE and the International Code Council (ICC) have signed a memorandum of understanding (MOU), helping to strengthen international collaboration on the development, promotion and application of best practice across the built environment.

The MOU formalises the organisations' shared commitment to collaborate on areas of mutual interest and use their expertise and resources to benefit members and the wider industry. CIBSE and the ICC will work together to:

- Identify and collaborate on shared priorities that support the advancement of building safety, sustainability and performance
- Jointly promote educational programmes, technical publications and events
- Encourage the exchange of knowledge through participation in technical initiatives and subject-matter expert groups
- Facilitate ongoing dialogue and engagement at the organisational level.

Dr Anastasia Mylona, technical director at CIBSE, said: 'By working closely with the ICC, we can amplify our collective impact and share valuable expertise that supports the development of robust standards and guidance for our global communities.'

This MOU reflects the growing importance of global dialogue in shaping the future of the built environment and reinforces both organisations' dedication to supporting their members through shared knowledge and collaboration.

CIBSE Annual Report 2024 now available

You can find out more about CIBSE's work and achievements over the past year in the Institution's *Annual Report 2024*, which is now available online at **www.cibse.org/annualreport**

The report includes a summary by CIBSE President Fiona Cousins. 'CIBSE has seen growth in all areas, with membership numbers reaching an all-time high, an elevated profile on the global stage, and hosting more events across our Regions to a broader, more diverse audience than ever before,' she states.

Training

NEW COURSE: Mastering the application of heat pumps

12 June, 12 August, 11 December

This new CIBSE course builds on the CIBSE Application Manuals AM16 and AM17, and provides a comprehensive guide to successfully implementing heat pump technology in residential and non-domestic settings. It is designed for building services engineers who are looking to integrate a range of heat pump technologies into their designs, and is invaluable for anyone looking to review, critique or troubleshoot a heat pump installation.

The course includes: exercises on the sizing of key components, including heat pumps and thermal stores; 'watch its' for each heat pump technology; and an overview of what is available on the market today.

It comprises an on-demand foundation module, followed by a one-day training course, and concludes with on-demand reinforcement sessions.

bit.ly/CJTHPM25

For full details and booking:
www.cibse.org/training

International building services projects
6 June, 5 August, 4 December

Energy surveys
9 June, 28 November

Understanding the law for engineers
12 June, 25 November

Low and zero carbon energy technologies
13 June, 21 July, 21 October

Introduction to the Building Safety Act
16 June

Life safety BS 8519
17 June

Fire safety in purpose-built blocks of flats
17–18 June

Leadership identity and self-awareness
18 June, 16 October, 17 December

Energy Savings Opportunity Scheme (ESOS)
19 June, 10 July, 13 November

Analysing heat pump systems
24 June, 5 September, 12 December

The electrification of heat
24 June

Introduction to heat networks code of practice
25 June

Low carbon consultant building operations
13–14 August

Design of heating and chilled water pipe systems
27 June, 4 September

Commissioning Code M – Commissioning management
30 June, 26 September

Emergency lighting to comply with fire safety requirements
1 July

Air conditioning inspection for buildings
3 July, 12 November

High voltage (11kV) distribution and protection
7 July

Above-ground building drainage
11 July

Mechanical services explained
14–16 July, 27–29 October
12–14 November

The importance of energy efficient buildings
22 July

Low carbon consultant building design
30–31 July, 24–25 September
3–4 November

Electrical services explained
15–17 July
22–24 September

Building services explained
18–20 August
10–12 September

Design of ductwork systems
2 September

Fire safety building regulations: Part B
9 September

BS9251 Automatic water suppression systems overview
29 September

Advanced simulation modelling for design for performance
1–2 October

Designing water efficient hot and cold supplies
2 October

Earthing and bonding systems
6 October

Embodied carbon in MEP design: how to use CIBSE TM65
7 October

Energy strategy reports
6 November

UK standard is major step towards safer HRBs

Competencies and ethical commitments are laid out in document supported by CIBSE

A new standard detailing the requirements and competencies of those working on higher-risk buildings (HRBs) was launched last month.

The UK Standard for Professional Engineering Competence and Commitment Contextualised for Higher-Risk Buildings (UK-SPEC HRB) responds directly to recommendations made following the Grenfell Tower fire, and is a major step forward in creating a safer built environment.

It sets out the competencies and ethical commitments expected of engineers and technicians working on HRBs. It builds on the core UK-SPEC framework, contextualising it to reflect the unique challenges and responsibilities involved in designing, constructing, maintaining and managing these buildings.

CIBSE President Elect Vince Arnold, director of membership Richard Goldsbrough, and head of membership and registration Julia Savage attended the launch at the House of Lords, hosted by the Engineering Council, demonstrating CIBSE's support for this initiative and its commitment to advancing safety, professionalism and ethical practice in the built environment.

HRB registration plays a critical role in ensuring that only qualified, peer-reviewed and competent engineers are eligible to act as the Responsible Person for HRBs. It serves as formal recognition that individuals working on these complex projects meet the highest standards of technical competence and ethical practice.

As one of the five professional engineering institutions licensed to assess candidates for the HRB Register, CIBSE plays a key role in promoting the highest standards of safety and professionalism within building services engineering.

For more information on the UK-SPEC HRB, visit: bit.ly/CJspecHRB

In June/July

CIBSE AGM

10 June, Royal Society, 6-9 Carlton House Terrace, London

The CIBSE AGM and President's Address, from incoming President Vince Arnold is being held as a hybrid event and a Teams link will be sent to those joining online. Members of all grades are entitled to attend the AGM, while the Presidential address is open to anyone.
bit.ly/4dpQ39h

Collaborate for net zero

10 June, Stirling, Scotland

A joint event by CIBSE, IStructE and RIAS, looking at how Scotland's multidisciplinary design teams are working together towards net zero within the construction industry. The CPD seminar, being held at the Engine Shed, Stirling, will also provide attendees with the opportunity to look around Historic Environment Scotland's dedicated building conservation centre.
bit.ly/CJScNZ25

Measuring performance and facilities management 2025

19 June, London

As operational performance continues to be a cornerstone of sustainable building management, this conference will explore the latest advancements in building management systems, data-driven decision-making, and health and wellbeing metrics. The event supports *CIBSE Guide M Maintenance engineering and management*.
bit.ly/CJMPFM25

Rethinking the future: the quest for sustainable lighting

2 July, Manchester

Technical event, with Kristina Allison, SLL President and co-author of CIBSE *TM65.2 Embodied carbon in lighting*, and *TM66: Creating a circular economy in the lighting industry*. Karl Gillam, senior associate at Hoare Lea, will also be speaking.
bit.ly/CJReSL25

Video reveals plans for CIBSE Skills Hub

CIBSE has launched a video bringing to life the development plans for its Skills Hub. The video features updates on the development of the new space, which is intended to provide modern, multi-use facilities to promote lifelong learning and knowledge sharing.

The video gives an idea of how the space is likely to look, with floorplans showing the training hub, members' area and conference facilities. The Hub is expected to launch in the autumn.

CIBSE is offering a once-in-a-generation opportunity to support the scheme by investing in the Skills Hub and being part of this transformative project, which will benefit the entire industry.

● To watch the video, and to find out more about the fundraising campaign visit: bit.ly/CJBFF25

SoPHE YEN hosts plumbing competition

The Society of Public Health Engineers' (SoPHE's) Annual PCE Plumbing Competition takes place at South Bank College on 20 June.

SoPHE's young engineers will compete with and alongside college students in plumbing problem-solving, hand skills and practical fault finding of plumbing installations.

The winners will be announced at the SoPHE London Dinner at the Royal Lancaster Hotel in November, when the society will be celebrating its 21st annual event.

It has partnered with the charity Village by Village to create a special prize for this year's SoPHE YEN competition. The winner will have the chance to travel to Ghana with Village by Village, which empowers communities by providing education, clean water and hope.

● The competition is open to all SoPHE YEN, so do please apply to take part. bit.ly/CJPCE25

Institution updates EDI guidance

CIBSE has updated its equity, diversity and inclusion (EDI) guidance for staff and members. The guidance, first published in 2019, aims to help CIBSE members, volunteers and staff understand the principles of EDI. It covers a range of issues, from accessibility at events to inclusive communications, providing actions that are clear and easy to implement.

The updated guidance was launched in May at the #growyourknowledge webinar 'Building belonging – practical steps to inclusion'. The presentation covered the principles of EDI and CIBSE's perspective on it, as well as the activities of its standing committee and four sub-panels (LGBTQI+, Neurodiversity, WiBSE and Minority Ethnic Groups).

● To read the guidance, visit bit.ly/CJEDI25 The webinar is available to view at: www.cibse.org/growyourknowledge

S&P receives Embodied Carbon Verification

S&P Ventilation Systems (S&P) has been awarded Embodied Carbon Verification (ECV TM65) for 120+ models within its product range, including counter-flow MVHR units, AHUs and in-line duct fans. It follows other well-known manufacturers in becoming an early adopter of CIBSE's ECV Scheme.

Run by CIBSE Certification, the scheme covers MEP products used for heating, cooling, ventilation, lighting, electrical and public health.

Kieran O'Brien, director of CIBSE Certification, said: 'S&P's adoption of ECV highlights its leadership in reducing environmental impact while strengthening confidence in the sustainability of manufactured products and systems.'

● For more information, visit: www.cibsecertification.co.uk

WiBSE vice-chair Helen Welch will be at the Manchester event

CIBSE celebrates International Women in Engineering Day

WiBSE is organising events to promote collaboration across identities and roles

Women in Building Services Engineering (WiBSE) groups around the UK will be celebrating women's contribution to the industry on International Women In Engineering Day (Inwed) on 23 June.

A series of events is taking place, in conjunction with other CIBSE groups and engineers networks, providing an opportunity to come together, celebrate, and inspire professionals across the building services industry and wider engineering sector.

Inwed is about celebrating women in engineering, but its broader message is about collaboration across identities and roles. Inclusion in engineering isn't about making space for 'others', but rather about acknowledging that the industry cannot thrive without full participation from all its members. This is reflected in the collaboration this year between different groups and societies.

Events include:

#TogetherWeEngineer

18 June, Aecom, Manchester

WiBSE North West and the BCIA Young Engineers Network host an evening that will bring together a wide range of voices to explore how we can work together across genders, generations and disciplines to create a more inclusive future for engineering. Speakers include BCIA vice president Jen Vickers and WiBSE vice chair Helen Welch.

Sponsored by Carrington West, E-ON, S&P and Rinnai

Built to slay: Inwed Drag Bingo night

18 June, Ramboll office Birmingham

Join us for an unforgettable evening of glamour, games, and giggles as CIBSE YEN West Midlands celebrate Inwed with a fabulous round of Drag Bingo, hosted by the sensational Dahliah Rivers! Expect fierce performances, big laughs, and brilliant prizes – all in honour of the amazing women driving change in the industry. Come for the bingo, stay for the vibes!

Role models within the industry

23 June, Ulster University, Belfast

WiBSE Northern Ireland and YEN Northern Ireland are hosting a panel discussion to bring together professionals from across the sector to share experiences and perspectives on the impact of visible role models. Speakers include: Karen McShane, Margaret Taggar, Áine Murray, and Margaret Rafter.

Sponsored by Mitsubishi Electric Ireland

Inclusive leadership and actioning change

25 June, Hilson Moran, London

CIBSE Home Counties South West and WiBSE host this panel discussion and workshop to bring together voices from across engineering to discuss practical action we can take to bring workplace and institutional change and impact. The panel discussion will look at the importance of inclusive leadership in creating environments for better collaboration, with speakers Edith Blennerhassett, Jessica Glynn and Ruth Tatanga.

Events are also planned in other CIBSE **Regions. For details, visit www.cibse.org/events**

CIBSE takes the stage at Installer Show 2025

Explore the future of building performance on the Build2Perform Stage

CIBSE is preparing to lead three days of expert discussion on building performance at this year's Installer Show, curating the Build2Perform Stage to deliver exciting insights and thought leadership.

Taking place from 24 to 26 June at the NEC Birmingham, the programme will explore the pivotal themes shaping the future of the built environment.

Day one on the Build2Perform stage centres on decarbonisation, with keynote speaker Josh Bird, from Rethink Buildings, opening with an address on the future of heat pumps. There are also sessions on refrigerants, sustainable cooling and electric boilers, covering new and existing buildings.

Day two turns to the challenge and opportunity of retrofit, offering practical insights and pioneering approaches for upgrading the UK's existing building stock. Expect case studies, tools and lessons learned from across the sector, with sessions on domestic heat pumps guidance, non-domestic retrofits and air source heat pump selection, specification and design.

Day three explores healthy buildings and wellbeing, investigating how engineering and design can directly impact occupant health, comfort and productivity. Explore the power of light, gain insider knowledge on the newly developed parametric concept design for Passivhaus, and take a deep dive into the growing concerns around water scarcity. With wellbeing moving higher up the industry's agenda, this day promises valuable perspectives on future-ready environments.

Join CIBSE at the Installer Show 2025, to connect with the latest thinking, share best practice, and be part of the movement towards a sustainable, resilient and people-focused built environment.

Register now at www.installershow.com. Come and visit CIBSE at stand 4D51

A panel discussion from last year's Build2Perform event

Redefining R32 VRF air conditioning

Mitsubishi Electric has launched the City Multi R32 VRF YXM range, with capacities from 22kW to 113kW in heat pump and heat recovery options, says the company's Graham Temple

Our City Multi VRF air conditioning system has led the market for more than 30 years. Suitable for medium to large buildings, it delivers the flexibility of design, installation and operation that make it the popular choice for new-build and retrofit projects.

With R32 becoming the refrigerant of choice, we expanded our R32 offering in 2020 to include City Multi VRF systems up to 30kW.

Now we are adding to this with the new City Multi R32 VRF YXM range, which is available to specify now and to install from spring 2026 – offering system capacities from 22kW to 113kW in heat pump and heat recovery options.

A completely redesigned modular chassis offers a 6% smaller footprint than the market average, reducing embodied carbon emissions. Yet it is packed with advanced technology to deliver improved comfort, greater energy savings, and all the familiar benefits of a variable refrigerant flow (VRF) system with true plug-and-play simplicity.

Our most versatile VRF system to date, the new City Multi R32 YXM VRF features a patented 2-pipe design, significantly reducing the number of brazing points and conserving valuable riser space. The system is simple to design, with only basic height and length limitations between the outdoor and indoor units, helping to streamline and shorten the design process.

Our unique patented vertical flat tube heat exchanger increases overall system performance and a flexible piping configuration, with a new vertical extension to 113m, makes it ideal for high-rise building designs.

With BS EN378 part 3-compliant safety measures, this VRF solution not only meets the latest legislative requirements, but also delivers market-leading seasonal efficiency. With an expanded range of options, it simplifies design and installation, making it easier than ever to deliver high-performance climate control.

Do you have a specification project suitable for City Multi R32 YXM VRF? To speak to a Mitsubishi Electric account manager, or simply register for future updates, please visit **bit.ly/CJMitCM25**

Graham Temple is marketing manager at Mitsubishi Electric

Keeping the bar high

Under the Building Safety Act, building services engineers must demonstrate competence when working on higher-risk buildings. Dr Anastasia Mylona explains how CIBSE has created a competency framework for members working in the sector

The UK's building safety landscape has changed dramatically in the eight years since the Grenfell Tower fire. What began as a profound shock to public confidence has evolved into a wholesale reform programme, the centrepiece of which is the Building Safety Act.

Now fully in force, the act assigns clear legal duties to those who commission, design, construct and operate higher-risk residential buildings (HRBs), defined as structures more than 18m or seven storeys high, containing at least two homes.

At the heart of the new system is the principle of demonstrable competence. Regulators, insurers and residents are no longer satisfied by persuasive CVs or corporate track records; they want objective evidence that the people making decisions about life-safety-critical assets understand the risks they are taking and the standards they must meet.

In January 2025, the Engineering Council – working with the Building Safety Regulator and the professional engineering institutions, including CIBSE – published the UK-SPEC HRB standard. This extends the familiar UK Standard for Professional Engineering Competence by overlaying multidisciplinary requirements specific to HRBs.

The standard asks engineers – whether chartered, incorporated or technician level – to show they can integrate fire and structural safety, manage the 'golden thread' of digital information, and communicate with duty-holders in a language that residents and regulators can understand.

Institutions with a licence to award HRB Registration, of which CIBSE is one, offer routes for members to demonstrate this competence and, with the required revalidation, provides an assurance mechanism that remains valid for the whole of a

member's practising life, not just at the point of registration

All corporate members are required to include at least one semi-structured CPD activity on building safety. CIBSE's Building Safety Working Group is running a pilot scheme to support the initial cohort of applicants in their HRB registration. This scheme is instrumental in shaping guidance and clarifying the standards required for HRB engineers. There are demanding expectations for these registrants, and everyone working on an HRB must understand and meet robust standards.

CIBSE is additionally now approved to assess the Façade Annex of the UK-SPEC HRB standard. In collaboration with the Society of Façade Engineers, we are actively developing guidance to support this important addition.

The Building Safety Act's emphasis on competence is matched by its focus on organisational accountability. Every company working on an HRB must appoint, and name to the regulator, individuals who carry the legal title of principal designer and principal contractor.

If organisations cannot point to staff who meet the standards, they face enforcement action that ranges from improvement notices to criminal prosecution. This is already altering procurement behaviour. Tier-one contractors report that clients now ask for evidence of HRB-specific competence at pre-qualification stage, while insurers insist on it before they will write professional indemnity cover.

Perhaps the most significant cultural shift lies in the way the act blurs the boundary between design and operation. Safety must live beyond practical completion; it must be updated whenever the building, or the knowledge about its risks, changes. That requirement elevates the role of building services engineers, because HVAC, smoke-control and digital monitoring systems are key to occupant safety.

Designers must think like facilities managers, ensuring that equipment choices enable straightforward inspection and maintenance, and operators must think like designers, feeding real-world performance data back into the golden thread so that future refurbishments can address actual, not just theoretical, risks.

The Building Safety Act and the UK-SPEC HRB promise a safer, more transparent construction sector – but only if the profession embraces the competencies now demanded of it. CIBSE's role is to provide the competency frameworks, training and guidance that allow engineers to meet those demands with confidence.

Our task as individual professionals is to engage with these resources, to document our competence honestly, and to recognise that the true measure of our expertise is both the detail of our designs and the long-term wellbeing of the people who live in the buildings we design. The bar has been raised; together we must ensure it stays there. ●

Dr Anastasia Mylona is technical director at CIBSE

For any questions on the HRB registration, contact membership@cibse.org

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The rise of the machines

Artificial intelligence was among the topics that grabbed the attention of delegates on day two of the Technical Symposium, with speakers stressing the importance of human oversight as the sector balances innovation with real-world climate challenges. **Molly Tooher-Rudd** and **Alex Smith** report

Presentations exploring the emerging potential of artificial intelligence (AI) in building services were among the most popular on day two of the CIBSE and IBPSA-England Technical Symposium, hosted by University College London in April.

The event culminated in an electronic vote by delegates for the two best papers presented during the two-day symposium. Simon Ho won the Most Effective Delivery of Material award with his presentation 'Are we building services engineers?', while Meysam Akbari Paydar was awarded with Most Significant Contribution to the Art and Science of Building Services Engineering for his presentation on 'Evaluating the potential of using energy certification models to assess decarbonisation pathways for primary healthcare buildings'.

Day one of the symposium was covered in last month's *CIBSE Journal*, but as we went to press, a lively debate took place around the challenges and potential of the UK Net Zero Carbon Buildings Standard. Hosted by UCL's Anna Mavrogianni and Rokia Raslan, the session was held under Chatham House rules, so no comments have been attributed to individuals.

Some panellists questioned the introduction of yet another standard and the industry's ability to absorb it while others praised the collaborative and wholistic approach it brings to the industry

A key message in a packed session covering AI and parametric tools was the shift from linear to collaborative design.

Inés Idzikowski Pérez, senior sustainability consultant at Aecom, shared a case study of a hotel in Spain where early-stage optioneering reduced upfront embodied carbon by 36%. 'We shifted the process from siloed decision-making to a circular design model,' she said, adding that a dashboard was used to allow teams to explore materials, cost and environmental impact together. 'It made the conversation visual and helped clients engage with sustainability.'

Dejan Mumovic welcomes delegates to the buffet reception hosted by Mason UK

One of the theatres at UCL

Carl-Magnus von Behr, co-founder of innex.ai, introduced an AI platform built for the NHS estate sector to solve the 'information overload' engineers face. He said people spend 11.35 hours a week searching for guidance and claimed his domain-specific AI cuts this time by 35% while improving answer quality by 53%. 'It's not just about faster answers, but safer, more compliant ones,' he said.

The promise and limitations of AI in building design was discussed by Andrew Corney, product director at Trimble – SketchUp. 'AI can extract space data and suggest energy strategies, but struggles with edge cases [unusual or complex scenarios],' he said. AI shouldn't be allowed to provide context, he warned, or designers risk losing control over sustainability goals.

The vast amounts of computing power required to make AI mainstream means there has been an exponential rise in data centres, which is putting a huge strain on electrical infrastructure.

Esam Elsarrag, from Hoare Lea, spoke on decarbonising data centres and looked at the optimisation of water and energy efficiency in cooling systems. He challenged assumptions that a decarbonised Grid solves everything and highlighted water scarcity as a huge

challenge to growth. Elsarrag's study examined trade-offs in four climate zones, revealing that water use per kW is highest in dry climates, while energy use spiked in air-cooled systems. He called for climate-specific configurations, stressing: 'We need to understand where every single drop of water has gone.'

Several sessions illustrated the rapid pace of climate change in the UK, and emphasised the urgent need for our cities to evolve through smarter design and adaptation.

Speakers tackled the growing risks of overheating, the urban heat island effect, and the technical and design innovations helping to build resilience in the built environment.

Macarena Cárdenas, senior adviser – resilience and nature, at the UK Green Building Council, warned of the human cost of inaction. 'Our cities are not always comfortable or safe,' she said, explaining how urban form, dominated by hard surfaces and with little greenery, amplifies heat stress. Cárdenas warned that the 2022 summer heatwave, which led to more than 3,000 heat related deaths in the UK, is a stark reminder that overheating is 'not just an inconvenience – it's dangerous'. A new Climate Resilience Roadmap, due to be released in June, aims to offer a robust, evidence-based path for the sector to adapt and protect communities.

This real-world urgency was echoed in a session on weather data innovations for climate-resilient buildings, where researchers presented new tools to support building design under future climate conditions.

The University of Manchester's John Parkinson highlighted the importance of accounting for urban heat island data. He said it is important that designers consider the greater difference in night temperatures between city centres and rural areas, and noted that night temperatures can exceed 25°C during the summer in cities such as Manchester. ●

Thank you to all the sponsors: WB Power Services, CIBSE Patrons, DesignBuilder, IES, Modutherm, Qvantum, Strebel and Mason UK
For more on the Symposium, including the papers, visit www.cibse.org/symposium, where there is a call for papers for next year's event at Loughborough University, closing date 16 June.

Anastasia Mylona chairs a session on heat islands and overheating risks

Call for papers 2026

Next year's Technical Symposium will be held at Loughborough University

The 2026 CIBSE Techical Symposium at Loughborough University will bring together industry experts, thought leaders, policy-makers and academia to explore the future of building services design, with a focus on wellbeing, inclusivity, and sustainable performance.

Home to one of the UK's largest integrated schools for the built environment, Loughborough University brings together expertise in architecture, building, and civil engineering to address global challenges. Its world-class facilities and interdisciplinary research make it the ideal host for a symposium focused on advancing building services for health, wellbeing, and sustainability.

What to expect

The event will highlight emerging technologies, strategies, and frameworks that drive the next generation of building design and performance. Topics will range from inclusive design – creating spaces that cater to diverse needs such as neurodiversity and sensory inclusion – to indoor air quality (IAQ), and address the broader implications of climate resilience, retrofit and advances in services design.

This symposium will highlight the tools, frameworks, and models necessary to drive meaningful change in the built environment.

The goal is to create healthy, inclusive, and resilient spaces that support the wellbeing of all occupants while meeting the pressing sustainability challenges of the future.

The Technical Symposium will take place on 23–24 April 2026 and will be endorsed by ASHRAE.

Easing the gridlock with DC power

Power-grid congestion threatens the clean energy transition, but a shift to DC microgrids in buildings could help bypass bottlenecks, reduce waste and usher in the next chapter of electrification – one that's decentralised, resilient and fit for purpose. Jacobs' **Adam Selvey** reports

For more than 2.5 million years, our civilisation relied on renewable energy sources such as wood and biomass. However, the Industrial Revolution marked a shift to burning fossil fuels at an exponential rate.

As we advance towards a renewable future, driven by the government's Clean Power 2030 initiative, we face one of the biggest energy disruptions in history, transitioning from an extract-store-consume model to a produce-transmit-consume approach.

One of the major issues as we move towards clean power meeting 100% of electricity demand within five years is grid congestion. Our power flow and alternating current (AC) electrical grids were designed around centralised generation and unidirectional flow from producers to consumers. The rapid deployment of renewables is outpacing the rewiring of these grids.

Recent events, such as the national power outages in Spain and Portugal, highlight the fragility of our AC network. While it is technically feasible to connect multiple AC sources, synchronising them is complex. Single incidents can trigger a chain reaction, causing parts – or all – of a country's AC grid to shut down.

"The power outages in Spain and Portugal highlight the fragility of our AC network"

To reduce these risks, this article argues that we should transition from AC to direct current (DC) and microgrids in buildings as soon as possible.

Why DC and why now?

As well as growing grid congestion, we are seeing the emergence of major trends forcing a significant rethink in energy policies. These include growing volatility in the electrical wholesale market, scarcity of resources, security of supply concerns, and weather-dependent and less predictable energy production (see panel, 'Power trends').

These emerging global trends in electricity generation, transmission and distribution are crucial to consider. Most current and future buildings are not equipped to handle these changes. Our approach to net zero buildings, which focuses on energy reduction while demand increases, overlooks the state

Power trends

Growing volatility in the electrical wholesale market
Since the 2010s, when demand was low and supply high, electricity markets have experienced 'negative prices', which can occur during times of significant wind capacity. In 2023, the UK recorded 2.5% of hours with negative prices, resulting in a £300m payout for wind curtailment.

Scarcity of resources
The International Energy Agency predicts that global electricity consumption will more than double by 2050, creating supply and demand issues for materials and products. A Wood Mackenzie study showed that, since 2022, procurement times for large power transformers have increased from 50 to 120 weeks.

Security of supply concerns
Recent events, such as high-impact power outages, have raised concerns about the security and sources of our energy. We have taken the reliability of our 20th-century extract-store-consume model for granted. The new 21st-century model requires a different way of thinking.

Weather-dependent and less predictable energy production
Renewable energy sources only produce energy when conditions are favourable, such as when the wind is blowing or the sun is shining. Although storage can help align supply and demand, the unpredictable nature of renewable energy production has the potential to create significant Grid instability.

of our infrastructure. We need to rethink our strategy to ensure it aligns with the evolving energy landscape.

Technology is reaching maturity, making Thomas Edison's vision of a DC future more feasible than ever. Since the 1950s, the world has gradually been moving towards DC.

Today, our consumer and power electronics, such as laptops and smartphones, primarily use DC, but they require numerous converters to connect to the AC grid. For example, more than 245.3 million laptops (**www.pcworld.com**) were sold globally last year, each needing a power pack converter, which could save around 10% of the demand if DC was used directly.

The need for more resilient and stable networks

The expansion of renewables, battery energy storage, and electric vehicles – all of which use DC – means that connecting them to the existing AC network results in significant conversion losses between 10– 20%.

To address this, manufacturers began adding solid-state breakers to their product lines in the early 2010s, to clear faults in microseconds and improve safety on DC networks. By the early 2020s, solid-state breakers became commonplace in DC systems containing renewables and battery storage.

Around the same time, companies such as ABB and DC Systems developed the 'active front end' (AFE), a device that controls the interface between the AC network and DC systems. This innovation allows buildings to connect renewable energy sources and energy storage directly to the DC grid, isolating them from the AC grid while still maintaining connectivity.

Local AC microgrids with multiple generation sources and battery storage still contribute to overall grid instability due to the difficulty in controlling their power injection back into the network. However, if buildings convert to DC and use microgrids, they can optimise onsite generation and energy storage, controlling the total power reinjected into the local AC network.

The AFE provides galvanic isolation, allowing multiple AC sources to connect to a DC network without synchronisation issues. This makes DC networks highly resilient, as they can be designed like communication networks, connected to multiple power sources simultaneously.

To prepare for the Clean Power 2030 revolution and take advantage of the new energy landscape, UK buildings need to transition to DC and microgrids. This will smooth demand on the Grid and decouple the pace of electrification changes in the built environment from electrical infrastructure.

To achieve net zero carbon power, we must recognise buildings are part of larger ecosystems and address the real constraints of their environments. By balancing demand, consumption and storage, net zero carbon-powered buildings can accelerate the decarbonisation of the built environment and adapt to the pace of change in the UK's electrical infrastructure.

Policymakers, industry leaders and electrical engineers are uniquely positioned to champion the integration of DC microgrids through supportive policies, investments and innovation.

Implementing net zero carbon power in buildings can unlock development sites, reduce energy waste, increase efficiency, and drive a new engineering movement focused on decarbonisation.

Collective efforts now, through initiatives such as Current/OS (see panel, above), can create a future where energy is generated, stored and used harmoniously, accelerating the journey to a net zero carbon world. ●

● **Adam Selvey is head of engineering design and innovation (built environment) at Jacobs**

Current thinking

Jacobs understands that collaboration is needed to advance the knowledge and thinking in this emerging field, and recently became the first global technical consulting firm to join Current/OS.

The Current/OS foundation was established to ensure that a standard and complete set of rules is available to manufacturers of DC products, system integrators, design firms and academic institutions.

Its primary goal is to establish a unified system specification for DC systems and provide comprehensive standards.

For more information visit currentos.foundation

Boxing clever

Sustainability is often seen as a cost, but at Cathedral Hill Industrial Estate it's become the key to a 220% rental uplift and a CIBSE award-winning retrofit. **Andy Pearson** reports

Sustainability – so often seen as a cost – has proven to be an asset at Cathedral Hill Industrial Estate.

When the 30-year old, 13-unit development was acquired by Diageo Pension Trust in October 2019, rental value was 33% below the average for Guildford, Surrey. Now, after a £10.6m deep refurbishment, the scheme is Breeam Excellent certified and on target for net zero carbon whole life, and rental values have increased by an impressive 220%.

This remarkable achievement was recognised at this year's CIBSE Building Performance Awards, where the scheme won Project of the Year – Portfolio Workplaces. The category judges praised it as an 'outstanding example of how regeneration can benefit business and the environment'.

The focus on sustainability was to increase the value of the pension fund's asset. While the bones of the estate were good, the industrial units were dated in appearance, with crinkly asbestos-cement sheet roofs and single-glazed windows. A lack of roof lights meant there were poor levels of natural light.

Maintenance costs were high, and although the average Energy Performance Certificate (EPC) ratings were C and D, the units performed poorly in practice, with inefficiencies reflected in energy use and running costs. This also meant they would fail to comply with tougher Minimum Energy Efficiency Standards (MEES) for commercial properties, due in 2030 – see panel, 'MEES', on page 22.

A brief drawn up by Savills Investment

Performance data*

Total energy use: kWh per year	370,944**
Floor area m^2 NIA (13 buildings)	8,782.46
Total embodied CO_2 $kgCO_2e \cdot m^{-2}$	693*
Total electricity use kWh per year	174,190**
Electricity use Grid kWh per year	73,980**
Onsite renewable PV kWh per year	178,600**
PV elec exported kWh per year	75,910**
Gas consumption kWh per year	67,701
PV capacity kWp	500
Airtightness $m^3 \cdot hr^{-1} \cdot m^{-2}$ @50Pa	4.68
Refrigerant data	
Refrigerant	R32 (small tenant AC)
GWP	670
Base charge kg	<6 per system

*Compliant with RICS WLCBE PS 1st edition
** For five of the 13 buildings

Management and Savills UK Building & Project Consultancy, working with sustainable built environment consultants SRE, set out the initial proposals for the scheme's sustainable retrofit.

SRE also undertook a whole life carbon assessment (WLCA) for the base build at the design phase, to account for the additional embodied CO_2 emissions resulting from the refurbishment of the industrial units and the external areas, and to assess potential savings in operational emissions.

The WLCA was based on RICS guidance, with the baseline set as the site at the time of the works. It was an approach that ensured all demolition material removed from site and new materials added under the redevelopment were accounted for within the assessment process. According to Savills, the aim of the assessment was to help it develop a strategy for the refurbishment of the site to be deemed 'zero carbon'. 'Net zero wasn't really talked about in 2019, but we felt that it was a good thing to aim for in terms of adding asset value,' says Anna Maclean, SRE's CEO.

The focus of the refurbishment was on fabric energy efficiency improvements. Eleven of the units had tenants in place, so Savills' approach was to upgrade one unit at a time. The two vacant units were upgraded first to allow incumbent occupiers to move into the modernised, energy efficient units. This freed up the next units for refurbishment.

'Savills only changed the things it had to, but it was an opportunity to make everything look sleek and modern at the same time,' says Cara Palmer, a director at SRE.

Servicing of the units is down to individual tenants' requirements, similar to a Cat A office fit-out. Nevertheless, gas supply was removed from the majority of units, with the exception of two of the tenanted workshops where it was a requirement for industrial processes.

A major element of the works was the removal of the asbestos-cement roofs and their replacement with energy efficient insulated panels. The roof replacement works included doubling the area of translucent roof lights to reduce the need for artificial lighting.

In addition, the units' giant access doors were removed and replaced with insulated versions, while the walls were over-clad with insulated cladding to improve the units' aesthetic appearance and thermal performance. Existing concrete floors were diamond polished, eliminating the need for finishing materials.

Internally, thermal improvements included the addition of insulation between the mezzanine-level offices and the unheated warehouse spaces, to enhance occupants' thermal comfort. The office areas are now heated by radiant electrical panel heaters.

The single-glazed windows were replaced with top- and side-hung triple-glazed windows, which have 100% opening areas to enable purge ventilation in the summer. A TM52 occupant comfort assessment indicated that, with the windows fully open, occupant comfort could be achieved without the need for mechanical cooling, even for future climate scenarios.

The scheme also included enhancements to the natural environment to improve the appearance and gain additional Breeam points. These included the use of gabion baskets, filled with stone-masonry waste from the site works, to define tenant areas and walkways.

Responsible sourcing helped reduce the refurbishment's embodied carbon emissions and, as a result, upfront carbon emissions for the base-build refurbishment were calculated at

The walls of the units were over-clad with insulated cladding to improve their thermal performance and appearance

281kgCO_2 m^{-2} GIA. This compares favourably with the emission limits in the pilot version of the Net Zero Carbon Buildings Standard, which, for 2025, are 600kgCO_2 m^{-2} GIA for offices (whole building) and 310kgCO_2 m^{-2} GIA for storage and distribution facilities

Perhaps the most significant intervention from an operational carbon perspective was the addition of a large rooftop photovoltaic (PV) installation. The base-build WLCA showed that approximately 75% of CO_2e emissions would come from heating and lighting the units over their lifetime.

To help offset this, 1,250 400W solar panels were installed on the roofs, giving a total installed capacity of 500kWp. While actual power output varies with weather and daylight, the system contributes significantly to onsite generation, reducing reliance on Grid electricity and associated carbon emissions. 'With a shed, PVs are a no-brainer,' Maclean says.

One year on from completion of the installation, Savills is reporting total generation from the PVs of 450,000kWh, in line with design predictions, giving a payback of five to six years and saving 82 tonnes of $C0_2e$ per year (based on UK average Grid carbon factor (2025) for electricity of 0.183kgCO_2e/kWh).

Tenants benefit directly from the power generated by the PVs on the roof of their unit, and from two Tesla Powerwall 2 batteries, giving each unit electrical storage capacity of 27kWh (351kWh total for the site). The batteries enable power to be stored during peak PV generation and allow tenants to import electricity from the Grid when tariffs are low, helping balance the Grid while providing financial savings to the tenants.

'Most of the units are not air conditioned, so the energy produced by PVs won't be used all the time – so it needs to be stored on site,' says Manas Bane, sustainability consultant at SRE.

Remote display screens are installed in the entrances of each unit, showing real-time energy generation and usage data for the PVs and the battery. This includes energy consumed, generated, charged and discharged, imported and exported. Some occupiers have seen their energy bills reduced to zero or have been able to sell energy back to the Grid. Of the electricity generated by the PVs, 95% is used on site, with 19,600kWh exported to the Grid. 'All the tenants have an app showing their energy use each day, so they can look at it and feel incentivised to reduce their energy,' says Maclean.

Rental values on the Cathedral Hill Industrial Estate have increased by 220% since the refurbishment works

Part of the WLCA used *CIBSE TM54 Evaluating operational energy use at the design stage*. This showed the contribution of the PVs and battery storage in reducing operational energy consumption significantly over the lifetime of the building. When considering all units from a shell and core perspective, Cathedral Hill Industrial Estate can be considered net zero operational carbon from cradle to grave (life-cycle stages A–C), including disposal.

While the base build is net zero operational carbon, emissions from tenants' operational energy and the embodied energy from the tenant fit-out need to be assessed and offset for the estate to be considered net zero carbon. This task is being undertaken as part of a tenant fit-out WLCA.

'Some of the units have only just reached 12 months occupancy, so we haven't received a full set of data for those units,' says Palmer. 'We're doing a 12-month review now to advise on operational net zero.'

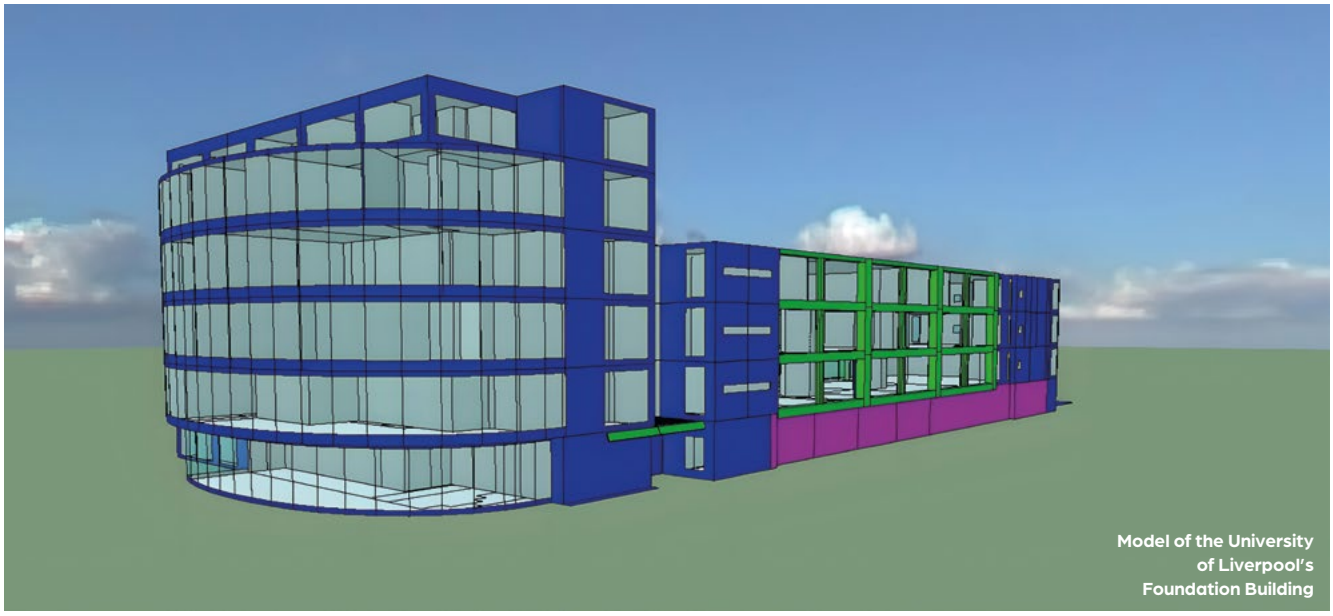
The ultimate aim for the refurbished scheme is for it to be described as net zero whole life carbon. To achieve this status, however, residual carbon emissions from the retained elements will also need to be offset.

Essentially, Cathedral Hill Industrial Estate is an outstanding example of a more sustainable approach to refurbishing industrial buildings, reusing existing structures and materials, limiting new and high-carbon material inputs, and installing onsite renewable electricity generation systems.

These measures have resulted in substantial operational CO_2e savings and, with all units now EPC A or A+, the scheme will no longer face obsolescence under MEES. ●

Minimum Energy Efficiency Standards (MEES)

MEES regulations for commercial properties in England and Wales require landlords to ensure that let properties have a minimum EPC rating of E. This requirement was implemented in 2018 and initially focused on new and renewed tenancies. From 1 April 2023, the scope of MEES expanded to include existing tenancies, making it illegal to continue letting properties with an EPC rating of F or G. Future regulations aim to further improve energy efficiency, with a long-term target of EPC B for all private-rented commercial properties by 2030, where cost-effective.



Model of the University of Liverpool's Foundation Building

Double act

Too often discarded after planning approval, design models can power advanced digital twins that cut energy use, carbon emissions and costs. **Alex Smith** looks at a pioneering IES project that has created a powerful engine for operational efficiency

Many building owners overlook the fact that their design model – often seen as just a compliance tool – can be a valuable asset capable of saving thousands in energy costs. Once the model has fulfilled its role in demonstrating compliance with Building Regulations and securing planning permission, it is rarely revisited.

Software developers are striving to change this by using the model as a basis for a digital twin that can simulate the impact of energy-saving interventions using live operational data.

'Building owners use the model to gain certification or comply with Building Regulations, then forget about it. The model helps tick the compliance box and that's it,' says Valeria Ferrando, associate director at IES.

'We want to maximise the energy model that they have already invested in. You can get more value and unlock savings without adding a lot of cost,' she says.

Last year, IES created a digital twin for the University of Liverpool that used its IES Live tool to link an energy model of the university's Foundation Building with data from the building management system (BMS) and sensors. The software enables the facilities management (FM) team to track operational performance and gain insights for energy, carbon and comfort. In this instance, they were able to see the impact on energy use of the university replacing an existing air handling unit (AHU) with two new units and implementing a demand-control ventilation strategy.

In phase one of the refurbishment project, IES Virtual Environment was used to create an initial energy model, which was calibrated against monthly measured data for 2019 (pre-pandemic) to create a performance digital twin. This allowed the prediction of the baseline energy use of the building and testing of refurbishment options – the digital twin predicted 14% estimated energy savings from the AHU improvement.

Once phase one was complete and the building reopened, the digital twin was recalibrated to match measured data from the BMS and energy meters on an hourly basis.

On a single-pane view (similar to that shown in Figure 1), IES Live displays the carbon and cost savings of building improvements compared with a baseline model featuring no interventions. It shows a 20.95% cut in energy consumption and savings of £50,080 in the period from February 2023 to May 2025. Ferrando says the larger savings were because the building was modelled before the Covid pandemic, when occupancy was higher.

If there is no energy model in existence, one can be created from scratch by IES, adds Ferrando. Monitoring systems – including wireless

sensors and current transformer clamps – can also be installed to capture relevant data.

The model is the organisation's own asset, but it will be in the cloud, to allow integration with tools such as IES Live, says Ferrando. The cloud also ensures there is enough processing power to run advanced analytics and simulations on real-time data: the cloud can dynamically scale this capacity based on demand, which local servers typically cannot do efficiently.

The university's FM team is also now using this operational performance digital twin, accessed via IES Live, to continually monitor and improve the building, and to look at further potential interventions.

Alerts can be set up if readings are not within a set range (for CO_2, for example). On the dashboard, a red dot will indicate if, say, the temperature measured by a sensor is not within the set range (see Figure 1).

The university is creating digital twins for another part of the Foundation Building – the Wing – as well as three other facilities: the Central Teaching Hub, the Materials Innovation Factory (MIF) and the Yoko Ono Lennon Centre.

Energy audits have been carried out, with suggested interventions, and digital twins will be used to model interventions. The university is using IES Live to assess the effectiveness of interventions already taken and to predict the impact of potential changes. At MIF, the software shows that a photovoltaic (PV) installation has cut energy use by 1.09% and saved £20,850 for the two years up to 13 May 2025.

Ferrando says simulations can be carried out for potential interventions that do not cost anything, such as changing temperature setpoints for heating and cooling. 'This is very powerful, because it can show that, without any investment, you can save money, and operate the building more efficiently,' she says.

Governance of the digital twin is important, because stakeholders may have different objectives, says Ferrando. For example, it may make sense to turn off heating on one floor of the library on a quiet day, but students may be upset if it restricts them from their preferred study areas. There may also be a compromise between comfort and energy savings, if temperature ranges are allowed to rise to reduce cooling loads, for example. 'It's not always straightforward to make changes. It's important to know who is deciding what,' says Ferrando.

Figure 1: Dashboard showing sensor out of temperature range, at 24.1°C

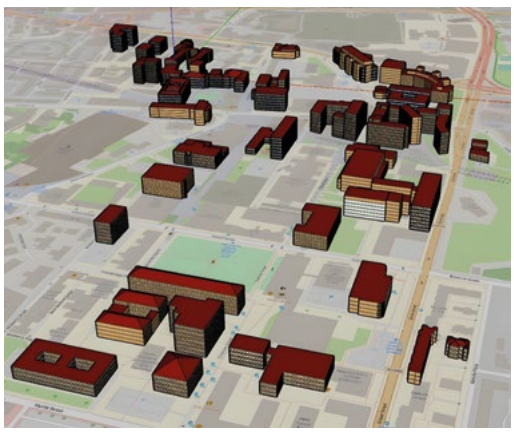


Figure 2: The energy centre model includes simple geometry of buildings connected on the heat network

The digital twin initiative is being overseen by Tony Small, the University of Liverpool's head of engineering services.

One of the biggest challenges is creating a connection for the data, particularly for sites with a complex BMS. 'It's important to get support from someone within the client who can obtain the data from a third-party supplier. We are working on solutions that standardise the data connection for specific protocols – for example, BACnet,' says Ferrando.

Twin interests

There is growing interest in digital twins from large energy users, such as data centres.

Ferrando says IES has built a demo based on a model created for a client's data centre, with the idea of taking the model beyond the design phase. Metrics clients are focused on include power usage effectiveness and space cooling.

Twins can be used for decarbonisation strategies for a portfolio of buildings. A high-level system-modelling tool allows users to create abstract representations of building services. With less model detail, simulations can be run across many properties.

An exciting development is the scenario modelling being done at the university's district heating system. IES has simulated six energy-conservation measures and potential energy saving, including fabric upgrades, distribution loss improvements and boiler replacements.

The savings – which range from 3.3% from thermal storage to 43.1% for boiler replacement without combined heat and power – represent significant opportunities for the university. ●

Indoor air quality and designing for dementia

As dementia rates rise and care demands grow, new research reveals how indoor air quality may be influencing aggressive behaviours in care settings. Newcastle University's Professor **Neveen Hamza** shares insights from the study

The number of people living with dementia in the UK is rising sharply. In 2024, approximately 850,000 people were affected, and this figure is projected to double by 2040. The financial burden is also increasing, estimated at £42bn in 2024 and projected to reach £90bn by 2040.

In response, researchers are exploring how the built environment can support the wellbeing of people living with dementia (PLWD). A recent study investigated a real-world care home to assess potential links between indoor air quality and incidents of agitation and aggression.

Dementia is a group of neuropsychiatric syndromes that cause progressive impairments in memory, thinking and behaviour. These symptoms can escalate to behaviours such as restlessness, agitation and aggression – defined as verbal or physical actions intended to harm or repel others. Up to 90% of people with dementia exhibit such behaviours, which are distressing for both patients and caregivers, and are associated with increased medication use, hospitalisation and mortality.

Pharmacological interventions such as psychotropic medications and sedation carry significant risks, including cognitive decline and increased mortality. Non-drug-based interventions are therefore critical to managing these behaviours safely and effectively.

While architectural design has been shown to influence wellbeing in care settings, there remains limited understanding of how specific environmental and sensory conditions – such as air quality and temperature – affect behavioural symptoms. As a result, built environment professionals may lack the tools to design environments that reduce stress and aggression in dementia care.

The physical environment plays a vital role in quality of life for residents. Research has linked poor homeostasis, agitation and aggression in PLWD to indoor air quality and thermal conditions. For example, maintaining temperatures between 22°C and 24°C was correlated with reduced incidents of aggression in a monitored care setting.

Indicators of air quality, particularly carbon dioxide (CO_2), have long been used as proxies for inadequate ventilation and crowding. Elevated CO_2 levels are also associated with increased risk of airborne infections.

A collaborative study between the Cumbria, Northumberland, Tyne and Wear NHS Trust (CNTW) and Newcastle University's School of Architecture, Planning and Landscape examined the relationship between indoor air quality and behavioural incidents. The study was funded by the Wellcome Trust.

Environmental conditions were monitored in an NHS inpatient facility specialising in the management of severe behavioural and psychological symptoms of dementia. The research team monitored CO_2 levels, temperature and humidity, while the psychiatry team at CNTW anonymised incident reports of agitation and aggression.

Although the ward was equipped with high-level windows intended to support cross-ventilation, the responsibility for opening them fell to staff already engaged in extensive one-to-one care, making regular ventilation difficult to maintain. The air conditioning systems included controls for temperature and humidity, but

Supporting wellbeing for people living with dementia through environmental design

A growing body of research is exploring how internal environments can be optimised to support the wellbeing of people living with dementia. A recent systematic review of studies published between 2007 and 2024 highlights several other key environmental factors:

Daylight exposure has been shown to help regulate circadian rhythms, and may reduce sleep disturbances and mood-related symptoms.

Noise levels – whether too high or too low – can contribute to agitation and distress, underscoring the need for acoustic balance.

Thermal comfort is also critical, with increased behavioural symptoms observed when conditions are perceived as too hot or too cold.

These findings suggest that both overstimulation and understimulation of environmental factors can contribute to behavioural and psychological symptoms of dementia. Carefully managing light, temperature and acoustic conditions can improve comfort and reduce the incidence of challenging behaviours.

References:

[1] Au-Yeung WM et al 'Examining the relationships between indoor environmental quality parameters pertaining to light, noise, temperature and humidity, and the behavioural and psychological symptoms of people living with dementia: scoping review' *Interact J Med Res* 2024;13 doi: 10.2196/56452 **bit.ly/CJPLWDsc24**

lacked CO_2, particulate matter and volatile organic compound monitoring.

The study found that levels of aggression increased as CO_2 concentrations rose, even when concentrations remained below the commonly cited threshold of 1,000 parts per million (ppm). Notably, behavioural effects were observed at concentrations around 800ppm, suggesting that even modest increases in CO_2 may influence behavioural outcomes (Figure 2).

To extend the findings, building performance simulations were conducted in collaboration with Dr Mohamed Mahgoub, at the United Arab Emirates (UAE) University. These examined the impacts of increasing ventilation rates under current and projected climate conditions. The measured air change rate in the ward was approximately 1 air change per hour (ACH). Modelling explored a range of scenarios from 2 to 6 ACH and found that reducing CO_2 levels below 800ppm would require increasing ventilation to 4 ACH. This would lead to a 23% increase in annual energy use under current climate conditions.

Despite additional energy use, better ventilation could significantly reduce incidents of aggression and medical interventions, easing the burden on staff and potentially improving care outcomes for PLWD. ●

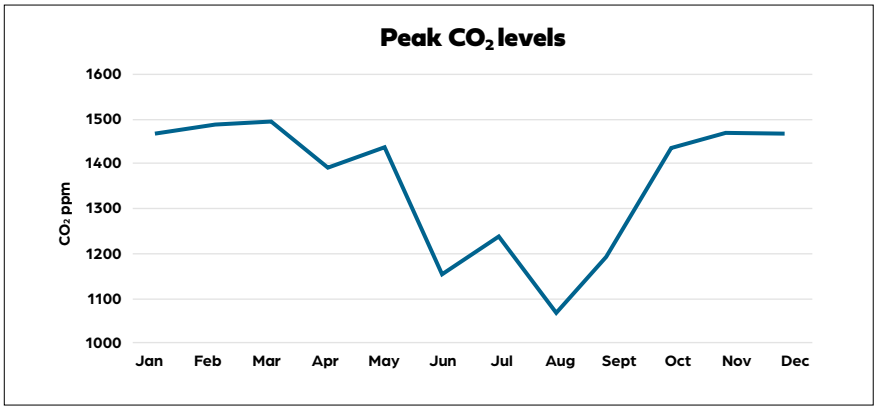


Figure 1: The peak CO_2 levels recorded in a hospital ward designed to support ventilation but limited in performance because of operational constraints

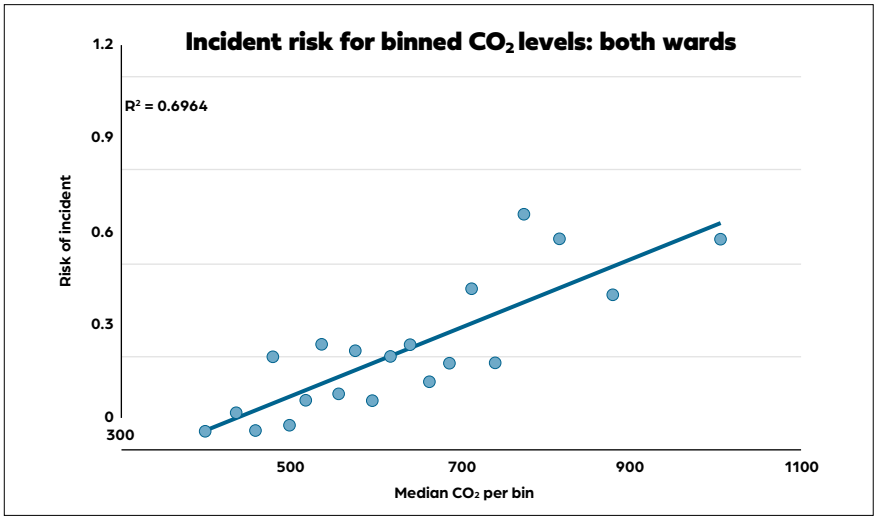


Figure 2: Direct correlation between carbon dioxide concentration and incidents of recorded aggression in both a male and female ward in the north-east of England

The paper 'Do indoor environmental conditions affect behaviours of people living with dementia?' (Hamza et al) was presented at the CIBSE IBPSA–England Technical Symposium. Papers will be avaliable later this year at www.cibse.org/symposium

● **Neveen Hamza is professor of architecture and building performance at Newcastle University, and chairs IBPSA-England. The paper's co-authors are: Dr Mohamed Mahgoub, associate professor, Department of Architecture, UAE University; and Dr Keith Reid PhD, consultant forensic psychiatrist, Dr David Anderson, consultant psychiatrist, and Dr Leigh Townsend, specialist psychiatrist, all at CNTW.**

Living proof

Regenerative design takes inspiration from nature to heat, cool and purify buildings. Aecom's **Dave Cheshire** explores real-world examples where natural systems are replacing conventional HVAC practices

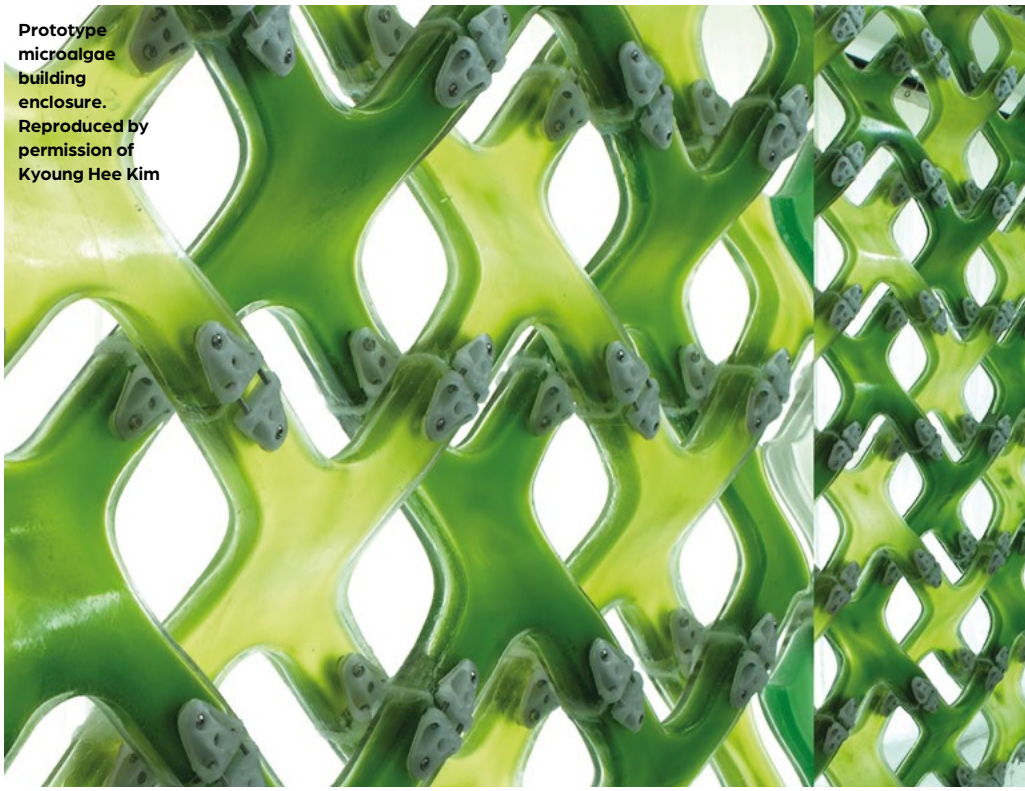
Biology and building services are rarely mentioned in the same sentence, but imagine if our buildings could be serviced by plants and natural processes fuelled by organic waste and sunlight.

This sounds very far-fetched, but some aspects are closer than you might think. After all, the ecosystem has been conditioning our air and cleaning our water for billions of years.

Human-designed systems consume resources from mines, oil fields and reservoirs, and release pollutants, creating a degenerative pattern of consumption. In contrast, natural systems use locally available resources; they are highly complex structures and networks that use water, air and nutrients, and energy from the sun. By-products are life-friendly and recycled into new organisms. The whole ecosystem is dynamic and self-perpetuating, with life creating the conditions required to sustain life.

Over the past 30 years, we have designed sustainable buildings that use less energy, water and materials, and that generate less waste and pollutants. This has been invaluable in raising awareness and starting the journey towards improving performance, but it has only made the built environment less harmful to the planet. Increasing natural disasters and freak weather events are a stark reminder that this is no longer enough. What if we could design buildings that have a positive impact on the planet – that restore and regenerate natural systems and even metabolise, like living organisms?

Plants have been used to treat wastewater in buildings for more than 60 years (since the advent of the Living Machine, a natural wastewater treatment system) and interior living walls help clean air through phytoremediation. More recently, rooftop greenhouses have been integrated into HVAC systems, microbial fuel cells are generating energy from wastewater, and microbial façades are providing multiple functions in servicing buildings.



Prototype microalgae building enclosure. Reproduced by permission of Kyoung Hee Kim

Active green walls

One way we can employ natural systems in our buildings is active green walls. The active modular phytoremediation system, or green wall, installed in the Public Safety Answering Call Center II in New York has hydroponically-grown plants that clean the building's internal air. The plants' roots are exposed, which allows rhizomes on the roots to digest airborne pollutants, such as volatile organic compounds and particulate matter[1].

Anna Dyson, from the Center for Architecture, Science and Ecology, notes: 'Conventional HVAC systems are almost like antibiotics. They take the airstreams and filter them, and they can take the good out with the bad' – whereas a green wall actually improves the air, like probiotics instead of antibiotics[2]. The plants clean the air and enrich the microbiome of the building, creating a healthier internal environment. As they are oxygenating the air, they also have the potential to reduce the amount of fresh air needed to be brought into the building.

Building integrated greenhouses

At the Universitat Autònoma de Barcelona, the Institute of Environmental Science and Technology (ICTA) has constructed a rooftop greenhouse that is integrated into the building (Figure 1). Residual heat from the laboratory and offices maintains the greenhouse temperature at night and in the heating season, while the greenhouse provides a buffer space that moderates solar gain and heat loss for the building. The CO_2-rich air from the building is used to increase crop yields, and the pre-heated,

filtered and oxygenated air is fed back into the building. The result is a symbiotic relationship where food is grown where it is consumed, so reducing the need to heat vast polytunnels in southern Spain.

Microalgae façades

Microalgae façade systems feed on the nutrients in wastewater and absorb CO_2 produced by occupants when it is bubbled through the array. The 'bioreactor' façade absorbs energy from the sun, which can then be piped to heat exchangers that reclaim the heat to supplement space heating and hot-water demand, moving heat out of the living space in the summer. The microalgae generates oxygen, reducing the demand for fresh air from outside, and sequesters the CO_2 produced by occupants into biomass that can be used for energy generation, pharmaceuticals or food.

Kyoung Hee Kim and her team at the Integrated Design Research Lab at the University of North Carolina EcoClosure have created an elegant prototype of interlocking bioreactors that can be retrofitted against windows (see image, opposite).

Microbial fuel cells

This amazing technology is fed on wastewater, including blackwater, and takes advantage of electricity that is released when the bacteria break down sugars as part of respiration. The system has been trialled in a school in Uganda, providing lighting for the toilet block and treating the sewage before it enters the watercourse.

Ioannis Ieropoulos developed microbial fuel cells at the University of the West of England, and is now head of the water and environmental engineering group at the University of Southampton. The aim is to scale up the technology and deploy it in buildings as part of the Living Architecture project.

Conclusion

The abilities of natural processes are beyond anything that our technology can do. How else could a system be designed that can treat blackwater safely while generating electricity, biomass and nutrients as by-products? Similarly, creating a façade that can provide reactive shading, sequester carbon, generate oxygen, treat wastewater and produce biomass is some design challenge without the help of nature! ●

● Dave Cheshire, a director at Aecom, sets out the regenerative building agenda and design principles in his book *Regenerative by Design*

References:
[1] Active Phytoremediation Wall System, *Architect, Sept 2012*, **bit.ly/CJAPWSAM**
[2] Living Wall, Fast Company, July 2016 **bit.ly/CJFCLivWall**

A session on nature-based climate resilience took place at the CIBSE IBPSA-England Technical Symposium at UCL in April. See www.cibse.org/symposium where papers will be uploaded later this year

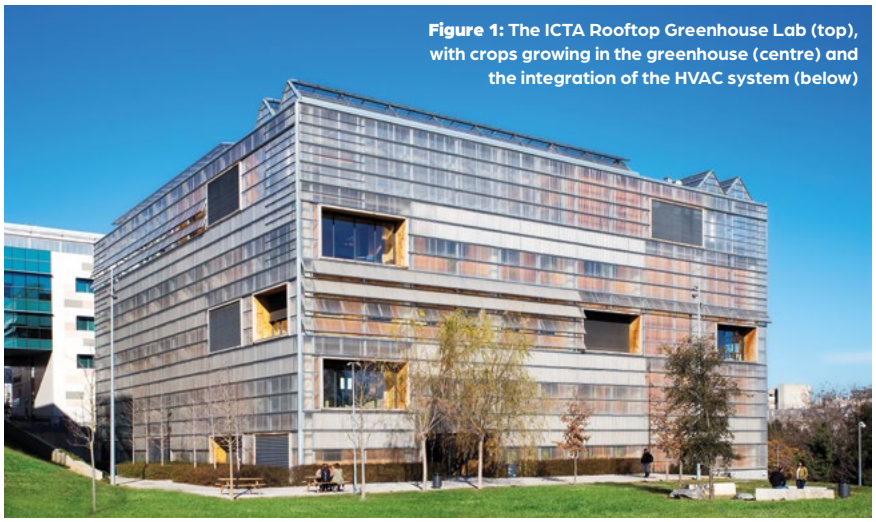
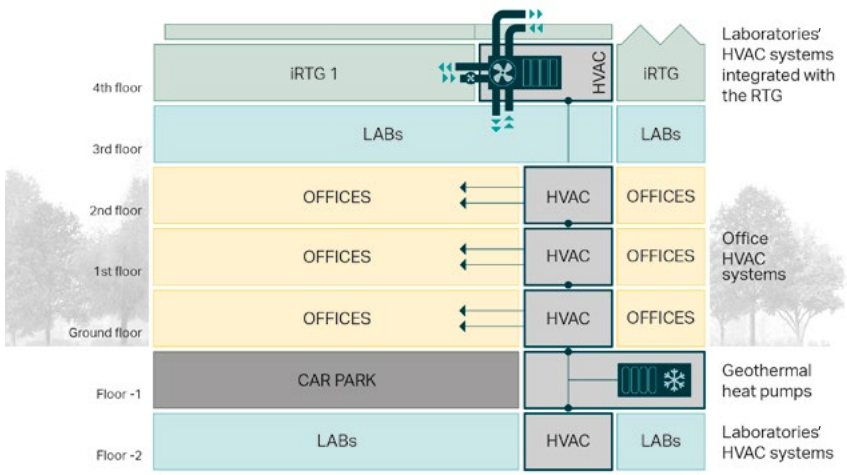
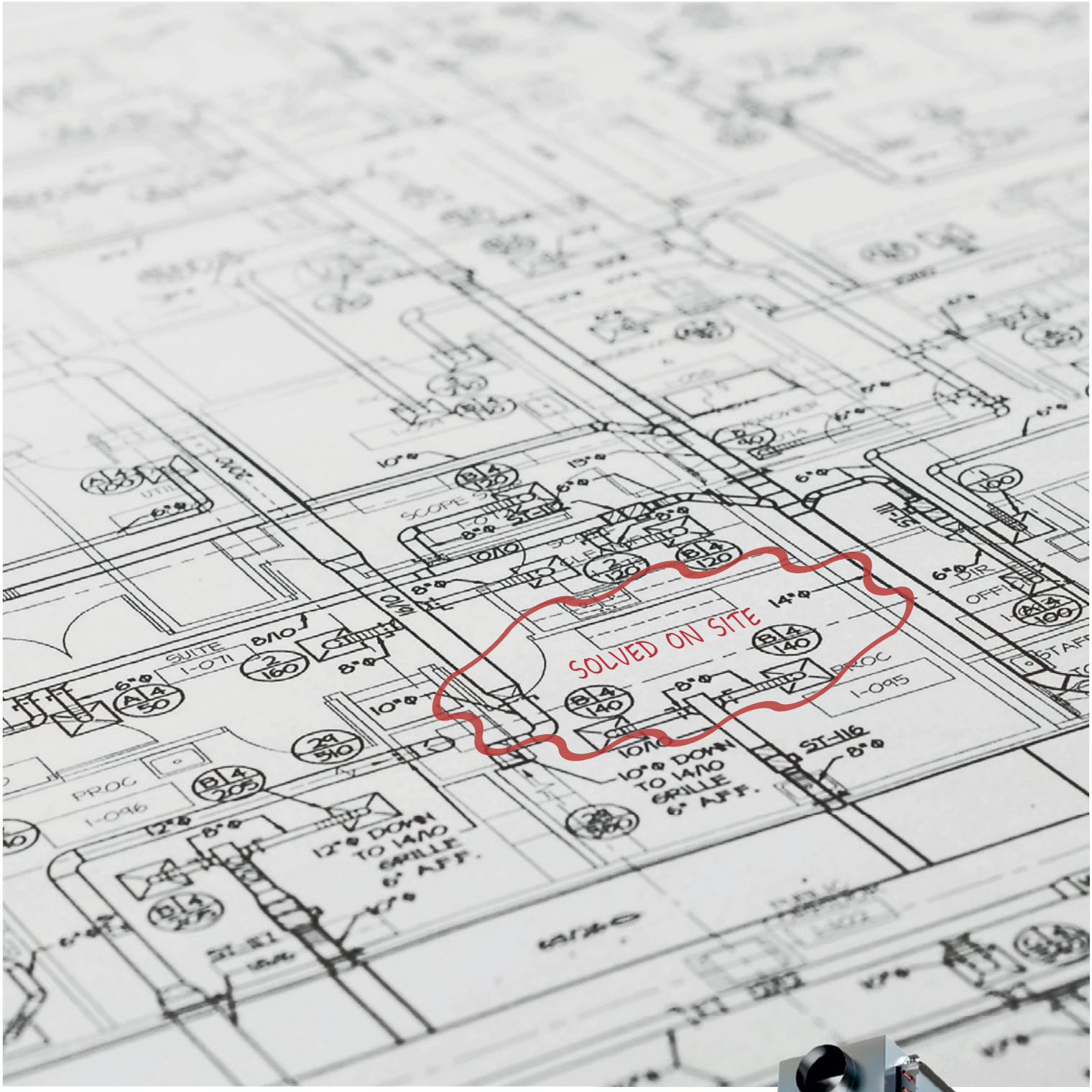


Figure 1: The ICTA Rooftop Greenhouse Lab (top), with crops growing in the greenhouse (centre) and the integration of the HVAC system (below)





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Fire and smoke control

Application of fire dampers, smoke control dampers and NSHEVs for safer buildings

This module explores how fire dampers, smoke control dampers and natural smoke and heat exhaust ventilators (NSHEVs) can be used to ensure critical building safety

Fire dampers, smoke control dampers, and natural smoke and heat exhaust ventilators (NSHEVs) play a vital role in life safety – either by helping to contain fire and smoke within defined compartments, or by extracting smoke to keep escape routes clear and usable during a fire. This article examines some key considerations in the successful application of these systems.

In a building fire, smoke presents the most immediate threat to life, as it can rapidly spread, obscure escape routes, and cause fatalities within minutes. To reduce this risk, fire compartmentation divides a building into fire-resistant zones that help contain fire and smoke, protect structural integrity, and provide occupants with time to be evacuated from the building. Building regulations recognise the importance of both containing and extracting smoke, with smoke control dampers and NSHEVs playing distinct but complementary roles in these strategies.

Where ductwork penetrates compartment walls or floors, fire dampers are used in combination with penetration seals – fire-resistant materials that restore the fire-stopping performance of the barrier. During normal operation, fire dampers allow airflow, but they are designed to close automatically when exposed to heat, helping to contain fire within its compartment of origin. Closure is triggered either by a mechanical fusible link or by a motorised actuator with an integral thermal release. Motorised dampers, such as the example shown in Figure 1, can respond to a control signal or a loss of power, whereas mechanical dampers rely solely on heat activation.

Smoke control dampers may be integrated into general ventilation systems or dedicated smoke extraction systems. Their primary function is to help establish a controlled path from the fire compartment to the open air, enabling smoke to be safely removed from the building during a fire. A smoke control damper – such as the example shown in Figure 2 – is designed to regulate the movement of smoke and hot gases from the fire zone to a designated exhaust point, in line with the programmed cause-and-effect strategy within the smoke control system. These dampers respond to signals from the system controller, actuating to an open or closed position typically within 60 seconds, helping to maintain clear escape routes and support safe evacuation.

Smoke control systems are categorised as either automatic activation (AA) or manual activation (MA). AA systems respond automatically to a fire or smoke signal without the need for human input, whereas MA systems require manual intervention to trigger a predefined sequence of automatic actions. Dampers certified for use in MA systems are generally more robust and also meet AA requirements, but this added durability comes with increased weight, complexity and cost. In the UK, particularly for residential and commercial buildings, AA systems are more commonly

Figure 1: An example of a CE-marked 'ES classified' fire damper suitable for duct mounting that can be used in concrete/masonry floors/walls, dry walls, and composite wall systems (Source: Swegon)

Figure 2: An example of a CE-marked 'EIS classified' multi-blade smoke control damper for use in multi- and single-compartment automatic activation smoke control systems (Source: Swegon)

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specified because of their simplicity and reliability.

A further distinction is made between single-compartment and multi-compartment dampers. Multi-compartment dampers are tested to more stringent criteria, including higher temperature exposure and longer fire durations, making them suitable for use across multiple fire zones. Single-compartment dampers, by contrast, are typically tested only to 600°C and are restricted to the terminal section of a ductwork run. Given the scale and complexity of modern basement and mixed-use developments, multi-compartment dampers have become the industry standard. Multi-compartment dampers can be used in single-compartment applications, whereas the reverse is not permitted.

Smoke control dampers should not be confused with fire dampers, or with ambiguous terms such as 'fire smoke dampers', which have no recognised status under current standards. Unlike fire dampers, which fail-safe to a closed position using thermal links or probes, smoke control dampers must be actively controlled. They are driven to an open or closed position in accordance with a defined cause-and-effect strategy and must not rely on passive mechanisms. These dampers use powered actuators to maintain or change position, and are required to respond within 60 seconds of activation as part of an automated smoke control sequence. To meet compliance requirements, smoke control dampers must be tested to at least 10,000 actuation cycles, while a more demanding 20,000-cycle test confirms suitability for modulating applications – such as systems that combine ventilation and smoke extraction and require air balancing in day-to-day use.

If dampers in a smoke control system operate while fans are running, the aerodynamic load must be replicated during cycle-testing. However, if fans only start after dampers have moved into position, testing can be done without this load. This underscores the need to consider damper operation as part of life-cycle planning at the design stage.

Smoke control dampers, fire dampers and NSHEVs are categorised as life safety systems under the Construction Products Regulation (CPR). As such, they fall under the CPR Assessment and Verification of Constancy of Performance (AVCP) System 1, which requires both independent type testing and ongoing factory audits by a notified body.

Since 2013, it has been a UK requirement for fire and smoke control dampers to carry CE marking to demonstrate compliance with standards, as outlined in Table 1, and confirms performance in three key areas: integrity (E), insulation (I), and smoke leakage (S). The classification required will vary depending on the application and can incorporate a number of parameters – examples for a smoke damper are given in Table 2. CE marking remains dominant in the UK, especially in the construction products sector, and UKCA marking remains aligned to EU standards, but future divergence could present a challenge for designers and manufacturers.

Controlling damper operation during a fire event is fundamental to effective smoke control and compartmentation. Historically, simple fusible link systems were widely used, relying on heat activation alone to close dampers. However, modern codes increasingly require active control of dampers, particularly where means of escape must be protected. To achieve this, two broad approaches to damper control are available: hardwired and addressable systems.

In a traditional hardwired system, each damper is connected directly to the control panel using dedicated cables for both power and monitoring. While this method is straightforward, it becomes impractical as the number of dampers increases. The need for extensive cable containment, combined with voltage drop limitations restricting cable runs to around 100 metres, can make hardwired systems complex and costly on larger projects.

Addressable damper systems offer scalable control and real-time status

Aspect	Fire dampers	Smoke control dampers
Product standard	BS EN 15650:2010 Ventilation for buildings – Fire dampers	BS EN 12101-8:2011 Smoke and heat control systems – Smoke control dampers
Test standard	BS EN 1366-2 Fire resistance tests for fire dampers	BS EN 1366-10 Fire resistance tests for smoke control dampers
Classification standard	BS EN 13501-3 Fire classification of construction products (fire dampers)	BS EN 13501-4 Fire classification of construction products (smoke control systems)

Table 1: Standards-related classification of fire dampers and smoke control dampers

Code	Meaning	What it confirms
E	Integrity	Resistance to flame and hot gases for a stated duration (for example, E60 = 60 minutes)
I	Insulation	Ability to restrict the temperature rise on unexposed side (for example, EI90 = 90 minutes integrity and insulation)
S	Smoke leakage	Ability to restrict the passage of smoke at ambient (~20°C) and elevated (~200°C) temperatures (for example, S_{1500} tested at 1,500Pa)
ve / ho	Orientation	Tested for vertical (ve) and/or horizontal (ho) mounting – with optional subscripts d = duct, and w = wall to indicate installation location
(i ↔ o)	Installation direction	Tested for airflow and leakage from inside to outside (i→o) and outside to inside (o→i) the duct
C	Durability of cyclic opening/closing	Indicates the number of opening and closing cycles the damper has been tested for (for example, C_{10000} = 10,000 cycles)
MA/AA	Activation type	MA = manual activation, AA = automatic activation
multi/single	Compartment application	Approved for use across multiple fire compartments or restricted to a single compartment
Example classification EI 90 (ve_{dw} i↔o) S_{1500} C_{10000} MA multi		

Table 2: Examples of smoke control damper classifications as defined in BS EN 13501-4

monitoring, supporting complex cause-and-effect strategies. These systems can manage large numbers of dampers efficiently, and are increasingly integrated with building management systems (BMS) for proactive fault detection and maintenance.

At the heart of any damper control strategy is cause-and-effect logic. In relatively simple buildings, the cause-and-effect may involve closing all dampers upon fire alarm activation. In more complex environments, however, more sophisticated control is required. In hospitals, for instance, it may be necessary to maintain air supply and extract in operating theatres during a fire elsewhere, meaning damper responses must be based on specific zone requirements. Similarly, large basements and car parks require selective smoke extraction, supplying fresh air to the fire zone while isolating adjacent areas to contain smoke spread. Addressable systems allow these complex and dynamic responses to be programmed and adjusted as the building's use evolves.

Typically, a dedicated damper control panel will manage the control and monitoring of dampers. Dedicated panels will typically provide facilities for scheduled damper testing, remote monitoring, and fault reporting. Firefighters' override functionality may also be provided, depending on the application. Integration with the BMS enables centralised management and further supports ongoing maintenance regimes.

It is essential that all elements of the smoke control system – not just the dampers, actuators and control panels, but also the interfacing electronics, network cabling and related control components – are adequately protected from fire. In MA systems in particular, thermal protection must be continuous across the system to ensure it remains operational during the early, critical stages of a fire when smoke control is most vital.

While both NSHEVs and smoke control dampers support smoke control, NSHEVs differ in that they vent smoke directly to the outside via the roof or façade, using natural buoyancy or wind pressure rather than ducted extraction. By allowing smoke and hot gases to escape from a building, NSHEVs help to maintain visibility, lower internal temperatures and support safer conditions for firefighters. Certified under BS EN 12101-2 *Smoke and heat control systems – Natural smoke and heat exhaust ventilators*, NSHEVs must meet stringent requirements for aerodynamic free area, reliability under fire conditions, and resistance to adverse environmental factors. Properly designed NSHEV systems can significantly improve evacuation conditions, particularly in large volume spaces such as atria, shopping centres, and warehouses.

Two versions of BS EN 12101-2 coexist. The 2003 version remains the harmonised standard listed under the CPR, and is the only version that can be used to support CE or UKCA marking. Although a revised edition was published in 2017 with updated and clearer guidance, it has not been harmonised and cannot be used for regulatory compliance purposes.

A growing trend is the dual use of NSHEVs for both smoke control and natural ventilation. In these applications, the ventilators respond to environmental conditions such as CO_2 levels, indoor temperature and weather, helping to maintain indoor air quality during normal operation. In the event of a fire alarm, the system overrides the environmental controls to prioritise smoke clearance. This dual-function approach – common in schools, care homes and office buildings – requires actuators and control systems to be cycle-tested for frequent use without compromising life safety performance. NSHEVs used for both smoke control and natural ventilation must be certified for dual use, including additional cycle-testing. Common errors – such as specifying manual-only vents or obstructing the aerodynamic free area – can compromise performance and should be avoided. Retrofitting actuators to standard windows without full testing under BS EN 12101-2 may also lead to non-compliance and potential system failure in a fire.

The integration of damper and NSHEV systems with a BMS is becoming increasingly common, enabling more effective monitoring and control. Test results, fault notifications and maintenance alerts can integrate into central dashboard that can be accessed remotely.

Emerging technologies are influencing the design and operation of life safety systems. For example, environmental control strategies can be layered onto damper systems, using occupancy sensing and temperature data to optimise heating, ventilation and air conditioning (HVAC) efficiency under normal operation, with fire control priorities overriding environmental settings during an emergency. In large projects, particularly hospitals and data centres, multiple damper control panels can be networked, allowing coordinated cause-and-effect strategies across multiple zones, and supporting phased evacuation strategies where necessary.

Specifiers must ensure that only CE- (or UKCA-) marked, fully tested products are used, that cause-and-effect strategies are appropriate and documented, and that maintenance regimes are in place and verifiable. Wherever possible, early engagement with manufacturers' experts can ease, and inform, fire strategy development.

Figure 3: An example of UKCA-marked NSHEV, tested to BS EN 12101-2, for integration into an external wall (Source: Swegon)

Accurate damper specification – clearly defining criteria such as classification, installation orientation, pressure rating, leakage class and actuation method – is critical to avoiding costly over-specification or inappropriate product selection. Design teams should engage with manufacturers early to ensure compliance with smoke control standards. Regulatory changes following the Building Safety Act are likely to place even greater emphasis on the demonstration of competence, accountability, and traceability in the design, installation and maintenance of life safety systems.

Testing and commissioning are vital to ensure dampers and NSHEVs function correctly in a fire. Full system testing should confirm device operation, response to alarm inputs and performance under fault conditions. The code of practice BS 9999:2017 *Fire safety in the design, management and use of buildings*, and the residential version BS 9991:2024, emphasise the importance of ongoing maintenance, with specific recommendations for testing regimes. In all cases, work must be carried out by competent persons, with issues promptly addressed and records properly maintained.

Fire dampers, smoke control dampers and NSHEVs are critical, complementary tools in building fire strategies. Their correct specification, integration, control and maintenance directly impact the ability of a building to protect life during a fire event. As regulatory expectations rise, delivering compliant, well-maintained smoke control systems is not only essential for safety but integral to professional practice. ●

● **With thanks to the team at Swegon for sharing their expertise, experience and thoughts in the creation of this CPD article.**

Module 248

June 2025

1 What is the primary function of a fire damper in a ventilation system?

- ☐ A To balance airflow across multiple compartments
- ☐ B To cool incoming air during normal operation
- ☐ C To maintain compartmentation by closing ductwork during a fire
- ☐ D To prevent smoke leakage in vertical shafts
- ☐ E To regulate temperature for HVAC efficiency

2 What distinguishes a smoke control damper from a fire damper?

- ☐ A Fire dampers can be used interchangeably with smoke dampers
- ☐ B Fire dampers require external power to function
- ☐ C Smoke control dampers are actively driven open or closed in response to control signals
- ☐ D Smoke control dampers are passive by design
- ☐ E Smoke control dampers operate using fusible links

3 What does AVCP System 1 certification require for life safety products?

- ☐ A CE marking without factory oversight
- ☐ B Independent type testing and ongoing factory audits by a notified body
- ☐ C Monthly testing by the building operator
- ☐ D Only one-off type testing for prototypes
- ☐ E Testing only in modular building applications

4 In dual-use NSHEV applications, what must be certified?

- ☐ A That it has been cycle-tested and certified for daily ventilation and smoke control use
- ☐ B That it has passed acoustic performance testing
- ☐ C That it includes a built-in weather sensor
- ☐ D That it is powered by the building's emergency lighting system
- ☐ E That the actuator is fire-rated for three hours

5 Why are multi-compartment dampers preferred in large or complex buildings?

- ☐ A They cost less than single-compartment dampers
- ☐ B They are installed without fire sealing
- ☐ C They are not required to be CE-marked under CPR
- ☐ D They require no actuation or control systems
- ☐ E They are tested for use across multiple fire zones and to higher temperatures

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Further reading:

- CIBSE Guide E: Fire Safety Engineering – particularly Chapters 10 and 12, which cover smoke control systems, compartmentation, and damper integration.
- *CIBSE Journal* CPD Modules 44 and 155 – provide additional detail on damper types, testing requirements, and their role in compartmentation and life safety strategies.

A ground source heat pump system is replacing gas at Birmingham Children's Hosptial

Heat in transition

Experts laid out the case for accelerating the move from gas boilers to heat pumps at the CIBSE Decarbonisation of Heating and Cooling conference last month. **Molly Tooher-Rudd** reports

Non-domestic buildings account for around a third of the UK's energy use for space and water heating, yet only 2,000 to 3,000 heat pump retrofits are completed in this sector each year, barely half the number required to stay on track for net zero.

That was the warning, from energy and buildings consultant Roger Hitchin, that framed a session on decarbonising heat at the CIBSE Decarbonisation of Heating and Cooling conference last month. Hitchin was joined by three other experts who shared data, insight and technical strategies to accelerate the transition from fossil-fuelled heating.

Independent consultant Colin Goodwin opened the session by positioning heat pumps as 'the best available technology for decarbonising heat', while also calling for future-ready thinking. 'Fifteen years ago, it was CHPs,' he said. 'Technology changes, and we need to be thinking about what comes after heat pumps.'

CIBSE is actively contributing to that evolution through updated guidance, including TM51 on ground source heat pumps and the upcoming AM17.1, which focuses on retrofitting heat pumps in non-domestic buildings. 'That's where we see the biggest change and opportunity,' Goodwin said. 'The guidance we're writing today we couldn't have written five years ago. We didn't have the experience, the knowledge or the feedback from real-world projects.'

Driving the domestic market

Heat Pump Association chief executive Charlotte Lee presented an overview of the UK's domestic heat pump landscape. She said that nearly 100,000 heat pumps were installed in 2024, up 63% from the previous year – 43,500 installations were supported through government grants such as the Boiler Upgrade Scheme.

Lee said the Climate Change Committee (CCC) anticipates a 50% growth rate, with 150,000 installations in 2025, spurred by new-build market drivers such as the Future Homes Standard and clearer fossil fuel boiler phase-out timelines.

'Housebuilders are getting ready for the inevitable,' she said, but added that retrofitting existing dwellings remains the big challenge.

'The CCC has proposed that, by 2035, more than 25% of homes should be fitted with a heat pump, rising to 80% by 2050.' Achieving this requires more than 10,000 individuals per year to be upskilled. 'It's crucial we bring installers on the journey as well as consumers.'

Lee also called for policy reforms. 'We need the lowest-carbon heat to be the lowest-cost heat,' she said, emphasising the urgency of electricity/gas price rebalancing and Energy Performance Certificate reform. With the government's Spending Review imminent (11 June), Lee added a note of caution regarding government support: 'We need to be prepared not to get quite what we expect,' she says.

She stressed that consumer priorities must remain central. 'We need installations that don't cost more to run – that's really what people care about,'

she said, adding that strong guidance is key to 'maintaining quality and consistency, providing confidence to installers and speeding up delivery, while maximising system efficiency'.

Laura Bishop, from the Ground Source Heat Pump Association, addressed the complex task of retrofitting non-domestic buildings.

She highlighted three key aspects to consider with commercial retrofit: type of system, sizing and temperature.

When determining the type of heat pump to install, it is important to 'think about the balance of easiest and cheapest to install against running costs and carbon savings', she said. In terms of sizing, Bishop warned that an error made too often was using gas boiler sizing to determine heat pump size. It is important to use heat-loss calculations, dynamic modelling, weather files and half-hourly gas data to inform system design, she said.

She also stressed the importance of reducing system temperatures where possible, from 80/60°C in traditional systems to 60/40°C or, ideally, 50/30°C for heat pumps. 'The idea is to upgrade your building so you can bring those temperatures down,' said Bishop, warning that existing radiators are often not able to meet heat demands at lower temperatures.

Bridging the retrofit gap

Bishop discussed the technical shift towards natural refrigerants such as R290, supported by evolving EU and UK regulation. High operating costs remain a barrier, she said: 'Heat pumps are expensive to run compared with gas.'

Hitchin focused on the lag in non-domestic heat pump uptake. He highlighted several constraints, including price, system design quality and complex supply chains.

'There is a mismatch between worrying about carbon savings and worrying about quality design installations. Only a quarter of heating firms say they offer heat pumps, and many of those are very small businesses,' said Hitchin. 'There are excellent firms, but many focus only on installation or design, without ensuring end-to-end system performance.'

Hitchin added that training and guidance will be vital, and said CIBSE's upcoming retrofit guide for non-domestic buildings would close the knowledge gap.

Graham Evans, heat pump business development manager at Strebel UK, the session's gold sponsor, stressed the role of accessible information.

'Published data on these systems should be freely available and easy to find,' he said, arguing that case studies will be critical to shifting public and professional perception.

'Getting the good news out there that heat pumps actually work and do decarbonise is just as important as the project itself,' he said.

Heat pump insights from *BSER&T*

Building Services Engineering Research and Technology (*BSER&T*) journal author Dr Andy Shea has highlighted two papers on heat pumps in the current issue

'Predicting the heat pump readiness of existing heating systems in the UK using diagnostic boiler data' (**bit.ly/CJBSHP25**) presents analysis of diagnostic data from approximately 4,600 boilers in the UK. The heating system data indicates that up to two-thirds of UK dwellings could operate with high-temperature heat pumps without upgrading existing radiators.

'An energy analysis methodology for residential heat pump retrofits' (**bit.ly/CJBSHTM25**) reports an energy analysis methodology for residential heat pump retrofits.

This research aims to provide residential heat pump retrofit providers with cost-effective methods for assessing the suitability of dwellings to accept heat pump retrofit solutions, and to extend these techniques for the effective monitoring and performance evaluation of heat pumps post-installation.

The paper focuses on a method drawn from theory set out in CIBSE TM41, and shows how real building heat-loss coefficients can be determined from regression analysis over different timeframe resolutions.

***BSER&T* is available free to CIBSE members. Follow this link to access the research journals bit.ly/CJRJs**

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Chiller moves

Traditional metrics are not always enough to accurately predict chiller energy use, say Cundall's **Peter Owens** and **Jakub Borowiec**, who outline a practical modelling alternative that accounts for part-load scenarios and outdoor conditions

The cooling of buildings accounts for 20% of electricity use worldwide, a figure that is projected to triple by 2050. As demand for data centres increases and global temperatures climb, the chiller market is projected to grow from $10.3bn in 2024 to $13.4bn by 2030.

A major driver of this increased energy consumption is the shift in data-centre cooling. The microchips used for artificial intelligence processing are pushing past the limits of traditional air cooling, with power demands expected to exceed 700W per chip by the end of 2025. Many of the facilities that were once cooled by direct-air cooling will soon require the generation of chilled water on site to facilitate direct-liquid cooling. (For more about the demands of data centres, see 'Power struggle', *CIBSE Journal,* April 2025.)

With the increased demand for cooling, and the urgency to reduce carbon emissions, predicting chiller energy consumption accurately has never been more important.

Early in the design process, engineers typically rely on the seasonal energy efficiency ratio (SEER) metric to estimate annual energy consumption of air cooled chillers. While useful for snapshot comparisons between machines, using SEER for this purpose is limited in its scope. It fails to account for basic factors such as hot exhaust recirculation and how numerous chillers will be staged when operating in tandem – and, therefore, how long each machine could operate in 'free cooling' mode. As a result, engineers risk miscalculating energy consumption and making sub-optimal equipment choices, which will have a real-world impact on a building's energy use.

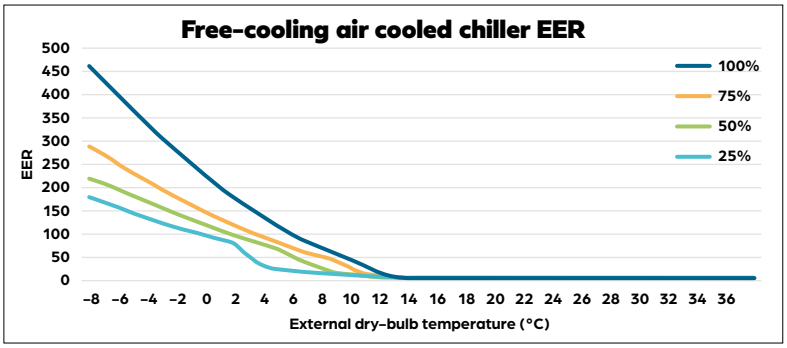


Figure 1: Example of true FC-ACC EER performance varying with temperature and part-loading

Life cycle carbon and energy modelling for optimal choice of chillers presents a simple and effective alternative model that can be used early in the design process to more accurately predict energy consumption. By using the linear average method, combined with a small amount of additional data from the manufacturer, engineers can map chiller performance across all external conditions and part-load scenarios, allowing for more in-depth analysis.

Linear average method

The proposed method for modelling gaps in the data is the linear average method. This is a two-step method that fully completes the gaps in the climatic information at 25%, 50%, 75% and 100% loading before modelling the gaps in the part-loading data. Manufacturers would need to provide performance data for various ambient conditions at 100%, 75%, 50% and 25% load. This would aim to capture the energy consumed by the fans, compressor and chiller circulating pumps. Some manufacturers may provide comprehensive data across all ambient conditions, while others might only be able to supply data at intervals, such as every 5K. Figure 1 shows how the energy efficiency ratio (EER) varies with ambient and part-loading conditions. The goal of the method is to accurately indicate the chillers' efficiency during any of these.

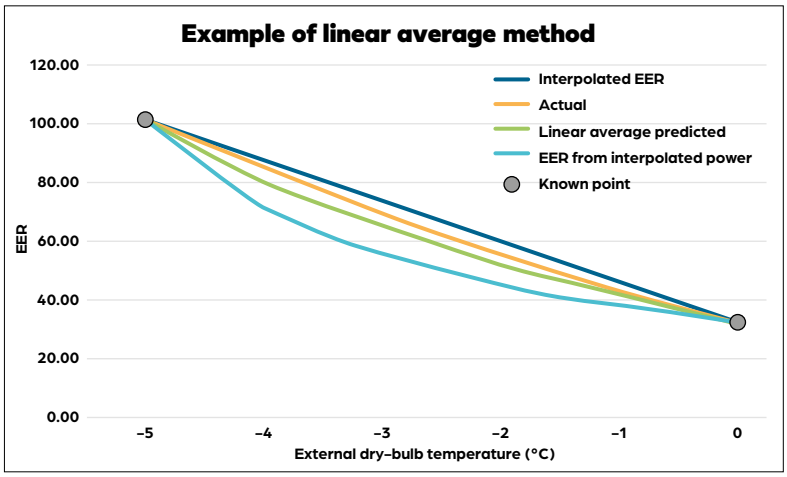


Figure 2: Actual and linear average predicted chiller EER between 0°C and 5°C

Modelling gaps in climate performance data

Figure 2 illustrates a method for estimating chiller efficiency (EER) when only two performance data points are available – in this case, at -5°C and 0°C

external dry-bulb temperature. The actual performance curve, shown as the orange line, is derived from known EER values across the full temperature range and serves as a benchmark.

The first approach applies simple linear interpolation between the two known EER values generating the straight 'Interpolated EER' line (blue). This method tends to overestimate actual performance, however, because the true EER profile is typically convex – meaning that EER declines more rapidly than a straight-line assumption suggests. As a result, the linear interpolation is above actual performance curve.

An alternative approach involves interpolating power consumption rather than EER directly. Assuming constant cooling output, interpolated power values can be used to calculate estimated EER values, resulting in the 'EER from interpolated power' line (light blue). This method reflects a more realistic curvature in the performance profile, but tends to underestimate actual EER values.

To improve accuracy, a third method takes the average of the EER values produced by the two previous approaches. This produces the 'Linear average predicted' line (green), which is a much closer approximation to the actual EER curve than either method on its own and crucially does not overestimate the EER.

The example shown in Figure 2 examines just two points; the method is then applied between all known data points for a particular part-loading condition and shown in Figure 3 as the 'linear average predicted'.

The advantage of this method is that it is very simple to implement in a spreadsheet. It is also robust when applied to a small dataset, as demonstrated in Figure 3 with nine data points for a given part-loading curve. A disadvantage of the method is that, with a very small dataset, it struggles to predict the large fall-off in performance when switching from full free cooling to mixed mode. By adding in this specific point, the issue can be alleviated, and its impact can be observed in Figure 3. It is recommended that this point is included in the initial dataset.

Applying this methodology for the data provided at all four part-loading conditions (100%, 75%, 50% and 25%) provides a dataset with four EER values at each external temperature. Gaps between these part-loading points can be approximated using a similar approach, to create a complete performance dataset. This set can then be used by engineers to try to perform further complex calculations – such as the application example in Figure 4.

This shows the optimal number of chillers to be used for a given external temperature to minimise annual energy consumption. The profile

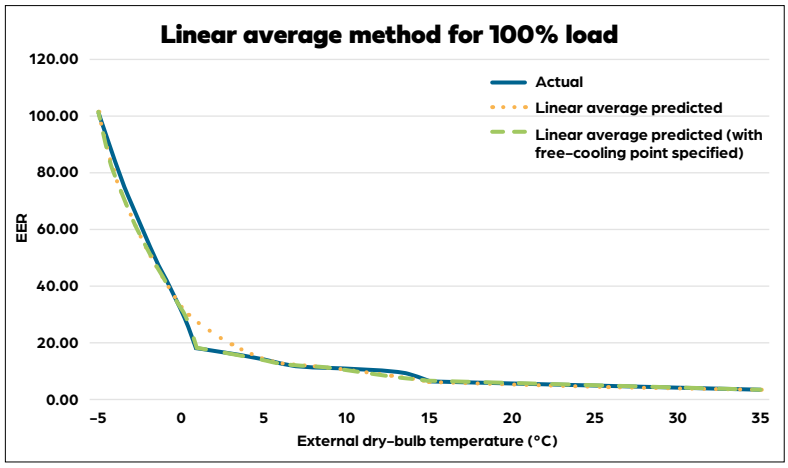


Figure 3: Actual and linear average prediction of EER varying with external temperatures when at 100% load

starts staging the chillers at low temperatures in a conventional manner, only operating the number of chillers that are needed to meet the load – in this example, three machines. However, as temperatures rise, we slowly use more and more chillers, before abruptly returning to the minimum. The reason for this is part-loading, as an individual chiller can stay in full or partial free-cooling mode for longer, delaying the point at which its compressor activates. Overall, this approach will make it more energy efficient to run multiple chillers at part-load, only increasing capacity as the temperatures rise higher. This means running the minimum number of chillers at any time, reducing pumping power.

Whether a control regime such as this could be implemented on site requires further exploration, but the opportunity lies within having a full dataset – so engineers can start having these conversations with manufacturers and thinking more creatively about where additional energy savings could be sought. ●

The research was presented at last month's CIBSE IBPSA-England Technical Symposium

Jakub Borowiec is a mechanical engineer and Peter Owens is associate director at Cundall

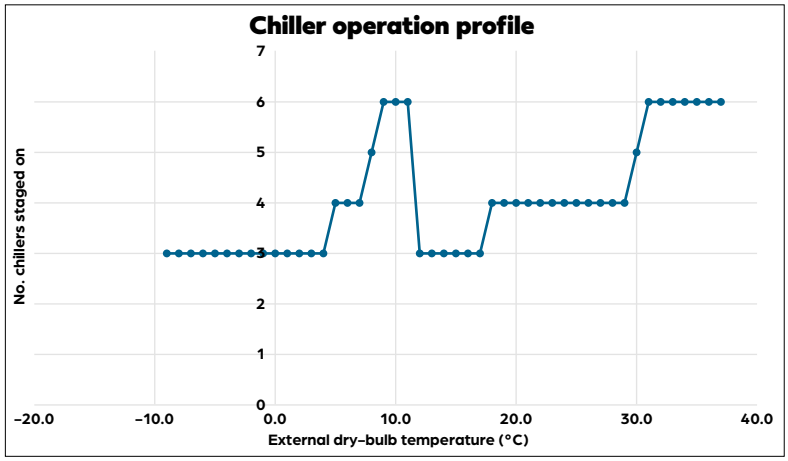


Figure 4: Optimised chiller staging profile

Air levels: passing the embodied carbon test

A review of a hybrid and active ventilation system in a secondary school aims to highlight the embodied carbon impacts of choosing one ventilation strategy over another. **Mat Naccarato**, of Savills Earth, describes the method and key learnings

The pilot version of the UK Net Zero Carbon Buildings Standard confirms the urgent need to mitigate embodied carbon in addition to operational emissions. While there is growing consensus in the industry about the importance of addressing this issue, lack of quality data makes it challenging to make informed decisions.

CIBSE TM65 Embodied carbon in building services outlines the need to assess the embodied carbon of BSE systems and provides calculation methodologies. It is particularly useful for assessing ventilation systems, often underestimated because of missing Environmental Product Declarations. The mitigation potential is evident: large units in ventilation systems can be made of up to 95% carbon-intensive metals (for example steel, aluminium and iron).

In educational buildings, this sharpens debate within design teams between active strategies and passive strategies that make use of natural ventilation fundamental principles. In classrooms, the latter is not often considered, and is criticised for the heat loss from exhaust air and the lack of indoor air quality (IAQ) control.

However, Building Bulletin 101 reminds us that ventilation is not a simple matter of active versus passive systems; there is also a wide range of intermediate solutions. Hybrid systems explore ways to reduce operational and embodied carbon by making the most of both worlds.

This study compares two ventilation systems, both with heat recovery and CO_2 sensors, to address the limitations of passive strategies. The hybrid system S1 (Figure 1) benefits from a wind-driven roof cowl and buoyancy effect through a vertical chimney. An intermittent active fan controlled by CO_2 sensors maintains IAQ and addresses wind fluctuations. The active ventilation system S2 (Figure 2) represents 'business as usual', with conventional central air handling units (AHUs) and dual rectangular steel ducts.

The study aims to assess the life-cycle embodied carbon of the two systems over 60 years. As the buildings differ in geometry – and for comparison purposes – both systems are sized in 3D for a hypothetical building designed with *Building Bulletin 103 Area Guidelines for Mainstream Schools*.

The occupancy is 30 people for a floor area of 62m^2. As some systems serve several classrooms and others have a vertical distribution, the hypothetical building is composed of two levels of eight classrooms, separated by a corridor. This hypothetical building is the basis for comparison and may represent a small school or facility wing (Figure 3).

System components are listed and measured, and the TM65 basic calculation is used. It requires simple information on the material breakdown, product weight, refrigerant type and quantity, equipment capacity, product service life, and repairs.

A scale-up factor is applied according to the complexity of the product, to account for all modules. A buffer factor is applied to reflect the simplicity of the calculation. For this early-stage analysis, refrigerants, operational energy and water are excluded, to focus on air supply for ventilation only. The relevant embodied

Figure 1: Hybrid ventilation system (S1)

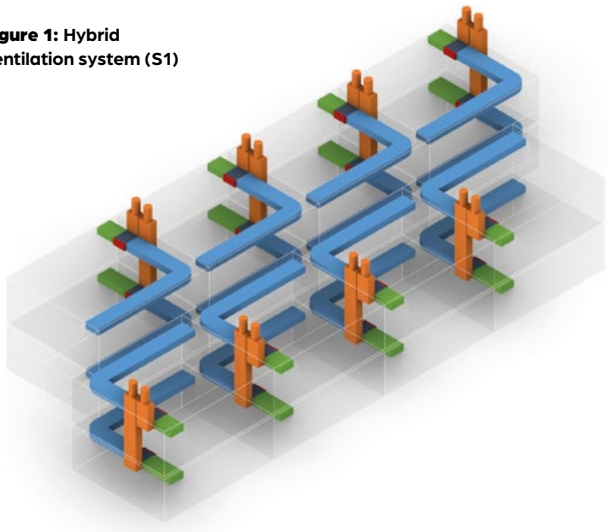
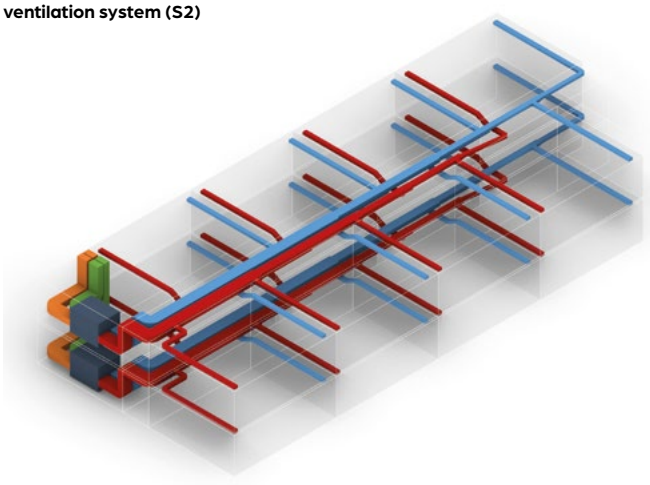


Figure 2: Active ventilation system (S2)



carbon coefficient is used for the assessment of each material.

Results

The results are calculated in $kgCO_2e$ and shown per gross internal area (GIA). Overall, the hybrid system S1 emits a quarter less embodied carbon than the active system S2 over 60 years.

Although the number of components is multiplied by the number of classrooms in S1, S2 is composed of very heavy units with a short lifespan. In addition, the glass-wool ventilation ducts in S1 are almost half as long and half as carbon-intensive as the galvanised ducts in S2.

The number of component replacements has a significant impact on results. Pessimistic and optimistic lifespan scenarios arose from interviews with design professionals and are used to highlight the potential deviations from *CIBSE Guide M: Maintenance engineering and management*.

This raises the question of how accurate assessment assumptions are compared with the actual lifespan of building components yet to be measured.

Operational energy emissions are not included, which would worsen the results of S2, with a specific fan power expected to be higher than S1.

It is important to note that this study considers two specific systems from case-study buildings, and the results cannot be generalised as typical values for types of ventilation strategies.

The review of the two ventilation systems highlights the benefits of the hybrid ventilation system (Figure 4). Unlike a mixed-mode system, which uses two systems in parallel, the hybrid system combines them, limiting the quantity of materials used.

However, the analysis also reveals the importance of ensuring that the fundamental passive principles are not compromised by this combination. While the roof fan must be able to be driven by wind, it should also be large enough not to reduce the stack-effect potential.

This reminds us that the debate is not binary between mechanical and passive ventilation, and that fully active systems are not the only solution. While the drive for net zero carbon pushes designers to seal the building envelope and reduce air permeability, the industry should also take into consideration the negative effects on indoor air quality.

The improvement of filters, while effective, also requires greater amounts of energy to turn the fans. More research is needed to explore the environmental impact of HVAC systems and to enhance the quality and quantity of data available.

However, some recommendations can already be made. First, ensure the good quality of outdoor air, as it directly impacts IAQ and occupant health. Second, optimise the potential for passive strategies in natural or hybrid ventilation systems, to significantly reduce reliance on mechanical components, thereby reducing operational and embodied carbon emissions. Where mechanical ventilation is necessary, it should be well sized to meet the needs of the space. A layout that minimises the quantity of ducts can further reduce material use and carbon emissions. Finally, products should be selected with lower embodied carbon and with components that have a long service life.

The findings highlight the importance of combining passive and active strategies, the need for robust embodied carbon data quality, and the lack of feedback on the real-life expectancy of building products.

This paper was based on one presented at the CIBSE IBPSA-England Technical Symposium 2025 that offers valuable insights into the potential of hybrid ventilation systems to reduce embodied carbon emissions in HVAC systems, contributing to the wider goal of achieving net zero carbon buildings by 2050. ●

Mat Naccarato is a senior consultant at Savills Earth

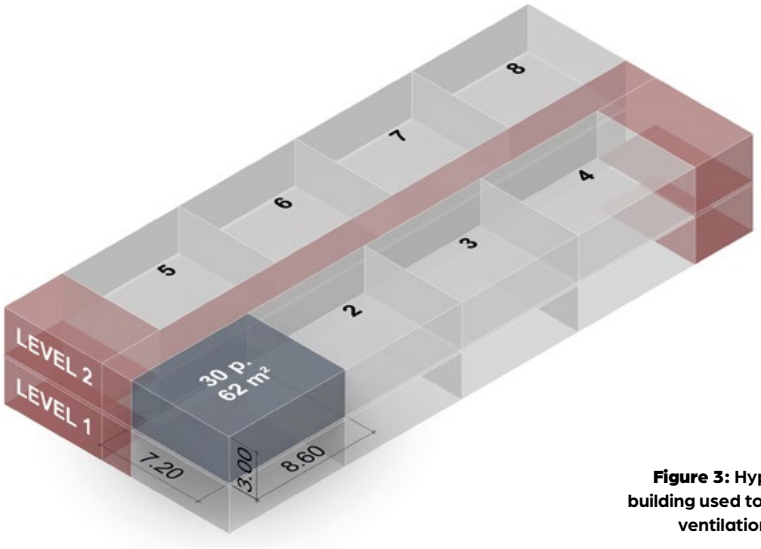


Figure 3: Hypothetical building used to compare ventilation systems

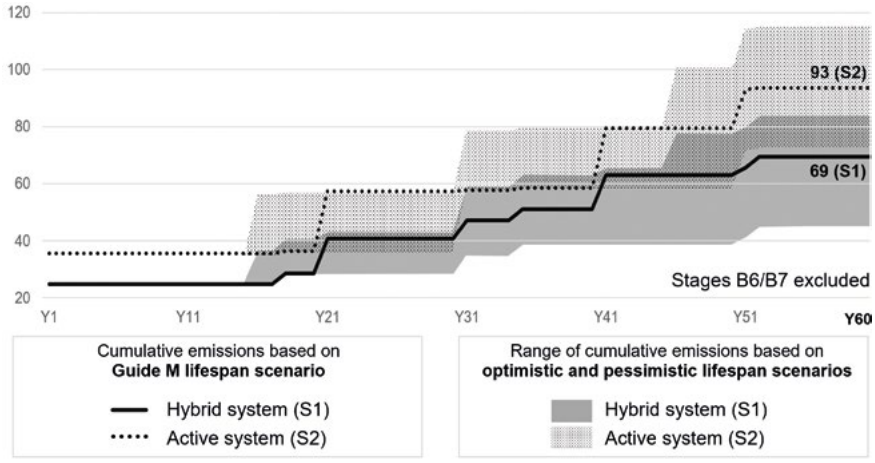


Figure 4: Life-cycle embodied carbon emissions over 60 years (kg $CO_2e \cdot m^{-2}$ GIA)

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Energy performance gap

Closing the gap: operational energy prediction in UK buildings

This module explores how CIBSE TM54 and NABERS UK Design for Performance are providing tools and frameworks to help narrow the UK's energy performance gap

Bridging the energy performance gap (EPG) requires a fundamental shift in design approach. This CPD article explores how CIBSE TM54[1] and NABERS UK[2] Design for Performance (DfP) provide the tools and frameworks necessary to predict and achieve real-world energy performance in UK buildings, and introduces some of the software-driven techniques that will help narrow the gap.

For projects within the UK, CIBSE TM54 and the NABERS UK DfP framework present practical and effective tools that enable design teams to progress beyond simple regulatory compliance towards buildings that genuinely achieve their intended in-use energy performance. Both approaches advocate a performance-led design philosophy by proactively addressing uncertainties, accurately refining assumptions, and integrating realistic system modelling throughout the building's life-cycle.

CIBSE TM54 offers a structured methodology specifically designed for the evaluation of operational energy use during a building project's design stages. The primary aims are to facilitate the creation of buildings aligned with ambitious net zero carbon targets, and to significantly reduce the well-documented discrepancy between predicted and actual energy consumption – the EPG. This is achieved by encouraging modellers to consider the inherent uncertainty in input parameters and the complex behaviour of building systems – representing an important shift from typical 'design-for-compliance' approach. These are often based on simplified methodologies such as required by Part L in England and Wales, Scotland's Section 6, or Northern Ireland's booklets F1/F3, and tools like the standard assessment procedure (SAP) or simplified building energy model (SBEM).

The TM54 methodology provides flexibility by accommodating a range of modelling complexities, from spreadsheet-based estimations to steady-state methods and dynamic simulation modelling (DSM). This allows for the selection of the most appropriate level of detail based on the project's specific complexity and available resources. A key strength of TM54 is its comprehensive scope, encompassing both regulated energy loads (such as space heating, hot water, cooling, fans, pumps and lighting) and typically unregulated loads (including office equipment, IT servers, lifts and catering). For mixed-use or multi-tenant buildings, TM54 highlights the need for clear and precise differentiation between base building (landlord-controlled) and tenant-specific energy consumption.

A key characteristic of TM54 is its integration across the entire building project life-cycle. Commencing at the initial briefing stage, the methodology evolves through concept design, detailed design, construction, commissioning, handover and, ultimately, into in-use operation. The design-stage TM54 model is intended as a living document, iteratively updated as the project progresses, culminating in an as-built energy model. This provides a baseline for post-occupancy evaluation (POE), particularly in conjunction with CIBSE TM63[3], which offers specific guidance on evaluating energy performance in occupied buildings. Consequently, TM54 actively supports continuous, data-driven commissioning and ongoing fine-tuning of building systems based on this evolving model.

The TM54 methodology is structured around 17 core steps, as summarised in Table 1 (overleaf).

The NABERS UK DfP framework closely aligns with the principles of TM54, and is specifically targeted at office buildings. A significant step forward is the contractual, pre-construction commitment made by the developer or building owner to achieve a specific NABERS UK energy base building rating once the building becomes operational. This – hopefully ambitious – target then serves as a central and unwavering reference point throughout the entire design, construction and operational phases of the project.

In contrast to compliance-driven modelling, NABERS UK DfP mandates the use of advanced dynamic simulation to estimate base building energy consumption with a high degree of accuracy. These simulations must account for hourly operational profiles, internal heat gains, the thermal properties of the building fabric, thermal inertia and, crucially, the detailed dynamic behaviour of heating, ventilation and air conditioning (HVAC) systems and their associated

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controls under realistic operating conditions. This necessitates modelling that incorporates part-load performance characteristics, seasonal variations in efficiency and the inherent losses associated with real-world operation.

To ensure the robustness and credibility of the DfP process, NABERS UK requires an Independent Design Review (IDR) conducted by qualified and accredited reviewers. These independent experts critically assess the modelling approach, the detailed representation of HVAC systems, the proposed energy metering strategy, and the overall likelihood of the building achieving the agreed-upon energy target. The IDR plays a vital role in ensuring consistency with DfP principles, and in identifying potential risks and opportunities for further energy optimisation.

Echoing TM54's emphasis on presenting a range of potential outcomes, scenario testing is a fundamental element of NABERS DfP. The framework requires the model to explore 'off-axis' scenarios that represent potential variations in control logic, unforeseen specification gaps, delays in the commissioning process, deviations in occupancy patterns, or unexpected operational strategies. DfP also mandates the inclusion of a modelling margin to account for any residual uncertainties that may still exist.

The developed building systems will almost certainly include – possibly intelligent – controls that adjust output to match dynamic demand to improve part-load efficiency. However, standard DSM templates may not capture these nuances. The increasing availability of building technologies, including building management systems (BMS) with Internet of Things (IoT) sensors, and digital twins, offers the potential for even deeper insights into energy consumption patterns and occupant behaviour. When these technologies are combined with the power of artificial intelligence (AI), machine learning (ML) algorithms, and 'sensor fusion' (combining data from multiple sensors) techniques, they can enhance the quality and granularity of design inputs. This enables the development of more sophisticated models that more accurately reflect how buildings are occupied and operated. Tools such as building information modelling (BIM) and virtual reality/augmented reality (VR/AR) are increasingly popular for engaging stakeholder engagement, as well as informing iterative design processes.

Shared data platforms, the adoption of open data standards and the development of consistent ontologies can facilitate more effective coordination and the reuse of high-quality occupancy and performance data. The implementation of IDRs provides an additional critical layer of scrutiny, helping to verify the rigour of the modelling process, the realism of underlying assumptions and the suitability of the proposed energy metering – and submetering – strategies.

Placing the needs and behaviours of occupants at the very centre of energy strategies is fundamental. The increased application of occupant-centric controls (OCC) – informed by behavioural research, intuitive user interfaces, and real-time feedback mechanisms – can lead to building systems that dynamically adapt to actual occupant needs, ultimately improving both comfort and energy efficiency.[4] The development of standards and guidance for accurately modelling human-building interactions, alongside updates to building codes that better reflect occupant behaviour and internal environmental quality (IEQ) considerations, will support more consistent and effective implementation of performance-based design.

Despite the significant progress represented by TM54 and NABERS DfP, several persistent limitations in current modelling practices and process integration continue to contribute to the EPG. Traditional simulation tools often lack the inherent sophistication required to accurately represent the intricate control strategies of modern HVAC systems, such as the heat pump in Figure 1, their part-load efficiencies across a range of operating conditions, and the complexities of real-world operational dynamics. A reliance on simplified or default assumptions regarding occupancy patterns, internal heat gains from equipment, and building management practices can lead to unreliable energy projections. The very real constraints of time and budget in practical projects can also limit the extent to which highly detailed modelling can be realistically undertaken.

A further challenge lies in the absence of a widely adopted and standardised data model for representing the multifaceted aspects of occupant-related behaviour within building performance simulations. This deficiency hinders the effective integration of both qualitative data insights (from occupant surveys) and quantitative data (from building sensors) into building performance models. Consequently, the significant influence of occupant behaviour – a critical driver of actual energy consumption – is often underestimated or inaccurately represented in design-stage predictions.

Process-related issues, including fragmented communication pathways and a lack of clear accountability across the various stages of design, construction, and ongoing operation, further exacerbate the EPG. The absence of consistent protocols for systematically capturing and modelling occupant behaviour compounds this challenge.

The increasing prevalence of smart, connected HVAC systems presents valuable opportunities for continuous performance monitoring, automated fault detection and ongoing energy performance optimisation. These advanced capabilities enable building operators to directly compare in-use energy data with the original design-stage predictions, providing crucial feedback that supports ongoing commissioning activities and helps to identify any operational inefficiencies or control-related issues.

TM54 Step	Summary
Step 0	Select modelling approach, software, and detail level based on project goals and data.
Step 2	Define realistic usage patterns: operating hours and occupancy.
Steps 3–10	Model all key energy end uses—HVAC, lighting, plug loads (regulated and unregulated).
Step 12	Account for energy management and operational practices.
Step 13	Run sensitivity analysis to identify impactful input parameters.
Step 14	Test scenarios with varied occupancy, weather and control strategies.
Step 15	Assess model results against performance targets and benchmarks.
Step 16	Document assumptions, methods and outcomes; present predictions as a range.
Step 17	Implement quality assurance and track decisions using an implementation matrix.

Table 1: Brief summary of TM54 core steps

Both TM54 and TM63 explicitly promote the concept of design-stage energy models evolving into valuable operational tools. With appropriate documentation and calibration using real-world performance data, the original simulation model can be effectively utilised during post-occupancy evaluation to fine-tune control strategies, provide robust data for energy audits and inform strategic retrofit decisions. This integrated approach fosters a more feedback-driven process, closely aligning with the objective of achieving performance-in-use targets and providing a clear pathway towards net zero operational outcomes.

The ability to understand and accurately predict operational energy use at the design stage is continually being enhanced by several evolving techniques and ongoing research directions, primarily focused on improving the quality of input data, the sophistication of model architectures and the overall accuracy of key assumptions.

ML techniques are playing an increasingly significant role in building design, offering powerful capabilities for predicting energy performance, optimising system control strategies and supporting faster – more informed – decision-making. Among these, artificial neural networks (ANNs) have demonstrated the ability to learn from large datasets of building simulations to accurately estimate energy consumption for new designs. ANNs are already being applied in the early stages of architectural design to inform building form, identify key factors influencing energy consumption, select appropriate structural systems and develop realistic energy cost budgets.[5] While feedforward neural networks (FFNNs) have historically been the dominant architecture in this area, convolutional neural networks (CNNs) – designed to detect spatial patterns in data – have gained significant traction in recent years. In building energy modelling, CNNs are increasingly being used to capture complex spatial relationships between various design features (such as building layout or orientation) and overall energy performance. Comparative analyses at the design stage have shown that ANN-based models often achieve higher accuracy and efficiency compared with other ML methods, such as support vector regression and long short-term memory networks.[4]

Emerging data-driven techniques are unlocking new possibilities for improving the accuracy of operational energy predictions during building design. Advancements in data processing – including sophisticated techniques for data cleaning (identifying and rectifying inconsistencies and errors), feature selection (identifying the most relevant input variables), and data integration (combining data from disparate sources) – are significantly improving the quality of inputs used in simulation models. Furthermore, the exploration of real-world data harvested from smart buildings and the application of generative models such as generative adversarial networks (GANs)[6] are enriching design-stage datasets. GANs – which learn to generate new, realistic data by pitting two neural networks against each other – can be particularly valuable in supplementing limited real-world datasets, thereby improving the training of predictive models even when actual performance data is scarce. More advanced ML architectures are also gaining attention, including hybrid models that combine the strengths of different approaches, and generative pre-trained transformers (GPTs).[5] Originally developed for natural language processing, GPTs excel[7] at analysing sequential data, such as extracting valuable insights from post-occupancy surveys, interpreting building regulations or processing design documents to support automation and enhance decision-making.[8,9,10] GPTs have the potential to uncover hidden patterns within large datasets, leading to more robust and reliable energy forecasting. Ongoing research is also heavily focused on optimising the parameters of these complex models, refining critical input assumptions related to occupancy patterns and climate data, and improving the interpretability of the models themselves – ensuring that even sophisticated AI-driven predictions remain transparent and useful for informing design decisions. Collectively, these innovations are playing a crucial role in bridging the EPG and supporting a more accurate and truly performance-led approach to building design.

Together, CIBSE TM54 and NABERS UK DfP provide a comprehensive and robust framework for evaluating, and ultimately achieving, meaningful improvements in operational energy performance. By emphasising the integration of rigorous modelling techniques, comprehensive scenario analysis, the use of realistic building services plant data, and the crucial role of in-use performance monitoring, these methodologies are instrumental in helping to ensure that buildings not only meet their initial design intent but also perform as intended in real-world operation. ●

Figure 1: Monobloc air source heat pump (40–140 kW) using natural R-290 refrigerant, providing heating up to 75°C and operation down to –25°C outdoor temperature, with seasonal coefficient of performance (SCOP) up to 4.20 and energy efficiency up to 30% above Ecodesign requirements (Source: Carrier)

Module 249

June 2025

1. According to the text, what is a primary aim of CIBSE TM54?

- ☐ A To facilitate the creation of net zero carbon buildings and reduce the energy performance gap
- ☐ B To focus exclusively on modelling regulated energy loads like heating and lighting
- ☐ C To mandate the use of dynamic simulation modelling (DSM) for all project types
- ☐ D To provide basic compliance with Part L/Section 6/TB F regulations using simplified tools like SAP or SBEM
- ☐ E To replace the need for post-occupancy evaluation (POE)

2. CIBSE TM54 recommends differentiating between which types of energy consumption in mixed-use or multi-tenant buildings?

- ☐ A Base building (landlord-controlled) vs. tenant-specific energy
- ☐ B Heating energy vs. cooling energy
- ☐ C Peak load energy vs. baseload energy
- ☐ D Regulated energy vs. unregulated energy
- ☐ E Simulated energy vs. actual measured energy

3. What is a mandatory requirement of the NABERS UK Design for Performance (DfP) framework mentioned in the document?

- ☐ A A contractual, pre-construction commitment to achieve a specific NABERS energy base building rating
- ☐ B Benchmarking performance against industry standards instead of detailed calculation
- ☐ C Conducting sensitivity analysis only after the building is operational
- ☐ D Focusing solely on improving the design of HVAC systems
- ☐ E Use of spreadsheet-based estimations for energy modelling

4. The text identifies which factor as a persistent limitation or challenge contributing to the energy performance gap in current modelling practices?

- ☐ A Lack of available performance data from equipment manufacturers
- ☐ B Over-reliance on Independent Design Reviews (IDRs)
- ☐ C The difficulty in accurately representing the complex control strategies and part-load efficiencies of modern HVAC systems
- ☐ D The mandatory inclusion of detailed occupant behaviour models in all simulations
- ☐ E The overuse of sophisticated dynamic simulation modelling (DSM)

5. Which emerging technology is mentioned as having the potential to analyse sequential data like post-occupancy surveys or design documents to support automation and decision-making in energy performance?

- ☐ A Convolutional neural networks (CNNs)
- ☐ B Generative adversarial networks (GANs)
- ☐ C Generative pre-trained transformers (GPTs)
- ☐ D Support vector regression (SVR)
- ☐ E Virtual reality/augmented reality (VR/AR)

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FLOWGRID AIR VOLUME SENSOR

- Accurate average air volume measurement
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- Suitable for bi-directional volume measurement
- Low velocity detection from 0.5 m/s
- Frame made in galvanised metal or stainless
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- Length 300 mm to fit the CMR Dampers
- Sizes 3000 x 3000mm have been manufactured
- Custom made sizes can be manufactured
- 35 Years field application experience

CMR FLOWGRID

The FGG Flowgrid has been designed to measure air volume in ventilation ducts. The Flowgrid consists of a standard duct section with a length of 200 and 300 mm and is available with a 20-30 or 40mm duct connection flange to suit standard duct work

The CMR sensing probes are fitted across the internal duct frame area in predefined spacing. Each probe has a number of pressure inlet points to measure the impact and static pressure at the same time and provide an average velocity measurement.

The result is a velocity pressure which ultimately provides a total air volume measurement. Both static and impact pressure have an independent pressure averaging tank which provides a smooth pressure signal of the whole measured area.

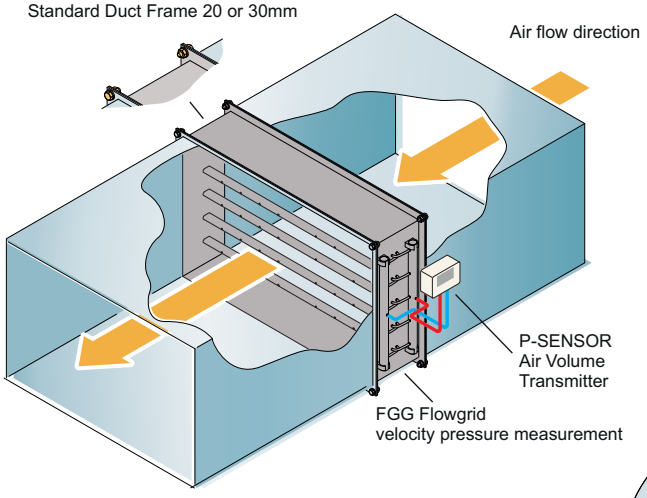
Another great advantage of the FGG Flowgrid is, that it can measure bi-directional as it is manufactured equally on both sides. This means, the air flow is measured in one direction and should there be a reverse flow, this can be detected and measured when using the CMR P-SENSOR.

The Flowgrids are manufactured in standard height increments of 100mm going up to a maximum height of 1200mm. Custom sizes can be made 3000 x 3000mm

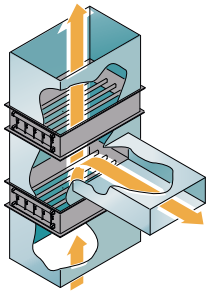
The Flowgrids are installed in many projects such as

Commercial Buildings - Industrial Production Plants - Pharmaceutical Production - Validated Monitoring Systems Hospital Isolation Rooms - Operating Theatres - Data Centres

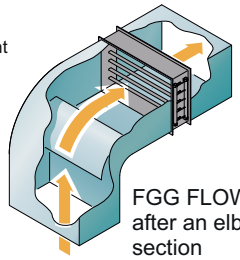
FGG FLOWGRID and P-SENSOR providing accurate average air volume measurement in ducts.



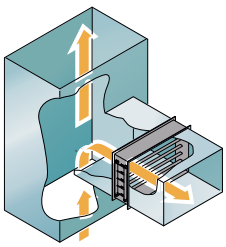
P-SENSOR
With LCD display
and keyboard



FGG FLOWGRID
before and after a
T- duct section



FGG FLOWGRID
after an elbow duct
section



FGG FLOWGRID
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Products of the month

Terminals now integrated into IES Virtual Environment

The new technology will allow users to simulate their entire Passivent range

Passivent has announced the full integration of its roof ventilation terminal range into the latest version of the IES Virtual Environment (VE) 2024, Feature Pack 1. This expansion builds on the company's existing partnership with Integrated Environmental Solutions (IES) and follows the successful inclusion of the Airscoop roof terminal in a previous VE update last year.

The IES Virtual Environment is widely used by specifiers and building services consultants for advanced building performance modelling. With this latest development, users can now simulate the entire Passivent range, including the Airscoop for displacement ventilation, the Airstract and Airstract iAT for passive stack ventilation, the innovative Hybrid Plus Airstract for mechanical assist, and the Litevent Airstract, which combines daylighting and ventilation.

A new dedicated Passivent VE Navigator has also been introduced within the platform. This tool guides users through a step-by-step process to simulate the performance of ventilation strategies, evaluate thermal outcomes and check compliance with building regulations.

'The VE provides a fast, streamlined and easy-to-use method of simulating the effects of Passivent natural ventilation roof terminals,' said Richard Quincey, technical director at IES. 'It supports accurate, whole-building performance simulations, and integrates energy and performance analysis throughout the design process.'

Huw Poppy, business operations manager at Passivent and secretary of CIBSE's Natural Ventilation Group, added: 'We are delighted that our full range of roof terminals is now available in IESVE. This allows consultants to explore more efficient and cost-effective natural ventilation solutions at an early design stage.'

All key products in the Passivent roof terminal range are available in multiple sizes, styles and finishes, and are backed by a 15-year no-leak guarantee. Manufactured at Passivent's Nottinghamshire facility, the terminals support sustainability goals and reliable performance.

● **Call 01732 850 770 or visit www.passivent.com/ies**

Nuaire is first to use low carbon XCarb steel

Nuaire has become the first UK ventilation manufacturer to use XCarb recycled and renewably produced steel in its products, cutting carbon emissions significantly.

The switch to this low carbon steel, developed by ArcelorMittal, aims to reduce CO_2 emissions by 64% in the first year for selected systems, including Nuaire's BPS air handling units and XBOXER XBC heat recovery units.

Manufactured using 100% renewable electricity and high scrap content, XCarb steel has an embodied carbon footprint of just 0.898tCO_2e/t, much lower than the 2.51tCO_2e/t of conventional steel.

Nuaire's adoption of XCarb supports customers aiming to meet their own carbon-reduction goals and aligns with the company's wider sustainability efforts, including providing TM65 datasheets for embodied carbon reporting.

Engineering director Alun Thomas said: 'This is a clear statement of our intent to drive sustainability across our operations.'

The move is part of Genuit Group's pledge to reach net zero by 2050.

● **Visit www.nuaire.co.uk/about/xcarb**

Reliable waste water pumping with Jung Pumpen Systems

The Jung Pumpen DrainMajor Duo and DrainKing twin-pump systems aim to provide dependable duty standby solutions for waste water management. Compatible with all Jung Pumpen pumps, including the 730/1030HES models rated for 90°C continuous operation, these systems ensure high performance in demanding conditions.

Their unique, rigid, triangular, low-level float design reduces issues from turbulence and debris, offering superior reliability over suspended floats.

● **Email Davidj@pumptechnology.co.uk or visit www.jung-pumps.co.uk**

PhD sheds light on MVHR in low carbon housing

Faisal Farooq, sponsored by Nuaire, has been awarded a PhD for his research on mechanical ventilation with heat recovery (MVHR) in low carbon homes.

Conducted at Cardiff University, the study evaluated ventilation effectiveness and comfort in social housing using Nuaire's MRXBOXAB-ECO2 systems. The findings offer practical design guidance and support industry best practices.

Nuaire technical director Colin Biggs co-supervised the research.

● **Download the thesis at orca.cardiff.ac.uk/id/eprint/172233**

Modutherm's AW90 heat pump powers Belfry expansion

The AW90 Monobloc air source heat pump from Modutherm is playing a key role in the £80m expansion of The Belfry Hotel & Resort.

Six AW90 units – chosen for their energy efficiency, intelligent Nordflex+ controls, and compact footprint – will support the new swimming pool complex. With a 90kW capacity and cascade capability, the system meets complex commercial demands.

Incorporating the latest inverter and enhanced vapour injection technology, the AW90 Monobloc provides a highly efficient heating solution, achieving an A++ energy rating and a coefficient of performance of up to 4.5.

● **Call 03455215666, email modutherm@modularhg.co.uk or visit modutherm.co.uk**

Hamworthy Heating offers free commissioning on Stratton Mk3 boilers

Hamworthy Heating is offering free commissioning on all Stratton Mk3 wall-hung condensing boilers ordered after 1 April and invoiced by 31 December 2025.

Featuring stainless steel heat exchangers, 97% gross seasonal efficiency and low NOx emissions, the compact Stratton Mk3 is ideal for space-constrained plantrooms. Available in seven models (40–150kW), it suits retrofit projects and can be cascaded for higher demand.

● **Visit www.hamworthy-heating.com**

Diffusion unveils Highline 275 fan coil range at Great Scotland Yard

Diffusion launched its new Highline 275 modular fan coil range at Great Scotland Yard, London, on 8 May. Designed for energy efficiency and quiet performance, the compact units deliver high airflow and are ideal for large-scale spaces. With more than 300,000 configuration options and innovative side-access servicing, the Highline 275 aims to enhance flexibility for specifiers.

● **Visit www.diffusion-group.com**

Ideal Heating supports specialist housing with efficient heat network

Ideal Heating Commercial has supplied four Evomax 2 boilers and 50 POD heat interface units to Ash View Extra Care in Huddersfield, a new development for Kirklees Council, supporting older residents.

The 400kW heat network provides efficient heating and hot water to 50 flats and communal areas. Evomax 2 is highly efficient, with up to 99.6% full-load efficiency and up to 110% part-load efficiency, can operate at up to 30° Δ T, and boasts a high turndown of 5:1.

● **Visit www.idealcommercialheating.co.uk**

EvacGo enhances safety at Lucent Square in Leeds

Lucent Square, a new six-storey residential development in Leeds, now features Advanced's EvacGo evacuation alert system, ensuring compliance with BS 8629 and enhancing resident safety.

Installed by S&R Electrical Contracting Services, the system covers 54 apartments and provides firefighters with secure, tamper-proof controls to manage evacuations.

● **Call 0345 894 7000 or email enquiries@advancedco.com**

ACV UK opens new training and technology centre in Fife

ACV UK has launched its new Expert Academy Training and Technology Centre at its Dalgety Bay headquarters in Fife. The facility offers accredited courses for installers, engineers and service professionals, with a strong focus on low carbon technologies, including heat pumps.

Equipped with modern classrooms and hands-on workshops, the centre supports training in domestic and commercial heating products.

● **Visit www.acv.com/gb**

Q&A

During Volunteers' Week, CIBSE highlights the role played by its volunteers in advancing the Institution's work. **Leon Markwell** shares how volunteering has helped him give back to the profession while learning, connecting, and supporting the next generation

Volunteers' Week 2025 is from 2–8 June, and gives CIBSE an opportunity to celebrate the invaluable contribution of its volunteers. Without the commitment of this highly active and engaged community, CIBSE would not function as it does.

The opportunities for volunteers, across regions, groups and societies, include contributing to articles, interviewing potential corporate members, serving on knowledge and technical groups, and standards work. Leon Markwell, chair of the Electrical Services Group, shares insights into his experience as a CIBSE volunteer.

Q What is the role of the Electrical Services Group (ESG)?

A The ESG is a group of engineers who are keen to disseminate knowledge, enhance health and safety, and generally help others. ESG members sit on various national and international committees inside and outside CIBSE, which allows us to input our experience and CIBSE views widely. It also helps us learn and share knowledge through written publications and lecture meetings.

Anyone is welcome to register for free through the CIBSE system, where they can also raise any questions they may have. As well as being on the ESG committee, I am a member of the CIBSE Technology Committee and have served on several other CIBSE committees in the past.

Q How did you originally get involved?

A As well as being a CIBSE member, I am a member of the Institution of Engineering and Technology (IET) and was introduced to the CIBSE ESG by an IET colleague. At the IET, I worked with technical committees and found that I could have a similar involvement at CIBSE. I knew several people who were members of both institutions.

Q What have been your highlights from the past year?

A My highlights have been becoming the ESG chair – and I was excited to recently be elected by ESG members to serve as chair for a further three years.

However, this was tinged with sadness, because I was invited by the previous ESG chair, Dr Tony Sung, to take over from him, which I was honoured to do – but I wasn't aware he was seriously ill, and he subsequently died. Tony was a great and very knowledgeable electrical engineer.

Q What is the focus of the Electrical Services Group?

A The ESG is focused on supporting the electrical industry and installation trade by sharing knowledge and promoting best practices, with a particular emphasis on engaging and empowering the next generation of engineers.

"I have made many friends and learned a lot of things that I would not have done had I not volunteered"

Q What do you get out of volunteering personally?

A It allows me to give something back to the industry and use my knowledge and experience, especially with the younger generation of engineers and electricians.

Q Are there any career benefits to volunteering?

A I am on the verge of retiring from full-time employment, having been involved with CIBSE and the IET since the mid-1990s, but I will certainly continue with the ESG. I have made many friends through my various roles, and have learned a lot of things that I would not have done had I not volunteered.

Whether you are just starting in your career, looking to improve your professional network and CV, or are well established and have a wealth of experience and expertise to put to good use, CIBSE has a volunteering opportunity for you. There is a breadth of volunteering roles to suit your experience and availability.

One of the main reasons people volunteer for CIBSE is to make a difference, and to develop and learn new skills and meet different people. CIBSE has many different volunteering opportunities, with varying time commitments, from becoming a mentor, to sitting on a committee, to assessing End Point Assessments.

CIBSE would like to thank all our volunteers for their hard work, dedication and time – you all make a huge difference.

For more information, visit www.cibse.org/get-involved/volunteering

CIBSE LIVE BUILD2 PERFORM

InstallerSHOW 2025 to host CIBSE's Build2Perform theatre

Access unrivalled live content and insights from 24-26 June at the NEC, Birmingham.

Curated specifically for those working in building services, CIBSE's **Build2Perform theatre** will discuss important topics such as:

- Domestic heat pump guidance – with the Heat Pump Association
- Basic principles of grooved mechanical joints
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Miatta Fahnbulleh MP, Minister for Energy Consumers leads the elemental Arena line-up.

Charlotte Lee, CEO at Heat Pump Association will speak on decarbonising heat

Ed Morris, Technical Manager at Altecnic will share modern solutions for domestic water services.

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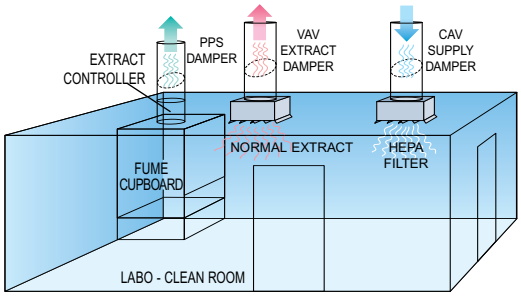

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