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March 2024

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## All-round performance



When you read this, the annual CIBSE Building Performance Awards, held on 29 February, will still be fresh in the memory. The 2024 Building Performance Champion was York Guildhall, which also triumphed in the Project of the Year Retrofit, and Commercial and Offices categories. The *Journal* went to press too late to capture the celebrations at Park Plaza, Westminster Bridge, but you can see pictures of all the winners accepting their awards at [cibsejournal.com](http://cibsejournal.com). There will be more coverage of the winners in the coming months.

The 19 award categories are indicative of the wide spectrum of professions and suppliers that sit under the CIBSE banner. The holistic nature of our industry

is evident in the *Journal* this month, with articles ranging from the new Biodiversity Net Gain (BNG) Regulation to Buro Happold's initiative to integrate the Fortnite gaming engine into its building simulations.

The new BNG Regulation, requiring a 10% increase in biodiversity on new projects, should not only help nature regain a foothold in urban Britain, but should also help building services engineers reduce the carbon impact of their designs (page 18). It should cut the amount of M&E plant needed to service buildings, as blue and green landscape features can reduce cooling loads significantly in the summer. Green infrastructure can also improve air quality and mitigate flooding with sustainable urban drainage features.

On page 44, we speak to Miraj Patel to learn about the innovative thinking that led to Buro Happold being crowned Digital Champion at the 2023 Society of Digital Engineering Awards. He explains how sophisticated digital twins are combining sources of data to reduce decision-making time and improve collaboration.

Buro Happold has been working on integrating the Unreal Engine into its digital twins. The engine allows users to experience 3D virtual environments in real time, with realistic lighting, shadows, reflections, and materials. Developed by Epic Games, Unreal Engine is most famously used to power the video game Fortnite, but the gaming behemoth is keen to expand applications beyond a 'third-person shooter'. It awarded Buro Happold an Epic MegaGrant to explore how Unreal Engine could stream geospatial data into an application in real time, while rendering graphics and making the environment interactive.

Last year, CIBSE President Adrian Catchpole called for a new wave of STEM Ambassadors to reach out to schools and galvanise the next generation of engineers. He spoke to three who have taken up the challenge and are now striving to make a difference. Read what motivated them to 'give back to the industry' on page 16.

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### Hywel Davies

Michael Gove's statement on means of escape in buildings above 18m high puts the onus on the developer



### Jess Glynn

Ahead of international Women's Day, a WIBSE volunteer explains how industry can attract more women to engineering



### Anastasia Mylona

Notes from a Chinese-UK collaboration on improving building resilience



### Tim Dwyer

This month's CPD is on chemical-free water treatment in closed-loop water systems in building applications



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## 'EPCs should be renewed every five years' – BRE

The validity of energy performance certificates (EPCs) should be halved from 10 to five years, the Building Research Establishment (BRE) has proposed.

In a report published in January, the BRE says the planned switch to renewable heating systems over the next decade means the current 10-year lifespan of EPCs is 'too long', and five-year validity should be considered.

The report also recommends the development of a provisional EPC rating for the 40% of homes that currently lack one, but which are often the 'least energy efficient' because they have not been improved or changed hands. It also calls for the headline metrics provided by EPCs to include energy efficiency alongside the cost of heating and lighting the home.

Gillian Charlesworth, chief executive of the BRE, said: 'EPCs are key source of information used in planning retrofit programmes and government policies. With targeted reforms, the government can ensure the EPC can really achieve its potential, as a trusted starting point for advice and information on how we can all make our homes better.'

# Labour scales back £28bn Green Prosperity Plan

**New proposals will reduce investment to £23.7bn over lifetime of next parliament**

The Labour Party has slashed proposals to boost spending on warm homes, as part of a controversial watering down of its £28bn per year Green Prosperity Plan (GPP).

Under the GPP, announced by shadow chancellor Rachel Reeves in 2021, Labour said it would earmark £28bn during each year of the next parliament for green investment if it forms the next government. This included £6bn per year over a 10-year period on a Warm Homes Plan to upgrade the energy efficiency of 19 million homes by 2035. However, Reeves and Labour leader Sir Keir Starmer announced last month that the GPP has been scaled back to £23.7bn over the lifetime of the next parliament. Labour will invest a further £6.6bn through its Warm Homes Plan, but this is barely a third of the £6bn per year previously pledged.

In a briefing document seen by *CIBSE Journal*, Labour has said the sums it has committed will enable up to five million homes currently below an energy performance certificate C rating to be upgraded. The £6.6bn will be split between energy efficiency grants delivered with local authorities, government-backed zero-interest loans for green home upgrades, and grants to boost the affordability of heat pumps. The GPP also earmarks £8.3bn of capital for Labour's proposed publicly owned Great British Energy company, including £3.3bn for its Local Power Plan to fund community renewables initiatives.

Bob Ward, policy and communications director at the London School of Economics' Grantham Research Institute, said: 'It is disappointing that Labour has apparently caved into pretty feeble criticism from a government that, itself, is not investing anywhere near enough to secure a pathway to sustainable economic growth.'

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## IN BRIEF

### Industry bodies urge swift action on whole life carbon

A cross-industry policy paper wants measures to reduce embodied carbon emissions in building construction to begin within two years of the next general election.

Published on 31 January, the paper proposes that measurement and reporting of whole-life carbon emissions for projects with a gross internal area of more than 1,000m<sup>2</sup>, or bigger than 10 dwellings, should be mandatory by 2026.

Legal limits on the upfront embodied carbon emissions of such projects, with a view to future revision and tightening as required, should also be introduced by 2028.

The next government should signal policies confirming these dates and interventions within six months of taking office, the policy paper states.

CIBSE is one of 11 industry bodies to have signed up to the paper, which seeks to tackle the approximately one in 10 UK greenhouse gas emissions related to 'embodied carbon' in the production and use of construction materials.

### BSRIA 'Rules of Thumb' to be replaced

BSRIA has published new guidance on Weights and Measures, the first in a series of documents that will replace the organisation's 'Rules of Thumb', which was in its fifth edition.

Further documents on mechanical criteria and electrical criteria, and a 'useful information' guide, will come out later this year.

The Weights and Measures guidance is being split across four documents, targeted at those who need it most, to enable more frequent updates.

New information has been included – for example, on space requirements for healthcare lifts and associated machine rooms.

Information that is no longer relevant or for which there is no longer an authoritative source has been removed. In particular, cost information is no longer included because it can get out of date very quickly. Instead, readers are directed to Spon's price books and the Building Cost Information Service.

The new guidance can be used for approximately calculating values, setting outline targets or rapidly comparing options.

# Global temperature exceeds 1.5°C target for whole of 2023

## January 2024 also the warmest month on record, reports European Union

Average global temperatures exceeded the 1.5°C target agreed by governments at the 2015 Paris climate change summit over a whole year for the first time in 2023.

The monthly climate change bulletin of the EU's Copernicus Climate Change Service (C3S) published on 9 February shows the global mean temperature for 2023 was 1.52°C above the pre-industrial average for 1850 to 1900. It also says the first month of this year was the warmest January on record, dating back to 1940.

The average global sea-surface temperature for January, outside the polar regions, also reached 20.97°C – only 0.01°C below the highest monthly figure to date, recorded in August 2023.

Samantha Burgess, deputy director of C3S, said: 'Rapid reductions in greenhouse gas emissions are the only way to stop global temperatures increasing.'

Philip Dunne MP, chair of the House of

Commons environmental audit committee, said: 'The world came together in 2015 to agree to try to limit temperature increase to 1.5°C; it is troubling that, because of the high temperatures experienced last year, the global thermometer tipped over this threshold for the first time.'

Dunne urged the UK government to heed his committee's report on heat resilience and sustainable cooling, which was published in January.

It wants ministers to consider the pros and cons of installing reversible air-to-air heat pumps, which also provide cooling, to reduce stress on the electricity Grid during heatwaves.

Reversible heat pumps may be 'unnecessary' and 'significantly' increase energy use and emissions if passive measures and fans have already been installed, the report says.

It also recommends the government combine existing initiatives on insulation and energy efficiency into a 'much more ambitious and comprehensive' housing retrofit programme that addresses the risks of overheating.

## LETI 'shocked' by Part L 'loophole'

LETI has said it is 'shocked' that the new Future Homes Standard (FHS) includes a 'loophole' that would enable local authorities to allow new buildings to opt out of achieving minimum performance requirements set out in Part L.

In its response to the FHS consultation, which concludes on 6 March, the voluntary network for built environment professionals welcomed proposals in the document to end the use of fossil fuels. However, it said there was a 'missed opportunity' to improve fabric performance beyond the Part L 2021 Building Regulations, which cover conservation of fuel and power.

LETI added that its members were shocked by the 'addition' of what it regards as a 'loophole' that would mean new buildings – in 'exceptional circumstances' – would not have to meet minimum Part L performance requirements.

Members of the network are also disappointed by the continued use of carbon emission and primary energy metrics, avoidance of accounting for unregulated energy, and the use of a notional building methodology.

A new generation of inefficient buildings – not the 'resilient, equitable country that we deserve' – will be created if the proposals in the FHS are enacted, LETI warns.

## Fracking sites to become energy source for heat networks

Geothermal power company CeraPhi Energy has acquired the business of former shale-gas fracking developer Third Energy.

The Great Yarmouth-based company develops closed-loop geothermal energy centres that can be connected to heat networks, and plans to repurpose Third's existing wells across North Yorkshire. Eight sites consist of 12 former gas wells, which are currently in a suspended state, and a network of subterranean pipelines.

Using boreholes down to a depth of 2km, CeraPhi aims to de-risk the scaling and commercialisation of large-scale heat networks by reducing the space required for their deployment and increasing the extraction of thermal energy. Drilling new wells and repurposing end-of-life and non-producing oil and gas wells will provide CeraPhi with 'huge commercial potential' for the scaling up of geothermal heat networks in the UK and globally.

The company completed a commercial demonstration project at a site operated by Third Energy last year.

# Government may scrap 'boiler tax' after campaign

## Clean-heat mechanism fines boiler makers for missing heat pump quotas

The government is considering whether to scrap its incentive scheme to encourage boiler manufacturers to sell heat pumps.

The Clean Heat Market Mechanism (CHMM), modelled on the zero emissions mandate being introduced in the car market, is designed to ensure manufacturers install a certain number of heat pumps for every fossil fuel boiler they sell. This will initially be one heat pump per 24 boilers from April, when the scheme is due to start, but the ratio will become more demanding over the years.

Manufacturers will have to pay a £3,000 fine for each heat pump installation that they fail to deliver.

However, after a campaign by the gas boiler industry, which labelled the CHMM as a 'boiler tax', the *Sunday Times* reported on 4 February

that Secretary of State for Energy Security and Net Zero Claire Coutinho is planning to scrap the scheme. This has sparked a backlash from some in government, however, with the *Times* subsequently reporting that minister of state for climate Graham Stuart has threatened to quit if Coutinho scraps the CHMM.

Several manufacturers have increased the price of their boilers to mitigate the cost of paying the £3,000 fines if they miss their heat pump installation targets. Justifying its decision to raise the price of its boilers by £120, Baxi said in a statement that it would have to sell 100 times more heat pumps to escape a fine.

The manufacturer counters as 'unfounded' the accusation that it is profiting from the CHMM surcharge. It says the targets set by government for heat pump installations are 'entirely unachievable' and will cause 'significant harm' to Baxi's business, and risk its 'ability to continue to operate'.

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Trevor, Senior Design Engineer





The Wild West End project seeks to increase green spaces in London

## Biodiversity targets come into force for new projects

### Biodiversity Net Gain Regulation requires a 10% increase in biodiversity

All major housing developments in England are now required to deliver at least a 10% net gain in biodiversity or habitat, under new government rules.

The Biodiversity Net Gain (BNG) Regulation became mandatory on 12 February under the Town and Country Planning Act, having first been introduced through the 2021 Environment Act. Its aim is to help deliver the government's commitment to halt species decline by 2030.

Developers in England are now legally required to deliver at least a 10% increase in biodiversity when major building projects are undertaken.

England is the first country in the world to make BNG a legal requirement, according to the Department for Environment, Food and Rural Affairs. The requirement can be met by furnishing habitat on the developer's own land or by purchasing a share of a nature-compensation scheme set up by a land

manager or farmer. However, delivery of BNG within the development's boundary must be considered first before looking off site.

Alternatively, applicants must buy statutory BNG credits from a government scheme administered by Natural England, and the money raised will then be reinvested in habitat projects across the nation.

A statutory metric tool will be used to calculate how many units a habitat contains before development takes place.

BNG requirements apply only to new planning applications and not to those already submitted.

They will be rolled out for small sites of fewer than nine dwellings from 2 April and implementation is expected for Nationally Significant Infrastructure Projects in late 2025.

However, according to a survey carried out by the Royal Town Planning Institute, 41% of public sector planners are uncertain about whether they have access to the necessary ecological expertise to comply with the new BNG requirements. See feature on page 18.

## IN BRIEF

### Blurred boundaries posing challenge to post-Grenfell reform

A blurring of boundaries across the industry poses a 'major challenge' to post-Grenfell Tower disaster efforts to improve building safety, a new report has warned.

The third and final report of the Competence Steering Group (CSG), entitled 'A Higher Bar - Achieving a Competence-led Built Environment', was published in January.

The report says: 'Design boundaries have become blurred over recent years, and the issue of where responsibility lies is at the heart of the current debate.'

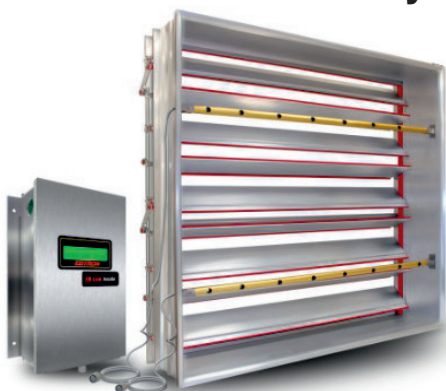
'The new inter-dependencies between product/systems manufacturers, architects and specialist contractors pose a major challenge to post-Grenfell reform.'

It says the CSG recognises that the construction sector is not yet ready for some of the 'significant changes' emerging out of the post-Grenfell Tower disaster building safety regime, and 'continued support will be needed'.

The CSG's work is being put on a more formal footing with the setting up of a new Industry Competence Steering Group. This will sit under the Industry Competence Committee, which has a statutory role advising on matters of competence.

The Construction Production Association's digital and policy manager, Hanna Clarke, has been named the new group's chair. She led the production of a CSG white paper on a proposed competence standard for the built environment, which is being taken forward by BSI to become a British Standard.

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## IN BRIEF

### Building services body aims to upskill installers

The new Engineering and Building Services Skills Authority (EBSSA) – which is charged with overseeing skills progress across all mechanical, electrical, plumbing and associated trade disciplines – was formally launched in January, at a meeting it co-hosted with the Construction Leadership Council. EBSSA, which was convened last year, is inviting multiple installer disciplines to begin codifying standards and competences for the sector.

### New managing director for Introba

Introba has appointed Richard Hansen as its new managing director for the UK and Europe. He will oversee and direct the business operations of Introba's UK and Europe teams, while also setting the direction for training and mentorship of technical talent.

# Many council building control services will cease, warns LABC

## Pressure to certify and register professionals before 6 April deadline

A 'significant number' of councils across England and Wales will be unable to offer building control services from 6 April because of a lack of registered professionals, the body representing these officers has warned.

The concerns are outlined in a letter from Lorna Stimpson, chief executive of Local Authority Building Control (LABC) to the Building Safety Regulator (BSR), the Welsh government, and the Department for Levelling Up, Housing and Communities (DLUHC), sent on 2 February.

She writes that a 'significant number' of council building control professionals will not be certified in time to meet the deadline for registration on 6 April.

More than 4,500 building control professionals will have to be assessed and

certified by that date. As of 31 January, only 1,500 had started the process, according to *Construction Management*.


A 'significant number of authorities in England and Wales' will be forced to cease undertaking a building control function from that date because of a lack of appropriate registered professionals, Stimpson writes. The introduction of the new requirements is prompting an 'exodus' of building control professionals, she adds.

Among the tasks councils will not be able to meet are inspections of 'in flight' construction and serving stop and compliance notices


Stimpson 'strongly' encourages the BSR, DLUHC and the Welsh government to delay the deadline for implementing registration by at least six months.


LABC's Building Safety Competence Foundation is one of three approved schemes that can carry out building control competency assessments.

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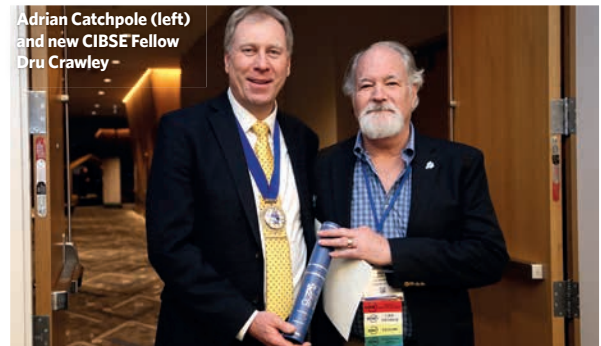


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He highlighted successes in the 130th year of ASHRAE, including a new region, a \$2.85m US government Department of Energy grant for training energy code officials, and a return to membership growth.

More than 3,500 delegates attended the conference and the accompanying trade fair was the second largest ever, with 1,864 exhibitors spread across 12 acres of McCormick Place.

ASHRAE's continuing focus on internationalising its activities was evident in the awards presented at the opening plenary event. Ten of the 23 ASHRAE fellowships awarded went to members from outside North America, and two of the three student design project awards went to students from UK universities – Loughborough and Sheffield.

The Winter Conference was attended by CIBSE President Adrian Catchpole, pictured above presenting Dru Crawley, director, building performance at Bentley Systems, with a CIBSE Fellowship.

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### Medal nominations

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Proposals for the 2024 Medals are open till 31 March. For further details visit [bit.ly/CJJan22CN](https://bit.ly/CJJan22CN)

### CIBSE marks fifth EPA anniversary

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# Technical Symposium presentations revealed

## Graeme Maidment will give keynote address on net zero cooling

Papers and presentations exploring net zero cooling, building performance evaluation, the heat network landscape, and heat pump retrofits will feature at the 2024 CIBSE Technical Symposium.

The symposium's theme is 'Fit for 2050 - Delivering buildings and defining performance for a net zero built environment', and it takes place at the Welsh School of Architecture, in Cardiff, from 11-12 April.

It will focus on redefining building performance in the light of social, environmental and digital change, and will feature a range of peer-reviewed papers and presentations. These will outline

developments in practice, technology and policy, and showcase the latest guidance for building services engineers.

Professor Graeme Maidment, of London South Bank University, will be the keynote speaker, and will highlight the opportunities for net zero-compatible cooling strategies across the building stock. Cooling activities represented about 5% of total greenhouse gas emissions in the UK in 2021, contributing to approximately 19% of total UK electricity consumption and about 1.6% of petrol/diesel consumption.

Delegates will also hear a paper titled *Applying natural language processing to sentiment analysis in building performance evaluation*, by Sahar Nava, from University College London. She explores the use of natural language processing, a subset of artificial intelligence, within post-occupancy surveys and compares this with human interpretation.

Phil Jones' paper, *Huge changes to regulate UK heat networks - including technical standards, zoning and consumer protection*, is a review that indicates the trajectory for heat networks for the industry. Tony Day's paper, *A new simplified energy analysis model for residential heat pump retrofits*, is a preliminary analysis designed to show the method under consideration (a TM41 degree-day approach), and how this can be used to assess building characterisation and predict a future heat pump retrofit performance, and as a method of monitoring installed performance.

The full symposium programme will be available in early March. To book your place, visit [www.cibse.org/symposium](https://www.cibse.org/symposium)

The 2024 Technical Symposium is taking place in Cardiff from 11-12 April



## Future Homes and Buildings Standards webinar available

The recent CIBSE webinar giving an overview of the Future Homes and Buildings Standards: 2023 Consultation is now available on demand.

As well as providing a summary of the standards, the webinar outlines the draft CIBSE position on key issues such as energy and carbon targets, energy modelling and Part F.

The webinar was followed by a Q&A session giving attendees a chance to contribute to the CIBSE response. The outcomes of this consultation package will shape the future of new homes and non-domestic buildings, as well as aspects of existing buildings.

While the consultation period to contribute to CIBSE's response has now closed, you can visit CIBSE's consultation page [www.cibse.org/policy-insight/consultations](https://www.cibse.org/policy-insight/consultations) for the current summary of its analysis, with draft messages and areas for feedback from CIBSE members. Register for the webinar at [www.cibse.org/growyourknowledge](https://www.cibse.org/growyourknowledge)



CIBSE's existing HQ in Balham, London

## CIBSE explores HQ opportunities

**Institution commissions charity management specialist to advise on attracting investment for retrofit of new office**

CIBSE is looking at opportunities to attract investors for the retrofit of a new headquarters.

The Institution is planning to move from its Balham headquarters to a location in central London, which CIBSE says is likely to require a retrofit.

As a charity, there are opportunities for CIBSE to explore 'private philanthropic investment and sponsorship' that would allow it to achieve, and potentially exceed, the objectives set down at the beginning of the moving process.

'This will be a once-in-a-generation opportunity to create a headquarters for decades to come that will have a great working environment for our staff, and better training spaces,' said a CIBSE spokesperson.

'It will be somewhere for the membership to be proud of and a place that will inspire and showcase the work done within our industry.'

CIBSE anticipates that the sale of its current property will fund much of the purchase of its new home. However, the new building is likely to require a retrofit, which may not be funded from the proceeds of the sale of the Balham site.

Fundraising and charity management specialist Morgen Thomas has been commissioned to conduct a planning study, and advise CIBSE on a strategy and how much might be raised.

Part of the process includes confidential consultations with stakeholders. If members would like to participate in the process, please contact [robin@morgenthomas.com](mailto:robin@morgenthomas.com)

## Drop by and say hello to CIBSE at Futurebuild

Visit the CIBSE Stand (K28) at Futurebuild, taking place at ExCeL London from 5-7 March, for an exploration of building services. Meet CIBSE's membership experts, who can guide you on your journey to professional registration, and be in with a chance of winning prizes in the golf-putting challenge.

Visitors can also dive into CIBSE's 2024 training brochure, as well as publications exploring the latest advances in the field of building services. The exhibition is a great opportunity to network, learn, and discover what CIBSE has to offer.

On 7 March, CIBSE's research manager, Zoe de Grussa, will take part in a panel discussion titled 'Climate adaptation: climate efficiency without overheating'. Other speakers will be Anna Mavrogianni, Hailun Xie, Rajat Gupta, and Susie Diamond. Register at [bit.ly/CJFBvis](https://bit.ly/CJFBvis)

## The jet set

There is a transformation taking place in the field of car park ventilation, with a move away from conventional ducted setups towards innovative impulse ventilation or jet-fan systems. S&P's Juan Marcos Laborda, explains

The core idea is elegantly simple: instead of the sprawling networks of ducts crowding a car park ceiling, jet-fan systems strategically position units to provide proper cross-flow ventilation.

Not only does this facilitate efficient air renewal for pollution control, but it also ensures effective smoke extraction during fire scenarios. This is achieved by reducing the smoke's temperature and density, reducing or nullifying fire spread potential and aiding the firefighting services in their task. This evolution calls for a studied arrangement of air intake and extraction points – typically shafts – necessitating early collaboration with engineers and architects.

Whether it's an existing facility or a new development, the adoption of jet-fan systems should begin with discussions among design stakeholders to understand project needs. The initial aim isn't to intricately define the ventilation system, but rather to establish a robust approach that accommodates everyone's requirements.

This collaborative effort results in well-defined supply and extraction points, freeing additional space for diverse uses, increasing available parking height, and minimising installations.

The installation's simplicity and timings reduce potential for interference with other systems, creating a more open and uncluttered environment. Maintenance tasks are also less disruptive for the car park activity, as units may be disconnected individually, cleaned, and put back into operation once more. The need to stop the complete system periodically for several hours disappears, representing a more cost-effective solution.

Compliant with strict regulations that surpass the general basic building codes, these systems enhance performance, reduce power consumption, and improve air circulation, especially during fire emergencies, thereby increasing overall safety.

Of course, without an adequate power and control unit, this ventilation system's potential cannot be maximised. Proper pollution and fire-detection panels and sensors must be present so the power and control unit can initiate or stop the sequences at any given time.

Tools such as computational fluid dynamics for risk analysis during fire events can also be considered. Their proper use requires vast amounts of knowledge and experience, as well as powerful software and hardware to run the simulations.

The collaborative approach, from locating the main supply and extract points to impulse fans and operation sequence, ensures the system's design, coordination, functionality, and overall success for all project stakeholders.

● Juan Marcos Laborda is a product manager at S&P Ventilation Group



# Building climate resilience in China and Britain

A China-UK Research and Innovation Forum met in China recently, to share the latest knowledge on climate resilience in the built environment. CIBSE's technical director, **Dr Anastasia Mylona**, looks at solutions proposed during the two-day event

**C**IBSE was among sustainability experts from the UK and China who met recently to share knowledge on climate resilience and low carbon solutions in the built environment.

The China-UK Research and Innovation Forum, on the theme of 'Urban built environments and thermal resilience under low carbon transition mode', featured academics from Chinese and British universities. CIBSE was the only professional body invited to showcase its research on climate resilience.

Experts from the UK included: Professor Tim Broyd, UCL; Professor Christopher Pain, Imperial College London; Professor Prashant Kumar, University of Surrey; Associate Professor Eugene Mohareb, University of Reading; and Visiting Professor Darren Woolf (chair of CIBSE's Building Simulation Group) and Dr Katherine Roberts, both from the University of Cambridge.

The event was organised by professors Runming Yao and Baizhan Li, of Sustainable Development in the Building and Environment (SuDBE) at Chongqing University, the National Centre for International Research of Low carbon and Green Buildings, and the Joint International Research Laboratory of Green Building and Built Environments.

I discussed the role of professional bodies in the translation and dissemination of academic research for industry and policy-makers. My presentation focused on the importance of climate adaptation, while also meeting net zero targets, in the design of buildings. I described the use of the adaptive comfort model (TM52) and CIBSE future weather profiles in the assessment of overheating in buildings.

## Sustainable cooling

Other themes from the UK delegation included the role of AI in computational and data analysis to inform urban and building design decisions (Pain), the role of cross disciplinary collaborations, and the importance of systems design and whole life assessment (Broyd).

The impact of green infrastructure on indoor and outdoor environments (Kumar) and retrofit decisions with occupant satisfaction and biodiversity in mind (Mohareb) were highlighted by UK experts. Woolf and Roberts discussed the role of natural ventilation and urban morphology in cities.

While the British experts discussed passive urban and building design solutions, the Chinese experts -



perhaps not surprisingly - focused on sustainable cooling systems, such as reversible heat pumps and radiant panels (Professor Borong Lin, Tsinghua University), renewable technologies, and indoor and localised environmental controls.

In a warming climate, the topic of sustainable cooling solutions will become more relevant in the coming years in the UK, and collaborations between the two countries could be beneficial.

Chong Meng (director at China Academy of Building Research) presented the Chinese government's Healthy China 2030 programme, which aims to improve public health outcomes by addressing challenges such as chronic and infectious diseases, and environmental health hazards. Professor Haidong Kan (Fudan University) looked at the impact of poor air quality and high temperatures on people's health and productivity. He said higher accident rates, suicides and incidents of violence have been recorded as a result of higher temperatures.

On the second day of the forum, the SuDBE team ran a workshop on building resilience. The most effective solutions suggested by the joint panel to address urban-scale thermal resilience were: blue-green infrastructure; reflective material/cool roofs; urban morphology to enable urban ventilation; human behaviour/adaptation and cultural changes; and resilient infrastructure.

The solutions to address building-scale thermal resilience were split between the two groups with the UK group suggesting: passive design; whole-life thinking; energy demand management and renewable generation; and occupant behaviour and education.

The Chinese group came up with: passive design; active design: controls/system design/system efficiency; renewable energy and electricity storage/local use. The two-day event established an international network of experts, encouraged the open exchange of ideas, and generated a lot of possibilities for further collaborations. The group will work together to put forward projects, and CIBSE will benefit from the research produced by these collaborations, to develop guidance and tools for its members and the wider industry.

# Means of escape

In July last year, the government announced that it expected residential buildings higher than 18m to contain a second staircase. Further details were set out last month. Hywel Davies explores the latest statement

On 19 February, Michael Gove, Secretary of State for Levelling Up, Housing and Communities, released a statement<sup>1</sup> on the government's long-term plans for housing. It included four paragraphs on the provision of 'second staircases' in higher-risk buildings – namely, residential blocks above 18m in height. It also refers to evacuation lifts.

One factor that contributed to the tragic loss of life in the Grenfell Tower fire was that the single stair core became unusable as a means of escape because of smoke. There has been debate about the need for a second means of escape ever since.

Second staircases were consulted on in December 2022. A further speech committed to an 18m threshold in July 2023 and the latest statement follows speculation about the detailed policy.

Gove has stated that 'the Building Safety BSR (BSR) will publish the new guidance on second staircases before April, making clear the need for a second staircase in new multi-occupancy residential buildings that have a top occupied storey above 18m, and confirming that evacuation lifts will not be called for as a matter of course, providing housebuilders with the clarity they need to progress developments'.

What does that actually mean for developers? It does not change their responsibility for the safety of their building. Government and the BSR are very clear that a developer applying for approval of full plans for a new residential building must show why they think the building will be safe to occupy. We must also be clear that there is no such thing as absolute safety. Second means of escape, sprinklers, evacuation lifts, even compartmentation and fire stopping may reduce risk, but they do not offer absolute safety.

Building Regulations in England and the rest of the UK are currently at variance with many other jurisdictions around the world in allowing taller residential buildings to be constructed with a single means of escape. Last July's announcement that new residential buildings above 18m in height would need a 'second stair' left many questions open, such as whether this would be a requirement or just guidance in the Approved Document.

How might developers of residential buildings respond to the latest statement? It seems clear that the BSR will expect them to provide a second means of escape – but what will that look like? That depends on the fire-evacuation



**"Rather than the government clarifying the issue, it has handed it back to the BSR and developers to resolve"**

strategy, already required in the package submitted for approval of full plans known as Gateway 2, and signed off by developers at submission.

Two functional requirements of the Building Regulations consider escape and access: 'appropriate means of escape from the building to a place of safety outside the building, capable of being safely and effectively used at all material times' (B1) and reasonable provision for fire-fighting, (B5). The developer needs to decide whether they are looking to reduce evacuation times by providing a basic second staircase. Or are they providing an alternative access route for firefighters? That requires both a second stair and firefighting lift. Each building needs a decision by the client and design team.

Gove's statement says that evacuation lifts 'will not be called for as a matter of course'. It could be taken to mean that, as a rule, they are to be expected, but a case may be made not to include one. It implies that it's up to the client to decide how to provide for those who cannot evacuate using the stairs, and for the BSR to accept that decision (or not?).

If the development contains social housing or student accommodation, there may be a public sector equality duty to consider in relation to the evacuation strategy. If it is entirely for sale or lease, how will that market react to the chosen strategy?

When complete, it will need a BSR building assessment certificate confirming it is safe to occupy, requiring a safety case specific to the building. With an ageing population, safe and equitable access and means of escape is also a demographic issue. Buildings will need to be adaptable.

It may be that the only feasible design with a realistic prospect of approval in many cases will incorporate two full cores offering genuine accessibility, resilience and redundancy in the event of a catastrophic incident.

This would align with the stance of the National Fire Chiefs Council<sup>2</sup>. Rather than clarify the issue the Department has handed it back to the BSR and developers to resolve. And then to clarify through the first tranche of applications, appeals, determinations and maybe a judicial review?

#### References:

- 1 Written Ministerial Statement: [bit.ly/3PfvMsv](https://bit.ly/3PfvMsv)
- 2 NFCC Opinion paper [bit.ly/49FmD43](https://bit.ly/49FmD43)

**DR HYWEL DAVIES**  
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CIBSE President Adrian Catchpole speaks to three engineers who have responded to his call for more STEM Ambassadors and finds out what they are doing to promote building services in schools

# LEADING THE CHARGE

**A**t the start of his CIBSE Presidency, Adrian Catchpole called on engineers to volunteer as STEM Ambassadors and help recruit the 200-300,000 people needed to deliver net zero in the UK across the built environment.

In his Presidential address, he said engineers needed to ‘step forward with solutions and commit to taking a lead’ and announced a new science, technology, engineering and maths (STEM) initiative that would involve CIBSE teaming up with STEM Learning to match engineers with schools and colleges.

Catchpole set a target for CIBSE regions to attract 10 STEM Ambassadors during his 12-month presidency. Last month, he met three young engineers who have responded to his call – Silviu Sidovici, Natalie Collcutt and Ikechukwu Umeokoli – and spoke to them about their experiences.

**Adrian Catchpole (AC): What attracted you to become a STEM representative?**

**Ikechukwu Umeokoli (IU):** I wanted to help younger people. I worked as an online maths tutor and was delighted to see someone gain a deeper understanding after sharing knowledge with them. Often, young people don't know what is involved with being an engineer. There is a knowledge gap there that STEM Ambassadors can fill to give them a sense of purpose and stronger drive.

**Natalie Collcutt (NC):** I signed up to encourage more women to get involved in engineering. I went to an all-girls school and, apart from engineering evening events, there was nothing that would make me consider construction or engineering. The attitude was always ‘oh why don't you do drama?’. Engineering covers such a wide range and I didn't understand that until I did my engineering A Level. I also volunteer with SheCanEngineer, which is linked to STEM Learning.

**Silviu Sidovici (SS):** I was inspired by one of Adrian's speeches last year. I heard him say that 300,000 people are



required to deliver net zero carbon, which is astonishing. Being a STEM Ambassador ties up with my long-term objective to teach. I would love to go into schools, and deliver lectures at university, to talk about engineering. I have a mechanical basis, so I really enjoy explaining the principles and I'm very passionate about sustainability.

**AC: What STEM activities have you taken part in so far?**

**IU:** I have attended a careers fair, where I gave advice and speed-networked with students. I had a huge number of students asking me about engineering. I broke down what I did in an easy-to-understand way. I don't want to overcomplicate anything and I emphasised the fundamentals.

**NC:** I attended a careers fair where there were 100 people exhibiting, and I was with other engineers. It was really interesting talking to students and I found parents also asked how their children could get into the industry. There were a couple of children interested and



**Adrian Catchpole** is director of Johns Slater and Haward and CIBSE President



**Natalie Collcutt** is a senior buildings services engineer at Watkins Payne





## HOW TO SIGN UP AS A STEM AMBASSADOR

- Register online at [www.stem.org.uk/register](http://www.stem.org.uk/register) and select 'STEM Ambassador'. List CIBSE as your professional institution.
- Complete the online induction. You'll be sent a link from STEM Learning.
- Apply for a free DBS or PVG - essential for working with young people. Read our guidance how to prepare for this here: [bit.ly/CIBSEDBS](http://bit.ly/CIBSEDBS)
- Download CIBSE presentation templates and career guides from [bit.ly/3UPbpFX](http://bit.ly/3UPbpFX)
- Visit the STEM Learning portal for activities in local schools and colleges. There are nine free training modules to help people prepare to start volunteering, as well as on-demand e-learning modules to further develop their presentation and communication skills.

## POPULAR STEM AMBASSADOR ACTIVITIES

- Workshops/practical activities in classrooms
- Presentations on becoming a building services engineer; careers advice/speed-networking sessions
- Mentoring
- Careers fairs
- Judging STEM competitions
- Educator development/CPD
- School governor/senior leadership advice

they said they would apply for work experience when the time came.

**SS:** I attended Skills London at ExCeL alongside a company called Quantum Learning. We had a working air source heat pump installation, and students were engaged and very curious to see how it worked. I also went to an engineering day at Bexley Grammar School, where there was a competition to design a research station in Antarctica. I presented the prize for the best design, and I really enjoyed the experience.

### AC: What presentations have you got planned for the future?

**NC:** I'm going to do six presentations at school in one day for Years 4 and 5 in Key Stage 2. I will use the CIBSE Stem Learning portal for a presentation template and will put my own spin on it. I find presentations easier than those asking for a practical activity. I'll take along a hi-vis, hard hat, and maybe a schematic and some attractive pictures of our projects.



**Ikechukwu Umeokoli** is a graduate mechanical engineer at AtkinsRéalis



**Silviu Sidovici** is a senior mechanical engineer at Buro Happold

**AC:** A practical demonstration for building service engineers would be using a computer. This is very attractive to young people because we can show off 3D modelling and daylight-based simulation. Our industry has got sexy. On top of all of that, the world now knows about net zero and how engineers are playing a part in achieving it. Together, that's quite a pull for youngsters that we have not had before.

**SS:** On my previous job, we had virtual reality glasses that allow you to explore building services models generated from Revit. That would be interesting to young people.

### AC: What would you say to anyone thinking of becoming a STEM Ambassador?

**SS:** Being a STEM Ambassador is rewarding. I enjoy explaining engineering to people and I'm an advocate for saving the planet – and we're definitely in a crisis. I want to communicate that to people. I'm taken very seriously at Buro Happold and am supported by the directors, who regard my time spent on STEM as business development. It is an opportunity to promote the company and, in practical terms, it improves my presentation skills.

**NC:** I have convinced one electrical engineer to become a STEM Ambassador. I told them it's an opportunity to find people at schools who maybe, one day, they'll be able to train. Most engineers like talking about engineering, so it's not hard to convince them. Part of it is letting them know they only have to do one activity a year. Most companies give you a day or two to volunteer.

Catchpole says another benefit of volunteering as a STEM Ambassador is that it counts towards your CPD hours, and he believes it is the right call to ask for a doubling of CIBSE's STEM ambassadors.

'We are well on the way to doing that, but it's only a small step in the overall journey,' he adds. 'I challenge you to become STEM champions and persuade others to join the initiative. It's a fairly low commitment and you only need to do one activity a year. There are 22,000 CIBSE Members – if each did one activity a year, we would smash through the 1,000 activities-a-year barrier.' [CJ](#)

■ If you wish to become a STEM Ambassador, visit the CIBSE website at [bit.ly/CBSESTEM](http://bit.ly/CBSESTEM)

The new Biodiversity Net Gain Regulation gives engineers the opportunity to reduce the environmental impact of their designs. **Molly Tooher-Rudd** speaks to biodiversity experts about the potential for nature-led solutions



# COMING INTO BLOOM

## EMBODIED ECOLOGICAL IMPACTS

The construction industry is incredibly resource-intensive, and accounts for approximately 50% of global resource extraction.

The UK Green Building Council is working on introducing an embodied ecological impacts tool to assess the environmental toll of resource extraction, manufacturing and transportation processes. Building services engineers can play a crucial role in delivering BNG by prioritising existing materials, promoting reuse and recycling, and optimising design. Embracing regenerative practices and minimising extraction can further reduce environmental harm.

Buro Happold's Aaron Grainger agrees that the BNG policy alone cannot fully address the profound impacts of the construction industry on nature. 'If global resource consumption mirrored that of the UK, we would require 2.6 Earths, highlighting the unsustainable nature of our current practices,' he says.

**T**he implementation of the new Biodiversity Net Gain (BNG) Regulation represents a significant shift towards a nature-positive and regenerative built environment.

Designers now have to pay attention to natural as well as mechanical plant under the new rules, which mandate that developers in England assess the pre-existing biodiversity of a project site and provide a BNG of 10% by the end of the scheme.

The building industry is resource-intensive, and a major contributor to habitat loss; it is responsible for 30% of biodiversity loss globally.<sup>1</sup> Fiona Cousins, CIBSE president-elect, is a keen proponent of biodiversity in building design. 'We need to take an approach that recognises every design decision as a pivotal factor in influencing climate change, social equity, and biodiversity,' she said during a TEDx talk last year.

Introduced into the Environment Act 2001, the BNG Regulation became law under the Town and Country Planning Act on 12 February for larger sites, and will come into force on 2 April 2024 for smaller sites.

Developers must aim to deliver BNG gains on site; however, they can be achieved off site if necessary, or as a last resort, by buying statutory biodiversity offset credits. Failure to meet targets will incur financial penalties,

including a fine of £5,000 if misleading information is included in biodiversity plans.

The BNG policy follows a mitigation hierarchy, prioritising the preservation of existing resources on site. This means developers must look to avoid losing biodiversity in the first place. Consultant engineers have responded to the regulation and the growing focus on nature-led developments by building teams of biodiversity consultants.

Arup's nature lead, Tom Butterworth, was once an academic who researched snails in Sri Lanka, and he has extensive experience in nature conservation. He welcomes the regulation: 'It is not going to solve all our problems, but this is going to transform how development happens, where it happens, and the outcome in terms of biodiversity.'

'We've lost 60% of abundance of our species in the UK since 1970<sup>2</sup> – that's staggering. We need to drive forward work for nature, because it's the moral thing to do and because it's crucial if we are going to deliver climate commitments; we can't do one without the other.'

Aaron Grainger, associate director for ecology and biodiversity at Buro Happold, believes the mental health epidemic is also linked with access to nature. 'Wellbeing is as inherently intertwined with biodiversity as the climate crisis is, and we're becoming more





Buro Happold was the consultant at Mayfield, a 6.5-acre urban park in Manchester

and more disconnected,' he says.

Butterworth believes biodiversity should be addressed from a project's start. 'Early involvement of biodiversity consultants is key, to assess risks and capitalise on biodiversity opportunities to make your asset as strong as possible', he says, while Robert Winch, senior environmental, social and governance consultant at Hoare Lea, highlights a need for improved education.

'The preparedness among our clients is varied; not everyone is fully aware of what BNG means. However, it's positive to see developers looking to push well beyond the 10% increase', he says.

Opting for green infrastructure over traditional 'grey' offers multiple benefits.

Green roofs and walls can play a significant role when it comes to energy efficiency. By transpiring moisture, plants cool their surroundings, reducing the load on mechanical cooling systems. Incorporating green spaces can substantially lower peak summer temperatures, mitigating the urban heat island effect.

While green walls offer aesthetic appeal, their effectiveness depends on plant selection and maintenance. Butterworth highlights examples of effective green walls. 'There's a beautiful vertical meadow, full of native species, on a hotel in London Victoria. It's designed so that the rainwater is harvested then pumped by solar power to feed the wall.'

As the climate changes, green solutions can also offer greater flexibility for adaptation – for example, sustainable urban drainage systems, such as ponds or lakes with reed banks. 'Unlike rigid grey infrastructure, green systems can be modified easily to accommodate evolving needs, such as increased storm surges,' Butterworth says.

In addition, green infrastructure contributes to improved air quality. Butterworth cites research in Torbay<sup>3</sup>, which found that trees, as well as storing and sequestering carbon, removed huge amounts of pollutants annually – 22.9 tonnes of ozone, 18 tonnes of particulate matter, and 7.9 tonnes of nitrogen oxide.

BNG not only enhances ecosystem services, but also increases financial and natural capital asset values, and provides long-term income prospects for landowners. 'The evolving understanding of nature's benefits is generating a market where land can yield returns beyond food production, encompassing clean air, water and biodiversity support,' says Butterworth.

To maximise the impact of green infrastructure, Grainger stresses that a coordinated approach at local authority



A living wall in Mayfair, London, designed by Arup

level is essential. 'Integrated planning is needed to ensure green spaces function as interconnected habitats, not fragmented islands.' He adds that post-construction monitoring will also be important to gauge the effectiveness of the regulation. 'While intentions are good, local planning authorities face funding constraints, which complicates enforcement.'

### Environmental net gain

Expanding on BNG, Environmental Net Gain (ENG) assesses other environmental factors, such as water resources, and assigns relative values to them to measure overall impact.

Along with initiatives such as the Taskforce on Nature-related Financial Disclosures, and standards such as GRI 101 *Biodiversity reporting and science-based targets for nature*, BNG and ENG offer consistency and guidance for businesses in assessing their global impacts and dependencies.

BNG can also help improve resilience to climate-related risks, such as flooding. Winch says: 'We want to help our clients understand the wider value that nature can offer as part of a holistic approach to sustainability.' **CJ**

### References:

- 1 *The embodied biodiversity impacts of construction materials*, November 2023, Expedition and ICE
- 2 *State of nature 2019*, State of Nature Partnership, 2019
- 3 *Torbay's urban forest: Assessing urban forest effects and values*, 2011, Treeconomics



Lavender on a rooftop in the West End of London

# CIBSE BUILDING PERFORMANCE AWARDS 2024

The CIBSE Building Performance 2024 Awards Celebration was held on Thursday 29 February 2024 at Park Plaza Westminster Bridge, London

## 1 BEST DIGITAL INNOVATION

Decarbonomics™ - AtkinsRéalis

## 2 BUILDING PERFORMANCE CONSULTANCY (UP TO 50 EMPLOYEES)

Inkling

Sponsored by Mitsubishi Electric

## 3 BUILDING PERFORMANCE CONSULTANCY (51 - 300 EMPLOYEES)

XCO2

Sponsored by Airflow Developments

## 4 BUILDING PERFORMANCE CONSULTANCY (OVER 300 EMPLOYEES)

Hoare Lea

Sponsored by ABB

## 5 CIBSE EMBODIED CARBON AWARD

Whitecroft Lighting

Sponsored by CMR

## 6 COLLABORATION

Decarbonisation via Data-Driven Collaboration -  
**Smart Managed Solutions & Savills**

Sponsored by Borough Engineering Services

## 7 ENGINEER OF THE YEAR

Philip Draper, Managing Director -  
**Twenty One Engineering**

Sponsored by Ideal Heating Commercial

## 8 FACILITIES MANAGEMENT

Broadgate - **British Land**

Sponsored by Gratte Brothers Group

## 9 LEARNING AND DEVELOPMENT

Unlocking Potential: CSA's Commissioning  
Management Training & Development -  
**Commissioning Specialists Association**

Sponsored by Automated Logic, A Carrier Company

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Congratulations to our

# WINNERS

## 10 PRODUCT OR INNOVATION OF THE YEAR - AIR QUALITY

Vent-Axia Sentinel Apex - **Vent-Axia**  
Sponsored by CIBSE Patrons

## 11 PRODUCT OR INNOVATION OF THE YEAR - THERMAL COMFORT

New Modular Highline 235 Fan Coil Range - **Diffusion**

## 12 PRODUCT OR INNOVATION OF THE YEAR - WELLBEING

Clarence System - Remote Water Monitoring - **Angel Guard**  
Sponsored by TamLite Lighting

## 13 PROJECT OF THE YEAR - COMMERCIAL AND OFFICES

York guildhall - **SGA Consulting**  
Sponsored by Crane Fluid Systems

## 14 PROJECT OF THE YEAR - INTERNATIONAL

Kyoto City Hall Annex Building - **Nikken Sekkei**  
Sponsored by Crane Fluid Systems

## 15 PROJECT OF THE YEAR - LEISURE

Ravelin Sports Centre - **Max Fordham**  
Sponsored by Crane Fluid Systems

## 16 PROJECT OF THE YEAR - PUBLIC USE

Hackbridge Primary School - **Introba/Architype**  
Sponsored by Crane Fluid Systems

## 17 PROJECT OF THE YEAR - RESIDENTIAL

Bryn Bragl - **Hoare Lea**  
Sponsored by Crane Fluid Systems

## 18 PROJECT OF THE YEAR - RETROFIT

York guildhall - **SGA Consulting**  
Sponsored by Crane Fluid Systems

## 19 BUILDING PERFORMANCE CHAMPION

York guildhall - **SGA Consulting**  
Sponsored by TamLite Lighting

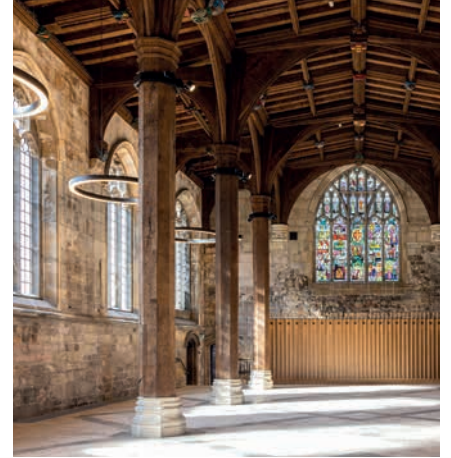
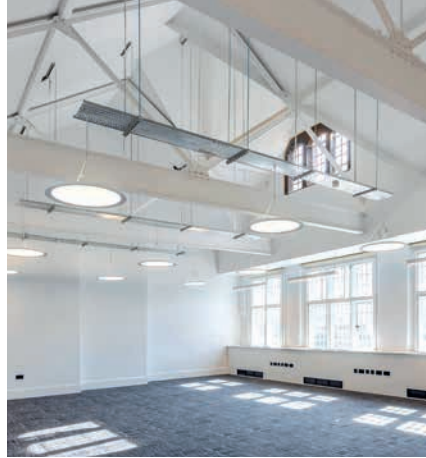
CIBSE  
BUILDING  
PERFORMANCE  
AWARDS 2024

WINNER

# YORK'S CULTURAL RENAISSANCE

York Guildhall, the 2024 Building Performance Champion, is an exemplary restoration of a historic landmark, which also provides a sustainable cultural hub for the city's future generations

## Building Performance Champion, Project of the Year – Retrofit, Project of the Year – Commercial & Offices



### Winner: York Guildhall – SGA Consulting

The 2024 Building Performance Champion ‘shows what can be achieved to deliver sustainable building refurbishment, minimise embodied carbon, and fulfil such a project with the most difficult site-access conditions’, said the judges.

York Guildhall, recognised as Project of the Year in both Retrofit and Commercial and Offices categories, clinched the overall title in a fiercely competitive field.

Located in a congested area in York along the River Ouse, the Grade I, II, and II\* listed Guildhall posed daunting logistical hurdles with its narrow archways onto a pedestrian street. Tasked with retaining and refurbishing existing structures while

adding a sizeable office extension and a new restaurant, SGA Consulting embraced a proactive, innovative, and collaborative approach. Its strategy was to make use of the unique building and site characteristics to achieve energy and carbon efficiencies.

SGA’s fabric-first approach, coupled with a water source heat pump and enhancements to the Victorian natural ventilation system, showcased adaptability and forward-thinking. A two-circuit reverse-cycle heat pump provides 110kW of simultaneous heating and cooling, yielding a remarkable 42% carbon savings compared to gas boilers. Underfloor heating and a boiler-fed trench heating system were

implemented, earning acclaim for their integration of low and zero carbon systems.

The judges acknowledged the project’s distinction in revitalising a centuries-old structure amid regulatory, historic, and environmental constraints. As the industry grapples with the imperative of renovating existing buildings for net zero targets, the Guildhall stands to demonstrate the potential of sustainable refurbishment.

[Building Performance Champion sponsored by TamLite Lighting](#)  
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## Engineer of the Year

### Winner: Philip Draper, managing director, Twenty One Engineering

‘A true leader by example and a genuine practitioner of engineering leadership.’ This is how judges described Philip, praising his passion for development and growth. Running his own business for the past five years, he empowers his team to make difficult decisions in resolving issues for his clients. He is also an advocate for apprenticeships and, as CIBSE Patron and Fellow, Philip has sponsored several engineers. As vice-chair of the CIBSE HVAC group, he runs the CPD events every quarter, and has organised training days that focus on collaboration and innovation. He has an unwavering appetite to take on new applications and challenge the conventional.

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## Building Performance Consultancy (up to 50 employees)

**Winner: Inkling**

Judges singled out Inkling as ‘an influential node in industry, using collaboration as a means to advocate for positive change through the support network built from its work’. Founded in 2011, Inkling is a building physics consultancy of only two permanent members of staff, however, its impact on championing the role and value of dynamic thermal modelling in improving building performance is significant. It has also established its blog as an influential place for industry discussion, spreading knowledge and understanding.

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## Building Performance Consultancy (51-300 employees)

**Winner: XCO2**

XCO2 demonstrates ‘leadership in delivery of exemplar professional services... fostering collaboration internally and across industry’, judges said when they named the company winner of this category. Dedicating a significant proportion of its effort to public and community projects, the consultancy has been a key contributor to the new Net Zero Carbon Buildings Standard, to LETI and UK Green Building Council initiatives. Judges also praised the consultancy for its broad inclusivity plans within the practice.

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## Building Performance Consultancy (over 300 employees)

**Winner: Hoare Lea**

Judges praised Hoare Lea’s wide range of activities aimed at promoting climate action and improving the competence of engineers on net zero delivery. In particular, the company’s Pollinate programme stood out, which funds innovative cross-discipline project proposals from employees. The consultancy’s wide-ranging initiatives, such as the Origin platform and project-specific requirements for net zero metrics, demonstrate an impressive commitment to industry best practices, with a focus on knowledge-sharing and upskilling.

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## Facilities Management

### Winner: Broadgate - British Land

British Land took the FM crown for its work across four buildings at Broadgate, in the City of London. The judges praised its strong engagement with building occupiers using real-time data, and highlighted its innovative financing mechanism for funding energy conservation measures. Whole building energy efficiency was improved by 33% across 1.3m ft<sup>2</sup> of space in 2023 vs 2019. The company showed how it had overcome the challenges of carrying out improvements in operational buildings, with exceptional collaboration and knowledge sharing. It represents the active role that FM can play in the decarbonisation of buildings and energy management.

Sponsored by Gratte Brothers Group



## Learning and Development

### Winner: Unlocking Potential: CSA's Commissioning Management Training & Development - Commissioning Specialists Association

CSA's research addressed a learning and development gap in commissioning, with potential industry-wide impact. It created the two-day Introduction to Commissioning Management (ITCM) course for M&E commissioning managers, covering all building services, working both individually and together. It improves CxMs' core knowledge and provides tools to manage projects. CSA's efforts to align ITCM framework with the relevant NVQ grades were commended.

Sponsored by Automated Logic, A Carrier Company



## Collaboration

### Winner: Decarbonisation via Data-Driven Collaboration - Smart Managed Solutions & Savills

Smart Managed Solutions & Savills' winning submission impressed judges because it 'demonstrated the art of the possible and where we all need to get to'. The company's embrace of data analytical tools facilitated improved outcomes across seven properties in collaboration with Savills. Through initiatives such as Sentinll's platform and internal analytics teams, substantial reductions in electricity, gas, and carbon emissions were achieved across, with 1,695,012kWh of electricity, 230,590m<sup>3</sup> of gas, and 865,152kgCO<sub>2e</sub> of carbon savings.

Sponsored by Borough Engineering Services



## Project of the Year – International

**Winner: Kyoto City Hall Annex Building – Nikken Sekkei**

Kyoto City Hall Annex Building stood out for its blend of traditional design principles and innovative solutions. Judges praised Nikken Sekkei's integration of the new annex with the existing City Hall, its responsiveness to local geography and climate, and its energy responsibility linking system. The judges were impressed with the way it 'cleverly linked responsibility for energy use to the building users'. The project achieved a 68% reduction in energy consumption compared with the baseline building, showcasing its commitment to sustainability.

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## Project of the Year – Leisure

**Winner: Ravelin Sports Centre – Max Fordham**

Max Fordham's project was hailed for its careful low carbon design and innovative technology integration to achieve a low-impact leisure centre with sports and swimming facilities. The project brief was to achieve Breeam Outstanding. Notable features at the centre include air source heat pumps, ceiling fans for cooling, and a photovoltaic array. With an annual energy consumption of 87 kWh·m<sup>-2</sup>, it surpasses efficiency targets, setting a new standard for leisure centres.

Sponsored by Crane Fluid Systems



## Project of the Year – Public Use

**Winner: Hackbridge Primary School – Introba/Architype**

Hackbridge was commended for the very high quality of its construction and exceptional airtightness. It's design fulfilled an ambitious brief to become the first UK Certified Passivhaus Plus school, aiming for net zero carbon in-use. With a focus on low carbon materials and innovative heating systems, the school achieved remarkable energy efficiency. The measured energy use intensity over the past year was 46 kWh·m<sup>-2</sup> per year. Its upfront embodied carbon (405kg/CO<sub>2e</sub>/m<sup>2</sup> including sequestration) is half that of a comparable school.

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## Project of the Year – Residential

**Winner: Bryn Bragl - Hoare Lea**

Hoare Lea's Bryn Bragl scheme was hailed by judges as a leading example of sustainable housing innovation. Funded by the Welsh Government, it aims to be Wales' first energy-positive social housing development, with its 14 homes generating more energy than they consume. Innovative features such as PV cell roofs, air source heat pumps, and Tesla batteries showcase its commitment to energy efficiency and resident wellbeing. Together, the homes have put more than 34,000kw/h back into the Grid, with residents paying bills of around £25 a month.

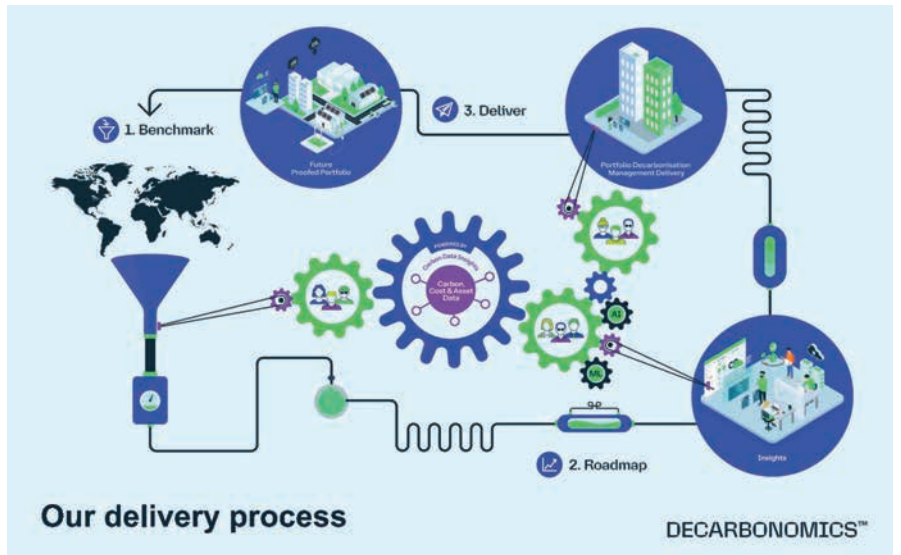
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## Best Digital Innovation

**Winner: Decarbonomics - AtkinsRéalis**

Decarbonomics stood out as the unanimous winner, with judges praising its 'exceptional', holistic approach to decarbonising the built environment. Decarbonomics helps owners and occupiers of buildings, of any scale, to understand how to deliver retrofit solutions and decarbonise their portfolio, integrating financial viability into strategies. It streamlines retrofit programmes, reducing time, costs, and resource requirements significantly. With notable success in reducing carbon emissions and operational costs, it is poised to drive substantial environmental change globally.



## CIBSE Embodied Carbon Award

**Winner: Whitecroft Lighting**

Whitecroft's cradle-to-cradle (C2C) approach to designing its products impressed the judges, as did its use of modularity to enable more efficient maintenance and reduce waste. It showcased efforts to reduce embodied carbon, exemplified by its Cascade Flex Vitality (CFV) luminaire, which boasts a 46% reduction over 40 years compared to standard panels. Using recycled materials and local suppliers, Whitecroft emphasises sustainability and circular economy principles, earning C2C accreditation and delivering industry CPDs on the topic.

Sponsored by CMR



## Product or Innovation of the Year – Air quality

**Winner: Vent-Axia Sentinel Apex - Vent-Axia**

Vent-Axia's Sentinel Apex is developed with equal focus on operational performance and whole life costing, which shone through in the data. Manufactured locally in a low-energy facility, it aligns with the company's low carbon manufacturing claims. The product provides excellent resources for correct application and sizing, featuring high-quality filtration to improve indoor air quality. Its energy-efficient design harnesses waste heat, achieving market-leading thermal efficiency and reducing energy loss through ventilation.

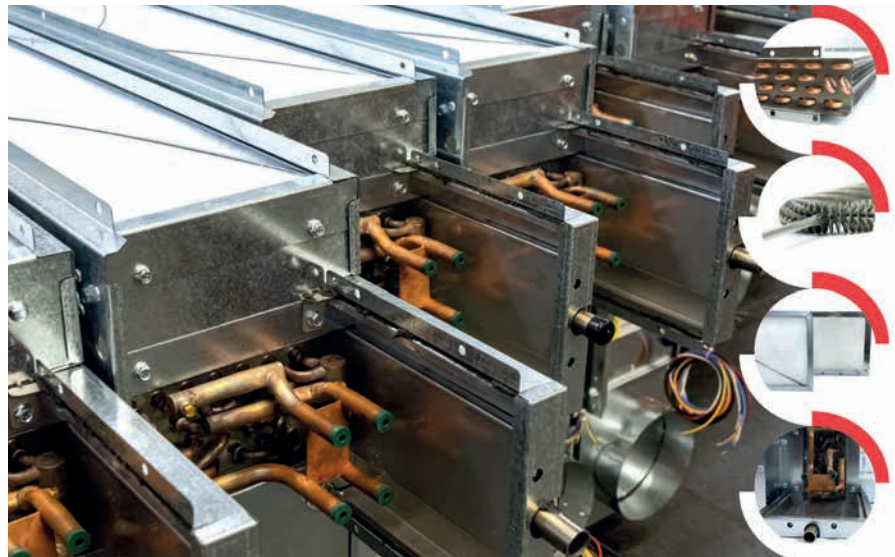
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## Product or Innovation of the Year – Thermal Comfort

**Winner: New Modular Highline 235 Fan Coil Range - Diffusion**

Diffusion's modularisation of its fan coil product impressed judges, who called it practical and customer-centric. The Highline range offers nearly 300,000 configurations, cutting energy use by matching precise performance needs. The design minimises materials, lowers carbon footprint, and supports reusability. High-efficiency EC motor and fan assemblies achieve low specific fan power and noise ratings. Judges praised the emphasis on testing in product development.



## Product or Innovation of the Year – Wellbeing

**Winner: Clarence System: Remote Water Monitoring - Angel Guard**

Judges were impressed by Angel Guard's innovative Clarence System, which not only conserves water but also prioritises water quality for user health. The system's remote monitoring measures temperature, flow events, and biofilm, uploading data to its water management hub for processing and easy risk assessment. Offering continuous readings and secure remote access, it enables targeted testing and faster responses to water supply issues, saving up to 3.12 tonnes CO<sub>2</sub> per installation per year and reducing water usage significantly.

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## Floor Box - 22 Series Stainless Steel

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## Rapid permission for heat pumps may be extended

### Government proposals include removing the one-metre rule

The government is proposing to extend fast-track planning rules for heat pumps.

A consultation paper, issued on 13 February by the Department for Levelling Up, Housing and Communities, outlines extensions to permitted development rights (PDRs) – a mechanism for securing permission for development without submitting a full planning application.

PDRs can currently be used for installing air source heat pumps (ASHPs) in 'limited circumstances'. The paper proposes to extend this by scrapping the rule that says

PDRs can only be used for ASHPs if they are at least one metre from a property boundary.

Another proposal is to relax the maximum volumetric size of an ASHP's outdoor compressor unit from the current limit of 0.6 cubic metres, which can be secured via a PDR. Increasing the size of evaporators and fans will enable ASHPs to run at lower speeds, helping to minimise noise levels from the units, the paper says.

PDRs could also be extended to more than one ASHP per property, while 'reversible' air-to-air heat pumps, which can also provide cooling, could come within the scope of PDRs.

The consultation closes on 9 April.

## Treasury urged to give tax breaks on heat pump energy bills

Lenders and energy companies are pressing the Treasury to grant tax breaks on energy bills for heat pump users, as a means to spur adoption.

High operational costs have been identified as a significant barrier to the uptake of heat pumps in the UK. With approximately 20% of costs associated with running a heat pump attributed to social and green energy tax, 16 organisations, including Nationwide Building Society and energy firm EDF, have written to the Treasury to ask for financial relief for electrically heated homes. The move would benefit around 250,000 homes that currently use heat pumps, and a further 2.3 million residences that use direct electric heating.

The UK is well behind on the government's target to install 600,00 heat pumps by 2028. Targeted tax reductions may incentivise more homeowners to replace their gas boilers for electric options, the organisations believe. Shifting green levies to the general tax burden could amount to savings of £130 a year, bringing the cost of running a heat pump down to just £16 a year more than a gas boiler.

## Octopus Energy and NGED join forces

Octopus Energy has announced a partnership with National Grid Electricity Distribution (NGED) to streamline the deployment of clean-energy technologies.

The partnership will optimise the installation process, with a focus on heat pumps and electric vehicle chargers.

It will allow Octopus to perform necessary upgrade work on fuses to address additional electricity requirements when fitting heat pumps. This should reduce approval and installation times significantly. It is hoped the agreement will slash customer wait times by up to 10 weeks, accelerating the nationwide rollout of these technologies.

NGED has also agreed to pre-approve the heat pumps provided by Octopus Energy for connection to its grid.

## New tech aims to support BNG policy

Software company AiDash has developed a technology that uses advanced satellite data and artificial intelligence algorithms to map natural habitats.

It said this will help companies meet the new Biodiversity Net Gain (BNG) Regulation, which requires developers to increase the biodiversity of new project sites by 10%. The software, BNGAI, will provide insights into the health profile of trees and other plant populations.

By partnering with industry giants such as Barratt Homes, AiDash said it wants to revolutionise biodiversity preservation efforts by facilitating faster, more accurate, and collaborative approaches to habitat assessment and conservation.



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Baxi's new high-temperature R290 air source heat pump

# HIGH HOPES

Retrofitting with high-temperature heat pumps can pose significant challenges if buildings are not properly investigated first. Baxi's **Ryan Kirkwood** navigates the highs and lows of swapping boilers for heat pumps in hard-to-heat buildings

**W**e all know the phrase 'fabric first'. It means to design with good thermal efficiency in mind, to ease the burden of heating (and cooling) plant.

When we say 'fabric first' in the context of renewables, however, we are really asking what can be done to the building envelope to reduce heat loss. A reduction in heat loss means that a lower kilowatt (kW) capacity of heating plant is required, meaning lower capital and installation costs. It also means heat pumps can run more efficiently (see panel, 'Why heat pumps suit fabric first').

However, if heat losses are high because the fabric first approach cannot be taken, heat pumps will struggle to compete with the boilers they are replacing in terms of running costs. (Improving the fabric efficiency may not be possible if costs are prohibitively high or buildings cannot be altered for conservation reasons.)

So, what can be done if a building owner

wants to decarbonise their heat and the existing building thermal envelope cannot be improved? One option, which is nearly always fast, affordable and efficient, is to design a hybrid system combining boilers and heat pumps – but this won't do if the client brief is for full electrification of heat.

Many argue that high-temperature air source heat pumps (HT ASHPs) have been developed to solve this problem. However, the solution is not as simple as it is often made out to be. For anyone considering this route, it is essential to investigate the building and system to ensure an appropriate design and specification.

This article considers possible solutions for high-temperature heat pump retrofits and looks at the key areas to investigate before undertaking such a project.

## Switching boilers for heat pumps

Discussions of high-temperature heat pumps allude to bringing the operation range into the familiar 82/71°C or, potentially,

80/60°C range. This, however, can be slightly optimistic, as an 80°C flow temperature for even the most modern of R290 (propane) ASHPs is at the very top end of the performance envelope.

BS EN 14825:2022, which recommends conditions for testing heat pumps, states that a high-temperature heat pump must deliver 65°C at -7°C/-8°C (dry-bulb/wet-bulb) ambient conditions, with medium and low classifications required to deliver 52°C and 35°C respectively at the same ambient conditions. Even when HT ASHPs are able to deliver 80°C, this falls slightly short of the 82°C flow required by 82/71°C circuits. Added to which, most heat pumps prefer to operate in the 5-10K ΔT range, making a straight swap on 80/60°C circuits not impossible, but challenging. From my experience, in 82/71°C circuits the boiler(s) will nearly always be set to -85°C to mitigate hydronic inefficiencies, the most common of these being temperature dilution.

Pragmatically, the challenges involved in the detailed design of swapping out boilers for heat pumps are not to be trivialised. Before embarking on a project of this sort, we strongly recommend that a significant amount of investigative engineering is undertaken. Try to ascertain (but not be limited to) the following:

- What were the original design temperature and loads?



- » ■ Are there hydronic inefficiencies – such as exposed, poorly insulated pipework or temperature dilution – that can be addressed?
- Has the building been extended/reduced/zoned or had alternative heating systems installed in localised areas?
- Can the true building load requirements in summer, winter and transient months be measured or calculated with a degree of accuracy?
- Are any bounding spatial constraints yielding enough to allow for new plant to be installed?
- Does budget allow for 100% of the required heating power to be via ASHPs?
- Are electrical capacities sufficient?
- Are there factors to offset the potential higher running costs, such as PV?

Design information for dated buildings is often limited to a hand-drawn schematic on the plantroom wall. To add to the confusion, many will have seen a dated building run, at some point, on one boiler out of three during winter, with no complaints.

Improving our understanding of the building profile can be done through installing items such as ultrasonic heat meters, undertaking a full heat-loss calculation (if budget and time allow) and using known data, such as gas-meter readings. Extrapolation of live data or interpolation of fragmented historic data help piece together the jigsaw, for a greater insight into the true thermal profile.

The goal here is to understand what might be changeable, what can't change, and the risks. For example:

- Flow temperatures may be reduced by fixing hydronic inefficiencies.
- Bracketing of the heating system may reduce the requirement to run all circuits at 80°C or 82°C all year, improving running costs (see below, 'Bracketing').

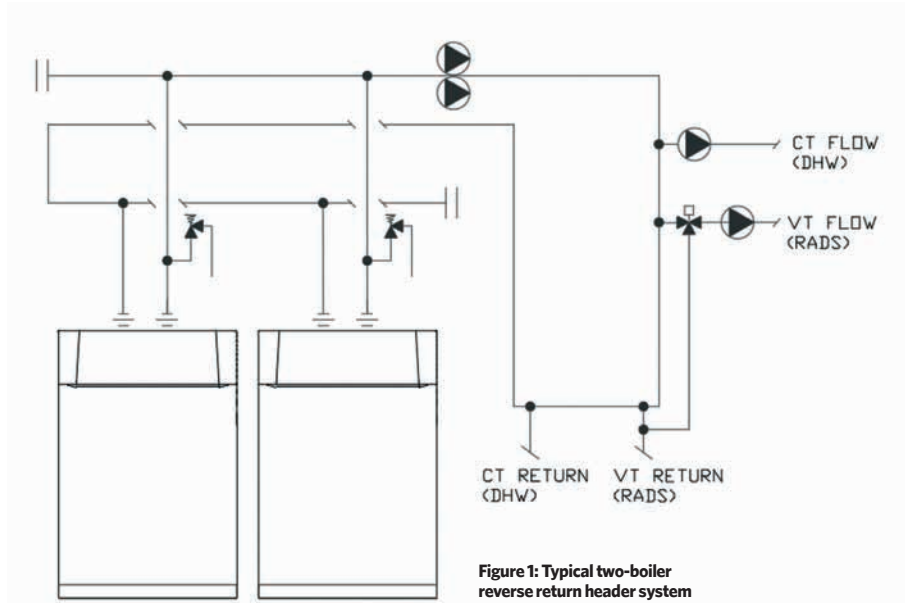


Figure 1: Typical two-boiler reverse return header system

- Spatial challenges can be solved by sizing real requirements through measuring and calculation.

This may take months to complete, and can be further complicated by seasonal conditions. Ideally, this would involve at least a year's worth of data, with any subsequent installation planned for warmer months.

**Bracketing**

Bracketing involves consolidating the heating system into frames of known and weighted data. For example, if the survey data shows a sizable constant temperature (CT) circuit serving an air handling plant exclusively, the decision may be taken to 'bracket' this out of the overall heating system.

By bracketing this circuit and serving it directly from its own heat pump plant, we are now able to change the tempering or reheat coils to suit a 55°C flow temperature (or lower). This decision alone could increase the heat pump efficiency by up to 150% from a design temperature of around 80°C.

The same principle can be applied to variable temperature (VT) circuits when the CT circuit is unable to deviate from the current design flow temperature.

VT circuit bracketing can yield massive efficiency rewards, as the weather compensation can be undertaken at the plant without the use of mixing valves.

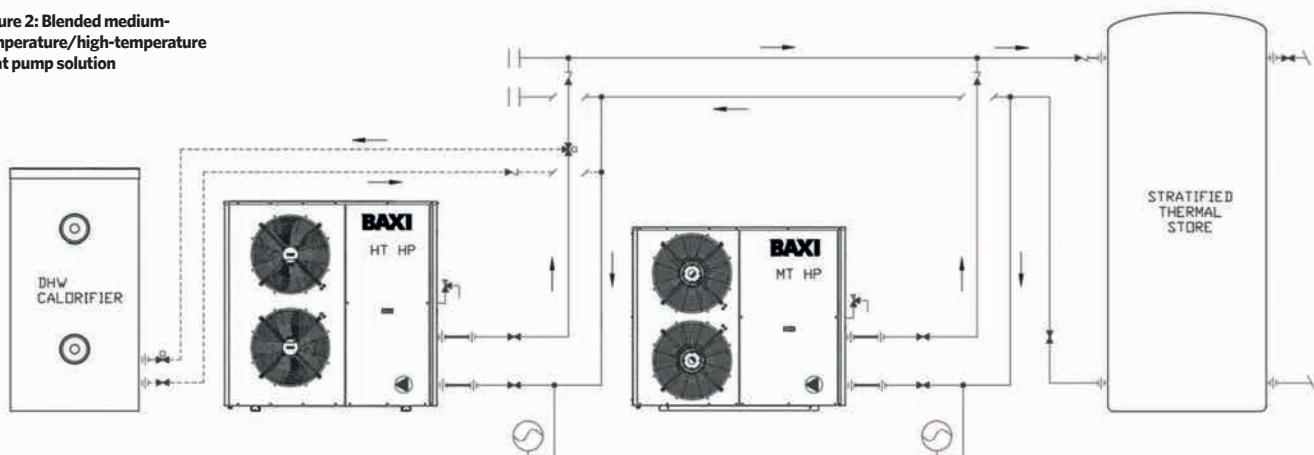
With direct weather compensation on HT ASHPs, the flow temperature could range from 35°C-80°C. If heat losses mitigations have been carried out then, potentially, emitters may be changed when and if possible, to allow a more aggressive reduction in flow temperature.

The proportion of the year when the HT ASHPs must remain at 80°C flow may be offset, in terms of net efficiency, by the period of time that flow temperatures are not required at 80°C via direct weather compensation.

The weighted aspect of bracketing involves understanding the split in capacity required for each circuit. If VT equates to 80% of the overall load requirement, then addressing that in isolation, with CT remaining on 80°C flow, may impact the

»

Figure 2: Blended medium-temperature/high-temperature heat pump solution



# Ask ME\*

about  
decarbonising  
heating

*\*Graham Jones,  
Customer Service  
Manager* →



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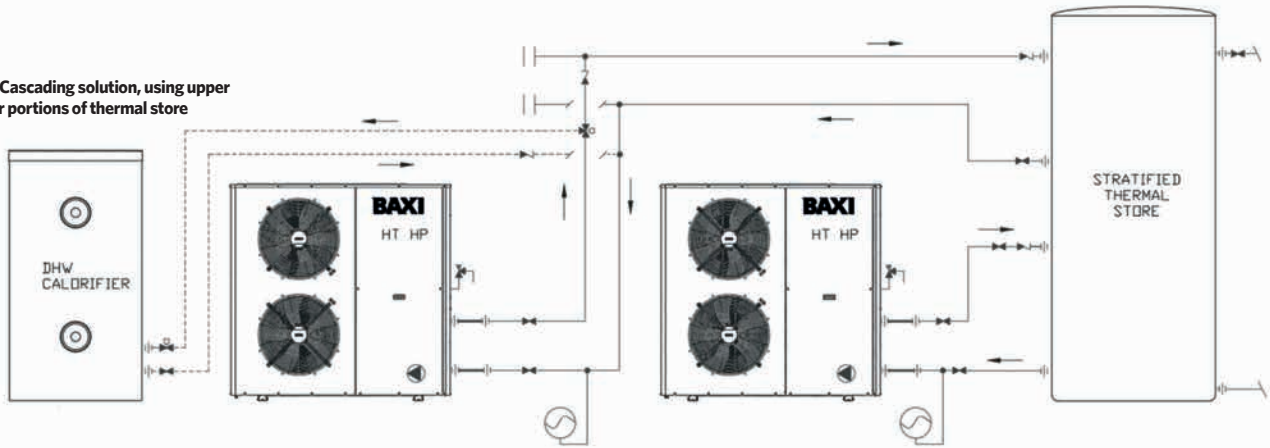
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Figure 3: Cascading solution, using upper and lower portions of thermal store



» overall efficiency of the building sufficiently, without the need to replace air handling unit (AHU) coils.

Figure 1 shows a two-boiler reverse return header setup, with CT and VT circuits, that is typical of many 82/71°C legacy designs. Using data from the current VT setup (if available), the VT minimum temperature can be reduced below current settings to assess whether the target space temperatures may still be maintained. Even a modest reduction in flow temperature will ensure higher efficiencies.

Most HT ASHPs would deliver a coefficient of performance (COP) of approximately 2.2 at 65°C flow and -2°C ambient conditions.

If we were able to drop the weather compensation to below 60°C, output from medium-temperature (MT) and HT ASHPs may be blended, potentially reducing any siting or budget complexities of a full HT.

In the blended MT/HT example solution shown in Figure 2, the heat pumps are cascaded, with a three-port diverting valve being used to deliver heat to the calorifier. Typically, the MT ASHP(s) would act as lead for the directly weather-compensated circuit, supported by the HT ASHP(s) during peak demands. When higher temperatures

### WHY HEAT PUMPS SUIT FABRIC FIRST

The main reason heat pumps are tied so intrinsically with fabric first is related to flow temperatures.

ASHPs are more efficient when the ambient temperature is higher and/or the sink temperature is lower. Ambient temperature is highly variable in the UK and not within our control. The sink temperature, or flow temperature, is within our power to reduce, when and if we can.

Lower flow temperatures reduce emitter outputs if they were originally designed for higher mean water temperatures, but if less heat is required because of fabric upgrades, the equation should balance itself out.

are required for more challenging design conditions, the HT ASHP can increase the thermal store temperature up to 80°C.

If Figure 1 (the reverse return arrangement) had been designed on a  $\Delta T$  of 20K, one solution is the alternate cascading method shown in Figure 3. This uses the thermal store lower and upper stratified sections to provide a cascaded temperature rather than the load. This is an identical philosophy to that used with

most hybrid solutions. Temperatures are still key, and with good weather compensation a blend of MT and HT ASHPs can still work. However, this solution is more suited to HT ASHPs as, at a higher design temperature of 80/60°C, MT ASHPs are unable to deliver any useful heat.

### Managing expectations

As clients start to review boiler-replacement projects and the achievable options to decarbonise asset heat, we must still ensure fabric options are considered first.

Emitter replacement to suit low-temperature heating will tend to yield a higher efficiency overall than a high-temperature heat pump system. Heat pumps should not be over-specified in terms of capacity, for economic and spatial reasons.

Ultimately, perfect is the enemy of the good when it comes to decarbonising buildings unable to offer a significant improvement from fabric upgrades.

However, a well-considered assessment of the building thermal profile delivers essential intelligence for a clearer understanding of the impact of the potential system solutions, to ensure true life-cycle benefit. **C**

**RYAN KIRKWOOD** is engineering solutions manager at Baxi

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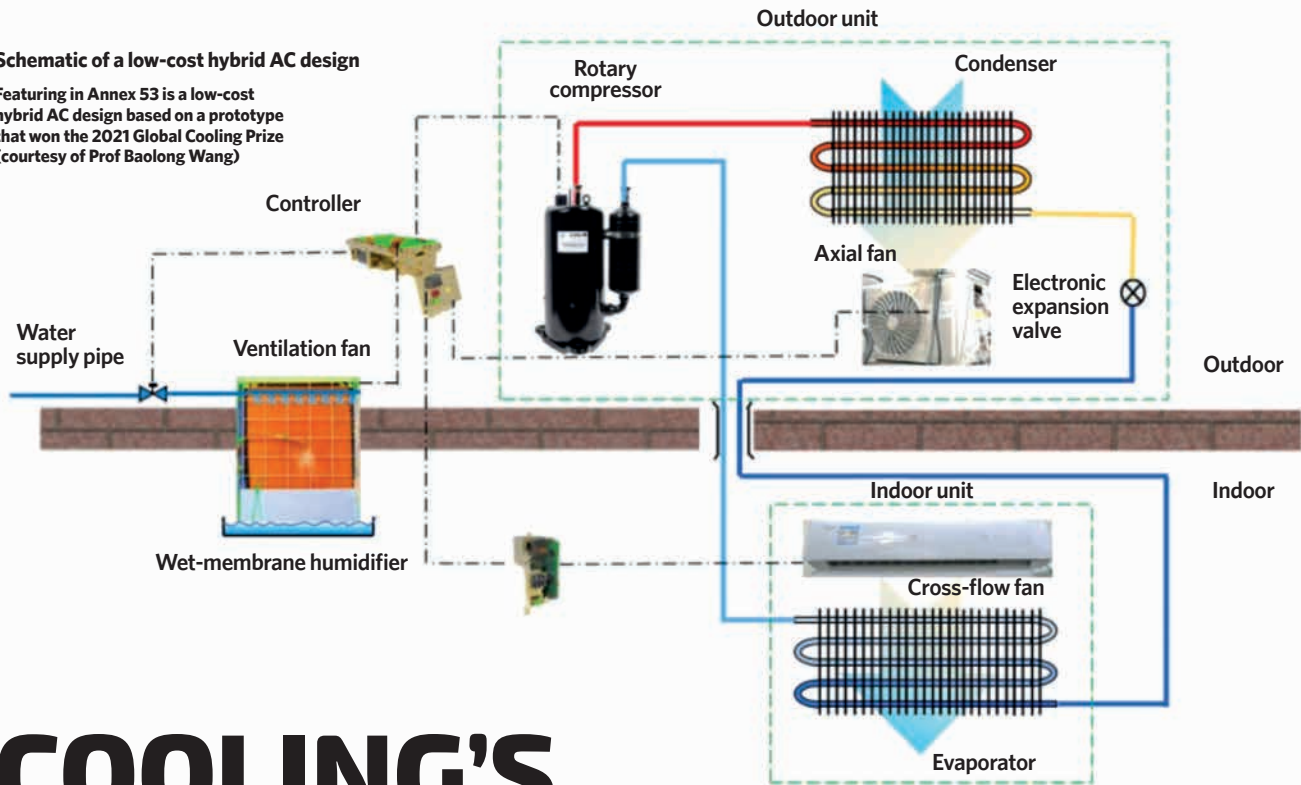
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### Schematic of a low-cost hybrid AC design

Featuring in Annex 53 is a low-cost hybrid AC design based on a prototype that won the 2021 Global Cooling Prize (courtesy of Prof Baolong Wang)



# COOLING'S RACE AGAINST TIME

In response to anticipated rapid growth in demand for air conditioning by 2050, the International Energy Agency has released a report on the latest technology developments in the AC and heat pump sector, as the executive summary explains

**A**ir conditioning (AC) and refrigeration systems account for a large share of current global energy consumption, and this demand is expected to increase sharply over the next 50 years unless actions are taken to ameliorate the increase.

In response, the International Energy Agency (IEA) initiated a project, Annex 53, to look at the development of high-efficiency and low-global warming potential (GWP) AC, refrigeration, and heat pump technologies. The final report for the project was published last month. Titled *Advanced cooling/refrigeration technologies development*, it was produced through the IEA Technology Collaboration Programme on Heat Pumping Technologies (HPT TCP).

The technical scope of Annex 53 was very broad by design. It is unlikely there will be only one, or even a few, so-called right solutions to the challenge. Therefore, the participants were free to investigate a wide range of possible technology solutions.

Research, development and demonstration (RD&D) efforts focused on advanced, higher-efficiency technology solutions for future AC and refrigeration systems.

The adoption of AC in developed countries increased rapidly in the 20th century, and the 21st century is expected to see increased adoption in developing countries – especially those with hotter climates and large, growing populations, such as India, China, Brazil, and Middle Eastern and African nations.

The IEA predicts that, by 2050, AC energy consumption levels will increase by 4.3 times the 2010 levels for non-Organisation for Economic Co-operation and Development (OECD) countries, as opposed to only 1.5 times for OECD countries<sup>1</sup>.

The demand for refrigeration is expected to increase at similar rates, driven primarily by food-preservation and storage needs; food demand is expected to increase 70% by 2050 relative to 2010<sup>2</sup>. India, for example, has the largest refrigerated warehouse capacity of any country in the world, and this is expected to reach

»

## GLOBAL RESEARCH

An IEA Annex is a collaborative research project undertaken by the IEA to address specific challenges and opportunities in different energy-related fields. These projects bring together experts from various countries and organisations to conduct research, share knowledge, and develop solutions.

Participants are typically research institutions, universities, and companies from multiple IEA member countries. Each Annex has a well-defined theme or research area, such as building energy efficiency, renewable energy integration, or advanced cooling technologies.

Annexes typically last for three to five years and culminate in a final report, technical papers, and other resources freely accessible to the public.

The findings and technologies developed through Annexes contribute to the IEA's overall mission of secure and sustainable energy supplies.

For more Annexes produced by the IEA Technology Collaboration Programme on Heat Pumping Technologies, visit [heatpumpingtechnologies.org](https://heatpumpingtechnologies.org). Also see 'Critical juncture', *CIBSE Journal*, February 2023.

» approximately 40.7Mmt<sup>(3)</sup> – almost a 35% increase since 2014<sup>4</sup>. Global action – both short-term (for example, increasing deployment of current best technologies) and long-term (RD&D for advanced, higher-efficiency technology solutions) – is urgently needed.

Annex 53 was initiated in October 2018 to help address the long-term RD&D need. Its main objective is to share information to encourage the development of high-efficiency and low-GWP AC, refrigeration, and heat pump technologies.

The annex was led by the United States, with participation by R&D institutes in the People's Republic of China, Germany, Italy, and South Korea. Its report provides a summary of the current RD&D status of the leading technologies examined by each R&D institute.

Technologies of interest follow two distinct paths: those based on the time-proven vapour compression (VC) cycle, electrochemical compression, absorption and adsorption (including compressor-assisted) systems; and others based on non-traditional cycles – including magnetocaloric, elastocaloric, electrocaloric, and heat pipe-assisted caloric cycles – that are being increasingly investigated. Technology-readiness levels for the investigated technology options ranged

from approximately two to about eight by the end of the annex.

VC systems could continue to be the system of choice, especially for the near future and, possibly, for the long term. To the extent, however, that VC-cycle systems continue to use refrigerants with non-zero GWPs – even in small amounts – they will remain vulnerable to further international refrigerant restrictions.

Non-traditional technologies – for example, caloric or other types – generally are not subject to this challenge because they do not rely on refrigerants in the traditional sense. However, all the non-traditional technologies discussed will require additional development before they can affect the market significantly. **C**

■ Annex 53 *Advanced cooling/refrigeration technologies development* was published in February 2024. The authors and cooperating agents are Reinhard Radermacher (Minta Martin professor of mechanical engineering at the University of Maryland) and Van D Baxter (Building Equipment Research Group, Oak Ridge National Laboratory, retired)

■ The report is available at: [heatpumpingtechnologies.org/annex53](https://heatpumpingtechnologies.org/annex53)


**References:**





- 1 Goetzler, W et al 2016. *The future of air conditioning for buildings*. DOE/EE-1394. Washington, DC: US Department of Energy Office of Energy Efficiency and Renewable Energy, [bit.ly/CJFutACDoE](https://bit.ly/CJFutACDoE)
- 2 University of Birmingham. 2015. *Doing cold smarter*. University of Birmingham Birmingham Energy Institute, [bit.ly/3T8Zoty](https://bit.ly/3T8Zoty)
- 3 The Business Research Company. 2023. *Cold chain global market report*, [bit.ly/3T37sfs](https://bit.ly/3T37sfs)
- 4 Salin, V. 2018. 2018 *Global cold storage capacity report*. International Institute of Refrigeration.

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# Awakening digital twins

Digital twins brought back to life in operational buildings could help minimise the performance gap for owners and occupants, says IES's Don McLean

A vital part of decarbonising our existing building stock will involve working to reduce the performance gap between predicted and actual in-use energy performance. Technology will play a pivotal role in the industry's ability to achieve this, and many buildings already hold the key to getting started.

3D design, energy compliance or BIM models, created in the design and development stage, exist for the vast majority of buildings. However, these are rarely used to their full potential throughout the building's remaining life-cycle. We have developed and trademarked the Sleeping Digital Twin initiative – the idea that these dormant models can be 'awakened' and turned into performance digital twins – as a means to change this.

By this theory, existing models can be updated, calibrated, and integrated with real operational data to monitor, in real time, how well a building is performing and where there is scope for improvement. It also sheds light on why a building's energy use might diverge from initial aspirations, enabling engineers to move beyond guesswork, identify any faults, and make informed decisions on the best solutions.

A digital twin can be used to investigate a variety of 'what if' scenarios to get a holistic view of the options before money is spent on specific improvement or retrofit measures. Cost, energy and emissions savings, payback periods, and the impact on internal comfort conditions can all be considered, to determine the best route to improving the performance of a building. Furthermore, once the chosen solution is in place, the digital twin can be used to measure its performance against expected outcomes.

Of course, better building performance should mean improved energy efficiency and reduced emissions. As such, turning existing models into digital twins can play a role in accelerating the move to net zero. Lower energy consumption also means lower costs.

While a focus on energy efficiency is crucial, this can't come at the expense of occupant comfort. The use of a digital twin enables a balance between the two, providing a means to see the impact of different measures on occupants and understand how efficiencies can be



**“Turning existing models into digital twins can play a role in accelerating the move to net zero”**

realised in a way that's mindful of their needs. This provides the ability to fine-tune the operation of the building in line with different occupancy scenarios and heating and ventilation requirements.

Using existing energy models in operation can also aid post-occupancy evaluations. By referring back to original design intentions, it's possible to highlight things that may have been missed, or changed, in the building's development that could impact how it performs on completion. A digital twin can then be used to identify how to bring a building up to predicted performance levels. In addition, this helps to prevent the same errors from being repeated in the future, ultimately resulting in improved design, build and operation.

Finally, repurposing dormant digital assets into a digital twin can support the attainment of in-use performance certifications, such as Nabers, Breeam and Leed for O+M, by providing the level of data required to illustrate that targets have been met. With these certifications ensuring that optimal performance is obtained, energy, carbon and cost savings can be realised, and the building made more attractive to tenants or buyers.

Our research found that 90% of the 167 architecture, engineering and construction practitioners surveyed see the value of energy models in operation, with the top three benefits of doing so being: to close the performance gap; achieve sustainability goals; and improve operational performance.

The appetite is there for better use of existing models, and digitisation of building performance more broadly, but barriers to making this the norm are still in place. After all, for building services engineers to benefit from the models, they need to be able to access them, and stakeholder collaboration and model handover remain areas that require improvement.

The physical and virtual should always go hand in hand, but, often, it's easier said than done to ensure continuity across the complete building life-cycle.

The next steps are not straightforward, but facilitating a shift towards this approach has the potential to ensure building performance is optimised at every stage and that we move closer, and more quickly, towards net zero goals.

**DON MCLEAN**  
is CEO at IES

# A MODEL RETROFIT

The integrated modelling of an office retrofit in Weybridge won Yorgos Koronaios the Building Simulation Award 2023. Savills Earth's **Alexandros Chalkias MCIBSE** looks at the work that gained Building 100 an impressive Nabers Design for Performance rating of 5.5

Building 100, Bourne Business Park, Weybridge



The annual Building Simulation Awards are organised by the CIBSE Building Simulation Group. [www.cibse.org/get-involved/special-interest-groups/building-simulation-group](http://www.cibse.org/get-involved/special-interest-groups/building-simulation-group)

**T**he optimisation of an existing office through an integrated modelling workflow was the deserved winner of the 2023 CIBSE Building Simulation Award. For his winning entry 'Integrated modelling workflow for retrofit building performance optimisation', Yorgos Koronaios, associate – sustainable design at Savills Earth, demonstrated the modelling undertaken for the refurbishment of Building 100, Bourne Business Park, a three-storey 2,600m<sup>2</sup> office building in Weybridge.

The objective was to provide general design optimisation advice from early stages, with a focus on façade and window optimisation, and to conduct feasibility studies and energy strategy optioneering. The project's scope included support for various modelling studies, such as thermal comfort, daylight and compliance modelling. Additionally, detailed TM54 (operational energy) modelling concluded with a formal Nabers Design for Performance (DfP) assessment that awarded the building a 5.5-star rating (out of 6), one of the few in the UK.

The selection of the modelling tools was made to provide robust feedback within a demanding timeframe. The tools were used for early fabric and operational performance analysis, complex scenario modelling, interoperability, parametrisation for ease of scenario testing and a single modelling platform for the Stage 3-4 analysis (coordinated technical design and final specification.)

The tools selection included:

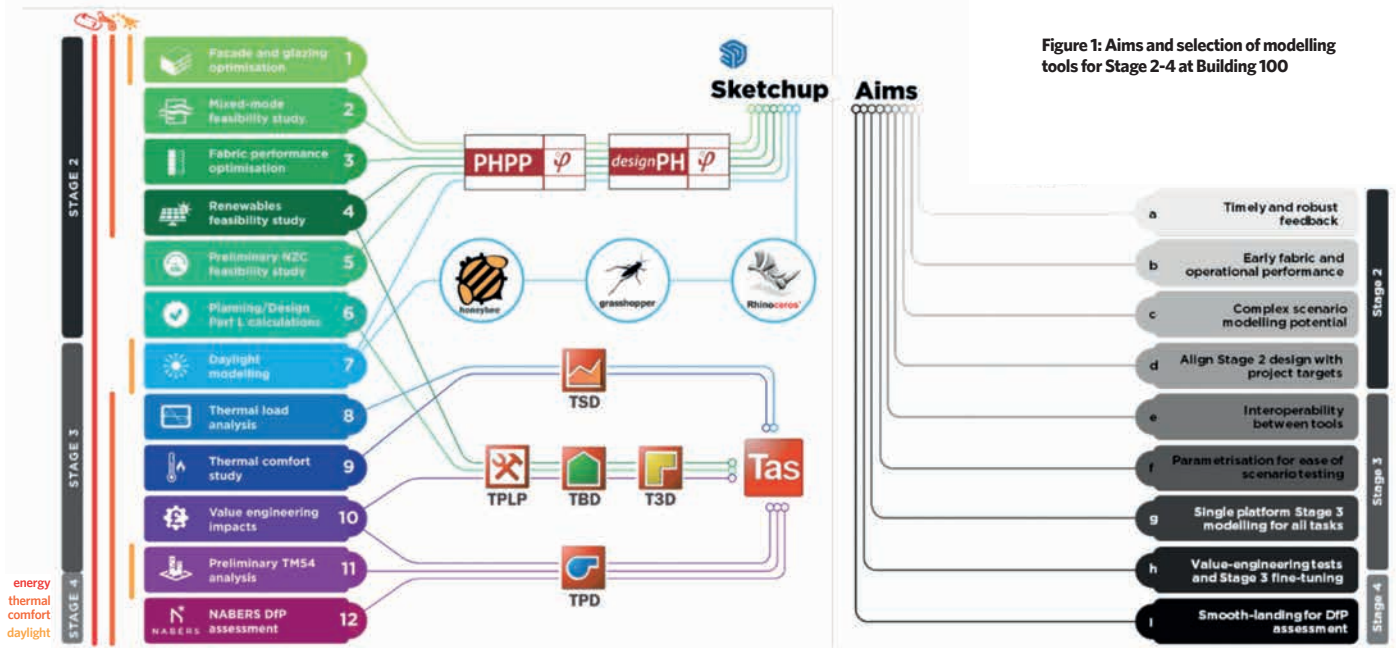
- 'SketchUp, designPH and PHPP for Stage 2 feasibility studies
- 'Rhino, Grasshopper, Honeybee for Stage 3 daylight analysis
- 'EDSL Tas for Stage 3-4 detailed loads, comfort and energy modelling.

Early Stage 2 included modelling with SketchUp, using the plugin designPH that simplifies the entering of data into Passive House Planning Package (PHPP) to understand energy demands, test the feasibility of different options and set project-specific targets. The combination of tools allowed for a quick feedback loop, where different fabric specifications were tested to see their impact on heating and cooling demands. Ventilation options were also tested, including a fully mechanical option and two scenarios with a mixed-mode approach, which showed that significant reductions on cooling and ventilation demands could be achieved.

To evaluate the impact of these options on project targets, an early-stage TM54 model was built in PHPP, with internal gains aligned with Nabers DfP and the available design input at the time. The study indicated that implementing mixed-mode ventilation could elevate the performance from one UKGBC Net Zero bracket to another, prompting the decision to integrate it into the detailed design. The key findings and results at this stage played a pivotal role in guiding the client's decision to pursue an official Nabers rating.

Ease of geometry manipulation in SketchUp allowed for quick updates in the model's form in Stage 3, which was then transferred to Rhino, where it was progressed further to carry out a daylight study using Grasshopper (thermal and parametric modelling in Rhino) and Honeybee (building performance simulation in Grasshopper). This model allowed for quick tests on materialities (material selection for specific aesthetic and functional effects) and glazing lighting performance. The results were not only used to inform the Breeam certification, but also to gain insights into the daylight control conditions in the perimeter zones defined by reviewing the resulting illuminance levels.

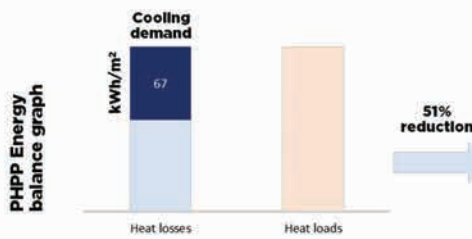
Throughout Stages 3 and 4, EDSL Tas building modelling and simulation software was used to carry out modelling tasks that informed the design further, such as load calculations, Part L compliance, and thermal comfort, and to reinforce the overall design by verifying performance. In Stage 3, Tas was also used to build a preliminary TM54 model that informed the potential Nabers rating. In



energy  
thermal  
comfort  
daylight

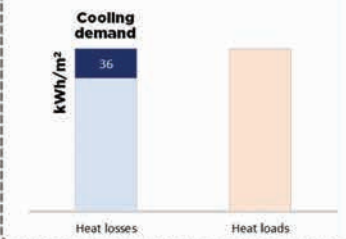
**1. Mechanical ventilation only**

- 14 l/s/person
- boost rate of 13,800 m<sup>3</sup>/h (12 l/s/p)
- Model assumes constant ventilation at 77% capacity of boost rate
- Supply and Exhaust duct lengths 10m each
- Lower heat losses due to shorter duct inlet and exhaust duct lengths.
- Higher pressure drops and specific fan power



**2. Mixed mode (daytime)**

- 0.8m<sup>2</sup> free area per opening
- 150mm restrictor
- All bay windows of every level openable
- 10 hours window open per day (summer)
- 4°C temperature difference with exterior
- 1 m/s wind velocity
- 0.7 air changes per hour



**3. Mixed mode (day & night time)**

- 0.8m<sup>2</sup> free area per opening
- 150mm restrictor
- Only 1<sup>st</sup> and 2<sup>nd</sup> floor windows openable (night)
- 10 hours window open per day (summer)
- 4°C temperature difference with exterior
- 1 m/s wind velocity
- 0.7 (day), 0.1 (night) air changes per hour

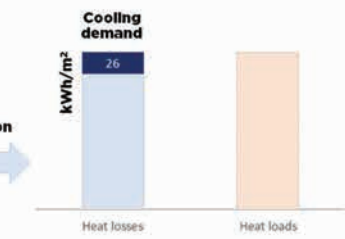


Figure 2: The ventilation options

Stage 4, more detail was incorporated into the model, including actual ventilation rates, size, performance and operation of each individual DX-coil unit, demand-control ventilation details, sizes of selected plant and product-specific parameters, such as temperature correction factors and part-load ratios, to inform the seasonal efficiencies of cooling and heating plant.

In addition, the proposed BMS weather

**As-built predicted performance**

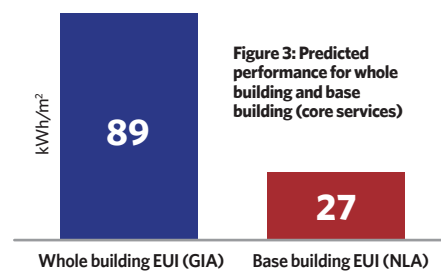


Figure 3: Predicted performance for whole building and base building (core services)

prediction component was introduced to regulate window operation, AHU and DX-coil units. This was achieved by generating schedules of open/closed-window days through an analysis of simulation weather files and defined operating conditions, including indoor temperature thresholds, outdoor temperature limits, wind speed, and CO<sub>2</sub> levels.

For the DfP assessment, to guide the design process while safeguarding performance, certain risk scenarios were modelled, including one where mixed-mode ventilation was not used. This scenario validated the conclusions drawn from the Stage 2 feasibility study, demonstrating how a mixed-mode approach can significantly reduce the operational energy demands of the building.

After concluding their involvement, the design included: a high-performing envelope with fixed shading elements in key locations; highly efficient all-electric air conditioning; mixed-mode ventilation; full LED lighting with daylight control; maximised PV installation; and sub-metering of all floors and plant equipment.

This highlights the value of an integrated modelling workflow, as it allows early feedback, thereby shaping the decision-making process, and driving the design process from initial stages to completion. **CJ**

**ALEXANDROS CHALKIAS MCIBSE** is director - Sustainable Design, Savills Earth and CIBSE Building Simulation Group events secretary

Virtual tour ▾

Tools ▾

Analysis ▾

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Layers &gt;

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Reset view &gt;

▾ Environment

▾ Hydrology

▾ Landuse/Development Zones

▾ Points of Interest

▾ Transportation

# TWIN CITIES

Buro Happold has collaborated with video games developer Epic Games to add another dimension to its digital twins. **Andy Pearson** speaks to Buro Happold's **Miraj Patel** about the latest developments in digital engineering and the potential of the Unreal Engine

Data

Progress

Clear Clusters

Buro Happold's digital twin models can create highly accurate and comprehensive virtual replicas of cities

**D**igital twins are a game-changer for Buro Happold, literally. The consultant's geoscience and digital twins team is using computer-game engine software to enable it to create immersive, collaborative and interactive 3D digital replicas of physical entities, such as cities.

'A big part of using a gaming engine is enabling user immersion, because interaction and experience are a big part of a digital twin,' says Miraj Patel, associate graphical information systems (GIS) and digital twin developer at Buro Happold. Another major benefit, according to Patel, is the almost photo-realistic rendering capability that game engines bring to enhance the immersive experience. 'Depending on how you build it, with a VR [virtual reality] environment users can jump into it and almost feel it,' he says.

The innovative use of game engines to enable the creation of immersive digital twins was one of the reasons Buro Happold was crowned Digital Champion at the CIBSE Society of Digital Engineering Awards in December. Game engines enable Buro Happold's digital twin models of cities, for example, to incorporate vast datasets of geographical and environmental characteristics, to create highly accurate and comprehensive virtual replicas of cities.

It is the ability to combine information within the digital twins, and use it to run simulations, that reduces decision-making time and enhances collaboration, says Patel. It also enables those using the model, such as urban planners, to make more informed decisions.

With this enhanced level of detail, municipal bodies are able to use the digital twin to monitor infrastructure performance, or run

scenarios to assess the impact of a road closure, say, or flooding. Environmental organisations can assess the impact of developments and their alignment with sustainability goals, while engineering firms can adapt and generate infrastructure designs more effectively.

## Levelling up

Buro Happold's digital twin journey started five years ago, when the team set out to ensure all the data it had and was collecting was saved in a format that was usable universally. To enable all of its various data sources to be used, the engineer put in place a framework and protocols to ensure its data management systems were sound. Patel describes these as 'technology/software agnostic' robust data standards.

This data management provides the foundation for Buro Happold to use its data in the development of digital twins for a wide variety of projects, scenarios and applications.

Patel says engineers generally come to the digital team with a problem statement/challenge that needs a digital solution. 'We



“The idea is to create a digital replica of a building or a system that allows you to challenge it virtually, change it easily, and even to break it”

test various heating scenarios without impacting homes. It also helped enhance community involvement.

‘We were able to use the digital twin to show “what if” scenarios within a virtual environment,’ says Patel. ‘We could say, “here’s your house, and you can see the predicated energy use and carbon output”’.

Initially, Buro Happold digital twins, such as the one for Barcombe, were developed as 2D and 3D web-based models, using open source QGIS and ArcGIS software to enable geospatial data to be visualised. The digital team works backwards from the outputs the model needs to deliver, and through the engineering steps, to establish the data sets and software required to build the model. ‘You work backwards to define your data requirements, then you have to see where you can source that data to start building up the model,’ Patel explains.

A major constraint with these web-based digital twin models, however, is that they are limited graphically and in the level of interactivity. ‘The web is great when you have a 2D to 3D platform for letting you see 2D and 3D shapes, but it’s not immersive, it’s not interactive, and the renderings are not realistic – so users

»

call it computational engineering; the idea is that a lot of the work we do can be aided by computation to improve our performance, by enabling us to challenge a problem in a lot more detail,’ he says. ‘The idea is to create a digital replica of a complex environment, a building or a system that allows you to challenge it virtually, to change it easily, and even to break it’.

Some of the areas where computational engineering solutions have been implemented include: masterplanning; facilities/asset management; design review and integration; construction management and progress tracking; scenario simulation; community engagement; building fabric analysis; and automated district energy network design and optimisation.

When Buro Happold developed the community heat digital twin for Barcombe (see ‘Heating made to measure’, *CIBSE Journal*, January 2022), one of the big benefits of having a digital model of the village was that it gave the engineers and the community a comprehensive image of what was happening. For the engineer, it was a way to



Digital twins can run scenarios to assess the impact of road closures or flooding, for example

“This gives you a whole new level of useability. It makes the digital model useful not just for the design or construction stage, but also for asset management”

» cannot get the full experience of what they are seeing and what they are building,’ Patel says.

With the digital sector continuing to evolve rapidly, Buro Happold’s digital team talked to Epic Games (the maker of *Fortnite*) about using its Unreal Engine software to create real-time 3D content for its digital twins. ‘It would allow users to jump into the model and be in a place virtually, which would make it a really useful communication tool for clients and the different engineering disciplines on a project,’ says Patel.

The benefit of using gaming software is that it allows the model to be adapted in real time. ‘We didn’t want to do what everyone else does – preload data into the model, which makes it a huge application. We wanted the data to flow from our database and we had already built the mechanism to enable that,’ says Patel.

‘This gives you a whole new level of useability. It makes the digital model useful, not just for the design or construction stage, but also for asset management, because you can bring in different live data sources by connecting in IoT [internet of things] devices.’ This methodology allows for live-operation digital twins and dashboards to manage a city, for example.

**Tomorrow’s epic cities**

Epic Games could see the potential in Buro Happold’s proposals and awarded it an Epic MegaGrant. This supported the digital team while it spent time navigating the technical challenges of using a gaming engine to stream geospatial data into an application in real time, then render it and make it interactive.

‘The MegaGrant allowed us to build up the functionality and to develop new texturing techniques within Unreal to make the buildings look realistic,’ explains Patel. ‘Every time we had a conversation with Epic, we showed them what we were trying to do and what we’d done. They were very interested to push it further; some of the stuff we showed them they had not seen before.’

Buro Happold’s gaming engine-driven digital twin development



has progressed to the stage where it is now capable of building advanced interactive digital models for numerous applications.

‘There are so many possibilities. When a user gets into the VR digital twin, they are able to interact with the data, so they can move buildings around, delete buildings and draw new ones; they can add comments for review and even tag people,’ Patel enthuses. ‘What’s more, everything is coming from a single source of truth: all the data is in one place and all the engineers work from it and update it, so the model is always live and always up to date.’

The generalised methodology Buro Happold has developed allows it to generate digital twins for cities worldwide. Patel uses a masterplanning project to redevelop a city (he is unable to say which one) to explain how these models are being used.

‘Before the client set about redeveloping

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The London city model data shown on these pages comes from Photorealistic 3D Tiles from Google Maps Platform through Cesium. The level of detail varies based on the source data used to build up the digital twins. BIM, CAD or any other data can be integrated into the digital twin. Buro Happold has created digital twins using the Unreal Engine but currently has non-disclosure agreements with these clients so cannot yet share any images

## DIGITAL ENGINEERING AWARDS WINNERS

The fifth Society of Digital Engineering (SDE) Awards were held at Build2Perform in London on 6 December 2023.

**The winners were:**  
**Outstanding contribution award:**  
 May Winfield, Buro Happold

**Best digital engineer:**  
 Winner: James Thomson, Ramboll

**Best manufacturer:**  
 Winner: Kinship

**Best consultancy:**  
 Winner: Buro Happold  
 Highly Commended: Red Engineering

**Best contractor:**

Winner: BAM Nuttall

**Best process and its application:**

Winner: WSP - GRETA - Grasshopper Embodied Carbon and Thermal Analysis Tool

**Digital champion and Best project and collaboration:**

Buro Happold - digital twins for cities

SDE also awarded Carl Collins, former head of digital engineering at CIBSE, lifelong membership of the society.

For more on the awards and the Society of Digital Engineering, visit: [www.cibse.org/sde](http://www.cibse.org/sde)

the city, they wanted a digital twin of how it exists at this point in time, including assets such as utilities, buildings, trees – even lampposts – so they could overlay the redevelopment masterplan to analyse its impact,' he says.

To create the model, Buro Happold takes GIS, planning and budget data for various scenarios, and processes it according to its protocols, to ensure it can be integrated into the Unreal platform and then develop the various functionalities the users need.

'A big part of this was being able to take the existing city model and look at where the new buildings would be going, what the scheduling might look like, what roads would be affected, and things like that,' says Patel.

'Using the digital model, you can see what the impact on the surrounding environment might be of closing a road, to help judge what the best option would be, rather than actually closing a road and then having to deal with what happens!'

It is not just towns and cities that can be modelled; the Unreal Engine provides the model with enhanced levels of granularity. 'When you look at a development in a web-based digital twin, you cannot go inside the buildings. Using Unreal enables users to look at the development from outside, with a third-person view, but they could also go inside the buildings,' Patel says.

'In theory, people could walk inside to see what the design would look like, then do a flow analysis to see how people move about, which you could visualise. You could even do a façade analysis to look at the impact of reflections on the space, for example.'

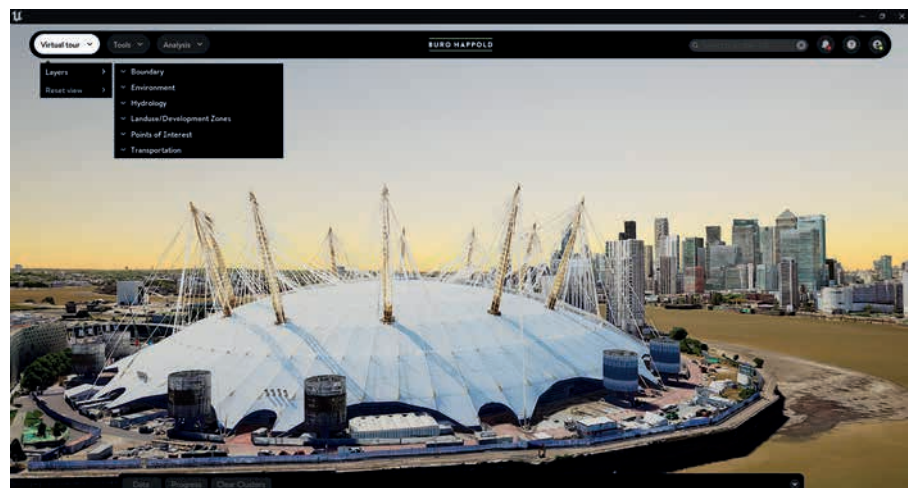
Each interactive digital twin is developed as a bespoke model. 'There are core

components, which make it easier to use again and again, but we don't subscribe to a one size fits all,' Patel says.

Development of the digital twin starts with what Patel describes as 'design thinking' sessions and user interface (UI) and user experience (UX) workshops, to identify individual user needs and define the model's functionality. Each user has an account that defines their level of access. 'We construct personas, story maps and wireframes to design and assess UI/UX, because no-one wants to click through seven pages to get to the information they need,' he says.

The generalised methodology Buro Happold has developed means it is not tethered to a single technology, so it can easily develop interfaces and systems that cater to the unique requirements of each project. This adaptability ensures that the digital twin remains scalable and future-proofed, capable of evolving with technology and the data.

So, what of the future? Patel has just taken delivery of VR glasses and AI-powered smart glasses to help the team develop Buro Happold's next generation of immersive digital twins. **CJ**





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## Chemical-free water treatment

**This module considers chemical-free water treatment in closed-loop water systems in building applications such as heating and cooling**

This article outlines the factors that drive the need for water treatment in closed-loop water systems and focuses on the processes that provide 'chemical-free' water treatments. It also explores how such systems provide treatment of closed-loop water systems, such as those used in heating and cooling systems for buildings.

Water treatment is typically undertaken at the pre-commissioning stage and as an ongoing process to establish and maintain water quality. This ensures that the circulating water does not become contaminated with particulate matter, bacteria or other harmful substances (such as shown in Figure 1), which can lead to system failure. As discussed in the comprehensive guide BSRIA BG 50,<sup>1</sup> appropriate water treatment can help to inhibit corrosion and protect the metal components of the system, so reducing the opportunity for leaks, reductions in efficiency and, ultimately, system failure. It can prevent the formation of scale on the inside of pipes, fittings and heat exchangers that will otherwise reduce the efficiency of the system and reduce system reliability. Appropriate water treatment can also control microbial growth, helping to prevent bacteria and other microorganisms that can grow in closed systems, causing problems such as corrosion and fouling.

Monitoring and controlling the water quality across the life of the installation will improve system performance, lower energy costs, reduce the need for repairs and maintenance, and potentially extend the life of the system.

There are several parameters that will impact the water quality in closed-loop systems. Oxygen dissolved in the water acts as a powerful oxidising agent, readily interacting with metals and accelerating corrosion processes. Dissolved oxygen may be minimised through proper system design, degasification, and by maintaining a closed loop with minimal air ingress.

Total dissolved solids (TDS) – an amalgam of minerals, ions, and other dissolved substances in the water – will increase the water's electrical conductivity and

impact the rate of scale accumulation and corrosion. Water 'hardness' is specifically identified as the amount of calcium and magnesium salts in water, generally in the form of bicarbonates, chlorides and sulphates that, if left, will accumulate as insoluble carbonate (scale) in water systems. Chloride ions are notorious for promoting localised corrosion, as they can penetrate and destabilise the naturally forming protective oxide layer, leaving the underlying metal vulnerable to corrosion.

The acidity or alkalinity of the water, as measured by the pH, significantly influences corrosion rates. Generally, lower pH (more acidic) environments increase corrosion, as this dissolves the protective oxide layer on the surface of metals, leaving the underlying metal exposed and vulnerable to corrosion. Conversely, slightly alkaline environments can help thicken the protective oxide layer, offering better protection – although excessively high pH can induce other degradation processes (such as disrupting the passivity of stainless-steel components).

Higher pH will tend to reduce most bacterial growth. However, the bacteriological quality of the water will be highly dependent on the cleanliness of the initial system and the fill water.

These factors interact and influence each other, so a holistic approach – considering





**Figure 1: A 40µm filter basket from a reaction tank (as in Figure 3) that was removed shortly after installation into a new-build system**

» all relevant parameters and implementing a customised treatment plan based on a specific system and water characteristics – is key to minimising corrosion risk and ensuring the longevity of a closed-loop system.

There are several methods that are used to treat water for closed-loop systems either for continuous use, or to treat fill or make-up water, that may be applied individually or in conjunction with others, depending on the specific system requirements. Physical methods are often used to remove impurities from the water. This may be through some form of filtration to remove particulate matter, by deaeration methods that reduce dissolved and partially dissolved gases; and employing techniques such as reverse osmosis, which forces water through a semipermeable membrane that has microscopic pores to allow water molecules – but not most contaminants – to pass through.

Resin-based demineralisation units (or cartridges), strainers, softeners and clarifiers are employed to remove impurities from the water.

In the UK, chemical water treatment is currently the most common type of water treatment for closed systems, where chemicals are added to the water to inhibit corrosion, prevent scale formation, and kill bacteria. However, chemical-free is becoming increasingly popular – a method of water treatment for closed-loop hydronic systems that does not use inhibitors or biocides. The method employs an initial fill of demineralised, clean water, and then electrochemistry is used to control the causal elements of scale and corrosion – minerals, salts, oxygen and other gasses. In recent years, this method has increased in popularity;

it also meets the requirements of Germany’s influential guideline VDI 2035<sup>2</sup> (see ‘VDI 2035’ boxout).

Chemical-free water treatment systems typically consist of a demineralisation unit and a reaction tank, and although this employs chemical and electrochemical processes, it does not add any chemicals to the system water.

As shown in the example system in Figure 2, mains water passes through the demineralisation tank, which contains a mix of cation and anion exchange resins. Cation resins exchange positive ions such as calcium and magnesium ions with sodium ions, and anion resins exchange negative ions and remove dissolved solids, salts and other ions from water, so that the fill water has no, or low, conductivity. The mixed resin also removes carbon dioxide. Over time, the resin becomes saturated with contaminants, and this will lead to decreasing water quality. Resin capacity is dependent on the hardness of the local water and the total flow through the unit over time. As the resin becomes saturated with mineral ions it needs regeneration or replacement. Regular monitoring of conductivity or specific ion levels helps determine when resins can no longer perform their function. Resin typically has a useful life of three years in a system, when it will then require changing even if it has not become saturated.

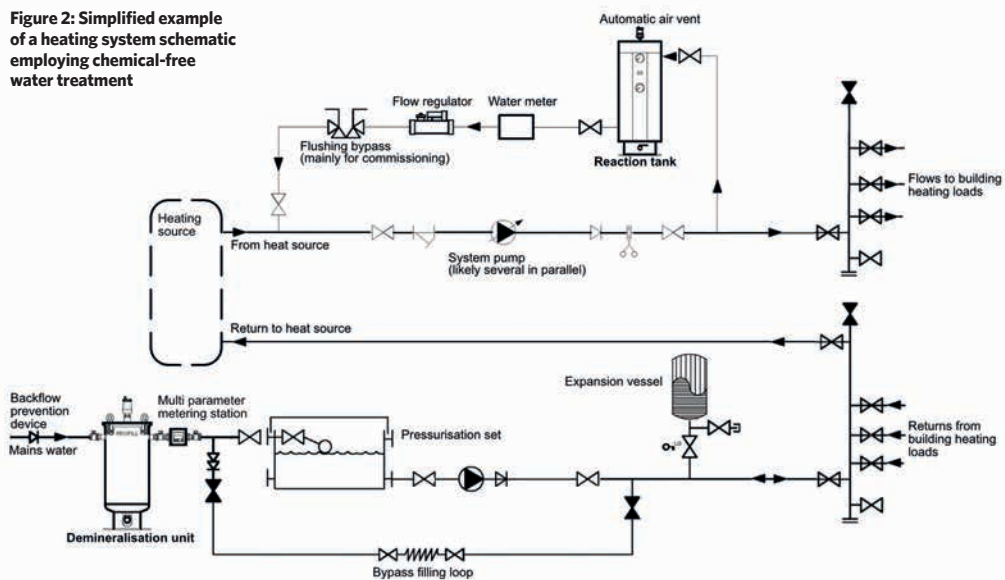
The reaction tank (such as that shown in Figure 3) employs sacrificial magnesium anodes surrounded by a filter and a strainer, which is then contained in a cylindrical stainless-steel housing. The tank is positioned in the system where the water is hottest (for example, near the boiler output – as in Figure 2 – or the input to a chiller), as this is where there will be the greatest number of bubbles of entrained air and gases.

In the illustrated reaction tank, the water enters tangentially, creating a swirling motion, and as a result of centrifugal forces, heavier particulate matter is thrown outwards, which then falls and collects at the base of the unit. The outer cylindrical strainer captures any remaining larger particles while a finer (micron) inner filter removes smaller particles. These particles will be held in the strainer and micron filter, and will drop to the lower chamber when the unit is being ‘blown down’. (During scheduled maintenance, the blow-down valve is briefly opened to force a controlled flow of water back through the filter and strainer screen, in order to force out accumulated debris through the blow-down valve into an appropriate waste-disposal vessel. The valve is then closed.)

This filter also traps micro air and gas bubbles, which then amalgamate and buoyantly rise, to be removed from the system by an automatic air vent. This degassing process is continuous, and when the treated, degassed water leaves the tank, it cools and passes around the distribution system absorbing trapped system air that will, in turn, be removed to atmosphere as the water passes back through the reaction tank.

The magnesium anodes in the tank have significantly more negative

**Figure 2: Simplified example of a heating system schematic employing chemical-free water treatment**



REACTION TANK KEY

**1** Automatic air vent **2** Magnet to capture metallic particles **3** Air and other gases rise through buoyancy forces **4** Water enters with entrained particles, dissolved oxygen and air micro bubbles (located at point of hottest system water) **5** Magnesium anodes **6** Strainer to capture larger particles. **7** Approximate water path **8** Micron filter (40µm) basket to remove smaller particles and entrained air – can be swapped for bag filters down to 0.5µm for finer particle filtration **9** Dirt, sludge, debris, and metallic particles (including the magnesium residue from the expiring anodes) collect inside the basket **10** Blow-down valve periodically used to remove accumulated matter

electrochemical potential and so are more 'active', so they corrode when they are in electrical contact with the stainless-steel outer shell and stainless-steel filter assembly – which act as a cathode – in the presence of an electrolyte (such as the ion containing water). As a result of the electrochemical reaction between the magnesium anodes and the surrounding cathode, magnesium hydroxide is produced (at the anode), and any dissolved oxygen is gradually removed (through a reaction at the stainless-steel) as the water recirculates. Hydroxide ions produced at the cathode increase the pH of the water – a process known as 'self-alkalisation'. However, excessive alkalinity can also lead to issues such as scale formation and reduced heat-transfer efficiency, so the pH should be carefully monitored. (The electrochemical reactions also produce chloride and hydrogen gas, which rises to the top of the tank to be released to the atmosphere.)

The cathode and the anodes are connected through a galvanometer that shows the electrical flow between the two. As pure water is non-conducting, more impurities and oxygen in the water will increase the current. As the water quality improves, the current diminishes. The system is self-regulating, as the anode automatically works harder with corrosive water. All the components should be cleaned on a regular maintenance cycle, which will be scheduled depending on the installation.

Reaction tanks are typically sized based on the system heating or cooling load, the system volume, and the system operating temperature. So, for example, chilled water and heat pump systems will typically need a larger unit than a boiler-fed system, as they do not benefit from the higher temperatures to assist the removal of bacteria – this is achieved by a greater surface area of the anodes.

For the initial system fill, a chemical-free installation requires ideal fill water that is bacteria-free with a controlled pH and low conductivity. Typically, the fill will pass through a bacteria filter of 0.5 microns or a reverse osmosis filter (with an appropriate protective pre-filter) to block microbes from entering the system. The water will then pass through a mixed demineralising resin bed to deliver the required quality fill water. Early operation of the system at its maximum temperature after filling should be carried out to remove gas and air pockets. Once filled, the installation debris is cleared by circulating the system water to velocities as recommended in BSRIA BG 29,<sup>3</sup> using a mobile high-flow filtration unit that filters the system water without discarding any water to drain.

As reflected in VDI 2035,<sup>2</sup> BSRIA BG50,<sup>1</sup> and CIBSE Guide M,<sup>4</sup> system performance monitoring is essential for the proper maintenance of closed heating

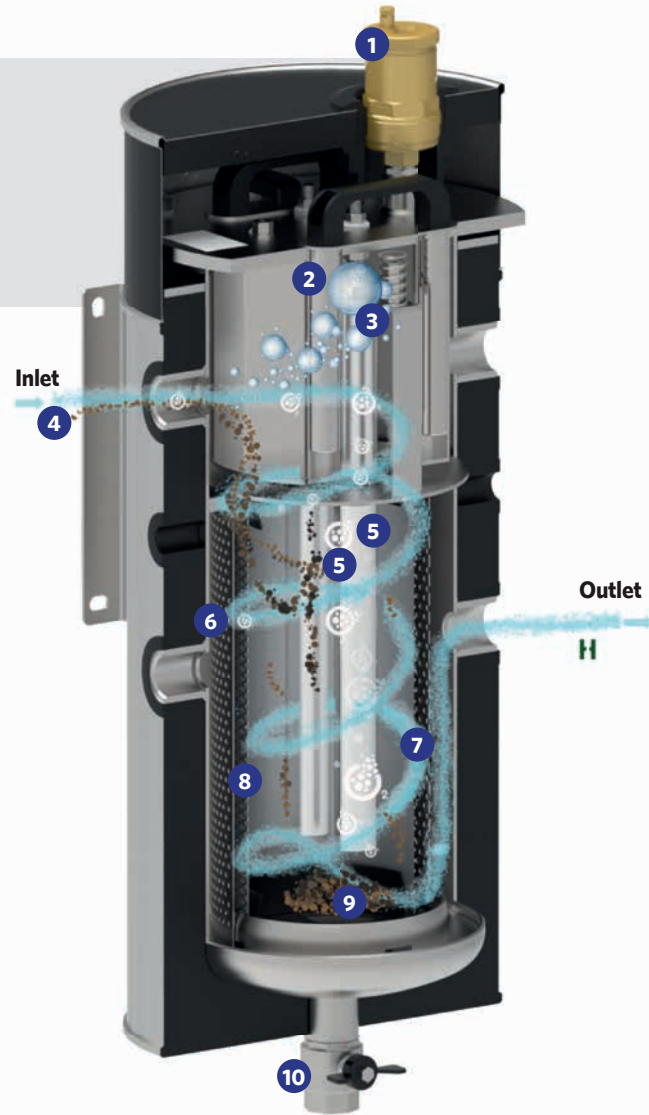


Figure 3: An example of a commercial reaction tank (Image source: IWTM)

and cooling systems. It can help to identify potential problems early on, prevent costly repairs, and ensure that the system is operating efficiently. Recommendations in CIBSE CPI<sup>5</sup> are to continually monitor corrosion in the system water using electronic coupons (that mimic the behaviour of a physical metal coupon to measure corrosion parameters electronically), which, in conjunction with automatic pH and TDS monitoring systems, can feed into building management systems (BMS). Reaction tanks are available with real-time monitoring that can deliver information both locally and directly to a BMS to provide a continuous record of these critical factors.

Despite being widely embraced for many years across Europe, it is only in recent years that chemical-free water treatment for closed-loop systems has been more widely adopted in the UK. It is increasingly being referenced by HVAC manufacturers as being suitable for systems operation, and is being adopted by a growing number of designers and users.

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■ Turn to page 44 for further reading and references. >>

VDI 2035

VDI 2035<sup>2</sup> Part 1: Prevention of damage in water heating installations – Scale formation and waterside corrosion is a German guideline that provides extensive commentary and recommendations to prevent scale and corrosion in heating systems. It offers guidance on selecting suitable corrosion-protection methods, including the use of demineralised system water, both for the initial fill and for make-up water, and adjusting water chemistry through pH modification. It explains techniques to minimise scale formation, and for effective demineralisation, deaeration and filtration.

The guideline tabulates recommended values of three parameters, which limit the likelihood of damage resulting from scale formation and corrosion.

- Total water hardness – the combined measurement of all the dissolved minerals that contribute to hardness, primarily calcium and magnesium, listed in °dH (where 1°dH ≈ 17.8mg·L<sup>-1</sup> CaCO<sub>3</sub> or 17.8ppm).
- Electric conductivity measured in µS·cm<sup>-1</sup> (microsiemens per centimetre). Dissolved ions, such as salts, minerals and acids, are the primary factor affecting the electrical conductivity of water.
- pH, where the recommended value is related to whether the system includes aluminium alloys. Correctly meeting the provisions that aim to prevent scale and corrosion will also contribute to preventing bacteriological growth, and so also reduce the risk of sludge formation.

# Module 230

March 2024

» 1. Which BSRIA publication provides comprehensive guidance on water treatment?

- A BG 6
- B BG 29
- C BG 50
- D BG 75
- E BG 80

2. Which of the following is noted as being associated with local corrosion in water systems?

- A Bicarbonates
- B Calcium salts
- C Chloride ions
- D Magnesium salts
- E Sulphates

3. Which of the following is least likely to be true?

- A Excessively high pH can disrupt the passivity of stainless-steel components
- B Good water treatment means initial system cleanliness is not important
- C Higher pH will tend to reduce most bacterial growth
- D Lower pH (more acidic) environments increase corrosion rates
- E Slightly alkaline environments can help thicken the protective oxide layer

4. Where in a heating system would it be most appropriate to include the reaction tank?

- A After the water pressurisation unit
- B At the highest point in the system
- C At the point that mains water enters the system
- D Close to the flow from the heat source
- E In the return pipework adjacent to the heat source

5. What metal is used for the sacrificial anodes in the illustrated reaction tank?

- A Aluminium
- B Iron
- C Magnesium
- D Stainless steel
- E Zinc

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### Further reading:

Chapter 12 of CIBSE Guide G provides an excellent foundation for understanding corrosion and corrosion protection.

Annex E of CIBSE CP1 *Heat networks: Code of Practice for the UK (2020)* provides useful tables of recommended parameter limits for heat networks (closed-loop networks).

### References:

- 1 Simpson, P, *BSRIA BG 50/2021: Water treatment for closed heating and cooling systems*, BSRIA 2021.
- 2 *VDI 2035 - Part 1: Prevention of damage in water heating installations - Scale formation and waterside corrosion*, Verein Deutscher Ingenieure 2021.
- 3 Parsloe, C, and Ronceray, M, *BSRIA BG 29/2021 Pre-commission cleaning of pipework systems*, BSRIA 2021.
- 4 CIBSE Guide M.
- 5 *CIBSE CP1: Heat networks: Code of Practice for the UK*, CIBSE 2020.



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## › Products of the month

### Rinnai's product range embraces electrification

Electric options for hot water heating align with sustainability and decarbonisation goals

**R**innai has expanded its product line-up to include electric options, aligning with UK energy strategies focused on clean and sustainable electrification. UK energy strategists believe that clean and sustainable electrification is currently one of the best options for reducing carbon emissions while maximising efficiencies and lowering end-user customer costs.

In recognition of this, Rinnai has adapted its extensive product range to include electric versions of its hot water applications and continues to focus on developing new product innovations. Further launches are expected in the first part of this year.

New additions include the Infnit-E range, an optional three-phase all-electric water storage heater for commercial hot water applications. These are designed for flexibility, with units fitted with between one and six titanium elements. The kilowatt (kW) rating within the Infnit-E range is scalable from 12kW to 72kW, ensuring that they are suitable for a wide variety of applications.

Each cylinder is manufactured with stainless steel, which adds durability and enables Rinnai to offer extensive warranties on the product. The use of stainless steel also makes the Infnit-E range lightweight and easily manoeuvrable compared with glass-lined variants, with a maximum empty weight of 54kg.

All electrical elements can be fitted to a single-phase supply, mitigating against site limitations. Each element within the appliance range also has its own controllable thermostat, with a temperature range of 49°C to 90°C. Fuse protection of each element eliminates the need for expensive sacrificial anodes because of the tough stainless-steel build.

All-electric systems can benefit from Rinnai's modulating smart electric cylinder range, ensuring that only direct electricity used fills the performance gap from the renewable heat source. Rinnai's electrical hybrid solar heating and hot water systems deliver identical performance compared with traditional options.

Rinnai's range of electric products includes monobloc air source heat pumps (ASHPs), available in variants from 4kW to 110kW. Rinnai's heat pump technology allows up to



seven units to be cascaded together for larger commercial applications. A cascade system works by using multiple heat pumps in conjunction, allowing for a level of functioning synchronicity and greater operational performance.

The HPI models feature ultra-low sound capability, complying with stringent standards for areas with prohibitive sound legislation.

All Rinnai commercial heat pumps use low-global warming potential (GWP) refrigerants, including R32 and R290, which are capable of reducing electricity consumption by up to 10% and holding a lower GWP. Rinnai's HPI heat pump range is rated A+++ for energy efficiency and offers operational flexibility to switch between settings of heating, hot water and cooling.

Rinnai's HPI ASHPs, hybrid formations, electrical formats, and hydrogen gas mix-powered water heaters are all part of the H3 range of products. This range was designed to facilitate decarbonisation, energy efficiency, and reduced customer costs.

Rinnai aims to offer practical, affordable, and feasible solutions to all UK customers. It is committed to giving customers various options of carbon-reducing technology for an improved lifestyle. Additionally, it strives to keep UK customers informed about major

changes and developments in the international energy market.

The H3 range of decarbonising products includes hydrogen/BioLPG-ready technology, hybrid systems, low-GWP heat pumps, and solar thermal solutions. The range also features Infinity hydrogen blend-ready and BioLPG-ready continuous flow water heaters, designed for long life, robustness, durability, and customer satisfaction.

Rinnai's H3 range of products offers contractors, consultants and end-users efficient, robust and affordable decarbonising appliances, providing practical, economic and technically feasible solutions.

Rinnai's units can be delivered to any UK site within 24 hours. The manufacturer also offers a carbon and cost-comparison service that will calculate financial and carbon savings made when investing in a system.

A system design service can also be provided that will suggest to clients an appropriate system for the property in question.

Rinnai offers comprehensive training courses and technical support in all aspects of the water heating industry, including detailed CPDs. More information can be found on Rinnai's website and its Help Me Choose webpage.

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

## Products of the month

### R290 heat pump expands Rinnai's decarbonisation range

#### High-temperature air source heat pumps added to manufacturer's product list

Rinnai has recently added the R290 high-temperature air source heat pump (ASHP) to its extensive product portfolio. This move is part of the company's commitment to providing low-cost, efficient, and environmentally friendly solutions for its customers.

Scheduled for release at the start of 2024, the introduction of these ASHPs marks a significant milestone in Rinnai's journey towards offering viable decarbonising options across various sectors.

The use of low-global warming potential (GWP) R290 refrigerant brings several operational benefits, including an improvement in energy efficiency of up to 10%.

These heat pumps are capable of achieving water temperatures of up to 75°C, catering to a wide range of heating needs in residential and commercial settings.

In addition to their operational advantages, the R290 heat pumps align with European regulations, specifically the F-gas Regulation, by mitigating the environmental impact associated with refrigerants.

The launch of the R290 heat pump range is part of a broader strategy by Rinnai to provide comprehensive decarbonising solutions to its UK customer base. Throughout the year, the company plans to unveil a diverse array of systems and appliances tailored to meet the specific needs of domestic, commercial and off-grid properties.

With options ranging from residential heat pumps to large-scale commercial systems, Rinnai aims to address the varying requirements of its clientele while advancing the cause of sustainability.

The versatility of the R290 heat pumps for a variety of applications is reflected in its availability across 11 sizes, ranging from 6kW to 50kW. Each of the heat pump units comes fully equipped with advanced control systems that allow for precise, time-sensitive programming and customisation, to fulfil individual customer requests. This means the unique demands of every customer and their properties can be met.

This focus on flexibility and adaptability underscores Rinnai's commitment to delivering solutions that are not only efficient

and effective, but also tailored to individual preferences and requirements.

Rinnai's ASHP range is ratified with an Energy-related Products rating of A+++ and A++ depending on size, and can fulfil UK customer decarbonising ambitions.

The manufacturer's dedication to sustainability extends beyond product development to encompass comprehensive support services. Its carbon calculation service, for instance, offers customers a holistic view of the potential savings and environmental benefits associated with transitioning to Rinnai's decarbonising solutions. By comparing the costs and benefits of existing heating systems with Rinnai's offerings, customers can make informed decisions that align with their decarbonisation goals.

In addition to its R290 heat pump range, Rinnai offers a diverse portfolio of decarbonising products under its H3 range. With this, the company aims to provide pathways to customers cost reductions for commercial, domestic and off-grid heating and hot water delivery. This includes hydrogen/BioLPG-ready technology, hybrid systems, and solar thermal solutions,

catering to a wide range of heating and hot water delivery needs.

The H3 range represents a holistic approach to decarbonisation, offering customers practical, economical and technically feasible solutions across various energy formats and applications. It covers all forms of fuel and appliances currently available - electric, gas, hydrogen, BioLPG, DME solar, thermal, low-GWP heat pumps, and electric water heaters.

Rinnai puts a huge emphasis on customer education and support. The company offers a range of online resources, including training courses and technical support, to empower contractors, consultants and end-users in adopting sustainable heating and hot water solutions. Additionally, it offers system design assistance to help customers select the most appropriate solution for their specific requirements, ensuring optimal performance and efficiency.

The introduction of the R290 heat pump range represents a significant step forward in Rinnai's efforts to advance decarbonisation in the heating and hot water industry.

By leveraging innovative technologies and having a commitment to sustainability, the company continues to provide efficient, cost-effective, and environmentally friendly solutions to its customers across the UK and beyond.

■ Visit [www.rinnai-uk.co.uk/contact-us/request-brochure](http://www.rinnai-uk.co.uk/contact-us/request-brochure)

**“These heat pumps are capable of achieving water temperatures of up to 75°C, catering to a wide range of heating needs”**



**Vent-Axia Lo-Carbon systems selected for Castle Green Homes** ✓

Castle Green Homes has chosen to have Vent-Axia's decentralised mechanical extract ventilation (dMEV) units installed in its homes, to meet updated Building Regulations.

Vent-Axia will supply its Lo-Carbon NBR dMEV C units for installation in 500 homes a year across North Wales and the north-west of England.

The aim is to ensure good indoor air quality and to comply with Part F requirements. These units provide efficient ventilation, meeting the new airflow rates with minimal noise.

■ Call +44 (0)344 856 0590 or visit [www.vent-axia.com](http://www.vent-axia.com)



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CPD ASFP

**Ventilation solution launched for new-build homes** >

Domus Ventilation has introduced dMEV-NICO, a decentralised mechanical extract ventilation (dMEV) fan tailored for new-build homes. This fan ensures continuous background extraction for waste and moist air, which is crucial for areas such as bathrooms and kitchens.

Equipped with automatic monitoring, it adjusts extraction speeds based on occupants' activities. dMEV-NICO meets Part F and L Building Regulations, boasts low maintenance costs, silent operation, and a sleek design suitable for any home style.

■ Visit [domusventilation.co.uk/catalog\\_products/dmev-nico](http://domusventilation.co.uk/catalog_products/dmev-nico)

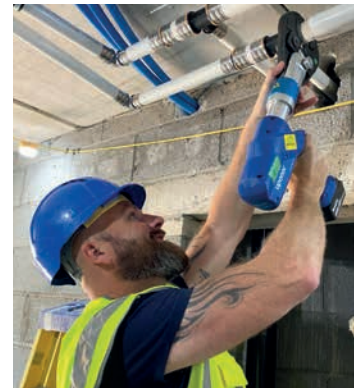


**Uponor announces WRAS-approved Uni Pipe** ✓

Uponor, the global water solutions provider, is celebrating Water Regulations Advisory Scheme (WRAS) approval for its Uni Pipe, which is capable of withstanding up to 16bar pressure. This extends Uponor's reach to high-rise buildings, offering corrosion-resistant MLC piping for boosted cold water supplies.

Previously limited to five- to six-storey structures, this approval aligns Uponor with traditional metal piping systems. Uni Pipe Plus ensures seamless water delivery, with tried and tested connection technologies and enhanced flexibility for faster installation.

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



**^ New SoPHE IWG committee representative for South West region**

David Johnson, marketing and business development director at Pump Technology/Jung Pumpen, is the new Society of Public Health Engineers' (SoPHE's) Industrial Working Group (IWG) Committee representative for the South West region. His role will include coordinating CPD sessions, setting up exhibitions and running demonstrations, factory visits, training, and the annual dinner. Johnson is eager to assist consultants and IWG manufacturers.

■ Call David Johnson on 07984 520515  
email [davidj@pumptechnology.co.uk](mailto:davidj@pumptechnology.co.uk)





Jess Glynn

# Join the movement

From addressing challenges to fostering inclusivity, Women in Building Services Engineering aims to shape a more equitable and diverse future for the industry. Jess Glynn sheds a light on the group's plans as it looks to attract more volunteers

As we gear up for International Women's Day on 8 March, Jess Glynn, an associate at Atelier 10 and active member of Women in Building Services Engineering (WiBSE), shares insights into the committee's recent work and future vision. Established in 2012, WiBSE has been instrumental in advancing equity, diversity and inclusion across the industry. Now, WiBSE looks forward to an ambitious 2024, with plans to expand its membership, foster collaborations, and provide essential resources.

## What is the biggest challenge for women in the industry?

There are numerous, so it's hard to choose the biggest one! The lack of representation of women at senior leadership levels, in consultancies and contractors (and others), is particularly concerning. I don't think it gives young engineers the confidence to see that this is something they can aim to achieve in their careers.

Many factors contribute to the challenges women face throughout their careers in the building services industry, which all need to be overcome if we want things to change. This includes sexism and bias, unfair treatment associated with parenthood responsibilities, and harassment in the workplace— all of these are feeding the leaky pipeline!

## Could the industry be doing more to encourage women to return to work?

Absolutely, there's always more that can be done. As we highlighted in a LinkedIn article published last year on retaining women engineers, there are several critical points for encouraging women to return to work. These include: offering hybrid/flexible working; ensuring equal parental leave rights; providing 'keep

in touch days', where employees can work up to 10 days during their maternity leave to help women keep up to date with what's happening in the workplace; facilitating role sharing; having role models in the workplace; and ensuring good communication and training while on leave.

Additionally, professional institutions should enhance their processes to make it simpler and more transparent for individuals to maintain their CEng chartered status while on a career break.

## What plans does WiBSE have for the year ahead?

We're really keen to put together a number of standard industry guidance documents to promote inclusivity and equity in our working practices and recruitment practices. By offering best-practice tips, we hope to empower individuals and organisations to create more inclusive environments.

## How do we reach young female engineers?

Social media is a really great resource for interacting with young engineers, and can be a great tool for increasing awareness of the many amazing things that women can achieve as part of our industry.

The WiBSE LinkedIn page is very active, promoting events that are an excellent way to network and meet other women in the sector. We also regularly post very informative news pieces, which will help inspire many young engineers.

## Why should you volunteer for WiBSE?

We are working hard to produce guidance documentation – and, hopefully, organise more events – with the goal of collaborating on these with the other equality, diversity and inclusion CIBSE panels.

To accomplish these goals, we rely on volunteers to support our vision. Currently, we have a dynamic and committed group of women, and eagerly invite more to join our ranks. WiBSE is always actively seeking out new committee members.

If you are interested in contributing, please reach out to us at [inclusivity@cibse.org](mailto:inclusivity@cibse.org). Your involvement can make a significant difference!

- To find out more about WiBSE, visit [www.cibse.org/wibse](http://www.cibse.org/wibse) and LinkedIn at [www.linkedin.com/groups/3022887](https://www.linkedin.com/groups/3022887)

# EVENTS AND TRAINING



## NATIONAL EVENTS AND CONFERENCES

### **CIBSE Technical Symposium** 11-12 April 2024, Cardiff University

With the theme 'Fit for 2050 - Delivering buildings and defining performance for a net zero built environment', the 2024 symposium will offer a range of peer-reviewed papers and presentations outlining the latest developments in practice, technology and policy, and highlight the latest guidance for building services engineers.



## CIBSE REGIONS AND GROUP EVENTS

Check the website for up-to-date information on regions and groups meetings, webinars and podcasts. Visit: [www.cibse.org/events](http://www.cibse.org/events)



### **East Anglia: Digital hydronic HVAC systems** 6 March, Cambridge

An introduction to digital hydronic HVAC systems, presented by Phil Draper, CIBSE HVAC Group vice-chair, and Greg Langridge, business development manager, Danfoss Climate Solutions.

### **Home Counties North West: AGM** 7 March, London

AGM and presentation, with new officers and committee members appointed. Drinks and networking to follow.

### **Home Counties South East: AGM** 25 March, online

Online AGM with new officers and committee members appointed.

### **West Midlands AGM** 27 March, Birmingham

AGM at Edgbaston Stadium, with new officers and committee members appointed.



## TRAINING COURSES

CIBSE's courses are run as in-person or live online training. Corporate delivery is also available in-house face to face, or remotely online. See [www.cibse.org/training](http://www.cibse.org/training)

### **Mechanical services explained** 12-14 March, remote 9-11 April, remote 30 April - 2 May, London

### **Design of ductwork systems** 27 March, remote 6 June, London

### **Building services explained** 26-28 March, remote 23-25 April, London 21-23 May, remote

### **ISO 50001:2018 Energy management system/ Low Carbon Consultant** 19-20 March, remote

### **Energy Savings Opportunity Scheme (ESOS)** 24 April, remote

### **Energy surveys** 26 April, London 7 May, London

### **Energy strategy reports** 30 May, remote

### **Building Regulations Part O: Overheating** 23 April, remote 30 May, London

### **Electrical services explained** 19-21 March, London 16-18 April, remote

### **Introduction to the Building Safety Act** 13 March, remote 17 April, remote 7 May, remote

### **Introduction to Heat Networks and Code of Practice**

13 March, Remote  
16 May, London

### **Heat Networks Code of Practice full course** 6-7 March, London 19-29 March, Remote 10-11 April, Remote

### **Fire safety in purpose-built blocks of flats** 28-29 May, remote

### **Mentoring skills workshop** 26 March, remote

### **Below-ground building drainage** 18 April, remote

### **Design of heating and chilled water pipe systems** 14 March, London

### **Fire safety building regulations: Part B** 28 March, remote

### **The importance of energy-efficient buildings** 15 May, London

### **Low carbon consultant building design** 12-13 March, remote 9-10 April, London 24-25 April, remote

### **Emergency lighting to comply with fire safety requirements** 5 June, London

### **Commissioning Code M: Commissioning management** 14 May, remote

### **Earthing and bonding systems** 21 March, London

### **Energy efficiency-related building regulations: Part L** 21 March, remote 23 May, London

### **Understanding the law for engineers** 29 May, remote

## On-demand training

CIBSE has a portfolio of on-demand courses that contain interactive online content, with quizzes and additional resources to support your learning. [go.cibse.org/training-mycibselearning](http://go.cibse.org/training-mycibselearning)

### Benefits include:

- Online platform accessible on desktop and mobile devices
- Courses and modules available offline when using the app
- Flexibility
- Interactive content
- Corporate training exclusive tools (dashboards, reports)



## CIBSE JOURNAL WEBINAR

The latest *CIBSE Journal* webinar, sponsored by Vertiv and titled 'Deploying liquid cooling in air cooled data centres', is now available on demand. Register at [www.cibsejournal.com/webinars](http://www.cibsejournal.com/webinars)

All previous *Journal* webinars are also available on demand, including 'Our sustainability journey', which explores how the HVAC market needs to adapt to meet the UK's energy targets.



## MEMBERSHIP WEBINARS

CIBSE Membership hosts free, two-part webinar series to support members with applications for the Associate and Member grades and registration with the Engineering Council at Incorporated Engineer and Chartered Engineer level.

For upcoming dates and to register, visit: [bit.ly/CJMar23memweb](http://bit.ly/CJMar23memweb)  
Upcoming dates: 12 and 26 March; 9 and 16 April

# futurebuild

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CMR Controls manufactures low air pressure and air volume measurement sensors and control systems for standard air conditioning, clean rooms, sterile laboratories, containment facilities, and fume cupboard extract systems.

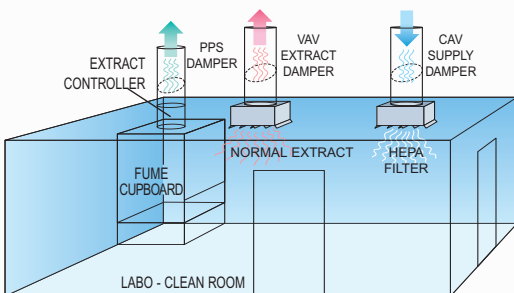


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