CIBSE JOURNAL

#Build2Perform

July-August 2024 www.cibsejourn

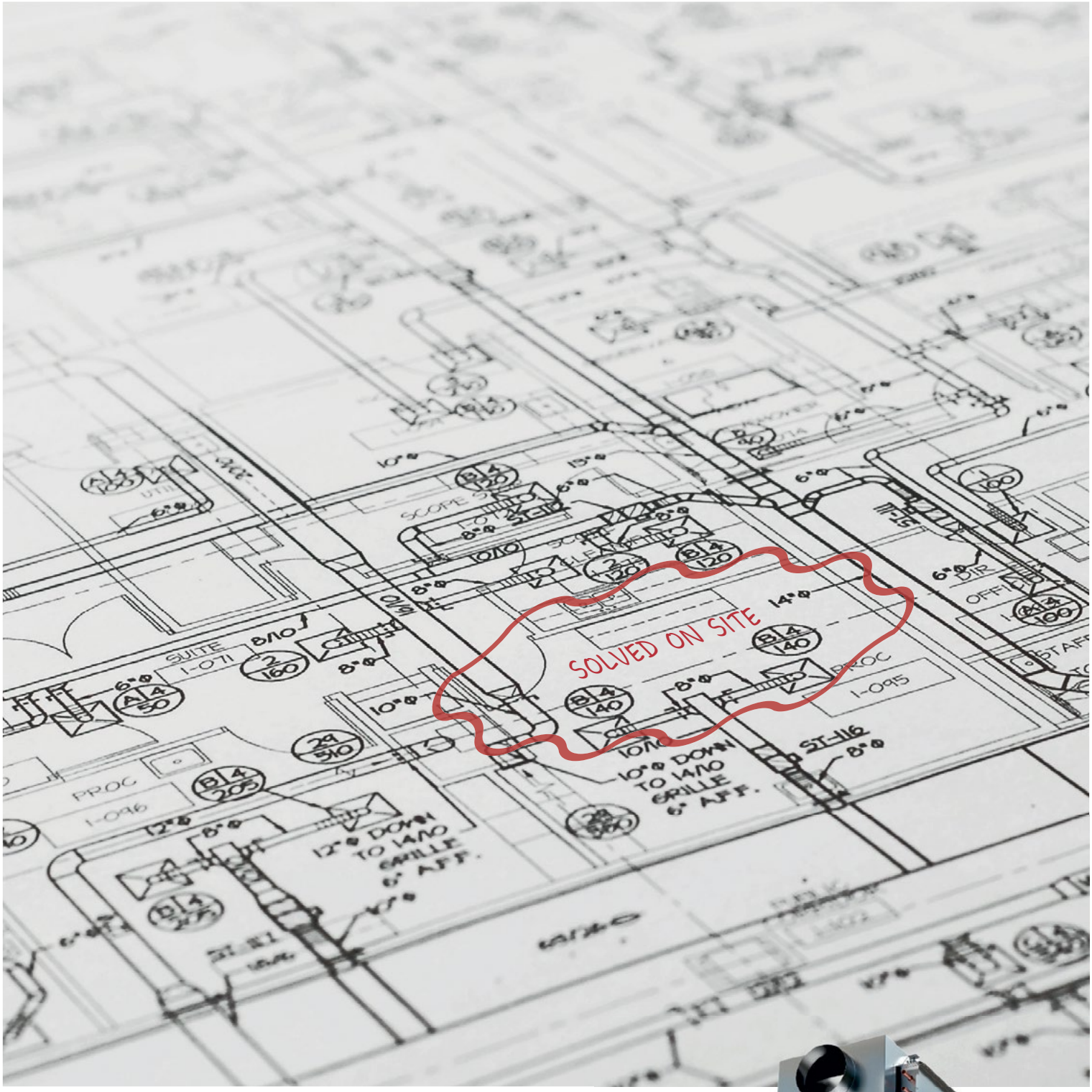
ENABLING CHANGE

CIBSE President Fiona Cousins challenges engineers to rethink building performance

HEAT PUMP IN A BOX SLASHES CONSTRUCTION-SITE CARBON

ALIGNING FIRE SAFETY WITH EMBODIED CARBON GOALS

ROUNDTABLE: STAYING ON TRACK FOR NET ZERO 2050



High performance 4-way distribution comfort module with cooling, heating and ventilation. PARASOL Zenith offers all the benefits of active chilled beam technology with added flexibility throughout your project. With the options of constant, variable or demand control air flow, PARASOL Zenith provides the optimal indoor climate.

PARASOL Zenith

Swegon

Editorial
Editor: Alex Smith
Tel: 01223 378034
Email: asmith@cibsejournal.com
Tel: 01223 378048
Technical editor: Tim Dwyer
Reporter: Molly Tooher-Rudd
Designer: James Baldwin

CIBSE Journal is written and produced by CPL One
Tel: +44 (0)1223 378000.
www.cplone.co.uk
1 Cambridge Technopark, Newmarket Road,
Cambridge CB5 8PB.
Editorial copy deadline: First day of the month preceding the publication month

Advertisement sales
Display and sponsorship Jim Folley
jim.folley@redactive.co.uk
Tel: +44 (0) 20 7324 2786
Products & services Daniel Goodwin
daniel.goodwin@redactive.co.uk
Tel: +44 (0) 20 7880 6217
Recruitment advertising
cibsejournaljobs@redactive.co.uk
Tel: +44 (0) 20 7880 6215
Advertising production Jane Easterman
jane.easterman@redactive.co.uk
Tel: +44 (0) 20 7880 6248

Inspiring and aspiring

A new government may have been voted in by the British electorate but the central challenge facing the construction industry and building services engineers will remain. Namely, how to decarbonise the built environment to ensure the UK reaches its net zero targets by 2050.

One thing the new Labour government could do for industry to achieve this ambition: provide more certainty and direction. In our roundtable this month, sponsored by Whitecode Consulting (page 26), participants called for more support for the green-collar skills and electrical infrastructure necessary to decarbonise our buildings. We'll be watching Labour closely in the next few months to see how their green energy strategy takes shape.

Last month, CIBSE's new President, Fiona Cousins, gave us an important reminder: building services engineers should not only be focused on cutting carbon and costs when designing their buildings. In her Presidential address, she called on Members to take a much more holistic view of building design that considered the wider impacts on society and the environment.

A new white paper – *Building Performance Reimagined* – has been published by CIBSE, which aims to support engineers and the wider industry in understanding the challenges facing society. Cousins says she has taken an 'outside in' approach by inviting people from a wide range of sectors to look at possible future scenarios and consider what the implications are for building services engineers.

The authors came up with four key themes that would affect performance in 2050: variety, readiness, connectedness, and emergence. The white paper explains what this would mean for engineers and other building stakeholders.

Variety – for example – may mean ensuring that buildings are multifunctional, biophilic and highly personalised, while readiness suggests buildings that offer physical refuges, are digitally secure and are able to manage people's risk.

Cousins is keen for CIBSE to use the white paper to frame its future strategy and ensure it is prepared for the future scenarios, however uncertain change may be. 'The "ready, aim" phase of a project is really important to ensure we are on target, and to drive the change we need to get ahead of the world around us,' said Cousins in her address. 'We need to be inspirational and aspirational – and never dogmatic – as change is constant.' To accept the new President's challenge to the engineering mindset, download *Building Performance Reimagined* at www.cibse.org

The *CIBSE Journal* is taking a summer break and will be back in September to look at how the new government's policies are shaping our industry.

ALEX SMITH, EDITOR asmith@cibsejournal.com

CONTRIBUTORS

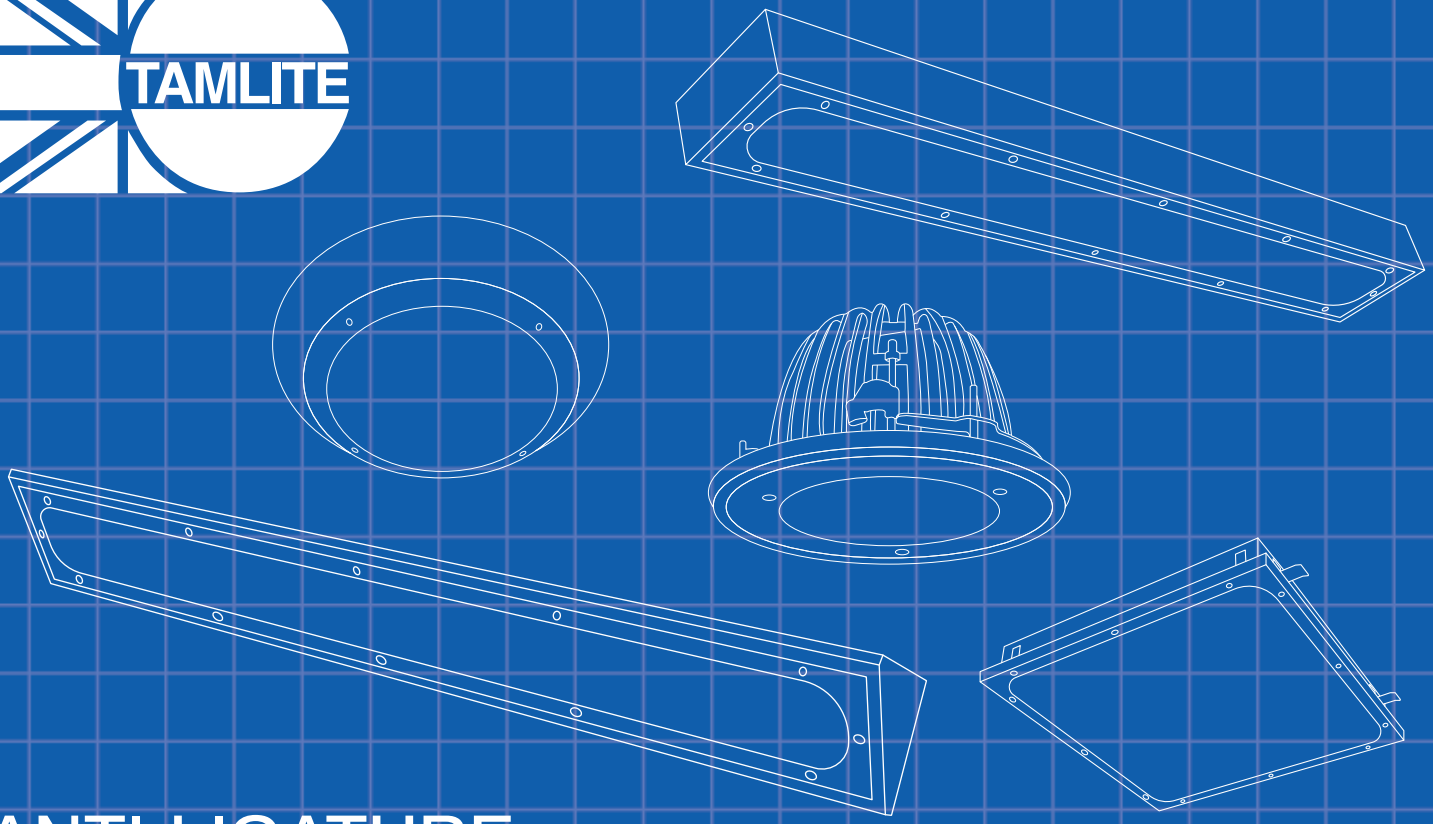
Julie Godefroy
Why mirroring CIBSE's Climate Action Plan will help organisations tackle the climate emergency

Anastasia Mylona
CIBSE's technical director responds to Fiona Cousins' call to reimagine building performance

Rebecca Sweeney
How research showed that heat pumps are viable for all UK property types and architectural eras

Tim Dwyer
This month's CPD is on robust sensing and control of airflow in commercial ventilation systems

TAMLITE®



ANTI-LIGATURE

SECURE RANGE

The SECURE RANGE by Tamlite Lighting.
This line of anti-ligature lighting fixtures are specifically designed and manufactured to resist vandalism and tampering, making them ideal for secure healthcare and high-risk facilities.

Discover the benefits offered by the Tamlite SECURE RANGE and download our comprehensive brochure to gain in-depth knowledge about the SECURE RANGE now

CONTENTS

CIBSE JOURNAL

www.cibsejournal.com

The official magazine of the Chartered Institution of Building Services Engineers

SOCIAL MEDIA

@CIBSEJournal

CIBSE LinkedIn

CIBSE Journal newsletter

www.cibse.org

FOR CIBSE

Journal production manager: Nicola Hurley
Tel: +44 (0)208 772 3697, **nhurley@cibse.org**

CIBSE, 222 Balham High Road,
London SW12 9BS
Tel: +44 (0)208 675 5211

 ISSN 1759-846X

SUBSCRIPTION ENQUIRIES

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

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

Subscription records are maintained at CIBSE, 222 Balham High Road, London, SW12 9BS, UK.

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

CREDITS

p07 Getty images / Justin Tallis
p24-25 Credit / © architecture VenhoevenCS & Ateliers 2/3/4/, photo: Salem Mostefaoui
P47 iStock.com / Panya_
P50 iStock.com / Dima Berlin
P55 iStock.com / Jaminwell
P62 iStock.com / Intpro

ABC audited circulation:
18,351 January to December 2023
Printed by: Warners Midlands PLC

More women leaving engineering between ages of 35 and 44

An increase in the number of women leaving engineering between the ages of 35 and 44 has contributed to a 'small but significant' reduction in the number of females in the engineering and technology workforce over the past year.

According to new data by EngineeringUK, women made up only 15.7% of the workforce, compared with 16.5% the previous year. The fall for women aged 35 to 44 is consistent with Engineering Council registration data, which shows that 43 is the average age at which females leave the profession, compared with 60 for men.

The results, published last month, have led to a call to action to reverse the worrying spike in women exiting the industry. EngineeringUK chief executive Hilary Leevers said it is taking this 'small but significant decline very seriously'.

Jessica Glynn, chair of the Women in Building Services Engineering panel for CIBSE, said it is 'crucial to think about ways we can support women more, and ask how can we make industry as inclusive as possible.'

Fiona Cousins takes over as CIBSE President

Arup regional chair urges members to 'reimagine' building performance

New CIBSE President Fiona Cousins FCIBSE wants members of the Institution to develop the traditional view of building performance by putting more emphasis on occupant wellbeing, air quality, acoustic performance, and resilience to climate change.

Cousins, who has taken over the presidency from Adrian Catchpole, said: 'Much of the work of building services engineers has been very sharply focused on energy use, where the relationship with climate change has long been clear. It's time to broaden that view to put more emphasis on other things.

'We spend most of our lives indoors, and buildings can support our wellbeing through air quality, acoustic performance, lighting design, or environments that support biophilia.'

Cousins has held several senior roles at Arup and is currently chair of the company's Americas Region, which includes more than 2,000 members across 16 offices.

In this role, she has contributed to critical climate legislation and held advisory positions, including on the advisory board for Local Law 97. This requires, from this year onwards, that large buildings in New York City meet progressively more demanding energy efficiency targets.

As Arup's Americas chair, Cousins has led numerous award-winning projects and been recognised as a leading figure in the commercial real estate industry, said CIBSE.

Having taken over the presidency from Catchpole, Cousins praised his efforts to promote STEM Ambassadors in schools and said certified practice initiatives will continue to be a priority for CIBSE under her leadership.

She extended 'heartfelt' thanks for Catchpole's 'significant contributions'.

Sir Kier Starmer delivers his victory speech in North London

Labour returns to power after 14 years

Party manifesto pledges an extra £6.6bn in energy-efficiency measures

The Labour Party has been elected to form the next UK government after promising to double investment in domestic energy efficiency.

The party, led by Sir Kier Starmer, swept into power with a huge parliamentary majority.

In the party's manifesto, published last month, Labour said it will invest an extra £6.6bn over the next parliament in energy-efficiency measures. This would double existing planned government investment, enabling five million homes to be upgraded.

The manifesto says that Labour will ensure private rented-sector homes meet 'minimum' energy-efficiency standards by 2030, which it claims would save tenants 'hundreds of pounds per year'. It also pledges that 'nobody will be forced to rip out their boiler as a result of our plans'.

The manifesto says the government will work with councils and devolved administrations to roll out its Warm Homes Plan, offering grants and low-interest loans to support investment in insulation and other improvements, such as solar panels, batteries and low carbon heating. The Labour Party manifesto also includes pledges to double onshore wind, triple solar power, and quadruple offshore wind by 2030.

In a bid to allay concerns that the 2030 push for a decarbonised Grid will imperil the UK's energy security of supply, the manifesto says the government will maintain a strategic reserve of gas power stations.

It also says Labour will extend the lifetime of the UK's existing fleet of nuclear plants – most of which are due to shut down during the upcoming Parliament – to ensure the sector's 'long-term security'.

Ed Matthew, campaigns director at climate and energy think tank E3G, said Labour's manifesto will 'kick-start a mission for energy independence and economic renewal, with net zero investment at its heart'.

'Labour has recognised that upgrading our homes will be key, and we welcome the investment boost and reinstatement of higher efficiency standards in the private rented sector. This manifesto gives hope that the UK's leadership in tackling the climate crisis will finally be restored.'

Heat pump installers charge £70/hour

Heat pump installation is the most sought-after green-collar construction skill across most UK regions, according to a new Turner & Townsend (T&T) report.

The consultancy's 2024 *International construction market survey*, published last month, says that heat pump installers are 'especially in demand' on the back of a pick-up in government-funded residential retrofitting programmes.

The report also says that heat pump installation is 'the most sought-after green skill in construction across the majority of UK regions'. In addition, green-collar operatives – which also include insulation and solar installers – are the highest-paid group of construction workers in the majority of regional cities surveyed by T&T.

In London, green-collar installers are paid around £70 per hour, which is more than site foremen, and two and a half times the £28 per hour that general labourers can command.

The report also says that UK construction faces an 'escalating capacity crunch', with real-estate development drawing on the same pool as major infrastructure programmes in clean energy.

IN BRIEF

Landmark court decision threatens oil and gas extraction

A landmark decision by the UK Supreme Court put the future oil and gas extraction in the UK in jeopardy.

The Supreme Court has ruled Surrey County Council should have considered the full climate impact of burning oil from new wells.

Judges ruled that the council should have considered the downstream emissions of the oil wells at Horse Hill in Surrey, when it gave the project planning permission in 2019.

Under planning law the assumption has always been that only the impacts from constructing the wells and not the use of the final oil products should be considered.

The case was brought by Sarah Finch, on behalf of campaigners.

Edinburgh residents face 450% heat network bill increase

Residents of an Edinburgh housing estate, served by a district heating system, face a 450% increase in their bills from August, the BBC has reported. Places For People Scotland has told residents on the 180-property Harvesters Way development that their heating and hot-water tariff will go up dramatically from 1 August. The homes are all connected to a district heating system, which uses a gas boiler. The housing association said the new heat tariff was procured at the end of last year and reflected the market conditions at the time.

Octopus Energy launches installation partnership

A nationwide partnership programme with installers of heat pumps and other clean technologies has been launched by Octopus Energy. Greg Jackson, the company's founder, announced the 'Octopus Trusted Partners' programme at the InstallerSHOW 2024, in Birmingham on 27 June. Octopus installs its own heat pumps, but under the partnership programme customers will be referred to trusted and verified local installers if the supplier lacks capacity to do the job. Octopus's primary partner is Heat Geek, which has more than 2,000 independent installers on its platform.

IN BRIEF

AI behind 48% jump in greenhouse gas emissions at Google

Google's greenhouse gas emissions in 2023 were 48% higher than in 2019, according to its 2024 *Environmental Report*, with the increase attributed to the rapid growth of artificial intelligence (AI). The report, published on 3 July, says the tech giant's target to reach net zero emissions by 2030 may be challenging because of increasing energy demands from electricity-hungry AI computing. It says that most of its data centres in Europe and the Americas get the majority of their energy from carbon-free sources, but those in the Middle East, Asia and Australia use far less carbon-free energy.

Major partnership aims to recover heat from data centres

Hewlett Packard Enterprise (HPE) and Danfoss have joined forces to help data centres manage and recover excess heat. Their Data Center Heat Recovery offers a combination of HPE's off-the-shelf modular data centres and the Danish manufacturer's solutions, including its heat-reuse modules. These capture excess heat from data centres to provide renewable heating on site and to neighbouring buildings and industries. According to the International Energy Agency, the artificial intelligence industry is expected to consume at least 10 times its 2023 level of electricity demand by 2026.

Good indoor air should be basic human right

Access to good-quality indoor air should be enshrined as a basic human right by the European Union, industry bodies have urged.

As the new five-yearly mandates of the European Parliament and Commission start, organisations have highlighted the critical importance of indoor air quality (IAQ) in a new manifesto.

The document, published last month, calls for greater political attention and legislative action to ensure IAQ receives recognition and resources. It outlines how IAQ could be integrated into the European policy framework to ensure that future policies prioritise the health and comfort of people living and working in Europe's buildings.

Extreme heat 35 times more likely with climate change

Weather records broken around the world despite cool start to summer in Europe

Man-made climate change made the extreme heatwave that hit the United States and central America in June 35 times more likely, according to a new academic analysis.

In the past month there have been heatwaves across the northern hemisphere. During the first half of June, more than 1,200 daytime and nearly 1,800 night-time high-temperature records were tied or broken in the United States, according to the National Centers for Environmental Information.

The maximum temperature hit 52°C on 13 June, in Mexico, a record for the month in the country.

The maximum temperatures seen in May and June are four times more likely than they were in 2000, according to an analysis carried out by the World Weather Attribution global network of climate scientists.

Human-induced warming from burning fossil fuels made the maximum daytime temperaturein June about 1.4°C hotter and 35 times more likely, the network has calculated.

Extreme heatwaves have also been experienced in other parts of the world, including India and Pakistan.

Parts of northern India, including Delhi, recorded maximum temperatures of around 44-45°C for several weeks.

Widespread use of cooling appliances, such as air conditioners, has led to electricity consumption soaring to record levels, prompting a spate of power cuts in the country's capital.

The Caribbean, meanwhile, has had the earliest category-five Atlantic hurricane since records began around a century ago.

Exceptionally high sea-surface temperatures in the Atlantic are believed to be a key reason why Hurricane Beryl has been so powerful.

Islands across the region have experienced maximum sustained wind speeds of more than 160mph (257km/h).

CIBSE and BESA form alliance to deal with AI and building safety

Partnership will also collaborate on IAQ, retrofitting and heat networks


Ruth Carter and David Frise

CIBSE and the Building Engineering Services Association (BESA) have agreed to work together on joint projects as part of a new alliance between the organisations.

The alliance will focus on delivery of the Building Safety Act, indoor air quality, retrofitting the UK's existing building stock and the growth in heat networks.

BESA and CIBSE will also work together to understand the implications of artificial intelligence (AI) for the industry and its potential to improve productivity. In addition, they will provide more support for each other's key events, including conferences, seminars and awards, while continuing to collaborate on technical guidance.

CIBSE chief executive Ruth Carter said: 'The building services industry is in greater demand than ever before as it increasingly accounts for a much larger proportion of the value of construction and facilities management projects. Supply chains must be more closely aligned and the different professions more joined up to deliver the higher levels of digital sophistication and integrated design necessary to meet growing client demand and legislative scrutiny.'

BESA chief executive officer David Frise said: 'The sheer scale of the technical, legislative and recruitment challenges now facing the industry calls for a concerted and joined-up approach on behalf of the whole sector.'

The relationship between the two organisations dates back to BESA's foundation in 1904 by a group of leading engineers, many of whom were already members of the Institution of Heating and Ventilating Engineers, which became CIBSE in 1976.

SAMSUNG
Climate Solutions

Say hello to our new Heat Pump featuring R290

Discover our new home solution

Meet Samsung's newest editions to its EHS heat pump line-up: the EHS Mono R290 and EHS Mono R290 Pump. A heating solution for residential homes. Available in a broad range of capacities -5, 8, 12, and 16 kW-, the heat pump uses R290: a refrigerant with a much lower GWP (only 3) compared to other refrigerants. It consistently provides hot water of up to 75°C* for domestic heating purposes. This can make it a suitable heating system replacement in older residential spaces. It boasts a reliable heating performance due to its larger heat transfer area, enabling it to deliver a 100% heating performance in temperatures as low as -10°C**. Furthermore, EHS Mono R290 Pump has hydraulics components, like the pump and expansion tank, included in the outdoor unit. This reduces installation time and requires less indoor space.

*Leaving water temperature when the outdoor temperature is -10~35°C. Results may vary depending on the actual usage conditions. ** Domestic hot water (DHW) leaving the DHW tank is 70°C when the outdoor temperature is -10~43°C. If the outdoor temperature is lower than -10°C, a booster heater is required. Results may vary depending on the actual usage conditions.

samsung-climatesolutions.com

Half of housebuilders not ready for Future Homes Standard

New research has revealed that almost half (49%) of housebuilders are unprepared for the introduction of the Future Homes Standard (FHS).

Designed to cut CO_2 emissions from new homes by 75-80% compared with existing standards, the FHS is due to come into force next year.

However, the study – commissioned by Polypipe Building Products – says that the FHS is not viable in the current environment.

Almost three-fifths (57%) of housebuilders say the FHS will be a barrier to future housing delivery, and 61% think it will be extremely challenging to meet new regulations encompassed by the standard. Just less than two-thirds (65%) feel that more government support is required to meet these regulations.

Hayley Hayes, head of specification at Polypipe, said the FHS is a 'significant and welcome step towards achieving net zero', but will only be effective if housebuilders are equipped to implement it 'properly'.

Consider local exhaust ventilation when cutting worktops

New guidance has been issued to help cut rates of aggressive silicosis among those working with stone kitchen worktops.

The British Occupational Hygiene Society, the UK's chartered body for workplace health protection, has published the guidance after a cluster of 30- to 40-year-old kitchen worktop finishers contracted the disease by inhaling tiny particles of silica, created when stone is cut, ground or polished.

The guide advises the use of local exhaust ventilation as a control method if water suppression is not practical.

Aggressive silicosis can lead to the need for urgent surgery, including heart and lung transplants.

Clara Bagenal George was named CIBSE Building Performance Engineer of the Year in 2019

Founder of LETI is made an MBE in King's Birthday Honours

Bagenal George recognised for significant contributions to the built environment

Founder of the London Energy Transformation Initiative (LETI) Clara Bagenal George MCIBSE has been made an MBE in this year's King's Birthday Honours.

Bagenal George, who is a CIBSE member and a chartered engineer, received the honour for her significant contributions to the built environment and climate change.

In May 2017, she launched LETI, which has brought together more than 1,000 built environment professionals to drive London towards zero carbon. The voluntary group includes developers, engineers, architects, planners, academics, sustainability professionals, contractors and facilities managers.

Bagenal George also serves as a CIBSE Stem Ambassador and contributes to the CIBSE Knowledge Generation Panel.

In addition, she is a technical adviser to Homes England, a Greater London Authority design advocate for good growth, and part of the core team developing the UK Net Zero Carbon Buildings Standard.

At Elementa, where she worked for nearly 10 years until joining Etude in April, Bagenal George established a Women in Engineering group, displaying a commitment to diversity and equality in the industry, said CIBSE.

In 2019, she was named CIBSE Building Performance Engineer of the Year for her leadership in mechanical, environmental analysis and sustainability consulting projects at Elementa Consulting.

Bagenal George, who has a MEng in architecture and environmental design from the University of Nottingham, was part of the team of authors on LETI's *Climate Emergency Design Guide*, the CIBSE TM65 embodied carbon of building services series, and the second edition of RICS' *Whole life carbon assessment for the built environment*.

COMPLETE

ENERGY EFFICIENT SOLUTIONS FOR ANY VALVE REQUIREMENT

For more than a century we have designed market leading solutions. Our variable flow valves, with outstanding hysteresis performance, can help reduce energy consumption by up to 27% based on a 10% improvement in the controlled flow rate.
So, why not take comfort in our efficiencies.

Find out more at Cranefs.com/solutions

CRANE FLUID SYSTEMS

IN BRIEF

BPA entry deadline is next month

Entries for the 2025 CIBSE Building Performance Awards (BPAs) 2025 must be received by 30 August.

There are 11 categories and more than 20 awards, including the new Client of the Year and Leadership accolades.

The BPAs recognise the people, products and projects that demonstrate engineering excellence in the built environment.

Entries are open to any organisation or individual, within the UK and internationally, that is responsible for the design, commissioning, construction, installation or operation of low energy and high-performance buildings. Manufacturers whose products enable efficient energy consumption or other building performance outcomes can also enter.

For more information and to enter, visit: **www.cibse.org/bpa**

CIBSE Canada's LinkedIn Group

A new networking group has been established in Canada to be a focal point for CIBSE members and like-minded professionals.

The CIBSE Canada LinkedIn Group aims to connect engineers in the country and those thinking of moving there. Visit **www.linkedin.com/groups/9848171** or search for CIBSE Canada to get involved

Year-round application process

CIBSE membership and professional registration applications are now being accepted year-round,

Previously, applicants had to work to two deadlines – 1 August and 1 February – but they can now submit their application for Associate (ACIBSE), Member (MCIBSE) or Fellow (FCIBSE) at any time of the year.

The process aims to issue the result of professional applications within approximately four months of submission.

To find out more, visit **go.cibse.org/app-timeline-journal**

Presidential baton handed on to Cousins

Adrian Catchpole steps down from role, as new CIBSE officers revealed

From top, left to right: Ted Pilbeam, Les Copeland, Adrian Catchpole, Vincent Ma, Ruth Kelly Waskett, David Stevens, Mike Burton, Laura Mansel-Thomas, Fiona Cousins and Mark Walker

At CIBSE's AGM on 10 June, Fiona Cousins FCIBSE took office as the Institution's new President, taking over from Adrian Catchpole FCIBSE.

In her Presidential Address, titled 'Building Performance Reimagined', Cousins launched a new report commissioned by CIBSE and researched by Arup. This outlines four core performance themes that relate directly to the changing values of our society and possible features of future buildings, as well as innovative ways to meet future needs (see interview, page 20).

Vince Arnold FCIBSE was welcomed as President-Elect, and the new CIBSE officers and Board members include:

- Immediate past-president: **Adrian Catchpole FCIBSE**
- Vice-president: **Mike Burton FCIBSE**
- Vice-president: **David Cooper FCIBSE**
- Vice-president: **David Stevens FCIBSE**
- Hon treasurer: **Les Copeland FCIBSE**
- Board members: **Lionel James MCIBSE**, **Ruth Kelly Waskett FSLL**, **Vincent Ma FCIBSE**, **Ted Pilbeam FCIBSE**, and **Mark Walker FCIBSE**

Further details can be found by visiting **www.cibse.org/board**

New game aims to flush out engineers of the future

Children take part in the Flush Challenge

An innovative game for nine to 11-year-olds, designed to engage pupils in building services engineering, has been launched by CIBSE.

The Flush Challenge is part of the Institution's commitment to nurture the next generation of engineers and address the industry's skills gap. Part-sponsored by CIBSE Patrons, the game will be available for CIBSE STEM Ambassadors to use during their educational outreach activities at schools.

It aims to spark interest and curiosity about building services engineering by challenging teams to assemble a functional system that uses water efficiently to flush a raisin down a 3D-printed model toilet using lengths of pipe.

This challenge introduces children to the fundamental concepts of services engineering, and encourages them to consider the importance of water conservation and environmental responsibility.

Dan Costelloe, CIBSE chair of the Talent Pipeline and Apprenticeships Panel, said: 'We wanted an activity that would combine building services engineering, sustainability and teamwork. By making learning fun and interactive, we can capture the imagination of young people and show them the exciting possibilities within building services engineering – maybe even inspiring some of them to become our engineers of the future.'

For more information, visit **www.cibse.org/flush-challenge**

CIBSE sells head office in South London

Institution plans to move to new premises before Christmas

CIBSE is a step closer to having a new head office in central London after selling its current premises at 222 Balham High Road, in South London.

The Institution has negotiated a peppercorn rent on Delta House for the next nine months and plans to move out by Christmas.

Ahead of the move, CIBSE is working diligently to store and preserve its library and other valuable legacy items.

The Engineering Centre at Balham is decommissioned, and training is now online or in meeting rooms at Delta House or elsewhere. CIBSE has pledged to meet the increased demand for training in 2024.

Significant work has already been done on gathering data from CIBSE's Special Interest Groups to steer plans for optimal building performance at the new premises. A design team has been appointed to use this research and create a building of which 'members would be proud', said CIBSE

Fundraising has also been initiated. CIBSE's said its financial position and reserves are very healthy, but it doesn't want the office move to impact its big ambitions for the Institution and its members.

CIBSE is actively looking for a new head office and has engaged a company to investigate potential new premises. It said the sale of the Balham office has put it in a strong position to negotiate for premises.

CIBSE chief executive Ruth Carter is positive about the relocation: 'The move is the next big milestone for CIBSE. We have ambitious plans as a leading global institution – our accessibility, reach and voice will support us in continuing our positive growth trajectory.'

- **CIBSE will be keeping members updated on the move, and further details will be published in the *CIBSE Journal.***

Commissioning Code A out now

CIBSE has published new guidance for commissioning ventilation and ductwork systems. *Commissioning Code A: Air distribution systems* should be read alongside CIBSE's *Commissioning Code M: Commissioning management* and additional guidance from BSRIA and the CSA, which offer detailed implementation instructions.

Effective commissioning of buildings requires specialised skills and knowledge, as well as early involvement in the project life-cycle to influence key construction decisions. Combined with good maintenance practices, it ensures a safe, high-quality, comfortable, and energy-efficient internal environment for building occupants. It also plays a crucial role in reducing carbon footprints during the construction phase and operation of buildings.

CIBSE thanks the guide's sponsors: Ashford Environmental Services, Atomic Weapons Establishment, CxAlloy, Sutton Services International, and Taylor & Stapleton. *Commissioning Code A* is available on the CIBSE Knowledge Portal **www.cibse.org/knowledge**

- **A webinar introducing Code A is taking place on 21 August. For more information and to register, visit moredetails.uk/CodeAWebinar**

Competence scheme for management system specialists

CIBSE Certification has launched a new scheme to assess the competency of individuals offering management system specialist services.

The Management System Specialist scheme certifies individuals against a list of competency requirements. They can then be placed on a register, enabling organisations to find and connect with them.

All competent persons must maintain appropriate insurance, adhere to the CIBSE Certification code of conduct, and undertake appropriate continuing professional development.

CIBSE has run accredited schemes for the Energy Savings Opportunity Scheme, Low Carbon Consultants, Display Energy Certificates, and Energy Performance Certificates since 2007, and offers management system certification to ISO 9001, 14001, 45001, and 50001.

CIBSE is aware of the common challenges facing organisations operating in this sector and is keen to offer support. The ongoing focus on decarbonisation, net zero and the Building Safety Act has put pressure on many organisations to have effective management systems in place.

They also face challenges with increasing costs, skills shortages, frameworks to manage competency of staff and suppliers, and increasing customer expectations. Optimisation of processes and systems is taking centre stage, and selection of specialists is essential to achieving efficient, effective and conforming systems and operations.

For more information on joining the register, visit: **moredetails.uk/ManagementSystemSpecialist**

To find a competent supplier, visit: **moredetails.uk/AssessorList**

Young public health engineers celebrated

The high standards of young engineers specialising in public health were showcased in the annual Society of Public Health Engineers (SoPHE) Plumbing Competition in June.

Organised by SoPHE's Centre of Excellence and Young Engineers Network, in collaboration with United Colleges Group, the competition aims to bridge the gap in students' learning from domestic to commercial installations. SoPHE's young engineers compete against college students in plumbing problem solving, hand skills, and practical fault-finding of installations.

The event is supported by SoPHE Industrial Associates, which provides tasks and materials for use.

The winners will be announced at the SoPHE London Dinner in November.

Broaden your horizons in a Society, Region or Group

CIBSE networks cover a broad range of specialisms all over the world

CIBSE's Special Interest Groups, Regions and Societies, collectively known as the CIBSE networks, offer a wealth of expertise and knowledge. The vast range of specialisms they cover provides a huge volume of additional resources, events and opportunities to tap into.

If you have not yet taken advantage of these – or attended any of the hundreds of online and in-person events hosted across the network – you are missing out on a rich pool of knowledge and the chance to expand your professional network and develop skills.

The hard work and dedication of the network volunteers cannot be overstated; they are, for many members, the face of CIBSE. Their desire to give back to the industry and help develop the next generation of engineers is appreciated by CIBSE staff and members.

Special Interest Groups

The 18 Special Interest Groups (SIGs) cover everything from daylight to healthcare, to lifts and natural ventilation. They have a combined membership of more than 40,000 people, and host many CPD events throughout the year. SIGs are free to join and open to CIBSE members and non-members – simply update your preferences in your MyCIBSE account.

SIG committees organise and host in-person events across the UK, while international members can join in discussions via the many online events. The additional activities of each SIG varies depending on the needs of the group members – some host annual lectures, some organise awards, and others focus on policy and updating knowledge publications.

Regions

The 20 volunteer-led Regions seek to connect, inform and inspire our members and the wider communities in which they work and live. In 2023, they organised more than 245 events.

There are 16 UK Regions and four international ones: Republic of Ireland, Australia and New Zealand, Hong Kong, and United Arab Emirates.

They engage with members and aim to improve the understanding of building services engineering among other professions and society in general. They arrange activities to promote building services engineering, provide networking opportunities for local members and support those looking to become professionally registered.

Members of the Society of Façade Engineering at Battersea Power Station

"All the CIBSE SIGs, Regions and Groups are run by an incredible network of volunteers"

As a CIBSE member, you are automatically enrolled into a Region, which gives you access to local events and networking opportunities, and enables you to meet other CIBSE members local to you.

Divisions/Societies

Key engineering specialisms are represented within CIBSE by Divisions, also known as Societies. These offer professional recognition to their members and support the art, science and practice of engineering within their field.

There are currently five Divisions: the Society of Light and Lighting (SLL); the Society of Façade Engineering (SFE); the Society of Public Health Engineers (SoPHE); the Society of Digital Engineering (SDE); and CIBSE Patrons. They have a combined membership of almost 7,000, and more than 180 company members and partners.

You can achieve professional chartered status with SLL, SFE and SoPHE, and the SDE is finalising its new professional grades, which will launch later this year.

CIBSE Patrons are often referred to as the 'corporate supporters' of CIBSE. They are a group of businesses that collaborate to give financial, technical and moral backing to a wide range of initiatives led by the Institution, and are open for membership from interested companies.

Get involved

All the CIBSE Societies, Regions and Groups are run by an incredible network of volunteers who are integral to CIBSE. Get in touch with your region, or visit the volunteer pages (**www.cibse.org/get-involved/volunteering**), to find out more about the opportunities available.

SIMPLY BEST IN CLASS

We manufacture in the UK a range of safety and pressure relief valves in gunmetal and stainless steel suitable for a wide variety of fluids including steam, hot water and air.

NABIC valves are ideal for vented and unvented heating systems, hot water and steam boilers, compressed air systems, pump relief and bypass.

Available online for next day delivery.

NABIC®

Buy online at nabicvalves.com

NABIC 5 YEAR WARRANTY

OUR GENIUS IS SAFETY VALVES

DRAFT MINUTES FOR CIBSE ANNUAL GENERAL MEETING 2024

The Annual General Meeting (AGM) of CIBSE was held on 10 June 2024 and was conducted as a hybrid model, with participants both in-person and online via Teams. Adrian Catchpole, CIBSE President 2023-24, chaired the meeting.

Chief Executive Ruth Carter read the Notice of Order convening the meeting and Adrian Catchpole then outlined the Agenda, and the Minutes of the AGM held on 13 June 2023 were accepted as a correct record of the Meeting. There were no Matters Arising.

ANNUAL REPORT

Adrian Catchpole introduced the Annual Report for 2023, pointing out that it reflected the impressive efforts of staff and volunteers in making CIBSE the global brand that it is today. The Report illustrates CIBSE's achievements in delivering an increased membership with a global voice, with greater investment in products and services than ever before.

Stating that his core message as President had been for engineers to show leadership, commitment to improvement, and specifically for CIBSE to make progress in helping to demonstrate competence, find new industry entrants, and deliver on its Net Zero Carbon agenda, he then detailed the highlights of the past year, including:

- CIBSE's impact at COP28, where he had addressed no fewer than five separate sessions on embodied carbon and climate resilience.
- Collaboration: CIBSE collaborates with more than 50 organisations around the world, including the USA, Middle East, Hong Kong, Ireland, Australia and New Zealand. Key themes range from building safety to climate change, air quality to embodied carbon.
- Continued focus and work on the UK Net Zero Carbon Buildings Standard: developing a standard to enable industry to robustly demonstrate that its built assets are truly net zero.
- CIBSE leadership of the Building Safety workstream for Actuate UK, pro-active participation in the Construction Industry Council (CIC) and Construction Leadership Council (CLC), Climate Change Committee and other government advisory committees.
- CIBSE and Nabers announcing in March a new strategic partnership, with CIBSE taking over as scheme administrator for Nabers UK.
- In 2023, the Building Safety Act enhanced the requirement to demonstrate competence, and the launch of CIBSE's new Chartered Organisation scheme now enables organisations to achieve Chartered status, show their commitment to engineering best practice, and to demonstrate their professionalism. CIBSE was also one of the first to be authorised to provide members with the assessments needed to join the Higher Risk Buildings (HRB) Register.

Adrian Catchpole then outlined key statistics and figures for 2023:

- CIBSE Training grew to almost 1,200 attendees, with Building Safety Act courses in high demand; a 43% increase to 3,500 members now registered on the Learning Management System; and more than 50,000 have now registered for our Grow Your Knowledge webinars.
- Membership stood at 21,462 at the end of 2023, up 6%, and is now more than 23,000.
- CIBSE successfully passed its Engineering Council Audit for its licence to be renewed for a further five years.
- Strong growth in End Point Assessment saw us help 290 apprentices in 2023.
- CIBSE guidance remains at the heart of its services, and 22 new or updated Guides were produced – the fourth consecutive year in a row to deliver more than 20 – including a new Guide M (Maintenance Engineering and Management), and with Commissioning Codes A and W (Air, Water Distribution).
- Technical Symposium in Cardiff attracted 200+ delegates; Build2Perform saw more than 2,000 attendees, speakers and exhibitors; and the Building Performance Awards welcomed a record 800 guests. The SLL Young Lighter of the Year, SFE and SoPHE Awards, Young Engineer Awards, and the President's Awards recognised and celebrated the achievements and potential of engineers and engineering.
- *CIBSE Journal* continues to attract respect all over the world; the CIBSE website attracted nearly 600,000 users; we now have more than 74,000 followers across social media platforms; and our content on YouTube achieved more than 17,000 hours of viewing.
- CIBSE now has more than 1,000 volunteers across 20 UK and Overseas Regions, five Societies and 19 Specialist Interest Groups. Our Societies provide professional recognition, tailored engineering routes and first-class CPD. Our Regions, Groups and Societies held an impressive 402 events with 17,500 registrants – a great credit to their committees. And they have risen to the challenge of having 10 active STEM Ambassadors in each Region: there are now more than 200, with more than 300 STEM activities taking place. Our aim now is to further increase the number of Ambassadors, and to double their activities.

In conclusion, the President thanked CIBSE staff for their work and support for members, partners and the industry, and thanked CIBSE members for the trust and faith they had shown in him. He then invited questions:

- In response to a question, it was confirmed that CIBSE's Balham Premises had been sold and that CIBSE could, if necessary, continue to occupy Delta House for up to nine months at a peppercorn rent while looking for a new HQ building.
- Chris Jones asked when CIBSE's Governance would catch up with respect to the Chartered Organisations scheme, and suggested that members of the scheme should be called Partners. The President noted

his comment and advised that Governance, as a whole, would be addressed in the Honorary Treasurer's presentation. The Annual Report is available at **www.cibse.org/annualreport**

REPORT OF THE AUDITORS

Julia Poulter, from Crowe UK LLP, reported that CIBSE's audit had been conducted in accordance with international Auditing Standards and that she had signed the audit on 23 April 2024. She had issued an unqualified audit opinion, with no matters arising to be reported at the AGM.

The President thanked Julia Poulter for Crowe's work and introduced Vince Arnold, Honorary Treasurer, to present the Financial Statements for 2023.

FINANCIAL STATEMENTS

Vince Arnold summarised the information given in the Annual Report, noting the strong performance delivered in 2023:

- Group Income: total income £9.5m (up £1m), with growth in many of the income streams of CIBSE Services Ltd and CIBSE Certification Ltd; interest and dividends up by £128k; membership subscriptions up £549k; End Point Assessment for apprentices up by £300k; other charitable activities up by £214k, reflecting increased event activity.
- CIBSE Services Ltd: training growth of £125k, with Building Safety Act courses leading the way; *CIBSE Journal* down £38k, reflecting market conditions; Publications down £175k after the sales success of new Weather data in 2022; Building Performance Awards up £69k; Build2Perform up £86k; other events up £48k.
- CIBSE Certification Ltd: registrations up £22k; lodgement credits level year on year; information management systems up £59k. Overall, up £81k.
- Group expenditure: trading subsidiaries up £533k in order to deliver the additional income; membership up £787k, with increased regional, society and groups activities, and full staffing impacting salary line and overhead costs; Research slightly reduced by £8k; Premises project costs £66k at year end.
- Overall, achieved an operating surplus of £181k, with investments recovering to a gain of £205k The Pensions scheme suffered a loss of £386k because of the effects of the asset ceiling applied in the actuarial valuation. Total Surplus for 2023 is therefore £5k (against £273k in 2022) and Total Fund Balance is £3.29m.
- Balance Sheet: depreciation of property and equipment results in a decrease to fixed assets, down by £105k; investments are up by £205k; debtors up £846k, mostly the result of large end-of-year invoices (which were cleared in January). Cash down £385k, reflecting the debtors figure. Creditors up £551k, largely because of income increasing the advanced balance.
- Governance: a standing item on the Finance Risk Audit and Governance (FRAG) Committee Agenda, with Vice-President Dave Cooper on the Committee. Documentation and Version Control is being reviewed with Governance input; external GDPR and Data Protection consultant in place to ensure good practice and compliance; the rules for Societies, Regions and Groups will be reviewed and updated.

In conclusion, Vince Arnold summarised the results for 2023:

- Revenue increased by £1m and is now 25% up on pre-pandemic levels.
- Membership increased by 13%, with record numbers taking the route to Chartership through CIBSE.
- Increasing content for training and events reflects CIBSE's strong position in the sector, leading to increased investment in the Technical team resource and driving a record year for the provision of guidance.
- Significant progress has been made in the Premises relocation project.

Questions were invited and raised:

- Chris Jones asked if CIBSE had considered an independent governance review, to which the Honorary Treasurer responded that FRAG monitors governance closely and reports to the Board. However, an outside perspective might be advantageous and would be considered by the Board.
- Desiree Blamey, Finance Director, updated the Meeting on the CIBSE Defined Benefit Pension Scheme. Having conducted a review of its investment strategy, the Trustees have managed to secure a surplus and are therefore happy for CIBSE, as the employer of the scheme, to discontinue the ongoing contributions via the debt recovery plan.

AUDITORS

The Proposal put forward by Vince Arnold to appoint Crowe UK LLP as auditors for the financial year 2024 was passed unanimously.

SPECIAL RESOLUTION

The second Proposal put forward by Vince Arnold for the annual membership rates for the financial year 2025 was passed unanimously.

ANY OTHER BUSINESS

Adrian Catchpole paid tribute to the dedication, commitment and contribution to the development of CIBSE and the profession of departing Board Members Laura Mansel-Thomas and Kevin Mitchell, thanking them for their years of service. He then formally concluded the AGM.

BOARD AND COUNCIL FOR 2024-25

Ruth Carter announced the Officers, Board and Council Members for the forthcoming year.

Officers:
President: Fiona Cousins
President-elect: Vince Arnold
Honorary treasurer: Les Copeland
Immediate past president: Adrian Catchpole
Vice-presidents: Dave Cooper, David Stevens, Mike Burton
Continuing Board members: Lionel James, Ruth Kelly Waskett, Mark Walker
Newly elected Board members: Ted Pilbeam, Vincent Ma
Newly elected Council members: Jon Belfield, Jennifer Cox and Geraldine O'Farrell

Holding up a mirror

Creating a Climate Action Plan that mirrors CIBSE's will ensure that engineers and organisations are being proactive in taking on the climate emergency. Julie Godefroy is keen to hear your views ahead of the next update in the autumn

In 2019, CIBSE published its first Climate Action Plan to communicate what it does, identify gaps, and plan future work. The plan extends to all areas in which CIBSE can have an impact on the built environment through policy, education and practice, as well as its own activities. The plan is updated every year.

Below are some of the latest activities and commitments in the Climate Action Plan, which is available at **moredetails.uk/3LbcQIL**.

- **Our role as a professional institution** The CIBSE Code of Conduct states that members shall promote the principles of sustainability and seek to prevent avoidable adverse impacts on the environment and society. Further, CIBSE will collaborate with other organisations, including through the Construction Industry Council Climate Action Plan.
- **Practising what we preach** In July 2021, CIBSE moved its investment portfolio to an ethical investment fund; CIBSE's new offices will test the UK Net Zero Carbon Buildings Standard.
- **Events, dissemination and awards** CIBSE regularly reviews the criteria for Building Performance Awards, and places climate action at the heart of reporting in the *CIBSE Journal*, including a regular focus on the retrofit agenda.
- **Education** Guidance for CIBSE-accredited higher education degrees was updated in 2023, placing more emphasis in the curriculum on the climate emergency.
- **Training and professional development** As of 1 January 2024, all corporate members of CIBSE are required to complete at least one semi-structured continuing professional development (CPD) activity on sustainability and net zero, and provide reflection on each.
- **Policy** CIBSE has recently: responded to consultations on the Future Homes/Buildings Standards; supported Part Z; contributed to Chris Skidmore's *Mission retrofit* report; and continued advocacy for more policy attention to retrofit and to the actual performance of buildings.
- **Research** Recent examples include future weather files and research leading to TM65 guidance on embodied carbon
- **Guidance** Latest examples include: 2023 Guide M revision; updated guidance on heat pumps; and continued development of the TM65 series on embodied carbon. Over 2024/25, CIBSE will start a workstream on low carbon heat networks.

Mirror action plan

In the past few years, members have told us that they would like guidance on how to develop their own climate action plan, building on and complementing CIBSE's.

DR JULIE GODEFROY
is head of net zero policy at CIBSE

As a result, in last year's update we introduced a draft Mirror Climate Action Plan. This proposes actions and commitments that organisations and individuals could take to frame their climate action (see panel, below). It is currently open for comments before we finalise it in this year's update.

The Mirror Climate Action Plan was discussed at June's Decarbonisation Conference in London, and attendees' suggestions included:

- Retain both sides to the recommendations – ie, client engagement (points 1 and 2),and organisations' actions (points 3, 4 and 5)
- Keep the Mirror plan voluntary at this stage, but consider ways to incorporate it in other initiatives in the future – as part of the CIBSE Chartered Organisation requirements, for example
- Work with other professional institutions, so that similar actions are recommended across disciplines
- Recommend assessing and reporting business travel, as this is the largest direct impact on emissions for most engineering firms.
- Extend the recommendation for climate action CPD to all staff, not just technical employees
- Provide guidance and examples alongside recommended actions.

Call for comments

The Climate Action Plan and Mirror plan will be revised in the autumn. Send **comments by 15 August** to Julie Godefroy, CIBSE's head of net zero policy, at **JGodefroy@cibse.org**. Please send examples of your organisation's efforts, or climate action topics that you would like CIBSE to work on in the future.

- **The CIBSE Building Performance Awards are open for entries until 30 August. Visit www.cibse.org/bpa for more information**

DRAFT MIRROR CLIMATE ACTION PLAN: FOR INDIVIDUALS AND ORGANISATIONS

1. **Offer operational energy modelling, embodied carbon, and post-occupancy evaluation services on all projects.**
2. **Offer a net zero option to clients on all projects.**
3. **Ensure that all technical staff take CPD on climate action (net zero and climate adaptation) at least once a year.**
4. **Monitor and disclose the energy use of offices; set out a plan, with objectives for energy use and moving away from fossil fuels.**
5. **Contribute to industry efforts and knowledge. For example, give staff the opportunity to contribute to volunteer networks on climate action; disseminate lessons learned via industry events/publications/ public channels; give energy and carbon data to CIBSE and the Built Environment Carbon Database.**

Creating the heat pumps and the skills for net zero

Replacing gas boilers with heat pumps can play a key role in decarbonising commercial buildings as well as domestic properties, says Mitsubishi Electric's **Graham Temple**

To reach our legally binding net zero targets, the UK needs to be installing 600,000 heat pumps a year by 2028 – a target set by government. The current rate of installation is far less than 100,000 a year, so more must be done to match the growing number of heat pumps being specified on projects.

As the UK's largest heat pump manufacturer, Mitsubishi Electric's Livingston factory stands ready to match this demand as it starts to increase. Around 80% of the heat pumps currently manufactured in Scotland are sold into Europe, and these can be quickly diverted to the UK as demand grows, with space available for new production lines when needed.

A lot of the focus for heat pump installations is rightly on decarbonising the nation's homes, but we should also concentrate on the significant opportunities in the commercial sector, where heat pumps can also play an immediate role in decarbonising buildings.

For the businesses involved in these commercial buildings and the installers ready, willing and able to capitalise on the opportunity, as well as for the country's carbon-reduction programme, these commercial projects offer some seriously 'low-hanging fruit'.

Many businesses are already looking at a more sustainable future, and to replace gas with renewable heating to future-proof their buildings and avoid ending up with an energy-inefficient, stranded asset. Beyond the private sector, initiatives such as the Public Sector Decarbonisation Scheme have helped reduce significantly the carbon footprint of schools, libraries and council facilities across the country. These types of funding models are likely to continue as government, at a local and national level, looks for more ways to reduce carbon emissions.

As we move from gas to the age of the heat pump, some question whether we have enough renewables installers to match demand. This is where facilities such as Mitsubishi Electric's latest training showroom in Scotland will play such an important role. Livingston joins our advanced facilities in Manchester and Hatfield in helping to increase significantly the number of heating engineers adding renewable heat pumps to their portfolio.

● **Graham Temple** is marketing manager at Mitsubishi Electric

BROADENING HORIZONS

New CIBSE President **Fiona Cousins** is challenging building services engineers to re-evaluate building performance and collaborate with other disciplines. She tells **Alex Smith** that CIBSE Members should be striving to deliver buildings that meet the needs of society and the natural environment

CIBSE President Fiona Cousins wants building services engineers to 'save civilisation'

'I think I've started with a bit of a bang.' Fiona Cousins FCIBSE may have lived in America for 18 years, but she describes the impact of her first days as CIBSE President with typical English reserve.

In her Presidential address at the Royal Society of Engineering in London last month, Cousins called on building services engineers to 'save civilisation', to look at the wider challenges facing society and apply their skills and expertise to shape a better future.

Arup's regional chair for the Americas told a full auditorium that engineers need to broaden their horizons and extend their understanding of building performance. 'Buildings don't just generate carbon – they also have impacts on our ecosystems, affecting biodiversity and air and water quality, and human health,' she said in her address, adding that engineers need to think about the consequences of their ideas and decisions on wider society, and understand more clearly the problems they are trying to solve.

'Einstein said if he had an hour to save civilisation he would spend 55 minutes understanding the problem, as it would then be easy to come up with a solution in the final five minutes,' said Cousins.

'The ready, aim phase of a project is really important to ensure we are on target, and to drive the change we need to get ahead of the world around us. We need to be inspirational and aspirational – and never dogmatic – as change is constant.'

To help engineers reframe the challenge, CIBSE has commissioned a paper, *Building performance reimagined*, to mark the start of Cousins' presidency. A CIBSE publication supported by Arup Foresights, the paper sets out a framework for a 'new holistic approach to building performance'. It combines the knowledge of building services specialists with insights from a diverse range of experts from across the arts, technology and the public sector.

'We reached out beyond industry to get these alternative inputs, because they offer different perspectives on change,' said Cousins. The aim of the document, she added, is to provide a starting point to think critically and proactively about what the future should look like in terms of performance.

> "The ready, aim phase of a project is really important to ensure we are on target, and to drive the change we need to get ahead of the world around us"

Output from workshops coalesced around four core themes: variety, connectedness, readiness and emergence (see panel, 'Core themes') and, at the end of the report, there are considerations aimed at 'bridging the gap between visionary futures and activities today'.

These cover economics, education and skills, governance and culture, technology, and policy and regulatory issues. For each, there are directions for four sets of 'change enablers', who are defined as: wider industry, regulators and policy-makers; CIBSE and institutional bodies; engineering organisations and employers; and individual building services engineers.

Adrian Catchpole passes the Presidential medal to Fiona Cousins

In an interview with the *Journal* after her inauguration, Cousins explains why building service engineers need to collaborate with other disciplines when engineering solutions.

'We need to avoid siloed, linear thinking based solely on cutting costs or energy use,' she says. 'Engineers shouldn't be focused on one thing; they should be looking at broader impacts, such as health and wellbeing, climate change and diversity.'

She gives an example of how a car park design with more green landscaping and reflective surfaces could contribute to climate-change mitigation and a healthier environment. 'There's nothing wrong with net zero goals, but if engineers are to save civilisation, they need to raise their eyes to the horizon and set broad design goals,' Cousins says.

One major issue, she adds, is that clients are often focused on the payback for environmental features that don't only offer a financial return. Cousins believes engineers should be looking at the benefits for society, as everyone will gain from a healthier planet.

'Climate-change mitigation is a benefit that goes to everyone – it doesn't go back to the designer,' she says, adding that it's important to make space at the beginning of a project to discuss overall goals.

'If you can talk convincingly about goal setting at the beginning, you can usually move people away from "I want the cheapest thing" to something that makes them look best in the market.

'Even the most commercial developer will say "I want everyone to know that I have a good-quality building", and they'll look like a hero because they have done the right thing from a climate standpoint.'

By the end of her year in office, Cousins would like CIBSE's strategy to use the framework in *Building performance reimagined*. 'The new strategy should reflect the idea that we need to push the boundaries of building performance. It will make us a forward-thinking organisation,' she says.

There could be new CIBSE Building Performance Awards, Cousins suggests, covering areas such as acoustics and biodiversity. 'CIBSE is very good at attracting M&E engineers working for design firms, but the conversations need to include other disciplines, such as operations engineers and user experience designers,' she says. 'It's a virtuous circle. It would be good for the definition of building performance, bring more disciplines to CIBSE, and provide more diversity of views of what good looks like.'

CORE THEMES

The four performance metrics proposed in *Building performance reimagined*

Variety
Creating flexible, multipurpose spaces that encourage diversity of use and users. For building services engineers, this could mean more integration of modular, adaptable services and new technologies, and localised occupant controls, and inclusion of ecology and user experience expertise in decision-making.

Readiness
A risk-based design where changing conditions, uncertainties and vulnerabilities are assessed and mitigated. For building services engineers, this could mean understanding physical and cyber risks, and stress-testing designs for multiple scenarios – for example, modelling building performance for multiple climate change scenarios.

Connectedness
Understanding and connecting to local people, spaces and infrastructure. For building services engineers, this could mean early integration with local infrastructure, and understanding the impact the building will have on the neighbourhood and local resources by engaging with the community.

Emergence
Responding to new circular models, material and trends, providing spaces for fixing and making, and encouraging local resourcing. For building services engineers, this could mean creating buildings where energy is generated by, and stored in, the building and, potentially, distributed to the community, use of phase change material and AI, creating spaces for fixing and repurposing material and equipment, and promoting reuse and local sourcing, rather than replacing with new.

Cousins would also like to see CIBSE publish more thought-leadership papers that address societal issues beyond engineering. 'CIBSE does a lot of brilliant technical guidance, but we don't generally do horizon-scanning white papers that could be supported by CIBSE Young Engineer Networks and broader voices from outside the institution,' she says.

Cousins' call to action is ambitious and inspiring, urging building services engineers to look beyond immediate technical solutions and consider the wider implications of their work.

As CIBSE embraces this forward-thinking approach, it stands poised to redefine what building performance means in the 21st century, creating a legacy of sustainable, healthy buildings that tread lightly on our planet and support our societies. CJ

Taking up the challenge

Anastasia Mylona looks at what CIBSE President Fiona Cousins' groundbreaking white paper might mean for building services engineers

Industry professionals who are familiar with CIBSE and who read the recently published *Building performance reimagined* report will undoubtedly think this is not a typical CIBSE publication. Presented by new CIBSE President Fiona Cousins at her inauguration, it does not talk about sizing of systems, maintenance or controls – not even about net zero or embodied carbon.

The aim of the research behind the report was to explore new horizons for CIBSE and its members. To look at building performance in the future, beyond energy and carbon. When we look into the future, we need to explore different scenarios and, as engineers, we are not always comfortable doing that. The report does that for us; it describes various future scenarios and changes, and areas that engineers could influence.

Reading the report, there are some key messages among the beautifully designed images and infographics.

Social, technical, economic and environmental changes are coming our way, to which we need to respond fast. These include climate change and its impacts, digital transformation and AI, the decline of biodiversity, population growth, and scarcity of resources.

Such changes require a shift in our focus and engineering mindset, from energy and carbon to health and resilience. The health of all occupants, human and non-human, and resilience of the built environment – for example, buildings and the infrastructure on which they rely and with which they interact.

The changes also introduce new, complex problems that require more than one set of skills and expertise to solve. Engineers will need to engage with other disciplines to ensure we have a whole built environment approach, including with experts in digital, AI and user experience, ecologists, and social scientists. But even getting the different engineering disciplines working together – from concept to completion and beyond – rather than in the current linear way, would be a step in the right direction.

As well as proposing four performance metrics to address the challenges of the future and the focus shift to health and resilience (see panel on 21), the report highlights the changing role of building services engineers. They are no longer just responsible for the basic function and energy use of a building, but also for the wellbeing of occupants (air quality, acoustics, thermal comfort, light, mental health and stimulation), the increase or maintaining of biodiversity, and the encouragement of social equity and diversity.

Furthermore, the responsibilities of building services engineers expand beyond buildings, to neighbourhoods and cities – influencing how buildings connect to the local and city infrastructure, as well as interface with people, businesses and biodiversity, and the use of local resources.

As an industry, we need to develop a language of common values that represent the performance metrics highlighted in the report, to better communicate with the clients and enable them to make the right decisions that extend beyond costs and regulatory compliance.

Building services engineers have the variety of skills and expertise, and the remit, to influence built environment performance and lead the industry in adopting more holistic performance metrics and values. What we now need, as engineers, is to ask the right questions and be curious about all aspects of the building, its life and its occupants.

DR ANASTASIA MYLONA
is technical director at CIBSE

MITSUBISHI ELECTRIC

CONSULTANT FOCUS

ON LOW CARBON HVAC SOLUTIONS FOR LARGE COMMERCIAL BUILDINGS

Innovative, energy saving, large capacity heat pumps and chillers

At Mitsubishi Electric we provide advanced solutions that heat, cool, ventilate and control buildings in the most energy efficient and cost-effective ways possible. Through our technical expertise and experience, we have continued to develop our comprehensive range of low carbon solutions for large-scale applications, bringing the quality you would expect, whilst also helping to reduce client energy costs.

Offering scalable and specific solutions for both comfort and process cooling applications between 5kW and 4.2MW, Mitsubishi Electric's understated quality and unparalleled performance is guaranteed, alongside the most innovative and sustainable heat pump and chiller solutions on the market.

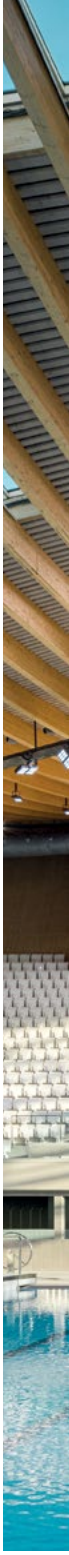
Our comprehensive range now includes both modular and fully customisable units, so your system can be configured for almost any large-scale, low carbon project requirement.

To find out more about our low carbon commercial solutions, visit:
les.mitsubishielectric.co.uk/products/commercial-heat-pumps-and-chillers

SCAN ME

PLATFORM FOR SUSTAINABILITY

The low carbon, sustainable design of the Paris 2024 Aquatics Centre will help halve the Olympics' carbon footprint compared with London 2012. **Andy Pearson** looks at the passive-first design and the lasting legacy of the Games' only new venue



Paris 2024 is being hailed as the greenest Olympic Games in history. The organisers are aiming to halve the event's carbon footprint, to 1.5 million tonnes of CO_2, compared with previous games in London (2012) and Rio (2016), which emitted 3.4 and 3.6 million tonnes of CO_2 respectively. The target is even lower than the 1.9 million tonnes of CO_2 emitted at Tokyo's Covid-19 Olympics, which had no spectators.

To meet this ambitious target, the plan is to do away with diesel generators and to connect all the Paris Olympic sites to the electric grid (London 2012 reportedly burned four million litres of diesel to power its venues).

Of the two million pieces of sporting equipment that will be used, three-quarters will be rented or provided by sports federations. More than 75% of the electronic equipment, such as computer screens, will also be rented, as will many of the venue tents. In addition, 25% of the ingredients for the meals served to spectators and athletes will be sourced locally.

The most sustainable element of the Games, however, is what the organisers are not doing: building new venues. Instead, many of the city's existing venues are being repurposed, including the Stade de France – built for the 1998 Football World Cup – which is being transformed into the main arena.

The one major exception to this reuse edict is the new, purpose-built Aquatics Centre – but even this incorporates a timber structure and uses recycled materials in its fit-out. Most importantly, after hosting the Olympics, the centre will be transformed into a multi-sports facility for the local Seine-Saint-Denis community for the next 50 years.

The Aquatics Centre has been constructed under a design, build, finance, maintain and operate contract by Bouygues Bâtiment Ile de France consortium, working with architects VenhoevenCS and Ateliers 2/3/4, along with MEP engineers INEX. The building's form has been kept deliberately compact to minimise construction costs, the quantity of materials needed and the energy required for the legacy phase of its operation.

Its thin, curved roof is the venue's most distinctive feature. This is highest above the diving tower and the raked spectator

> "One 71m-long pool incorporates two movable walls to allow it to be configured into a 50m swimming and 20m diving pool"

PROJECT TEAM

Client: Métropole du Grand Paris
Main contractor: Bouygues Bâtiment Ile-de-France
Operator: Récréa
Maintenance: Dalkia
Architects: VenhoevenCS and Ateliers 2/3/4/
Structural engineer: Schlaich Bergermann Partner
MEP: INEX
Water treatment: Katene
Acoustic consultant: Peutz
Sustainability consultant: Indiggo

A section view of the Aquatic Centre's sustainability features

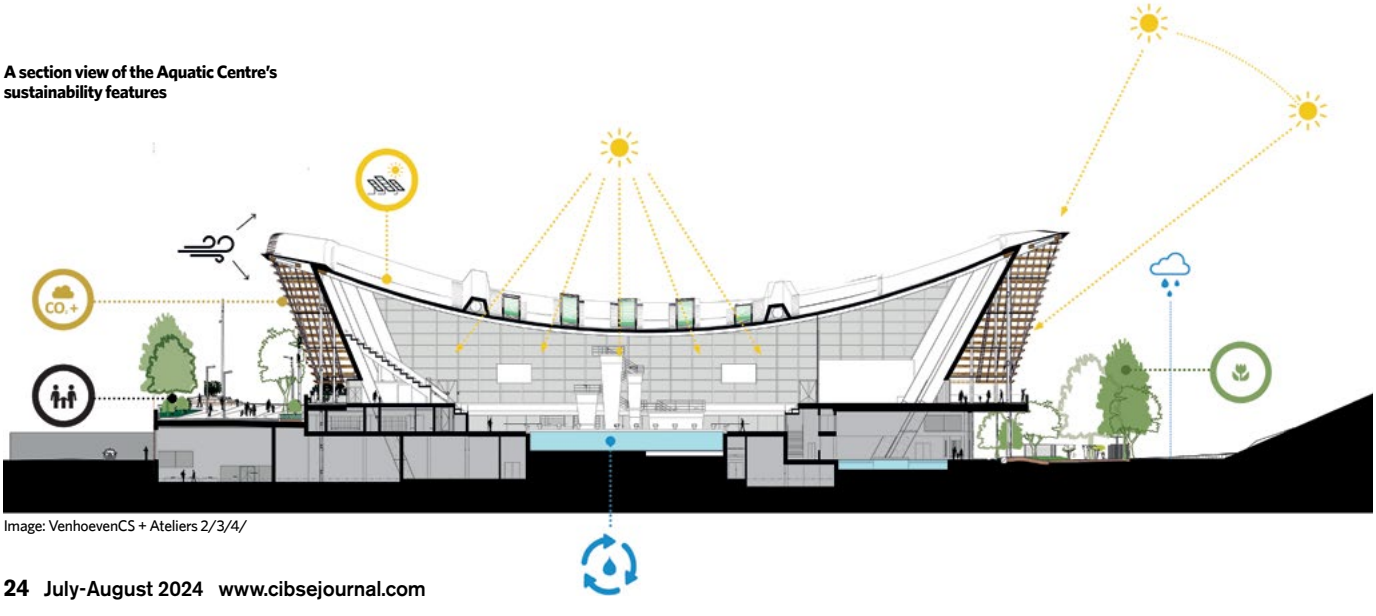


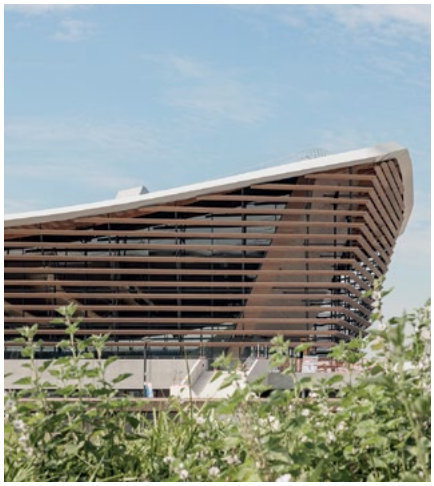
Image: VenhoevenCS + Ateliers 2/3/4/

The curved roof of the hall has reduced the volume of air that needs to be conditioned

stands that flank the pool north and south. From here it swoops down towards the swimming pool and the lower, less-imposing community-facing west façade.

According to Cécilia Gross, partner-director at Dutch architect VenhoevenCS, the roof's hollowed out, concave shape reduces the volume of the hall compared with designing a box. 'We are not talking a little reduction – we are talking about halving the volume and thus helping minimise the energy required to condition the air filling the arena,' she says.

The roof is supported on a lean catenary structure of 91, individually curved, timber glulam beams, which are just 500mm deep and 200mm wide, and span the 89m width of the building. The beam's slender profile helps minimise the void between beams, which co-architect Laure Mériaud, a partner at Paris-based Ateliers 2/3/4, describes as 'wasted space that would require energy to heat'.



Timber louvres provide solar shading for glass elevations

Lateral stability of the timber structure is provided by a timber deck. There is no ceiling, so the timber beams and deck are visible from the pool hall, as is the cabling, lighting and small air conditioning ducts. The larger, main distribution ductwork is located on top of the roof, so as not to detract from the structural form.

The roof incorporates 5,000m² of photovoltaic panels. These provide up to 20% of the centre's electrical demand. Rainwater is also harvested by the roof and stored in a subterranean tank for use in irrigating the surrounding planting.

Timber louvres form a slatted enclosure surrounding the building, which offers solar shading for the centre's fully glazed east and west elevations, and creates a sheltered colonnade for pedestrians. Gross says daylight from these glazed elevations brings 'magic' to the building, although the glass will be covered for the Olympics, to give the TV crews complete control of the lighting.

The reinforced, low carbon concrete pool is also designed to minimise the volume of water required. Rather than construct multiple pools for the diving, swimming, water polo and artistic swimming competitions, there is just one, 71m-long pool. This incorporates two movable walls to allow it to be configured into a 50m swimming and 20m diving pool, or a 33m pool to host water polo or artistic swimming and a diving pool.

The depth of the pool varies, too; it is at its deepest for the diving, but slopes up towards the west, where the swimming and other events will take place. Sculpting the floor means it contains 25% less water, which does not need to be kept warm or treated over the lifetime of the building. In addition to movable walls, the pool has a movable floor to further increase its versatility when operating in legacy mode.

The Paris 2024 Aquatics Centre is a fitting showcase for one of the Games' premier events. Ultimately, however, it is the people of Saint-Denis and other neighbourhoods who will benefit from its transformation after the Games into a multifunction sports facility. The huge bank of 2,500 temporary seats (made from recycled bottle caps) on the north side of the building will disappear, to be replaced by padel tennis courts and pitches for team sports, along with a fitness and bouldering area. CJ

WHITECODE CONSULTING

Roundtable sponsor

KEEPING ON TRACK FOR 2050 NET ZERO

The 2050 vision for net zero will veer off track if the built environment fails to decarbonise. Our roundtable, sponsored by Whitecode Consulting, discussed the challenges facing engineers and what is needed to accelerate change

A single silver bullet won't deliver net zero by 2050; several factors will be required. That was the conclusion of experts at *CIBSE Journal*'s latest roundtable, sponsored by Whitecode Consulting. Political courage, an urgent timeline and policy implementation were some of their key recommendations to help the industry achieve this vital target.

The topic of the event was whether UK buildings are in danger of missing net zero carbon targets without a definitive roadmap for their decarbonisation. Yogini Patel, head of campaigns at the Passivhaus Trust, stressed the importance of speed. 'Everything needs to happen now, and quickly,' she said. 'We need to decarbonise energy supplies, lower our demand, and skill up the construction sector. For that to happen effectively, we need a plan – leadership from the top and bottom, with a long-term commitment. All we have now is complete uncertainty.'

Julie Godefroy, head of net zero policy at CIBSE, agreed. 'The energy system is decarbonising, but there isn't enough happening with heat pump support,' she said. 'Retrofit is one area where there is nothing. The Climate Change Committee has flagged this up, but the government [Conservative] has hidden behind some vague plan.'

Another issue is the lack of adequate electrical infrastructure, which is threatening to derail the drive for decarbonisation, according to Daniel Logue, adviser for decarbonising sites at Energy Systems Catapult. Alex Hill, managing director at Whitecode Consulting, said it was affecting his projects, and he cited a scheme in west London where Whitecode Consulting installed heat pumps. 'We have been told we can have a megawatt a year and we want nine megawatts – they said we could have power in nine years. We have a big power problem,' said Hill. 'We need to deal with the transition for distribution so we can share the power we are making, such as the wind power generated further up the country.'

Tom Lowe, founding director of Thermal Storage UK and a retrofit assessor, is optimistic that the Grid will withstand future growth. 'We are

THE PANEL

Bean Beanland – director for growth and external affairs, Heat Pump Federation
Julie Godefroy – head of net zero policy, CIBSE
Stephen Hart – director of integrated solutions, Baxi Heating
Alex Hill – managing director, Whitecode Consulting
Ellen Huelin – sustainability director, Whitecode Consulting
Daniel Logue – adviser, decarbonising sites, Energy Systems Catapult
Tom Lowe – founding director, Thermal Storage UK
Yogini Patel – head of campaigns, Passivhaus Trust
Alex Smith – editor, *CIBSE Journal*

"A building passport would contain things that already exist, but that are currently disparate, paper-based and unusable" – Julie Godefroy

"It's important to provide incentives to encourage people to adopt heat pumps, particularly for commercial building owners" – Bean Beanland

now building it to be flexible; we have power generation coming in from the north and, along the east coast, we have massive grid build,' he said. 'To decarbonise homes, we need to put in an electric heating system, install heat pumps – which could be done for about 70% of homes over the next 10 years, assuming the Grid is built at the same time. The technology is there, we just need the workforce.'

Lowe added that the industry must learn lessons from historical transformations of heating systems if it is to achieve carbon zero by 2050. He warned that energy companies should not rely on people installing solar panels and heat pumps to decarbonise, as these devices are only for those who can afford it or who can get subsidies. Many people who don't fall into either of these categories will get left behind, he said. People will then vote for political parties that think net zero should disappear rather than be resolved. 'We need to commit to a 10 to 15-year plan now to coordinate this,' Lowe added.

Ellen Huelin, sustainability director at Whitecode Consulting, said the UK should focus on making buildings more energy efficient. The problem with new build, she added, is that it's policy-led, and developers only comply with a policy if its mandatory: 'We're moving towards the Future Homes Standard [FHS] and, unless it's contained within the policy for new build, clients will be reticent to go for upgrades.' Patel agreed that retrofit is a huge area to be unlocked, and stressed that a building's fabric must be considered and energy loads reduced. However, while fabric improvements should be considered, Lowe believes a fabric-first approach is not required for all homes to decarbonise.'

The discussion then moved to the value of heat pumps. Bean Beanland, director for growth and external affairs »

"We're finally picking up momentum with the Heat Networks Assurance Scheme, which will force developers to register their building and understand performance levels" – Stephen Hart

» at the Heat Pump Federation, stressed the importance of providing incentives to encourage people to adopt heat pumps, particularly commercial building owners. Hill agreed, but said he was worried domestic customers would pay more for their systems than they thought.

'Customers don't know that the running costs of heat pumps will, potentially, be 25% more because electricity is too expensive,' said Hill. 'My worry is that people will remove them, as they are too costly, and revert to gas. This will give heat pumps a bad name, because we haven't sorted our electricity generation. We must decouple gas from electricity.'

Most of the panel agreed that the high cost of heat pumps was a deterrent – but in commercial situations, Hill added, space and complexity are barriers, too: 'What's interesting, as a designer, is that there's no one solution; every site where we apply this technology is slightly different, so we go for hybrid [gas and heat pump].'

Stephen Hart, director of integrated solutions at Baxi Heating, sympathised. 'We must invest in our engineering staff to offer something that's more manageable for the designer,' he said. 'We know the future will be hydrogen, heat networks, heat pumps, or a combination. Hybrid is the way to go because sustainability shouldn't be the enemy of affordability or security.'

Lowe was asked about his experience with manufacturers of heat batteries in the domestic and industrial sectors. He said products are now being made that use phase-change materials – which alter the state of a substance and provide latent heat without changing the temperature – as the main storage capacity of the unit, instead of hot water. Huelin hoped that changes to the FHS and the new Home Energy Model (HEM) for calculating energy use would offer more opportunities to use these innovative technologies, as she believes the current Standard Assessment Procedure (SAP) is very restrictive.

'SAP was never designed to do full energy calculations; it's a compliance tool and is very rigid in what we can put into it,' said Huelin. 'It's a barrier for getting to net zero.'

Godefroy added that the Product Characteristics Database, which holds data for the technologies that can be used in a SAP, was in need of an update. There is a plan to allow innovative

"What's interesting, as a designer, is that there's no one solution; every site where we apply this technology is slightly different" – Alex Hill

products to be tested and mobilised faster, she said, and it was agreed that making this process quicker would encourage more people to select new products.

The panel then discussed how to deliver better-quality buildings, with Patel stressing the importance of quality assurance processes. 'You need to make sure you're testing things after they are built to close that performance gap,' she said. The performance levels being designed to should be met in operation, and 'funding should be linked to that. It's about having measurable targets.'

Incentivising people was also important, said Patel, so they feel involved and want to do a good job. She cited policy legislation for Scottish schools that would introduce a Passivhaus-style system to ensure buildings were tested against energy targets. 'When you connect funding with measured performance and outcomes, you incentivise a whole team,' she said. »

"SAP was never designed to do full energy calculations; it's a compliance tool. It's a barrier to reaching net zero" – Ellen Huelin

CIBSE BUILDING PERFORMANCE AWARDS 2025

ENTRIES OPEN

The CIBSE Building Performance Awards are back for their 18th year with over 20 categories to recognise and celebrate engineering excellence in the built environment.

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

Entries close: 30 August 2024

View all BPA categories

@CIBSEAwards
#BPA2025

Sponsors

MITSUBISHI ELECTRIC
AIRFLOW
ideal HEATING COMMERCIAL
TAMLITE

cibse.org/BPA

» Godefroy highlighted a proposal in the FHS consultation that would reward developers that measure performance in buildings. It's not yet clear whether this is for performance that goes beyond the Building Regulations, she added, but it was an acknowledgement of the importance of measuring.

Hill said making data visible is vital. 'We need a sharing of data... so we can use it and improve,' said Hill. 'The problem now is that lots of people who collect data use it for their own ends.'

Hart believes momentum is building around the Heat Networks Technical Assurance Scheme, which is due in 2025 and aims to ensure that heat networks meet a minimum level of performance and reliability. 'It will force developers to register their buildings connected to heat networks and understand what the performance levels are,' Hart said. 'It's driving people to investigate buildings and work out what they've got.'

Beanland would like to see public money spent on building assessments, with the resulting information contained in building passports. This could then be passed to the next owner to enable them to see a building's history. Godefroy added that the HEM could form the basis of a building passport, and confirmed that the idea is becoming more than a concept, and would contain information such as works carried out and a building's Energy Performance Certificate (EPC) rating. 'It [the passport] would contain things that already exist, but that are currently disparate, paper-based and unusable,' she said.

Beanland said people should also be aware of the Centre for Net Zero's 'Smart Building Rating', which is designed to complement a reformed EPC and the distribution network operator's (DNO's) 'Connection Readiness Certificate'. Subject to funding, a DNO will run a pilot on the rating and certificate next year and, if successful, it will be made widely available. 'It will mean that the DNOs have proactively inspected parts of their network,' said Beanland. 'This emerged from the DNOs trying to identify where the heat pump hotspots will come from, so they can plan for reinforcement.'

Logue was interested in these emerging tools as he is working on a project for Northern Powergrid that is predicting energy demand for non-domestic sites. The idea is to use data to forecast when the energy transition will happen in different areas of the country.

"Electricity generation isn't the problem, it's the lack of infrastructure" - Daniel Logue

Summary

Achieving net zero by 2050 requires a multifaceted approach, concluded the panellists, who emphasised the need for political courage, urgent policy implementation, and a clear timeline. Key recommendations included rapid decarbonisation of energy supplies, reducing energy demand, and investment in skills.

They also concluded that support for heat pumps and retrofitting remains insufficient, and that inadequate electrical infrastructure poses a significant challenge. The need for quality assurance, incentivisation and measurable targets was highlighted, and emerging tools – such as building passports and smart building ratings – were seen as promising steps towards a coordinated energy transition.

Ultimately, innovative technologies, strategic planning, and strong leadership are crucial if the UK is to meet its net zero carbon targets. CJ

"Fabric improvements are needed, but fabric-first is not required for all homes to decarbonise" - Tom Lowe

"We need to decarbonise energy supplies, lower our demand, and skill up a construction sector that's ready to deliver" - Yogini Patel

With site accommodation contributing significantly to construction projects' carbon footprints, engineers on a £227m residential scheme at Wembley Park have come up with a modular heat pump solution that cut operation carbon by 14 tonnes in six months, as Solaris Energy's Daniel Large explains to **Andy Pearson**

OUT OF SITE

Site welfare facilities are generally assembled from transportable, stackable modular cabins that are kept comfortable with electric heating and split air conditioning units. In addition, hot water for wash hand basins, showers and sinks is frequently produced locally, often with electric point-of-use heaters.

It is a setup that can consume a lot of energy during the construction, adding to the contractor's running costs and increasing carbon embodied in the building.

Now, at contractor Sisk's residential development for Quintan at Wembley Park, an innovative, containerised heat pump-based energy module is being trialled as a more energy efficient solution to supplying heating and cooling to the site's welfare facilities. The energy module, designed and built by Solaris Energy, has been up and running since January this year, and it has already helped reduce Sisk's site energy bill by around £10,000 a month.

What's more, the energy savings have resulted in 14 tonnes of carbon savings so far this year, which will be reflected in the embodied carbon of the six apartment blocks that Sisk is constructing for Quintain over the next five years.

PROJECT TEAM

Developer: Quintain
Contractor: Sisk
Heat pump design and installation: Solaris Energy
Building services engineer: ADR Consulting Engineers
Heat pump manufacturer: Kronoterm

'Like all good ideas, this one was formulated in a pub over a cold pint of beer,' says Daniel Large, director and owner of heat pump specialist Solaris Energy. He had been playing around with the concept of developing a mobile, containerised heat pump system that could be used to deliver energy-efficient, simultaneous heating and cooling. So, when a conversation with the project director turned to ways in which the amount of energy consumed by its site accommodation at Wembley Park could be reduced, Large suggested trialling a heat pump-based solution.

The welfare facility was being planned to accommodate up to 2,000 operatives when the project is at its peak. 'Sisk sent me details of the proposed facility, which was, in effect, a temporary, four-storey building, complete with offices, meeting rooms, induction rooms, a canteen and kitchen, changing rooms, toilets and showers – it was massive,' Large says.

Solaris Energy set about developing a heat pump-based solution – capable of meeting all the welfare facility's heating and cooling demands – that would fit into a standard 6

Part of the distribution system in one of the site offices

The site welfare facilities for the Wembley Park residential project are in the bottom right-hand corner

metre shipping container, to enable it to be relocated at the end of the project.

The heat pump specialist worked with ADR Consulting Engineers to produce a thermal model of the building and its associated heating and cooling loads. It then developed a solution based on two heat pumps (normally used as ground sourced heat pumps) that would deliver up to 160kW of heating and 150kW of cooling.

'The water-to-water heat pump captures heat from cooling to reuse it for heating, or to pre-heat domestic hot water [DHW]. It simultaneously provides heating and cooling,' Large explains. In addition to the heat pumps, the container contains a chilled water buffer tank, a low-temperature hot water (LTHW) buffer tank, and a pre-heat tank for the DHW.

The DHW pre-heat uses heat reclaimed from cooling the facility to heat a 500-litre vessel full of water to a constant 55°C. The DHW is pre-heated by circulating the system through a coil contained within the tank of heated water. 'Rather than oversize the system to meet the once-a-day peak demand from the showers, we decided to continue using electric showers and point-of-use water heaters, which we supply with water pre-heated to a temperature of 50°C,' says Large. The DHW is then brought up to a supply temperature of 60°C by the point-of-use devices, to kill off any legionella bacteria, with a thermostatic mixing valve to deliver water at an appropriately safe temperature.

ADR Consulting Engineers' thermal model showed the meeting rooms would require cooling throughout the year, even in winter, and that – for a large part of the year – the facility would require simultaneous heating and cooling.

'As soon as there is a cooling demand, rather than rejecting the heat outside, we take the absorbed heat to the heat pump evaporator, where it is turned into high-grade heat by the heat pump before being stored in the LTHW buffer or DHW preheat vessel, or it is used directly for heating if there is a demand,' Large explains.

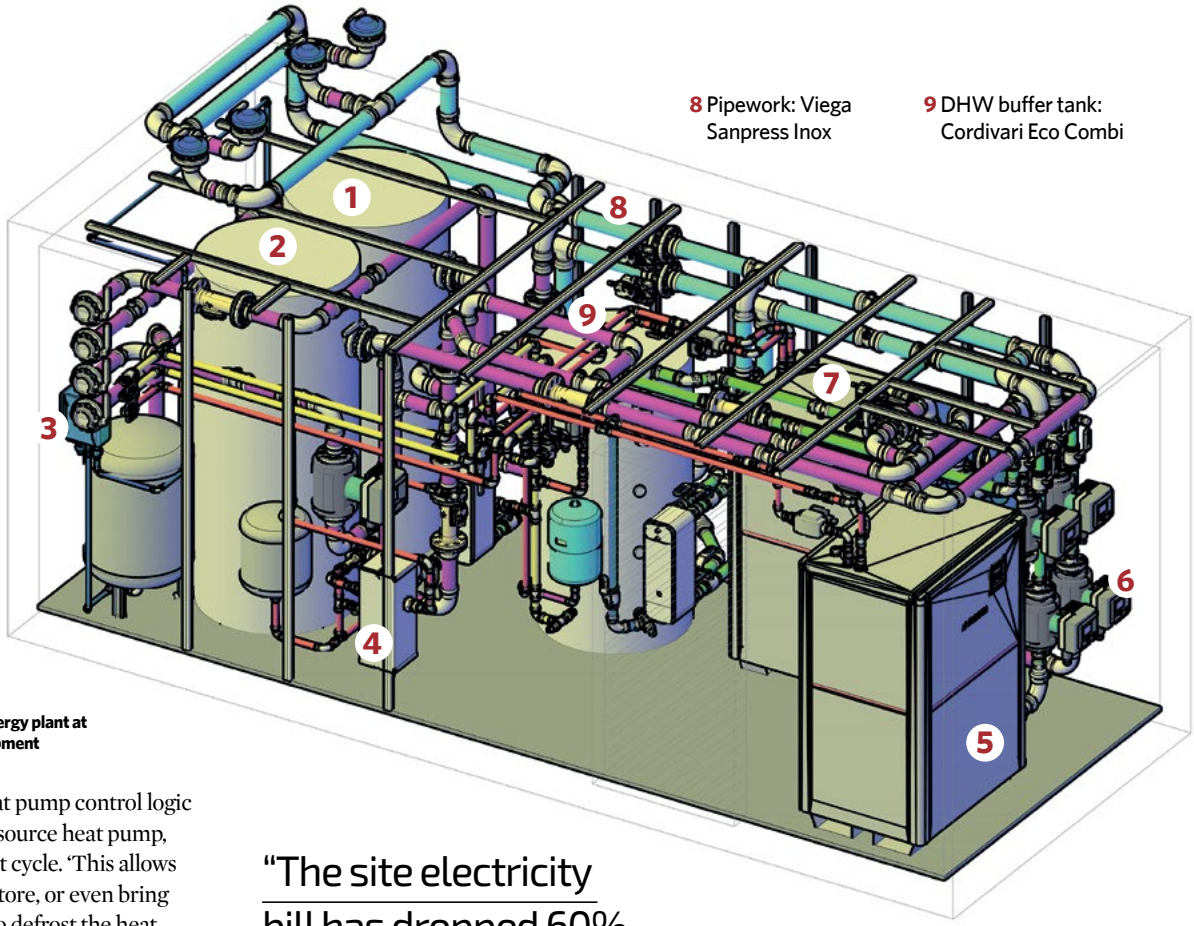
'Heat that would have been wasted is recovered and used in the building, which gives a better system COP [coefficient of performance],' he adds.

The heat pumps also connect to two dry air coolers installed on top of the container. These reject or absorb heat depending on the system demand. 'If there is cooling demand and no requirement for heating – and the buffer tanks are up to temperature – we'll use the dry air cooler to dump surplus heat,' Large says. 'Similarly, in mid-winter, when we might not have any cooling, we'll use the dry air cooler to source energy from the air to generate heat for heating and hot water.'

A particular challenge with using a GSHP coupled with a dry air cooler to provide heat when it is cold outside is that any moisture on the dry air cooler can freeze and frost the heat exchanger. 'Frost is not something you'd normally consider when using a water source heat pump,' Large says.

Fortunately, the manufacturer was able to »

The containerised plantroom, with a dry air cooler above, services a four-storey site accommodation block



1 CHW buffer tank: Cordivari ACQ

2 LTHW buffer tank: Cordivari ACQ

3 LTHW buffer tank: Cordivari ACQ

4 LTHW corrosion protection system: Elysator Trio 25

5 Heat Pump 1: Kronoterm WPG 110

6 Circulation pumps: Wild

7 Heat Pump 2: Kronoterm WPG 110

8 Pipework: Viega Sanpress Inox

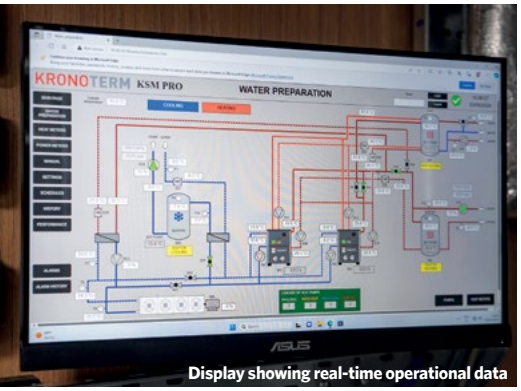
9 DHW buffer tank: Cordivari Eco Combi

Schematic of the modular energy plant at Sisk's Wembley Park development

» adapt its air source heat pump control logic to work with its water source heat pump, so it could run a defrost cycle. 'This allows us to use the thermal store, or even bring a compressor online, to defrost the heat exchanger if we need to,' Large explains.

In April 2023, while the accommodation modules were being assembled on site, Large visited the site with ADR Consulting Engineers to establish how best to tie in the containerised heat pump system to the temporary building, and to establish heating and cooling pipework routes.

'A heat pump is only as good as the system to which it is connected, so we had to develop a low flow temperature solution to ensure we could get the best energy reduction from using heat pumps,' he explains. ADR Consulting Engineers designed a simple heating circuit, using radiators for the welfare facility's ground and first-floor site accommodation, and fan coil units (FCUs) to deliver heating and cooling to the second-floor subcontractor office and Sisk's third- and fourth-floor offices.



Display showing real-time operational data

> "The site electricity bill has dropped 60%, to £15-20,000 – even though the price of electricity has increased by 77%"

Along with the mobile energy module, the radiators and FCUs are intended to be reused at the end of the project. Copper is used for the connecting pipework inside the building, which, Large says, will enable it to be recycled in future 'when the facility is decommissioned'.

The containerised heat pump system and buffer vessels were connected using stainless steel pipework, along with all the system controls, in an off-site process. 'It is a plug-and-play solution, with everything inside the box,' Large says.

The container was shipped to site in October, commissioned in November, and powered into use in January.

Heating and cooling has been scheduled to run between set times, with the system turned off out of hours. Weather compensation is also used to maximise system efficiency by varying the system temperature with outside temperature – so, at 0°C, the heating runs at a temperature of 40°C, which will increase to 50°C if the temperature drops to -10°C. Similarly, the cooling is designed to run at 12°C when it is 20°C outside and get progressively colder as outside temperatures increase.

The innovation has been successful. In the short time it has been in operation, its COP has been improving steadily and is currently running at a COP of 4.9, which, Large says, is 'pretty good for a temporary welfare facility'.

Savings in electricity use are equally impressive. On a previous site between 2017 and 2019, when the cost of electricity was £0.13 per kWh, Sisk was spending £25-£30,000 per month on site electricity. On the energy module site, the site electricity bill has dropped 60%, to £15-£20,000 – even though the price of electricity has increased by 77%, to £0.23 per kWh.

Large acknowledges that, if the cost of electricity was to fall, the savings from the heat pump solution would be less impressive compared with an all-electric solution, but the carbon savings would remain the same.

Perhaps more impressively, Large says the figures do not take into account additional infrastructure savings, including a reduction in the size of the site's leased step-down transformer, which was reduced in capacity from 2MW to 1.5MW, saving an additional £120,000 on set-up and leasing costs to date. 'If people are truly driven to reduce energy consumption, it can be done. The capital cost can be high, but the savings are not limited to the energy consumption alone.' CJ

NIBE

Our most powerful Exhaust Air Heat Pump yet

S735 Exhaust Air Heat Pump

INTEGRATED SOLUTION

Our compact indoor solution for the provision of heating, hot water, and ventilation.

NATURAL REFRIGERANT

R290 refrigerant for reduced environmental impact.

PERFORMANCE

Combining ventilation heat recovery with heat pump technology to deliver high seasonal performance and economic operation.

SMART VENTILATION

Smart ventilation based on temperature, humidity and CO2 levels with myUplink smart home.

EXCEPTIONALLY QUIET OPERATION

New design for low noise level, 49dB(A) nominal sound power level

Discover Exhaust Air Heat Pumps at nibe.co.uk

@NIBEEnergy NIBE (GB) nibeenergyuk nibe-energy-systems-limited

COOLING | HEATING | VENTILATION | CONTROLS

Ask ME about decarbonising your buildings

Ecodan CAHV-R

Decarbonising building operations has never been more important. Mitsubishi Electric provides a comprehensive range of innovative solutions tailored for all building types—from residential settings to offices, schools, hotels, shopping centres, and more. Our cutting-edge products are designed to significantly reduce your carbon footprint and energy consumption, helping you meet your Net Zero targets.

With our extensive service and maintenance solutions, we ensure optimal performance and efficiency throughout the product lifecycle, giving you peace of mind and maximising your investment.

Discover our **full product range** at:
les.mitsubishielectric.co.uk

Scan here

MITSUBISHI ELECTRIC

BESA warns of propane heat pump risk in new guide

New BESA safety guide carries warning over use of refrigerant


Graeme Fox

BESA has issued a warning about the increasing safety risks associated with the use of flammable refrigerant gases such as R290 in air conditioning and heat pump systems. This alert is featured in BESA's latest technical bulletin (TB57), coinciding with World Refrigeration Day.

'Working with R290 raises major concerns due to its highly flammable nature,' said BESA technical engineer Keegan Farrelly. 'It is classed as an A3 gas, which is the highest level of flammability and means it could even be ignited by static electricity.'

Currently, there are no UK regulations governing the purchase and installation of systems using R290 (propane), as it falls outside the scope of the F-Gas Regulations. However, the use of propane is expected to rise significantly with the phase-out of higher GWP refrigerants.

By 2027, new EU rules will mandate that stationary split air conditioning and heat pump equipment with capacities below 12kW must use F-gases with a GWP below 150, and below 750 for larger systems.

Although the UK is not bound by EU legislation, it is anticipated to adopt similar measures under the Montreal Protocol and Kigali Amendment.

BESA acknowledged R290's effectiveness as a refrigerant because of its low GWP, high heat transfer performance, and low pressure ratios that reduce leaks. However its high flammability poses significant safety risks during installation, maintenance, and retrofitting. In an interview with the *CIBSE* Journal, BESA technical director Graeme Fox said installers will need to upskill to work safely with the refrigerant. The bulletin calls for specialised training for technicians and engineers to handle these risks properly.

The technical bulletin highlights the need for extensive risk assessments for new and retrofit applications.

It stresses the importance of well ventilated areas around units and the use of leak detection systems, advising positioning R290 units at least 1.5 metres from other electrical equipment to mitigate ignition risk with leakage.

For more information and to access the technical bulletin, visit BESA's website.

Lochinvar powers heating and hot water at new care home

Four air-to-water heat pumps have been provided Lavender Fields Care Village, Barmby Moor, Yorkshire, as part of a new luxury 72-bedroom development. The fully integrated heating and hot water system was delivered by Lochinvar.

The advanced system incorporates energy-saving heat pumps, a thermal store, two storage vessels, and necessary ancillaries, all managed by a priority control system to optimise energy use.

The set-up prioritises hot water production, switching to heating mode once hot water demands are met. This approach, bolstered by a thermal store, smooths out peak loads and reduces compressor starts and stops, enhancing operational life and reliability.

Additionally, cascade control allows the system to manage the operating patterns of the heat pumps efficiently, aligning with Lavender Fields' goal of sustainability.

HPA makes strategic recommendations for post-election policy

The Heat Pump Association (HPA) has called on the new Labour government to implement policies aimed at reducing carbon emissions and enhancing energy security.

A list of Key Asks was released, including calls for regulatory changes, cost reductions for heat pumps, a skilled workforce, consumer engagement, and updated technical standards.

CEO Charlotte Lee emphasised the importance of these measures for reducing carbon emissions and enhancing energy security. She urged the new government to support the transition to low-carbon heating with financial incentives, robust policies, and investment in skills.

The HPA said they will continue to advocate for these initiatives, promoting heat pump technology as essential for the UK's net-zero journey.


Charlotte Lee

Panasonic showcases R290 heat pump

Panasonic Heating & Cooling Solutions introduced the new Aquarea M Series air source heat pumps at InstallerSHOW 2024 in Birmingham last month. With T-CAP technology, the new models operate efficiently at temperatures as low as -15°C.

The new range features R290 refrigerant and offers capacities from 9kW to 300kW and is designed for installations in individual domestic homes, multi-family or light commercial buildings.

Panasonic also announced new partnerships and significant investments in UK training centres to address the industry's skills shortage.

HIUs pass new BESA Regime 3 Test

The HIUs are the first to establish new pass/fail evaluation

The first heat interface units (HIUs) have passed the BESA Regime 3 Test for the heat network technology.

Inta was the first manufacturer to pass the test with its Hiper II HIU. It was followed by TP 70/10 A from Evinox, INDIRECTV2 from YGHP and the Pioneer from Cetetherm.

Established by the Building Engineering Services Association (BESA), the pass/fail evaluation is pivotal for setting high standards in performance and efficiency within the construction and HVAC sectors.

The BESA Regime 3 Test, implemented in September 2023, is the latest version of the standard. It is a comprehensive evaluation of HIU performance under various operational conditions, including space heating and domestic hot water (DHW) delivery.

The new regime replaces standards developed in 2016 and revised in 2018. This third edition includes significant improvements and adopts a modular approach, allowing for the testing of additional HIU types, including space heating-only models. It also introduces a DHW load test and changes to the calculation of the annual volume weighted average return temperature.

It is a voluntary process providing manufacturers with an independent method to compare product performance. This has proven successful in enhancing HIU performance across the sector, helping specifiers make informed decisions for their projects. The results are verified by a BESA technical consultant before publication on the BESA HIU Test Register.

The Hiper II HIU has passed the BESA Regime 3 Test

Equans secures contract for six solar farms

Equans, under its Equans Solar & Storage brand, has secured a contract with global renewable energy company Low Carbon to design and build six large-scale solar farms in the UK.

Four of these sites will include battery energy storage solutions (BESS). The solar farms will have a total capacity of 267MWp, while the BESS portfolio will range from 95MW to 190MWh.

Building on a long-term partnership with Low Carbon, Equans has delivered four solar sites since 2014 and is currently progressing with nine additional projects. These initiatives aim to provide up to 616MWp of renewable electricity, powering more than 100,000 homes and contributing significantly to the local distribution network.

The projects are expected to avoid some 200,000 tonnes of CO_2e emissions annually, supporting the UK's net-zero ambitions.

Extensive stock!

ACROSS OUR RANGE OF HEAT PUMPS WITH **IMMEDIATE DISPATCH AVAILABLE**

Check our current stocks

Need more information about a Lochinvar solution?
Visit lochinvar.ltd.uk or call us on 01295 269981

Lochinvar®

info@lochinvar.ltd.uk
lochinvar.ltd.uk

All hands to the pump

The Electrification of Heat Demonstration Project shows that heat pumps are viable for all UK property types and architectural eras. Energy Systems Catapult's Rebecca Sweeney looks at the implications of the main findings

Decarbonising home heating is a significant challenge on the road to net zero. The UK has some of Europe's leakiest building stock, and around 23 million homes use a natural gas boiler. In 'off-grid' areas, 25% of homes depend on an oil boiler to keep warm.

Typically, home heating systems are replaced every 10-15 years, when a boiler dies or becomes impractical to repair. This means most UK households will only have two opportunities to switch to low carbon heating by 2050. The transition is multifaceted, with technological, integration, energy system, consumer and financial challenges, but the most crucial is the policy challenge to create an environment that encourages innovation in low carbon heating.

The challenge ahead

The Electrification of Heat Demonstration Project (EoH) – funded by the UK's Department for Energy Security and Net Zero – has highlighted the challenges and consumer barriers to scaling up heat pump adoption to meet the government's target of installing 600,000 heat pumps per year by 2028. The Scottish government is targeting a peak of 250,000 renewable heat installations in the 2030s.

These are ambitious goals. UK homes are host to just 280,000 heat pumps, and only 30,000 MCS-certified heat pumps were installed in 2023. We have six years to increase installations from the thousands to the hundreds of thousands. That is going to require scale and consumer-friendly offers – we are not seeing enough of them today.

Are heat pumps viable?

The EoH has shown that heat pumps are suitable for all property types and architectural eras, debunking the notion that they are only viable for new builds. The project installed 742 heat pumps in various homes across Scotland, Newcastle, and South East England.

The way heat pumps operate has also been debunked. The median seasonal performance factor observed in air source heat pump (ASHP) systems during the project was 2.80 (280%), a significant increase – of around 0.3 to 0.4 (30-40%) – since the Renewable Heat Premium Payment scheme trial was undertaken between 2011 and 2014.

Performance data on some of the UK's coldest days (as low as -10°C) found only a marginal decline in whole system performance. The median ASHP system efficiency was 2.44 (or 244%) on the coldest days, indicating that heat pumps operate with high efficiency, even in cold weather conditions.

"We have six years to increase installations from thousands to hundreds of thousands"

Consumer appetite

There is an appetite for heat pumps in the UK; the project received more than 8,000 expressions of interest from the public in our target areas. Applicants cited sustainability and low carbon heating (78%) and interest in new technology (63%) as the primary reasons for wanting to transition to a heat pump.

Despite this, data from the EoH point to two key barriers to installation that could hinder progress: cost and disruption.

- 47% of participants who opted out cited disruption as the main reason for saying no.
- The average cost per property for the installation of a heat pump was £14,800. This included additional measures such as the installation of hot water tanks and radiator upgrades, plus labour costs.

Innovation and training are critical to the success of a mass rollout of heat pumps. The project has demonstrated that the UK's homes are heat pump-ready. We must innovate to make the customer journey as seamless as possible. From design discussion to installation and operation, the consumer must come first. Without consumer demand, we cannot hope to install 600,000 heat pumps per year.

Consumer-first

People are not yet sure about something unfamiliar. By offering well-designed services that meet consumer needs and provide comfort, the industry can make low-carbon heating solutions attractive. Innovations should cater for diverse consumer needs, from medically vulnerable individuals to economically vulnerable households.

It's important to work with consumers, and bring them into the design and testing of the future net zero energy system. Any low carbon heating solution needs to be as good, or better than, the alternatives if we are to go at the scale and pace needed.

Fundamentally, to meet climate targets, it is essential to make switching to a heat pump as smooth a journey as possible, drive down the costs of installation, and provide a much better consumer-heating experience.

REBECCA SWEENEY
Business lead – home decarbonisation at Energy Systems Catapult

ideal HEATING
COMMERCIAL

JOIN THE NET ZERO JOURNEY

Natural refrigerant commercial heat pumps from the **UK's leading** heating manufacturer

Helping the UK decarbonise heating in commercial buildings

UP TO 70°C
High temperature

ULTRA-LOW GWP
Ultra-low GWP

R744 REFRIGERANT (CO_2)
Natural refrigerant

ECOMOD CO2 & CO2Q

AVAILABLE TO ORDER NOW!

65kW – 130kW

SCAN ME

GET A QUOTE TODAY

idealheating.com/commercial-heat-pumps

Trane Heating.
Maximum Comfort.
Minimum Impact.

The world is our building.
We're all in it together.

t 08457 165 162
e customer.care@trane.com

www.trane.co.uk

TRANE®

WHAT'S YOUR ARCHETYPE?

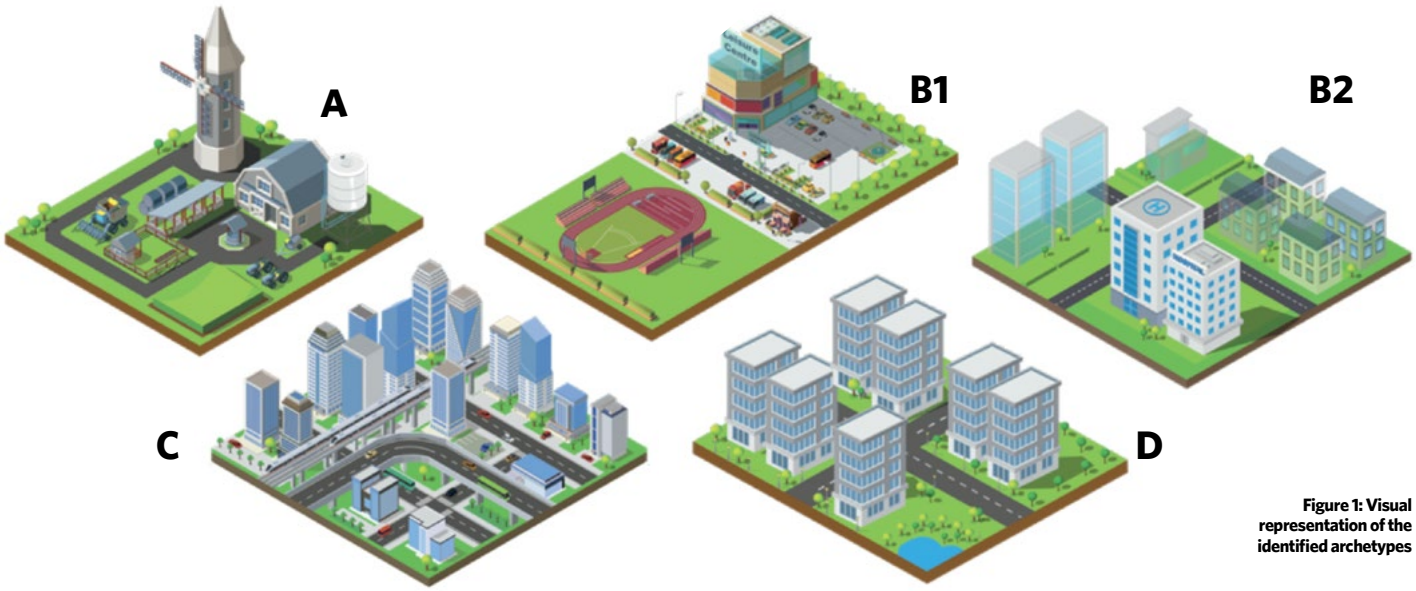


Figure 1: Visual representation of the identified archetypes

The data on heat networks is disparate and inconsistent. **Aya H Heggy** describes a project that aims to create five archetypes that will allow policy-makers to pinpoint effective decarbonisation strategies

HEAT NETWORK ARCHETYPES

- **Archetype A:** Mainly rural networks, decentralised, using bio-energy and CHP systems
- **Archetype B1:** Small-scale, urban/suburban non-domestic systems that use gas-fired CHP and heat pumps, adapting to changes in occupancy
- **Archetype B2:** Larger, consistently demanded networks, in urban/suburban settings, such as hospitals and hotels, using gas-fired CHP
- **Archetype C:** Primarily domestic urban networks that might include mixed-use areas, flexible in scale, using gas-fired CHP and heat pumps
- **Archetype D:** Large-scale, urban district systems with mixed uses, employing a diverse range of technologies

The number of heat networks in the UK has risen from 2,000 in 2013 to about 14,000 in 2020, serving nearly 480,000 people. These networks deliver around 12,000GWh of heat each year, making up 3% of the UK's domestic heat use[1]. About 990 heat network projects are in the pipeline. By 2050, it's expected that heat networks will provide heat for 20% of UK homes and 24% of commercial buildings[2].

Despite significant potential for expansion, the path forward for heat networks is challenging because of high upfront costs, regulatory complexities, problems securing reliable heat sources and gaining public acceptance[2], and – the subject of our study – the inconsistency of current data.

Our research dives into heat network data to spot key trends and patterns and come up with tailored plans for heat networks, to cut carbon.

Multiple databases – such as those of the Department for Energy Security and Net Zero (DESNZ) and the Heat Networks Delivery Unit – often provide incomplete or inconsistent data, making it hard to evaluate accurately how well heat networks are performing.

Ownership diversity, among utility companies, local governments and private entities, adds to the documentation discrepancies. For example, the Department of Energy and Climate Change estimated 4,000 heat networks in London in 2015, including 800 district heating schemes – but data from 2019-22 suggests a significant reduction[3]. This mismatch highlights the importance of reliable data: without it, strategies may not reflect the current situation, jeopardising decarbonisation efforts. Ensuring data accuracy is crucial for tailoring strategies to actual conditions.

These challenges underscore the need to develop market archetypes and conduct thorough market analyses. By systematically organising and categorising heat networks, this study aims to enable the development of targeted decarbonisation strategies.

We've built a new system to analyse UK heat networks[4]. By reclassifying the data, this research aims to spot key patterns within the sector through a process called cluster analysis. This helps pinpoint important traits across different types of heat network, making it easier to come up with carbon-reduction strategies.

We gathered data from various sources, to ensure a comprehensive analysis. This was then cleaned by removing duplicates, fixing errors, and making sure everything matched up with previous classifications of these networks. We considered nearly 960 networks, examining aspects such as location, type of network, customers, technology, and capacity.

We divided networks into two categories: communal and district. The former, which might include universities or hospitals, are further split, based on whether they serve a single site or multiple buildings under one ownership. District networks usually cover larger, city-wide areas.

We also categorised networks by their size – micro, small, medium or large – using normal probability analysis.

After organising the data, we applied two clustering techniques—manual sorting and k-mode clustering with Python[3], that aids »

identification of heat networks that share similar attributes. Comparing the results from both methods helped us pinpoint the most representative groupings of the UK's heat network market.

Data analysis and insights

Here's what the data told us about the UK's heat networks:

- **Geographical distribution:** Most heat networks are in urban areas, especially London and the North West. Rural areas, such as Wales and Northern Ireland, have fewer networks, showing potential for growth.
- **Technology distribution:** Smaller communal networks typically use combined heat and power (CHP) or heat pumps. Larger district networks opt for a mix of technologies, including energy from waste incineration
- **Capacity variations:** In urban settings, large-scale gas-fired CHP setups are common, whereas rural areas with less demand tend to go for bio-energy solutions.

The diversity in technology and capacity across the UK's heat networks shows the complexity of different operational models. Communal networks, usually under a single owner, are easier to manage in residential buildings or institutions, but face challenges in commercial settings because of changing rental situations. District networks involve many different stakeholders, which adds layers of complexity to planning, legal matters, and financial commitments. This means we need a flexible approach.

Our use of manual and k-mode clustering techniques helped us identify distinct groups within the market. From here, we developed four main archetypes, each reflecting unique characteristics and energy needs (see panel, 'Heat network archetypes', on page 43).

By splitting the market into specific categories, everyone involved – from firms to government bodies – can come up with custom solutions that tackle particular challenges and seize the opportunities unique to each type of network. This focused approach means we can target technological improvements more accurately, which boosts energy efficiency and cuts carbon emissions.

This study presents an innovative approach to decarbonising the UK's heat networks, emphasising the importance of customised strategies for leveraging low-carbon technologies. CJ

AYA H HEGGY doctoral researcher at the school of engineering, London South Bank University, **Heggya2@lsbu.ac.uk**

This article is based on the paper '*Bridging the gap: from disparate data to decarbonisation strategies in UK heat networks*', which won the Most Effective Delivery of Material award at the 2024 CIBSE Technical Symposium.

References:

1 'Combined Heat and Power – Technologies,' DESNZ, 2021.
2 Heat networks registered under the Heat Network (Metering and Billing) Regulations statistics: December 2022, DESNZ, 2023. **bit.ly/CJHnSt22**
3 A H Heggy *et al*, 'District heat networks: Addressing categorisation to unlock deployment potential', CIBSE Technical Symposium, 2023.
4 L Bai and J Liang, 'The k-modes type clustering plus between-cluster information for categorical data', *Neurocomputing*, vol. 133, pp. 111-121, 2014, **bit.ly/CJKMner**

Trusted Design Partner

Dive into LSD*

***Lean System Design**

SAV now offers half day training to introduce these design principles to Heat Network Consulting Engineers.

Launching at our office in the heart of Manchester on 10th July 2024.

SAV

To find out more visit **www.sav-systems.com/lsd**
call: **+44 (0)1483 771910** or email: info@sav-systems.com

Weather Data

Weather data is an essential component of virtually every new building design and major refurbishment.

CIBSE supplies the industry's standard weather data files used in building performance analysis and simulation. The data files have been created to better represent our current climate and weather pattern.

Data set packages* are available across 14 UK sites for the following:

- Test Reference Year (TRY) Hourly Data
- Design Summer Year (DSY) Hourly Data

Find the package that is right for your next project:

cibse.org/weatherdata

10% off
your first purchase

Simply call Amy Emmett on
+44 (0)20 8772 3667 and quote
"Journal Weather Data"

*All packages are available in EDSL Tas, EPW & Excel

LOW CARBON, HIGH SAFETY

The embodied carbon impact of fire safety measures is relatively unknown, so Arup's **Grete Wilson** and **Dr Emma McIntyre** have created a roadmap to establish how engineers can create low carbon designs without compromising fire safety

Fire remains a significant safety concern in the built environment, alongside the pressing need to decarbonise. As we strive to engineer buildings with low embodied carbon, it is crucial to ensure that novel designs and technologies do not compromise fire safety.

Research presented by Grete Wilson and Dr Emma McIntyre at the 2024 CIBSE Technical Symposium highlighted the evolving focus for fire safety engineers, setting out a roadmap to achieving safe, low carbon designs.

Traditionally, embodied carbon has not been a focus for fire safety engineers. At their core, however, is the aim to minimise the carbon impact of buildings by reducing the likelihood and consequence of a fire occurring in the first instance. An FM Global study summarised[1] that carbon emissions increase by 30-40kgCO_{2e}·m^{-2} of floor area when effective fire safety measures, such as automatic fire suppression, are not provided, exacerbating the impact of a fire (see Figure 1).

Fire safety engineers can consider the impact they have on embodied carbon through the fire safety measures they propose. For example, some building elements that exist might inherently meet fire safety requirements and do not need modifying for fire safety reasons – for example, walls and floors. Others may require modification to comply with the safety requirements – for example, changing the material in the external wall. Further, there are building elements that exist solely for fire safety reasons including fire suppression, fire detection and alarm systems.

As a priority, the amount of embodied carbon associated with building elements that exist just for fire safety purposes should be measured and understood. This understanding will help in making informed decisions that balance fire safety and carbon-reduction goals.

When establishing how a building responds in a fire, fire safety engineers typically set performance requirements for the specification, and guide clients and design teams to achieve regulatory compliance for the end products selected.

This should be included from RIBA Stage 2 (Concept Design), or earlier, when strategy-level options are presented and considered holistically with the design team. The primary goal of the fire safety engineers at this stage is to present options that could satisfy statutory requirements, along with any additional fire safety goals set out by the client.

The regulatory framework in the UK allows fire safety engineers to consider multiple fire strategy options to demonstrate compliance. In some scenarios, for example, providing an automatic sprinkler »

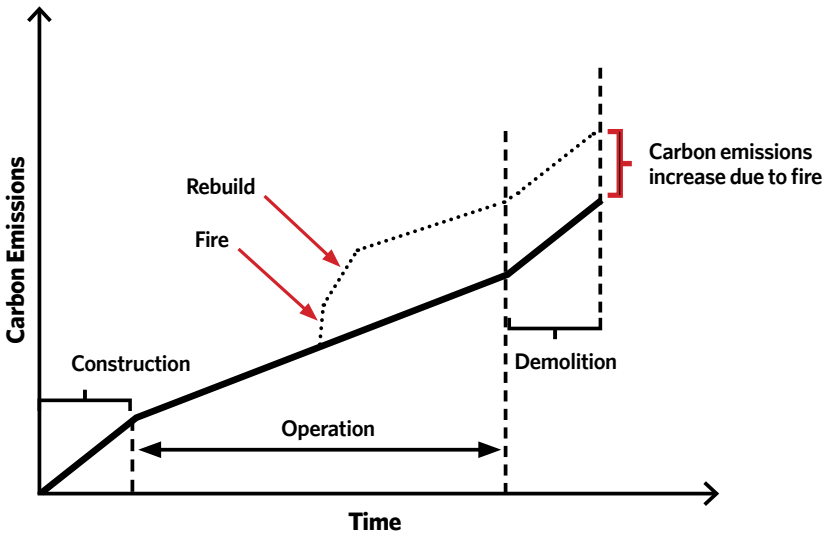


Figure 1: Increase in carbon emissions because of fire

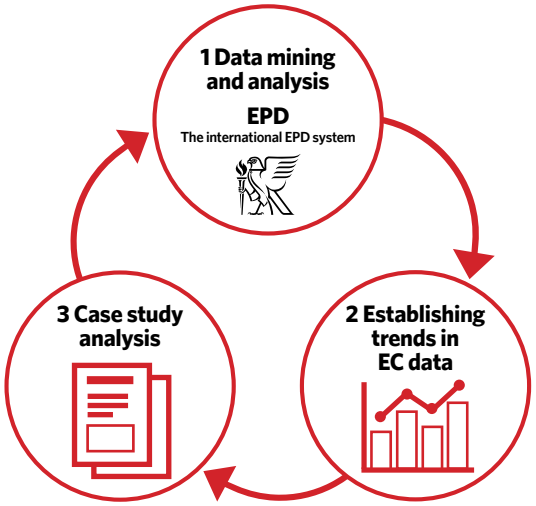


Figure 2: Fire safety and low embodied carbon roadmap

» installation allows a reduction in fire-resistance periods of load-bearing structures. It is unknown, however, which option worsens the impact on embodied carbon: the combination of sprinklers and reduced structural fire protection or comparatively more structural fire protection.

It is recognised that the greatest influence on the final design is at earlier design stages, so – if embodied carbon impact was known – an appraisal of fire strategy options could be undertaken that demonstrated the most desirable balance between low embodied carbon design and fire safety.

The roadmap

To enable low embodied carbon design, fire safety engineers, in collaboration with sustainability consultants and other engineers, should carry out the following three steps (see Figure 2):

Step 1: Data mining and analysis

We need to harness and harmonise global embodied carbon information for the fire safety measures proposed in buildings. Fire safety engineers have not traditionally been involved in product-level specification.

Typically, it might be expected that this would be provided in the form of Environmental Product Declarations (EPDs) or carrying out estimations based on a CIBSE TM65 calculation. We acknowledge that there are limitations in embodied carbon data in these forms – for example, limited production of EPDs, inconsistency between EPD reporting, and conservatism in CIBSE TM65 calculations.

Step 2: Establishing trends in embodied carbon data

After successful mining of embodied carbon data for fire safety measures, the next step is to understand the variation in the data on a product and/or system basis. Through engagement with sustainability consultants, it is necessary to determine where data can be plotted against a common variable – for example, period of fire resistance – to establish trends in the embodied carbon for a fire safety measure such as compartmentation. It may then be possible to use these trends to estimate the embodied carbon impact at concept stage. Crucially, it should be recognised that this data is based on a dataset at a given time.

Step 3: Case-study analysis

Establishing embodied carbon trends provides the opportunity to undertake optioneering at concept stage, considering both fire safety and low embodied carbon design.

As described above, fire safety engineers often specify certain fire safety measures that permit 'relaxations' in other aspects of the design. To determine the embodied carbon impact of fire safety relaxations, a case-study analysis can be undertaken on an existing building project to consider the relative change in embodied carbon when sprinklers are provided vs non-sprinklered fire-resistance requirements for the structure of a single floor.

Following the initial test case, this can be expanded to a full building and to different types of buildings that incorporate alternate construction techniques (for example, mass timber) and other fire safety systems (for example, smoke extract).

Undertaking case studies of common 'fire safety relaxations' to study the aggregated embodied carbon impact, and making those findings widely available will enable fire safety engineers to knowingly influence the design at concept stage.

Gradually, the outcomes of the various case-study analyses can inform decisions made at concept stage to fire safety engineers, to better engage with design teams on fire safety and embodied carbon project goals.

Ultimately, it is necessary to holistically assess the impact of fire safety strategies and work collaboratively to design low embodied carbon buildings, safely. CJ

■ The paper was presented at the 2024 CIBSE Technical Symposium **www.cibse.org/symposium**

■ The 2025 symposium is from 24-25 April 2025, in London.

ABOUT THE AUTHORS

■ **GRETE WILSON** AIFIRE, is fire safety engineer, and **DR EMMA MCINTYRE** AIFIRE, is senior fire safety engineer at Arup's Edinburgh office

References:

1 Gritzo L A, Doerr W, Bill R, Ali H, Nong S and Krasner L, 'The influence of risk factors on sustainable development', *FM Global Research Division Technical Report*. 2009.

UK • EUROPE • MIDDLE EAST • ASIA • USA

CASWELL FIRESAFE®

THIRD PARTY CERTIFIED

Applus certifire firas UL CERTIFIED SAFETY US R38800 european certification group ISO 9001 REGISTERED FIRM UKAS MANAGEMENT SYSTEMS

2019 CIBSE PATRONS CIBSE CPD ASFP

CASWELL FIRESAFE® is licensed to Manufacturing Partners worldwide by FIRESAFE Fire Rated Ductwork® Ltd

firesafeductwork.co.uk

HOT AND BOTHERED

The risk of overheating in buildings is growing significantly as temperatures rise, but a new survey by *CIBSE Journal* and Zehnder Group UK shows that mitigating the risk is not always a priority in design even though respondents say it's a hot issue. **David Blackman** reports

This year's UK summer has, so far, generally offered respite from the soaring temperatures seen in recent years. Last month's mini-heatwave, however, is more like the hot summers that experts believe will be the norm in the near future.

Nine in 10 existing UK homes will be at risk of overheating if worldwide temperatures rise to 2°C above pre-industrial levels, which is baked in by 2050 if global warming continues on its current trajectory, according to a report published by Arup two years ago. The Climate Change Committee has said that nearly one-fifth of UK homes already overheat, even during cool summers. A warming climate is largely behind this, but the problem is often exacerbated by the way buildings are being made more energy efficient, by installing more insulation and making them airtight. 'This issue isn't going to go away; overheating is only going to get worse,' says Jason Bennett, indoor air quality specialist at indoor climate solutions provider Zehnder.

To look into this growing issue, Zehnder and *CIBSE Journal* conduct research to get a better view of the understanding across the building industry when it comes to overheating. The majority of respondents were consultants (70%), followed by contractors (12%).

The findings show that, despite emerging evidence of overheating causing problems, the topic ranked relatively low on the respondents' list of concerns. Asked to identify their priorities when getting involved in a new building project, they ranked design top, followed by quality, Building Regulations and energy efficiency. Modelling against the risks of overheating ranked eighth.

Asked what worried them most when planning a new building project, the top three concerns were, in descending order, design, cost and quality. Modelling against the risk of overheating ranked sixth in this list.

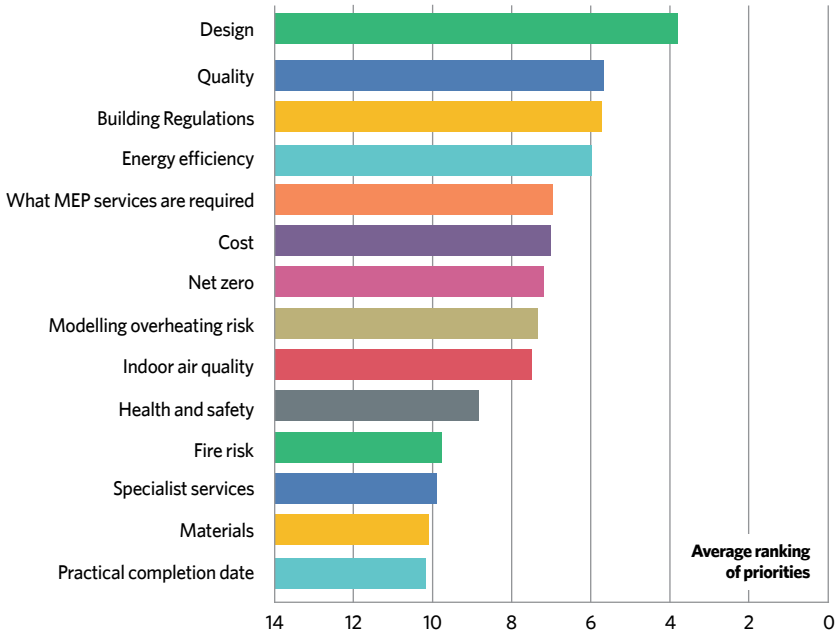
Bennett acknowledges that improved energy efficiency must continue to be a priority when designing new buildings, but 'the future is about cooling', he adds, pointing out that people's sleep starts to be affected at temperatures of 24°C and above.

'We create these really [energy] efficient homes and then spend a lot of money trying to reduce the temperature within those properties. We are creating hot boxes,' he says.

Insufficient awareness about the problem may be a reason why overheating is not higher up the industry's list of concerns, the survey indicates. A third (34%) of respondents said they are familiar with Approved Document Part O of the UK Building Regulations, which addresses overheating in buildings, while 46% said they are 'somewhat familiar'. However, a worrying 20% said they are not familiar with it.

Just more than one-third of the survey's

What are your priorities in a new building project (ordered in priority from 1-14)?



respondents said they know the Approved Document 'inside out', while 46% professed to understand the theory behind Part O, but were 'unsure how to put it into practice', and 19% said they 'don't understand it at all'.

This lack of understanding is 'a worry', says Bennett, who adds that the 19% may include contractors who tend not to get involved with specifying overheating measures, but will include others that do. 'I would expect the consultants, developers, specifiers and architects to know about Part O,' he says.

These groups of professionals should be 'very familiar' with Part O, which suggests that overheating should be more firmly embedded within the sector's education curriculum. 'It's education, education, education,' Bennett says, noting that Zehnder runs a programme of continuing professional development.

While the level of understanding about Part O could be better, Bennett says it is reassuring how the younger generation of engineers are more aware of its importance.

Nearly eight in 10 (78%) of the survey's respondents said they actively prioritise passive cooling options over mechanical ones, with just 14% opting for the latter, reflecting the approach laid out in Part O.

One respondent said mechanical cooling should not be used as 'a means of avoiding good design', with another noting that, even if it is required, putting in passive measures first will reduce the need for such interventions. Bennett responds that ventilation and 'air tempering' systems, such as MVHR, will work in the background without the need for 'much input' from homeowners. He said mechanical cooling can be acheived with air conditioning, but this method simply circulates stale and dirty air. A better solution is to incorporate air temperation into an effective ventilation strategy. The difference is fresh, clean air supply all year round with heat recovery in the winter and cooling in the hotter months – promoting better, healthy indoor air quality (IAQ). Zehnder can help by providing relevant information, he says, adding 'There's lots of great resource in regard to educating the homeowner on our website.'

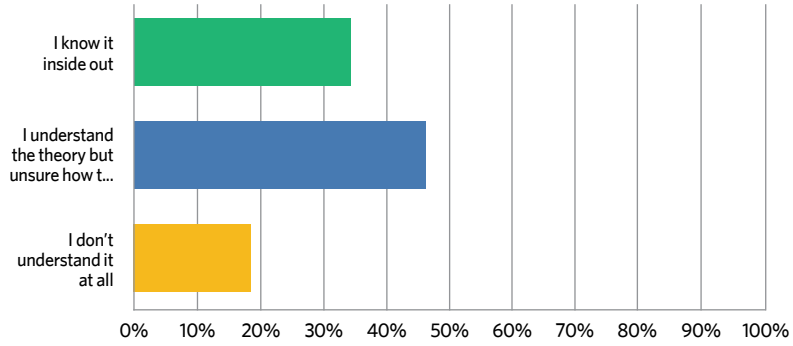
Another respondent noted that mechanical cooling is 'more predictable and dependable', and another said, it is not always possible to rely on passive measures due to boundary constraints. For example, in highly urbanised areas such as central London, where noise and air pollution prevent window opening, recourse to mechanical ventilation and cooling is 'nearly inevitable', they say.

High-rise apartments were identified by 65% of respondents as the type of building most at risk from overheating. However, a significant proportion raised concerns about schools (40%), care homes (39%) and hospitals (30%). All of these building types cater for children and the elderly, who are among the most vulnerable in society.

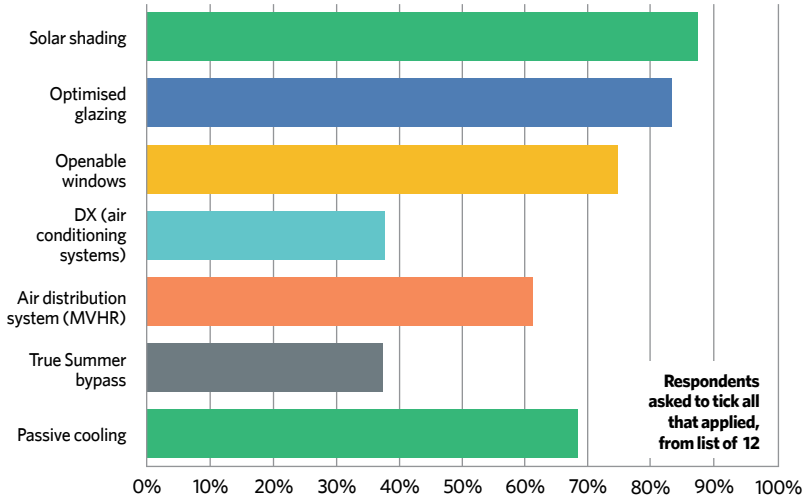
There were few concerns, though, about non-apartment type housing, such as terraced and detached homes. More than half of those surveyed (53%) said that new properties pose a higher overheating risk than older ones (21%). Respondents' concerns about new buildings included lack of comfort for occupants, high glazing-to-wall ratios, non-openable windows, highly insulated properties and many flats being single-sided.

One respondent said: 'Overheating in new buildings is a growing concern because of modern construction practices and climate change. The use of extensive glazing and high insulation for energy efficiency can trap heat, leading to uncomfortable and potentially hazardous indoor conditions. »

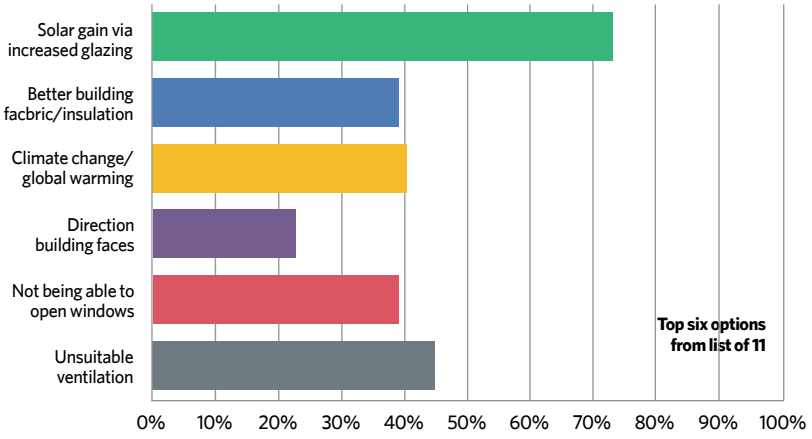
How well do you understand Approved Document Part O?



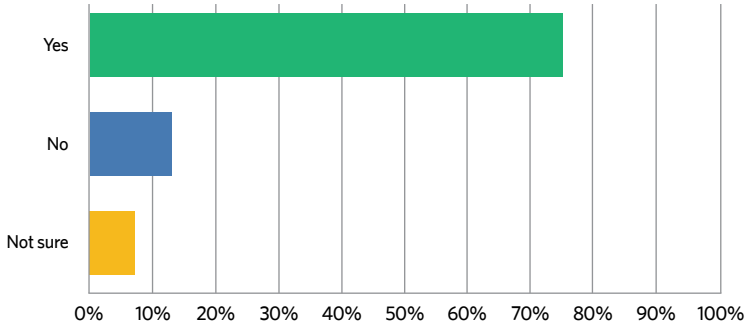
How would you tackle an overheating risk in your building project?



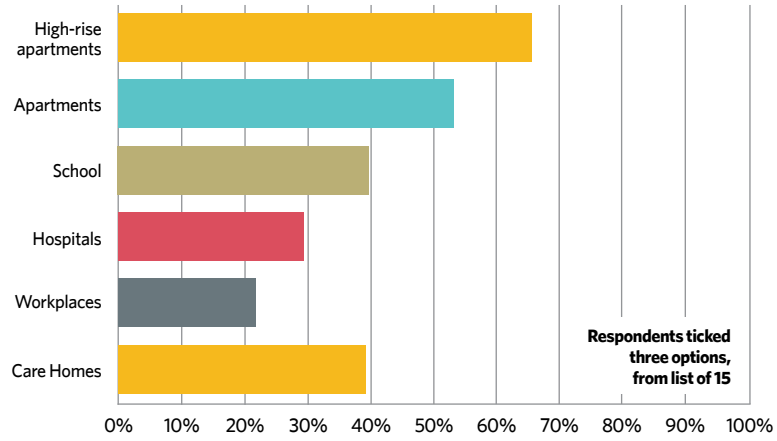
What do you think are the main reasons for overheating in homes?



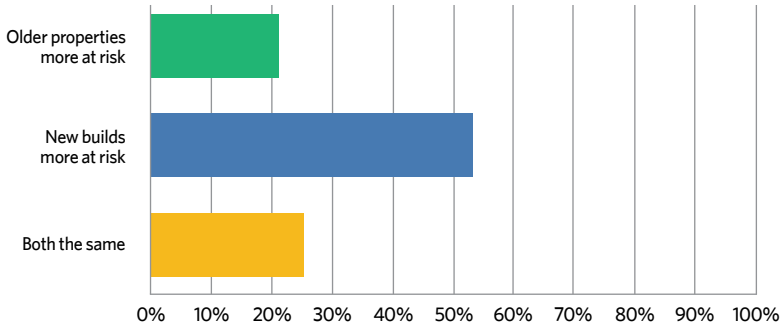
Do you actively prioritise passive cooling options over mechanical?



What type of buildings are most at risk from overheating? (Check 3 options)



Are older properties more at risk than new builds?



» This problem is exacerbated by rising global temperatures and heatwaves.'

Many raised concerns about new-build properties' lightweight structures and lack of thermal mass, with one respondent highlighting the 'greenhouse levels of glass' in some developments.

The top three solutions identified for tackling overheating were identified as solar shading, optimised glazing and openable windows. MVHR was identified as the fifth most popular solution, just behind passive cooling.

Several raised concerns about security, with one pointing to the risks of ground-floor openings. Bennett says, 'the security risks, particularly on ground-floor apartments, mean that you can't open your windows and doors at night-time when you would do normally and this is where a ventilation-based cooling approach is beneficial for the occupant.'

When asked what other methods or strategies they used to tackle overheating risk in their building projects, several respondents mentioned thermal mass and building orientation. A couple said ceiling fans, but very few respondents mentioned natural solutions, like planting trees on east and west elevations or using vertical shading. When asked to identify the main reasons for overheating in homes, most respondents named solar gain through increased glazing (73%). Jostling for second were unsuitable ventilation (45%), global warming (40%), not being able to open windows (40%) and more insulation (39%).

Zehnder always takes a holistic approach to ensuring that buildings don't overheat, says Bennett: 'Its principle is that thermal shading starts outside the building. You can't do that in a high-rise, 15 floors up, but we talk about a fabric-first approach – for example, how many external shutters and how much passive shading you can have on the property.'

He adds that overheating needs to be designed out and thought about almost at the pre-planning stages. 'We have to look at the dynamics of the building and we need to be coordinating our efforts along the way,' he says, 'and not just us, as an indoor climate solutions manufacturer – we should be networking and coordinating with the others responsible for mitigating overheating risks.

'It's great if I provide air tempering for your property, but if the sun is facing your window, I'm already fighting against 30 degrees.'

'Creating a tolerable environment isn't just about cooling and heating, but also about ventilation, an increasingly pressing topic as people spend a lot more time working from home post-pandemic,' Bennett says.

CIBSE-funded research by UCL found that with home working much more attention must be paid to the health impacts of high indoor pollutant concentrations, and concluded that occupants should be made aware of the benefits of sufficient air-exchange rates and environmental control to enhance IAQ.

'These systems are all cogs in the much larger machine of your home,' Bennett concludes. 'I'd much rather have a ventilation system that was filtering particles rather than capturing them in my lungs. I can change the filters - I can't change my lungs. If it can also keep my property cool, it's a win-win'. CJ

GROWING AWARENESS OF OVERHEATING

Dr Anastasia Mylona, technical director of CIBSE, isn't too surprised that one-fifth of the survey respondents lack awareness of Approved Document O.

Many building services consultants and engineers also don't come across overheating because of the specialised nature of their roles, says Mylona: 'If you're not doing overheating assessments, then you will not know a lot about Part O and how to comply with it.'

Engineers and consultants working in smaller teams are more likely to carry out Part O compliance calculations, says Mylona, who represented CIBSE on an advisory board that advised the government on the formulation of the regulation.

She says it must be looked at in the context of the much lower level of awareness about overheating just a few years ago: 'Five or 10 years ago, nobody thought about it: That is a massive improvement that Part O has brought.'

THE WATER MANAGEMENT SOCIETY
Presents:

SPECIAL NHS RATE AVAILABLE!

TRADE STANDS AVAILABLE
SEE WEBSITE FOR DETAILS

POSITIVE + IMPACT

CAN IMPROVEMENTS REALLY BE IMPLEMENTED?

GLASGOW SCIENCE CENTRE
24TH SEPTEMBER 2024

Attend this event to hear from renowned industry professionals and earn 6 CPD points. Delegates will also have the opportunity to network with peers and trade stand representatives in the breakout area.

FEATURING:

MORNING TOPICS:

The Great Paradox: Water & Carbon Savings in Healthcare Buildings
- What products and processes can provide carbon and water savings
- The challenges involved
- Examples of how to overcome the problems

by Jonathan Waggott, Angel Guard

Update on changes to CIBSE Guide G: Chapter 2 - Water services and utilities
- Domestic Water Supply Treatment
- Domestic Water Pipework Sizing
- Domestic Hot Water Generation
- Operation and System maintenance

by Steve Vaughan, Technical Director, AECOM

How Relevant is the HSE Guidance Today
- Does the guidance meet the microbiological challenges
- Are we learning anything new that can help reduce water borne risk
- Response to positives

by Dennis Kelly, Pro Lp Consulting

Remote Water Monitoring - A Real Life Case Study
- Why Remote Water Monitoring was selected
- Lessons Learnt with Deployment
- Results and Conclusions so far

by Kimberly Arbuckle, Angel Guard on behalf of NHS Lothian

AFTERNOON TOPICS:

AE Work in Healthcare

IPC: Providing assurance in new builds
- Key Stage Assurance review process
- IPC role in construction projects and KSAR process
- Lessons learned/future work

by Hayley Kane, Nurse Consultant, Infection Prevention and Control

The True Cost of Showers in Healthcare
- Showers are valued highly in new healthcare design
- Stamina and mobility problems mean showers can be unsuitable and underused
- Redundant water infrastructure amplifies waterborne infection risk
- Healthcare is unlikely to afford this underused facility if we intend to keep water safe

by Dr Joanna Walker. Microbiology Consultant and Infection, Prevention and Control Doctor. NHS Lanarkshire

www.wmsoc.org.uk/events

v4/21-06-24

AIR CHANGE RATE CONTROL

with precision air volume measurement

Air volume measurement:

* Fresh air intake
* Supply air into the Area
* Return air to the AHU
* Exhaust Air to outside
* Fume Hood extract air
* Laboratory make up air
* Industrial process air

CMR FGG FLOWGRID

Flowgrid and P-Sensor

* Averaging velocity summation
* Linear output in m³/s, m³/h and l/s
* Air Change rate calculation
* Duct Size and density calculation
* Air turbulence dampening
* Velocity pressure linearization
* Compatible with any BMS or PLC
* 0-10V, 4-20mA and Modbus rtu signal
* UKAS traceable calibration certificate

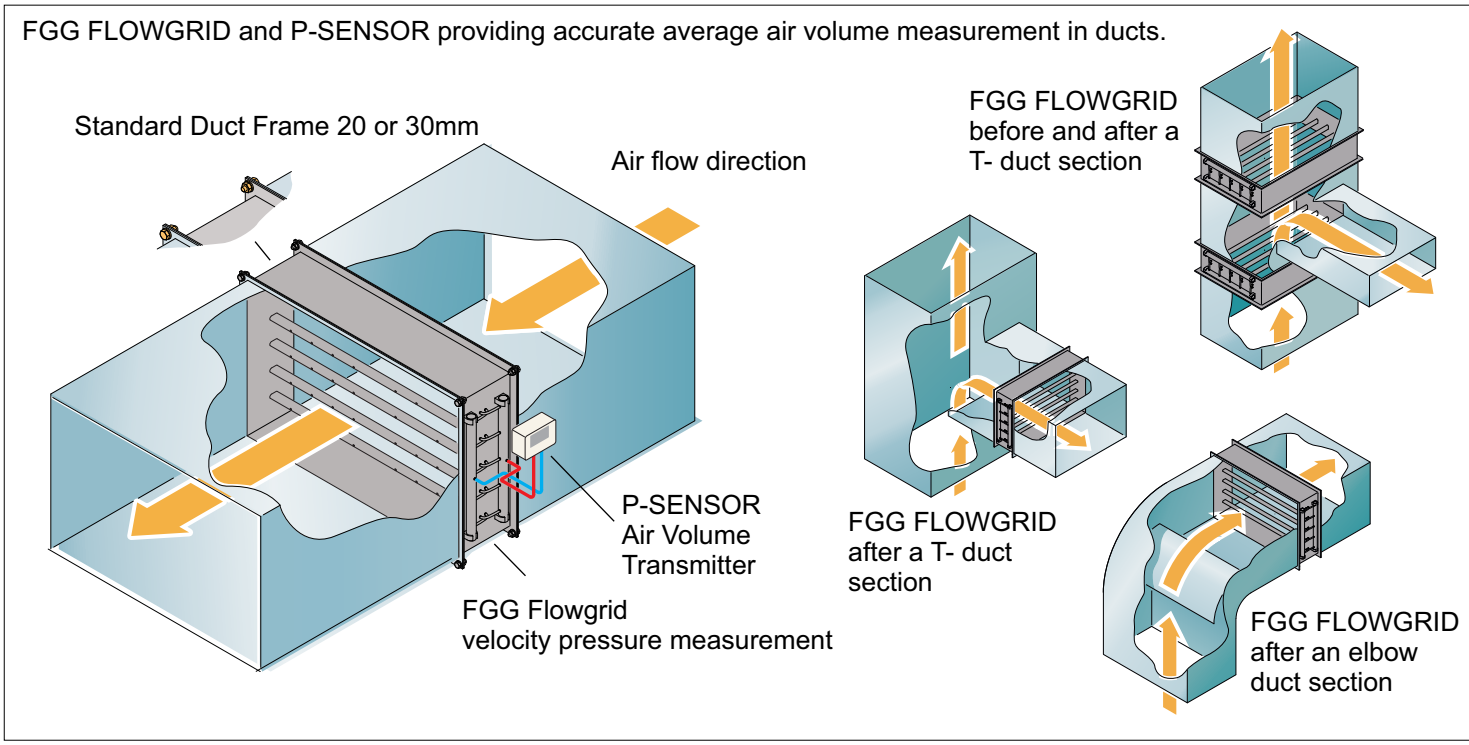
Installed in many projects

Commercial Buildings - Industrial Production Plants

Pharmaceutical Production Plants - Validated Monitoring

Hospital Isolation Rooms - Operating Theatres - Data Centres

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



CMR CONTROLS Ltd

Precision Air Pressure and Volume Sensors

22 Repton Court Repton Close
Basildon Essex SS13 1LN GB
web www.cmr-controls.com

Phone +44 (0) 1268 287222
Fax +44 (0) 1268 287099
mail info@cmr-controls.com

CMR® since 1978

ISO 9001 and UKAS accredited

CPD CIBSE APPROVED

Continuing professional development (CPD) is the regular maintenance, improvement and broadening of your knowledge and skills, to maintain professional competence. It is a requirement of CIBSE and other professional bodies.

This *Journal* CPD programme can be used to meet your CPD requirements. Study the module and answer the questions on the final page. Each successfully completed module is equivalent to 1.5 hours of CPD.

Modules are also available at **www.cibsejournal.com/cpd**

Robust sensing and control of airflow in commercial ventilation systems

This module examines the significance of controlled ventilation and the use of pressure-based airflow measurement to ensure suitable air flowrates

The supply of appropriate, known air flowrates through mechanical ventilation and air conditioning systems in commercial and industrial applications is fundamental to effective system operation. This CPD module considers the characteristics of moving air and explores the application of pressure-based airflow measurement as a means of assuring air flowrates.

A typical assumption at the design stage is that air flowrates in the installed systems will match the design intent; however, unless the systems are suitably controlled, this is unlikely to be the case. Poor control will, at best, lead to less-effective operation, poorer indoor air quality (IAQ), increased energy use and – for more critical applications, such as fume and smoke extraction – a potential health and safety risk to building occupants. Whether a system is operating at full or reduced air flowrate, it is important to ensure there is an appropriate supply of outdoor ventilation air to maintain IAQ by diluting indoor pollutants, such as carbon dioxide (CO_2), dust, allergens, microbes, and volatile organic compounds (VOCs). In most ventilation systems, there are minimum flowrates that are required to ensure adequate air distribution that not only maintain IAQ parameters, but – as discussed in the September 2022 *CIBSE Journal* article[1] exploring Khankari's work – also may limit the spread of contaminants from a source. Additionally, properly controlled airflow can be critical in smoke management during a fire, aiding safe evacuation and minimising smoke-inhalation risks. A well-controlled system can readily adapt to changes in building usage or occupancy, ensuring long-term flexibility in working practices while continuing to meet ventilation standards and comply with health and safety standards.

Precise control of airflow ensures that only the necessary amount of air is moved, reducing the energy required for fans and other components. For example, the key benefit provided by variable air volume (VAV) systems is that, by adjusting airflow based on demand, VAV can provide significant fan energy savings compared with constant air volume (CAV) systems. When using a CAV system, zoning may be used to close off, or reduce, the supply of ventilation air to cater for the specific needs and preferences of different occupants or activities. Zoning allows different areas of the building to be controlled independently and, potentially, provides the opportunity to fully isolate areas of the building that are not in use. This would enable the supply and extract fans to operate at a slower speed. As well as reducing the volume flowrate of the air that needs to be moved by the fan, this also reduces the load on heating and cooling equipment.

System and sub-system pressure drops will be dependent on the characteristics of the ducted system, including roughness and geometry of the ducting materials, the number and type of fittings, such as constrictions or bends that disrupt the air path, as well as the properties of the air itself.

The relationship between air pressure drop, Δp (Pa), and volume flowrate, Q ($m^3 \cdot s^{-1}$), of air flowing through a typical commercial heating ventilation and air conditioning (HVAC) ducted system can be normally characterised as proportional, so $\Delta p \propto Q^2$. So, for air flowing through a specific resistance, R, such as a filter or a purpose-

»

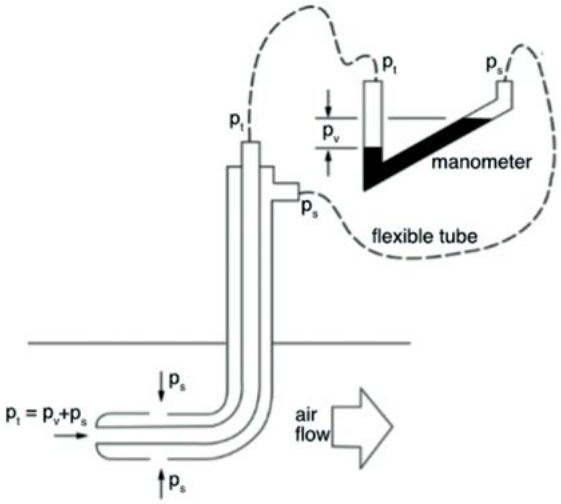


Figure 1: A simple, portable, pitot-static tube employed to measure velocity pressure and static pressure in a moving air stream (After Roger Legg)

» made measuring station, $\Delta p = RQ^2$, where R is a constant of resistance that is related to the particular item (for example, the filter, or the measuring station). If the measuring system is calibrated with respect to the specific resistance, R, then the flowrate may be obtained from $Q = (\Delta p/R)^{0.5}$.

Pressure differential sensing (measuring the Δp) is widely applied in HVAC systems as the means of referencing air flowrates. This may be to directly measure pressure differences across components such as air inlet louvres, filters, ducts, or heat exchangers, or be used in association with fully calibrated devices such as venturi measuring stations to provide measurements of air flowrates.

The total pressure, p_t, (Pa) in a moving airstream is the sum of the velocity pressure, p_v, and static pressure, p_s, so $p_t = p_v + p_s$. The velocity pressure may be readily established as $p_v = p_t - p_s$. This can be obtained using a liquid manometer, as illustrated in Figure 1, which is connected to a pitot-static tube that is held in the duct. Since velocity pressure may be calculated from $p_v = 0.5\rho c^2$, where ρ ($kg{\cdot}m^{-3}$) is the air density (typically assumed as $1.2kg{\cdot}m^{-3}$), the velocity, c ($m{\cdot}s^{-1}$), of the air can be obtained from $(2p_v/\rho)^{0.5}$. And from this, the volume flowrate, Q, may be obtained by multiplying the duct area (m^2) by the average air velocity across the duct. In most HVAC applications – other than when the air passes through a heating or cooling process – the temperature of the air in a particular duct run, along with its density and viscosity, are assumed as nominally constant, so the volume flowrate (and, of course, the associated mass flowrate) remain constant.

Devices such as the pitot-static tube only provide a point measurement. To gather more representative pressure data on a continuous basis, purpose-manufactured measuring devices may be employed. Historically, these have been applied in specialist systems when specific needs demand continuous airflow measurement, such as maintaining required air volume or room air pressure in laboratory or process environments to ensure positive movement of air and contaminants. However, ensuring adequate outdoor air supply is not limited to specialised applications. For example, any systems that vary the air flowrate require careful design and operation to maintain optimal outdoor air fractions as the total flow modulates. By actively and accurately monitoring volume flowrates of outdoor air, and total and individual zone flows, the control system is able to modulate outdoor and recirculated air proportions effectively. An example of a commercially available flow pressure sensor, illustrated in Figure 2, is a pair of identical stainless steel pressure probes that may be mounted in a duct. One probe measures the total pressure, while the other measures the static pressure. Unlike the simple pitot-static tube, the probes continuously collect pressure signals across the whole width of the duct and, through an associated electronic pressure transducer, may be precisely calibrated for a particular application.

It is important that the sensor remains stable across the operating range, since a drift of just 1Pa or 2Pa – particularly at the lower end of the range – can cause a significant error in the measurement of the air volume. For example, if designing a system with an air velocity of 4 to $5m{\cdot}s^{-1}$, with a resulting velocity pressure of under 15Pa, the error in pressure measurement could exceed 10%. This error may be magnified in systems that employ two separate sensing devices to maintain small positive or negative pressures compared with an adjacent, sometimes outdoor, space. Applications that rely on a small pressure difference to operate effectively include those positively pressurised to prevent ingress of contaminants, such as an airport terminal building designed to prevent the ingress of fumes from aircraft engines, or an office building in a polluted city centre that might otherwise be subject to vehicle pollution. Commonly encountered minimally negatively pressurised zones include hospital critical care spaces, clean rooms and laboratories that all rely on a robust pressure control to prevent cross-contamination. If the pressure sensors drift by just a few per cent in either the supply and extract systems, there is opportunity for significant pressure deviations leading to potential contamination.

Permanent installations, which require more exacting measurements, can incorporate frameworks known as velocity or flow grids, which are designed to capture measurements across a representative section of the flow area, as shown in Figure 3. These tubular grids are strategically populated with holes to obtain a representative average pressure. Total and static pressure are measured independently through holes drilled into sampling tubes at specific orientations. Such grids come with calibration factors that translate measured pressures into velocities or volumetric flowrates, or are supplied as part of a package with a matched microelectronic transducer and signal conditioner. Their design allows for

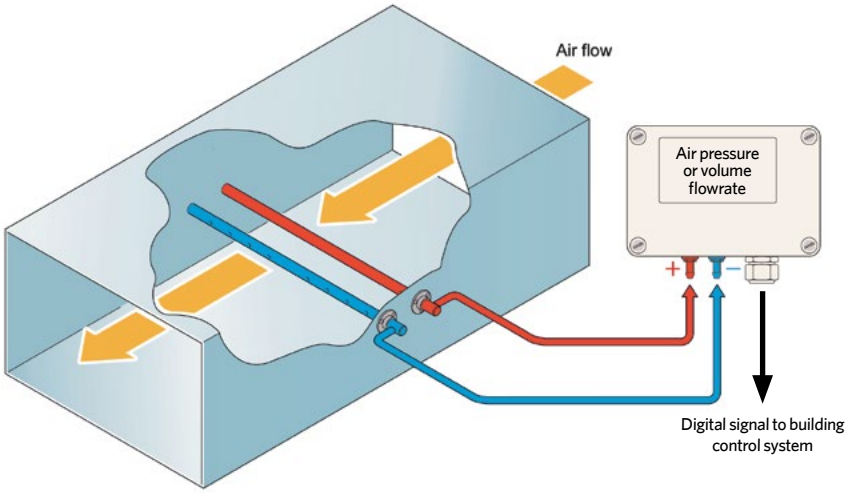


Figure 2: A pair of matching stainless steel pressure tubular probes – one with holes facing directly into the airstream and the other one with holes facing downstream (Based on CMR image)

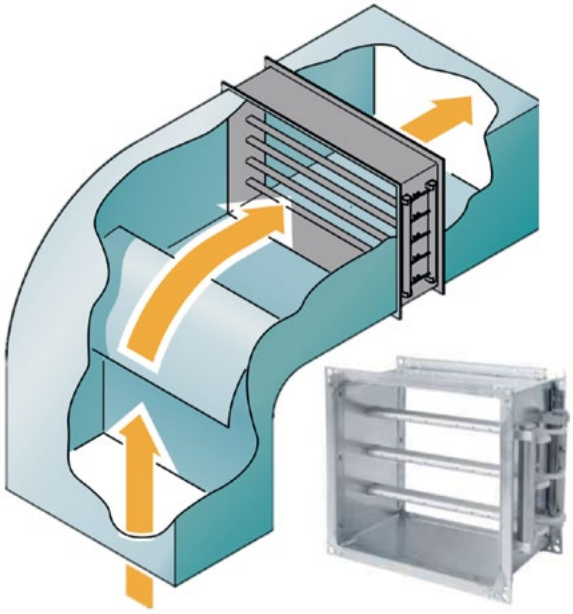


Figure 3: A flow grid. Such devices may be used to reliably produce a signal to correctly measure airflow even when close to fittings and bends. The multiple measuring points enable a more reliable interpretation of average velocity of the air (Based on CMR image)

Figure 4: Example of VR sensor packaged with microelectronics to transduce, calibrate and condition the differential pressure signal to provide local monitoring as well as visual and digital output of air pressure and air velocity

a stronger pressure signal compared with single-probe measurements, enhancing resolution and reducing potential errors, achieving measurement accuracies within ±0.2% of the full scale. They also offer a significant benefit, as with appropriately matched transducer and signal conditioning they maintain responsiveness at very low pressures, allowing very low air velocities, approaching 0m·s^{-1}.

The pressure signals from the measuring points then need conversion into a form that can be used by the control systems. This requires a transducer that, in commercial HVAC, commonly employs sensors based on piezoresistive or capacitive principles. However, the reliable, but less well-known, variable reluctance (VR) sensor, as described in the boxout, has a well-established pedigree in close-control ventilation systems such as those used in laboratories and microchip fabrication plants. Such sensors have proved robust – a manufacturer[2] reports such sensors with a copper beryllium diaphragm are still providing reliable output after more than 30 years' continuous use. The two pressure connections shown in Figure 5 are connected by tubes to the pressure outlets of the measuring device, and the diaphragm deflects in response to any pressure difference across it. When close-coupled with packaged local microelectronic conditioning, as in the example unit shown in Figure 4, the digital output may be transmitted to the local building management system (BMS) – using a protocol such as RS485 for Modbus connectivity – to ensure that the BMS receives the measurement that is representative of the sensor output (rather than employing uncertain BMS-based analogue-to-digital conversions). VR sensors can provide a cost-effective option for pressure differential sensing in HVAC compared with some alternative technologies, particularly when total life-cycle energy use, operating costs and environmental impact are considered.

Closely controlling the airflow in a building ventilation system offers significant benefits, from energy efficiency and cost savings to enhanced indoor air quality, thermal comfort and safety. These advantages make it a crucial aspect of modern building design and operation – and worthy of careful consideration when developing ducted air-distribution systems for HVAC applications.

Turn to page 58 for references. »

VARIABLE RELUCTANCE SENSOR

Typically known as a VR sensor or magnetic pickup, these sensors detect the position of moving metal objects. They operate on the principle of variable reluctance, which is the change in magnetic resistance caused by the movement of a ferromagnetic material in proximity to the sensor. The key components of a basic VR sensor are a permanent or electromagnet to provide a magnetic field; a moving metal object (known as a ferromagnetic 'target') that, when it moves, induces a voltage, and potentially a current, in an adjacent coil because of the changing magnetic flux.

Figure 5 shows the basic components for a VR pressure differential sensor, as used in HVAC applications. It consists of a ductile ferromagnetic diaphragm that provides a thin, movable membrane separating two air chambers. The coils are positioned on either side of the diaphragm.

When a pressure difference exists across the diaphragm, it deflects. This movement alters the magnetic flux path between the core and the coils. The reluctance, which is the resistance to magnetic flux, changes based on the diaphragm's position. The VR sensor coils are typically driven by an alternating current (AC) signal. The varying reluctance caused by diaphragm deflection affects the induced current in the coils. This change in current can be processed by local microelectronic circuitry to provide a calibrated digital or analogue output that corresponds to the pressure difference.

VR sensors can handle the wide range of pressure differential commonly encountered in HVAC systems and are able to detect small changes in pressure. The simple design, with minimal moving parts, adds to their reliability and long lifespan, while their small size allows for easy integration into various HVAC components. The key component is the diaphragm – the material for this must maintain ductility and integrity over extended periods of use.

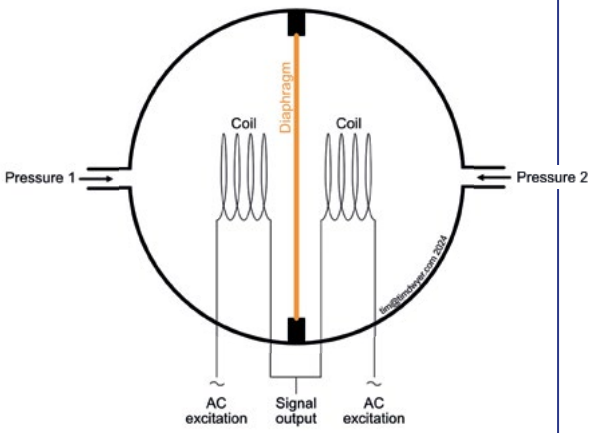


Figure 5: Simplified schematic of the functional components of an example of a variable reluctance sensor that can be applied to measure air pressure differential. The signal is locally conditioned to provide direct output suitable for the control system

Module 235

July-August 2024

1. What is the primary purpose of ensuring appropriate air flowrates in mechanical ventilation and air conditioning systems?

- ☐ A To decrease the humidity of indoor air
- ☐ B To enhance the aesthetic appeal of the building
- ☐ C To ensure effective system operation
- ☐ D To increase the temperature of indoor air
- ☐ E To reduce noise levels in the building

2. Which of these is not noted as being a benefit of providing required air flowrates throughout the system and sub-systems?

- ☐ A It ensures appropriate outdoor air to occupied spaces
- ☐ B Potential to zone off unused areas
- ☐ C It prevents ingress of contaminants in positively pressurised spaces
- ☐ D It provides safe smoke and fume extraction
- ☐ E It simplifies system design by employing single-speed fans

3. What is the likely velocity of air in a duct where the average measurement of total pressure is 140Pa and static pressure is 125Pa?

- ☐ A 3m·s^{-1}
- ☐ B 4m·s^{-1}
- ☐ C 5m·s^{-1}
- ☐ D 6m·s^{-1}
- ☐ E 7m·s^{-1}

4. What is the main advantage of using pressure differential sensing in HVAC systems?

- ☐ A It directly measures temperature differences
- ☐ B It eliminates the need for regular maintenance
- ☐ C It increases the system's noise levels
- ☐ D It provides accurate measurements of air flowrates
- ☐ E It reduces the need for air conditioning

5. What is the metal that is noted as providing exceptional service as a diaphragm in a VR sensor employed for HVAC applications?

- ☐ A Aluminium bronze
- ☐ B Copper beryllium
- ☐ C Nickel silver
- ☐ D Tin bronze
- ☐ E Zinc bismuth

Name (please print) .....

Job title .....

Organisation .....

Address .....

.....

.....

Postcode .....

Email .....

Are you a member of CIBSE? If so, please state your membership number: .....

The *CIBSE Journal* CPD Programme

By participating in this CPD module, you consent to sharing your details with CMR Controls. CMR Controls may contact you via email and/or telephone with further information and technical insight on its services. You have the right to opt out from such communications at any time.

I understand that I will receive marketing communications from CMR Controls after completing this module (please tick here) ☐

By entering your details above, you agree that CIBSE may contact you with information about CPD and other training or professional development programmes, and about membership of CIBSE, if you are not a member.

Go to **www.cibsejournal.com/cpd** to complete this questionnaire online. You will receive notification by email of successful completion, which can be used to validate your CPD records. Alternatively, fill in this page and post it to: **N Hurley, CIBSE, 222 Balham High Road, London, SW12 9BS**

References:

1 Dwyer, T C, 'Targeting the breathing zone', *CIBSE Journal*, September 2022.
2 Private communication with Clemens Richter, June 2024.

Products of the month

Ideal Heating takes a step towards net zero with new ECOMOD CO2 heat pumps

Natural refrigerant heat pumps offer flow temperatures of up to 70°C

Ideal Heating Commercial has launched the new ECOMOD CO2 monobloc air source heat pump, a significant advancement in its next-generation line of natural refrigerant heat pumps. These units offer maximum flow temperatures of up to 70°C, setting a new standard for environmentally friendly heating solutions.

Natural refrigerants, unlike their synthetic counterparts, are substances that occur naturally, with a low global warming potential (GWP). The ECOMOD CO2 uses R744 natural refrigerant, boasting a GWP rating of just 1. This makes it a great choice for businesses committed to achieving net zero emissions. The lower GWP not only benefits the environment, but is also economically advantageous, as high-GWP refrigerants are expected to increase in price because of their environmental impact and decreasing availability.

The ECOMOD CO2 heat pumps are available in three outputs: 65kW, 95kW and 130kW. For larger requirements, the system can be installed in a cascade arrangement, allowing up to six units to be controlled centrally via an intelligent lead controller, thereby enhancing efficiency and flexibility.

These high-performing units are capable of operating at a design ambient temperature of -10°C and feature a seasonal coefficient of performance rating of 3 or better. The ability to achieve high temperatures up to 70°C makes them suitable for a variety of applications, including domestic hot water (DHW) systems and district heating networks.

The ECOMOD CO2 series is also noted for its quiet operation. For installations requiring minimal noise, the CO2Q model offers an ultra-quiet noise level with a rating as low as 71dB(A).

In addition to the ECOMOD CO2, Ideal Heating's natural refrigerant heat pump range includes the ECOMOD 290HT. These systems can be integrated with other Ideal Heating commercial products, such as the Evomax 2 and Imax Xtra 2 commercial condensing boilers, to create a comprehensive low carbon hybrid heating system.

Ideal Heating continues to lead the industry with its innovative heating solutions, designed in accordance with the latest market trends and legislative requirements.

For more information on the ECOMOD CO2 and other products, visit idealcommercialboilers.com/products/ecomod-co2-co2q

Modutherm expands range with new Juniper HP Plus

Modutherm has launched the Juniper HP Plus, an advanced indoor heat pump water heater. Available in left- or right-handed versions, the floor-standing unit integrates an efficient air source heat pump with a stainless steel cylinder, transforming free energy from outside air or waste heat into renewable domestic hot water.

Ideal for electric-only residential or light commercial projects, it uses R290 refrigerant with a global warming potential of 3. It is Energy-related Products Part L compliant and offers significant cost savings, with a coefficient of performance of up to 3.80. The unit is available in 200- and 300-litre capacities

For more information, visit www.modutherm.co.uk

New contacts made at SoPHE South West's first networking event

The inaugural networking event of the Society of Public Health Engineers (SoPHE) South West – held at The Stable on Bristol's historic waterfront in June – has been heralded a success. Pump Technology said it was great to see so many people getting involved.

The evening was sponsored by 19 manufacturers and covered many areas of interest for public health engineers. New and helpful contacts were made, and SoPHE looks forward to arranging further opportunities for South West engineers.

To find out more or to join SoPHE, contact David Johnson, of Pump Technology/Jung Pumpen, who is a SoPHE (IWG) committee member.

Call 07984 520515 or email davidj@pumptechnology.co.uk

Breathing Buildings supplies ventilation system to ECO MEP's carbon-negative HQ ›

Breathing Buildings has equipped ECO MEP's new carbon-negative headquarters – in Ashford, Kent – with its cutting-edge NVHRe natural ventilation with heat recycling and heat recovery system.

ECO MEP, a contractor committed to sustainable solutions, chose the NVHRe C+ 1100 units because of its energy efficiency and compact design. The system combines natural and mechanical ventilation, offering comfort and significant energy savings, and provides excellent thermal comfort and enhanced indoor air quality. To maximise energy savings, the intelligent system automatically decides when and if mechanical ventilation is required.

■ **Visit www.breathingbuildings.com**

‹ Panasonic and Together Housing join forces to deliver sustainable heating solutions

Panasonic has partnered with Together Housing to provide sustainable heating to more than 1,200 properties in the north of England.

Hundreds of homes have switched from gas boilers to Panasonic J Series Aquarea Monobloc air-to-water heat pumps, with 750 more to follow later this year.

The initiative includes thorough home assessments and the 'Go Green Together' educational programme for residents.

This collaboration aims to create energy-efficient, comfortable living environments, while moving towards net zero emissions.

■ **Visit www.aircon.panasonic.eu/GB_en**

‹ GF Uponor renamed as GF Building Flow Solutions

GF has rebranded its GF Uponor division as GF Building Flow Solutions. Formed through the acquisition of Uponor and GF Piping Systems' building technology segment, this division emphasises water conservation and management in residential, commercial and public buildings. The Uponor brand will remain unchanged, enhancing the division's market presence. GF Piping Systems continues to lead in utility and industry flow solutions, with GF's global workforce of 20,000 generating nearly CHF 4bn (£3.5bn) in sales in 2023.

■ **Visit www.uponor.com/en-gb**

› DIRECTORY

Your guide to building services suppliers

Ultra-compact filter added to Fernox range ›

Water treatment expert Fernox has launched the new sealed and ultra-compact TF1 Sigma Mini filter, which is ideal for smaller systems with limited space. It is easy to install, with a slip-socket manifold design that fits in just 106mm of pipework. The TF1 Sigma Mini captures system contaminants effectively and serves as a dosing point for chemical treatments. With a 10-year warranty, it ensures minimal pressure loss and high collection efficiency. Available with 22mm pipework connections, it's perfect for social housing and new-builds.

■ **Visit www.fernox.com/tf1-sigma-mini**

Hamworthy Heating's new high-temperature heat pump with natural refrigerant ›

Hamworthy Heating has introduced the Tyneham 290HT commercial heat pump range, achieving flow temperatures up to 75°C with a global warming potential of 3. It offers a coefficient of performance of up to 4.94 for optimal efficiency and an inverter-controlled compressor for precise temperature control.

Available in five outputs from 15kW to 50kW, it operates quietly, at 64dB(A), and can be cascaded for higher outputs. Ideal for commercial buildings and DHW applications, it comes with a five-year warranty.

■ **Call 01202 662 552 or visit www.hamworthy-heating.com**

The eye-tracking headset will be used in a pilot study

Simone Bonavia

Shedding light on non-visual effects

The 2023 Jean Heap Bursary has helped fund an advanced eye-tracking headset, which is allowing lighting designer and researcher Simone Bonavia to assess how lighting affects people's non-visual functions

Simone Bonavia, a lighting designer at Steensen Varming, is studying for a PhD at University College London, supported by the Engineering and Physical Sciences Research Council and Steensen Varming. In 2023, she was awarded the Jean Heap Bursary for her research on the effect of spatial distribution of light on pupillary light reflex. The bursary, launched by the Society of Light and Lighting (SLL) in 2014, honours former SLL president Jean Heap's dedication to lighting research and education throughout her career. Open to anyone with an interest in light and lighting, successful applicants will receive up to £4,000 in funding.

What was it like winning the bursary?

I am incredibly grateful and honoured; it means a lot that my research is supported by an institution such as CIBSE. Initiatives such as the Jean Heap Bursary encourage designers to be interested in research and to keep abreast of the challenges of new findings, and researchers to keep in mind the implications that their research may have in practice.

What research are you undertaking?

I have a keen interest in the effects of light on human health. Beyond allowing us to see the world around us, light plays an important role in supporting non-visual functions, such as synchronising circadian rhythms, regulating sleep, and enhancing alertness. With today's indoor-centric lifestyle, the quality of light we are exposed to is largely influenced by our surroundings.

Research on how lighting impacts on non-visual processes has focused on the quantity, spectrum and timing of light. However, there remains a significant gap in our understanding of whether the direction of light within our field of view also affects these processes. This is the focal point of my research. Specifically, my study assesses whether varying the location of light within the field of view influences pupil response, as measured in a controlled laboratory experiment. The pupil response to light exposure is a valuable biomarker, reflecting the activity of photoreceptors in the retina that are linked to brain areas responsible for non-visual functions.

How is the bursary helping your research?

It has facilitated the setup of a technically challenging experiment, including funding an advanced eye-tracking headset. Alongside its application in the planned pilot study, this equipment can have a more lasting use in subsequent laboratory and field studies. Part of the funding is also being used to support the recruitment of participants for the pilot.

What do you hope to achieve with your research?

I hope that this research will enhance understanding of how light affects our physiology and whether the pattern of light in the visual field is worth investigating further in the natural environment. If the direction of light does have a bearing on the sensitivity of the non-visual system to light, the arrangement of windows or luminaires and surface finishes will be a factor in determining the biological effectiveness of light in space. Rather than light received at the plane of the cornea, an appraisal of how the retina responds to the light stimulus across the field of view is required to characterise light exposure.

How will it benefit SLL members and the wider industry?

This initiative addresses a fundamental question in evaluating light for non-visual functions. It will also raise awareness of the potential of light to affect physiology, promoting a holistic design approach.

The more we know about how light influences our biology, the more it becomes possible to optimise built environments to better support the specific needs of a project. For instance, night-shift workers can be supported in completing their visual tasks safely without unnecessarily stimulating the non-visual system. In conjunction with other research in the field, this study may inform future lighting standards and guidance.

- The bursary application process for 2024 is open, with a deadline for submissions of Friday 17 May. For more information, visit **bit.ly/JeanHeapBursary24**

EVENTS AND TRAINING

NATIONAL EVENTS AND CONFERENCES

CIBSE Building Futures: Performance reimagined
8 October, live online
The conference will focus on the work around developing CIBSE's industry thought leadership on future high-performance buildings, developing the outcomes of the Building Futures project conducted by the Arup Global Foresight team on behalf of CIBSE.

Young Engineers Awards
10 October, London
The annual accolades celebrating the best and brightest engineering talent and the employers that nurture them. The awards encompass the Undergraduate, Apprentice, Graduate and Employer of the Year Awards.
www.cibse.org/yea

The SFE Façade 2024 Design and Engineering Awards
6 November, London
The awards recognise and reward excellence and achievements in façade engineering, raising the profile of – and drawing attention to – the importance of this discipline.
moredetails.uk/4ezNB0f

Build2Perform Live 2024
13-14 November
The meeting place for forward-thinking industry professionals, visionary speakers, leading industry exhibitors and young talent.
www.build2perform.org

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**

FM Group, HVAC Systems Group and YEN London: Closing the loop
17 July, London
With a panel of four industry experts discussing how we address the net zero challenge collaboratively, and other issues.

CIBSE ANZ: Seminar series – The need for speed
30 July-27 August, Sydney

CIBSE South West and YEN summer social, including comedy set by Dominic Woodward
17 July, Bristol

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

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 Kohler Uninterruptible Power and titled 'Powering safety: uninterruptible power systems for life safety in buildings', is now available on demand at **www.cibsejournal.com/webinars**. All previous *Journal* webinars are also available on demand.

TRAINING COURSES

All CIBSE's courses are running as live online training at present because of the relocation of CIBSE's offices. Corporate delivery is also available in-house face to face, or remotely online.
www.cibse.org/training

Mechanical services overview
19 July

Mechanical services explained
23-25 July
10-12 September

Above-ground building drainage
3 October

Below-ground building drainage
2 October

Understanding the law for engineers
24 July
30 October

Low and zero carbon energy technologies
17 September

Building Regulations Part O: Overheating
18 July
27 September

Heat networks Code of Practice (CP1)
16-17 July
17-18 September
29-30 October

Introduction to heat networks Code of Practice
17 October

Emergency lighting to comply with fire safety requirements
15 October

Design of ductwork systems
25 September

Commissioning Code M: Commissioning management
19 September

Design of heating and chilled water pipe systems
19 September

Energy efficiency-related Building Regulations: Part L
23 July
17 September

Energy surveys
26 September

Energy strategy reports
22 July
22 October

Designing water-efficient hot and cold supplies
18 September

Advanced simulation modelling for design for performance
26-27 September

Introduction to the Building Safety Act
24 September
29 October

Building services explained
10-12 September
8-10 October

Fire safety building regulations: Part B
24 September

Earthing and bonding systems
1 October

MEMBERSHIP WEBINARS

CIBSE Membership host 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: **moredetails.uk/MembershipWebinarP2**

Upcoming dates:
9 and 23 July
6 and 20 August

Building Performance Reimagined

8 October 2024 The View, London

Introducing CIBSE's Building Performance Reimagined event

This event aims to redefine high-performance buildings, looking towards 2035 and beyond.

It will build on the outcomes of the Building Futures project, conducted by the Arup Global Foresight team on behalf of CIBSE.

> ***We hope that you are challenged and inspired to change your own day-to-day practice in small ways and to adopt a future-facing, systems thinking approach in the detailed work of delivering building services engineering.***

Fiona Cousins
CEng, FCIBSE, PE, LEED Fellow
CIBSE President 2024/5

Scan the QR code to receive £100 off the standard ticket price

cibse.org/building-performance-reimagined

CMR

in complete control

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.

DPC CONTROLLER

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

DPM PRESSURE SENSOR

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

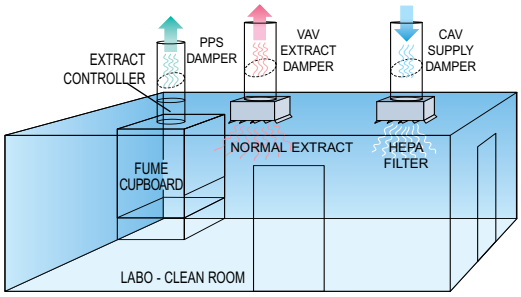
CAV AND VAV DAMPERS

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

Metal Damper

AIR MANAGEMENT SYSTEM

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



PPS EXTRACT DAMPER

Poly-propelene control and shut off valve incorporating the CMR Venturi Nozzle. This is essential when dealing with corrosive extract air especially from fume cupboard systems.

PPS Damper

PRECISION COMPONENTS FOR VENTILATION AND PROCESS CONTROL

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

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

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

CMR®