cibse Journal

May 2026
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The magazine of the Chartered Institution of Building Services Engineers

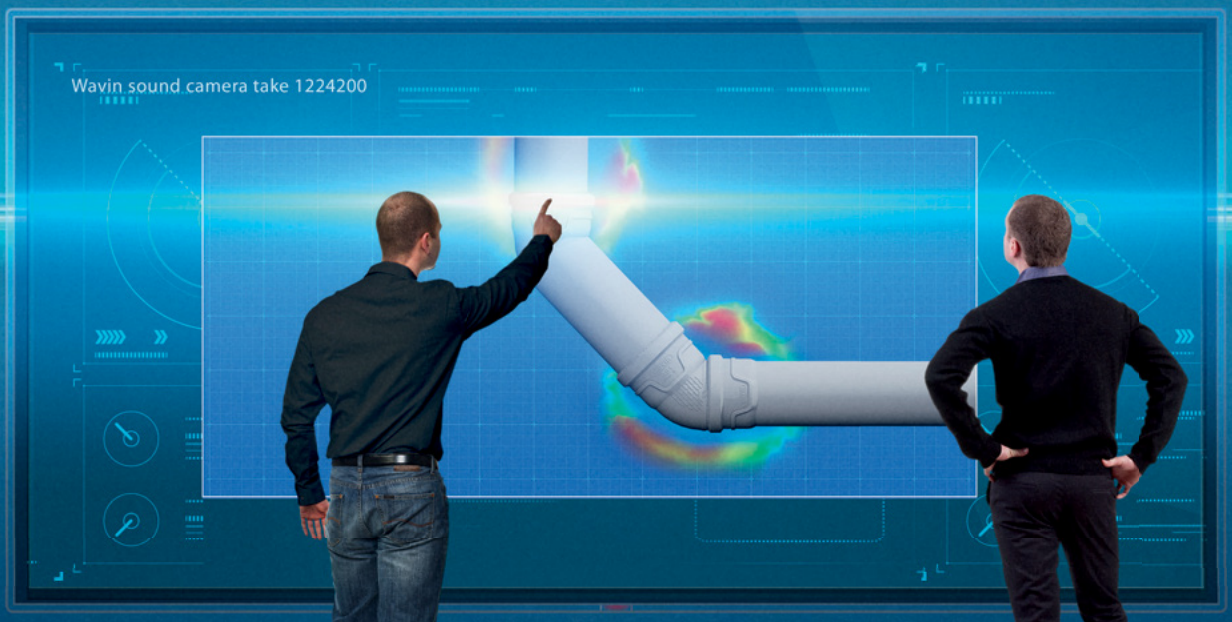
Inside track

The award-winning services strategy helping to conserve Britain's rail heritage

Commercial heating Special

CIBSE Technical Symposium highlights

AM10 natural ventilation guide



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Within reach

The keynote by Professor Cath Noakes at the CIBSE Technical Symposium reminded us of how quickly priorities change in society. An expert on airborne transmission of disease, Noakes highlighted the importance of good ventilation during the Covid-19 pandemic, when she was appointed to the government's scientific advisory board.

While the memory of the pandemic may be receding, Noakes is determined that lessons learned on maintaining indoor air quality are not forgotten, even if the world's attention is diverted to a looming energy crisis following the disruption of oil and gas supplies caused by the US-Iran war.

Noakes said there have been positive outcomes post-pandemic, including higher ventilation rates for infection control in the revised Part F of the Building Regulations and the widespread use of CO_2 monitors in buildings. She added that the tension between driving down energy use and increasing ventilation rates was best resolved by early collaboration on building performance and health.

This has been demonstrated by Ramboll at 2 Finsbury Avenue, in the City of London. The design for the twin office towers addresses the part-occupancy of workplaces post-pandemic, and its all-electric services strategy has been designed to be as efficient whether there are 70 or 7,000 people in the building. While the building is targeting a 5-star NABERS rating, it's not compromising on health, with Well Platinum certification in its sights. The system is sized to deliver a generous $16 L{\cdot}s^{-1}$ per person, but has been designed to only deliver those rates when needed, thanks to a demand-control system that aims to maintain healthy 750ppm CO_2 levels in 200m² control zones.

The new 2FA project incorporates the latest smart building technology, but it is encouraging to see that existing commercial buildings can also attain excellent building performance through low-cost optimisation measures such as control improvements, LED lighting and energy monitoring. That was the case at Hamilton House in central London, which was one of the pilot projects for the UK Net Zero Carbon Buildings Standard (UK NZCBS). Despite being refurbished before the pilot version of the UK NZCBS was published, a net zero audit uncovered some easy optimisation wins that allowed the building to meet the Standard's carbon limits.

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Wranga Wardak Why Whole Life Carbon Assessments should be made mandatory by government

Andy Pearson The CPD module explores why transcritical CO_2 refrigerant heat pumps are emerging as a low-GWP option

Anastasia Mylona Electrical engineers are at the heart of the transition from gas to renewable energy

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Government unveils plan to boost electrification

Energy Secretary to weaken link between gas and electricity prices

The government has increased Boiler Upgrade Scheme (BUS) grants for some households and outlined a mechanism to weaken the link between gas and electricity prices.

As part of a wide-ranging package of measures, drawn up in response to the increases in energy prices resulting from the ongoing US-Iran conflict, energy Secretary of State Ed Miliband and Chancellor of the Exchequer Rachel Reeves announced an extension of the BUS on 21 April.

Grants under the scheme will be increased to £9,000 for properties heated by oil and liquefied petroleum gas (LPG), compared with the general ceiling of £7,500 that households are entitled to receive in subsidies.

This move is designed to help those households and small businesses in England and Wales most impacted by rising energy prices – particularly in rural areas that are not connected to the gas grid – to electrify their heating, and provide greater certainty over energy bills.

Miliband also unveiled moves to weaken the link between wholesale gas prices and those for electricity generation.

The government is proposing to move all renewable projects onto long-term fixed-price Contracts for Difference (CfDs), and generators accredited under the legacy Renewables Obligation (RO) would be encouraged to swap these contracts for CfDs.

The RO, which was set up to incentivise the early development of the renewables sector, gives projects a top-up on the wholesale electricity price, which varies and is often set by that of generation by gas plants.

The government has also announced an additional £100m of funding to support solar installations on 57,000 social homes and 100 schools and colleges this financial year.

Charlotte Lee, chief executive of the Heat Pump Association UK, said: 'The move to begin decoupling electricity prices from gas is a significant step that will help unlock the UK's transition to electrification, ensuring that low carbon heat is the most cost-effective option, always.'

Industry warns against reduction of sprinklers in schools

The Construction Industry Council (CIC) has told the Secretary of State for education it is 'deeply worried' about new guidance that appears to reduce the level of fire suppression in schools.

The CIC has raised concerns in a letter to Bridget Phillipson about a document issued by the Department for Education (DfE), which appears to be a specification for all new schools.

The section of the DfE document dealing with fire safety states that the 2007 version of BB100, which required that new schools should be designed and built to include sprinklers unless it can be evidenced that the risk is low and sprinklers would not be proportionate, is 'no longer required'.

The letter says the CIC is 'deeply worried about the profound negative impact' of this move, which reverses the previous promotion of school sprinklers.

Optimisation could cut data centre emissions by 25%

New AI-powered software could cut emissions from power-hungry data centres by a quarter, according to researchers at Pennsylvania State University.

They have developed software that analyses real-time climate and economic data to optimise data centre cooling. This will be used to train an AI agent, which can then dynamically adjust data centres' power usage to peak when the weather is favourable and electricity is affordable, optimised for the facility's location.

Construction sector fears long-term impact of war

Global conflict now primary threat to industry

Concern is growing across the sector about the long-term implications of the US–Iran war, according to consultancy Gleeds' quarterly UK market report.

It shows that global conflicts overtook interest rates and inflation as the primary threat to the industry in the first quarter of this year. Around 65% of those questioned were worried about the impact of the war on commodity shortages and price hikes.

Respondents warned of tightening supply chains, cost spikes and a deteriorating economic outlook, and 85% reported that they had declined at least one tender in the first quarter of the year. Gleeds said this showed a 'reluctance' to take on risk in an 'increasingly uncertain' environment.

A further 57% said contractors had become more risk-averse, with many citing volatile input costs and concerns about a potential global downturn.

The latest S&P Global UK Construction Purchasing Managers' Index shows that March was the 15th consecutive month in which the sector's output has been below 50, the benchmark indicating whether the sector is contracting or expanding.

On 30 March, the Construction Leadership Council's Material Supply Chain Group said 'relatively few' construction products are at risk of availability issues 'directly linked' to the conflict. The main challenge is the 'rapid' rise in energy prices and their impact on material costs.

Fraud alleged in government energy efficiency scheme

The Serious Fraud Office (SFO) is investigating allegations of fraud by three UK companies in relation to the government's axed flagship energy efficiency scheme.

JJ Crump, South Coast Insulation Services and Warmfront are alleged to have been involved in a 'sophisticated conspiracy' to undermine the Energy Company Obligation 4 (ECO4) scheme by submitting claims where little or no work was undertaken.

Energy companies are suspected to have been defrauded of at least £44m. SFO investigators have arrested four people.

ECO was axed last November after a National Audit Office report concluded nearly all of the external wall insulation fitted under ECO4 required fixing.

Greater Manchester hospital retrofits with 2MW heat pump

A Greater Manchester hospital will get a new 2MW heat pump system as part of a £14m decarbonisation project. Vital Energi has partnered with Tameside and Glossop Integrated Care NHS Foundation Trust to build the new energy centre – which will house four air source and two water source heat pumps, supported by two efficient low-temperature hot-water boilers – at Tameside General Hospital. A new air source heat pump will also be installed in the hospital's pathology block, replacing the old gas boiler, and there will be cavity and pipework insulation, upgrades to building management systems and roof-mounted solar PV.

Go-ahead for first UK small modular reactor

Rolls-Royce has signed a contract with Great British Energy – Nuclear for the UK's first small modular reactor (SMRs). The deal between Rolls-Royce's SMR arm and the government's state-owned nuclear company will enable technology design activities to start on the mini-reactors, which are due to be deployed on Ynys Môn, in North Wales. The National Wealth Fund has committed up to £599m to support Rolls-Royce's SMR development activities, on top of £2.6bn announced by the Chancellor, Rachel Reeves, in last year's Spending Review.

TRVs can cut heat pump space heating

Thermostatic radiator valves (TRVs) in air source heat pumps can reduce the systems' space heating energy consumption by 6–8%, according to research by the University of Salford. Its test report, launched on 16 April alongside a Technical Bulletin by trade body Beama, says savings can be made without reducing the efficiency of appliances and systems, while potentially reducing the air temperature of adjoining zones.

Government confirms no gas in new homes from 2027

Renewable requirements also laid out in new standards

The government has implemented its long-awaited Future Homes and Buildings Standards.

Designed to ensure new homes and non-domestic buildings are built with low carbon heating and high levels of energy efficiency, the standards contain several updates to the Building Regulations.

Under the Future Homes Standard (FHS) – which is due to come into force in 2027 – all dwellings built will have to produce 75% fewer greenhouse gas (GHG) emissions across their lifespan than those built under existing regulations.

New homes will not be connected to the gas network and, instead, will have to be linked to a low carbon district heating system or have an air source heat pump installed.

The FHS also requires solar panels equivalent to 40% of each dwelling's ground-floor area to be installed, with exemptions for buildings more than 18m tall and sites where a 720kWh per year output cannot be achieved.

Specific changes in the new standards include:

- A new functional requirement (L3) for the provision of onsite renewable electricity generation for new homes
- Amending Part L of Schedule 1 to reflect the dual aims of reducing GHG emissions and conserving energy
- Amending the definition of 'fixed building services' to include lifts, escalators and moving footways in new buildings other than individual dwellings.

CIBSE welcomed the 'extensive' references in the standards to input from the Institution, including its guides and technical memoranda.

The FHS was originally announced under Theresa May's government, when it was set to be introduced in 2025.

MEES compliance dates for social housing relaxed after consultation

The government has relaxed the deadline for social housing landlords to meet its new Minimum Energy Efficiency Standard (MEES) for the sector.

In a consultation, carried out last year, the Ministry of Housing, Communities and Local Government (MHCLG) proposed that social landlords should meet Energy Performance Certificate Band C on two metrics by 2030 to be considered compliant with the new MEES for the sector.

However, in its response to the consultation, announced on 1 April, the MHCLG said social properties will only have to meet one EPC metric by April 2030 to comply with the MEES, unless a valid exemption applies.

Landlords will then have to meet a second of the metrics – which cover fabric performance, smart readiness and heating systems – by April 2039.

In its response, the government says staggering the compliance dates 'strikes a balance' between making 'significant improvements' for tenants while giving the social housing sector time to plan upgrades, such as heat pumps and solar panels.

BSR package aims to speed up safety works

Focus is on remediation for higher-risk buildings

The Building Safety Regulator (BSR) has issued a package of measures to speed up safety works on taller, higher-risk buildings (HRBs) across England.

Key measures in its 'comprehensive' improvement plan to reduce delays to safety works for HRBs (any 18m-plus building that contains two or more flats) include: more flexible approvals so that, 'where appropriate', projects can start safely while technical issues are resolved; a new external remediation multidisciplinary team (MDT); and a recruitment drive to increase regulatory lead capacity and reduce individual caseloads.

Account managers, who will be building control professionals, will be hired to support the MDT and release the capacity of case officers and technical regulatory leads.

The BSR said there had been an 'improved picture' when it comes to applications for external remediation projects since 2025, but decisions are taking longer on a 'high' percentage of complex, older cases.

The regulator has announced the appointment of Arup Fellow Dr Barbara Lane as the first independent chair of the Building Advisory Committee, and Hywel Davies HonFCIBSE as the deputy chair. Lane was an expert witness for the Grenfell Tower Inquiry Phase 2 from 2017 to 2024, and Davies is a former technical director at CIBSE and head of technical insight at the Chartered Association of Building Engineers.

No grants for hybrid heat pumps

An energy minister has defended the government's decision not to extend subsidies to hybrid heat pumps, on the grounds that they are a 'stepping-stone technology'.

Energy consumers minister Martin McCluskey told an event on home heating, organised by innovation charity Nesta in March, that the government has decided not to prioritise hybrid heat pumps that also contain a gas boiler.

He said: 'We wouldn't want to put government funding into supporting technologies that maybe act as a stepping stone but don't get us to where we need to get to.

'The choice that we've made is to incentivise the purchase of heat pumps and some of the other technologies that are available through the Warm Homes Plan.'

cibse news

CIBSE strengthens international collaboration on Australia visit

President Vince Arnold and CEO Ruth Carter met engineers and policy-makers in Sydney, Melbourne and Adelaide

CIBSE representatives met industry leaders, academic partners and early-career engineers in Sydney, Melbourne and Adelaide during a visit to the Australia and New Zealand (ANZ) Region in April.

CIBSE CEO Ruth Carter, President Vince Arnold and director of membership Richard Goldsbrough met the CIBSE New South Wales committee, Engineers Australia, the Green Building Council of Australia, the International Code Council and NABERS representatives. Discussions included professional mobility, mutual recognition, sustainability initiatives, embodied carbon verification and international collaboration to advance building performance.

The CIBSE delegation also hosted a Heads of Industry Breakfast, attended by more than 50 leaders, and participated in the CIBSE ANZ Young Engineers Network 'Aspirational Engineer' event, inspiring early and mid-career professionals.

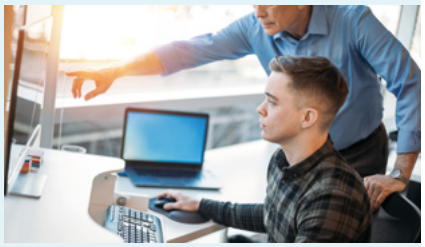
In Melbourne, meetings with RMIT University, Airah (the Australian Institute of Refrigeration, Air Conditioning and Heating) and the University of Melbourne focused on supporting students and graduates, expanding professional development opportunities, and strengthening links between academia and industry. A successful Heads of Industry Breakfast provided a platform for discussion on emerging trends, competence and mentoring the next generation of engineers.

From left to right: Ivana Brown, NABERS head of operations and standards; CIBSE CEO Ruth Carter; Magali Wardle, NABERS head of market development; CIBSE President Vince Arnold; Steve Hennessy, CIBSE ANZ committee member and CIBSE Gold medallist; and CIBSE director of membership Richard Goldsbrough

The visit ended in Adelaide, where the delegation hosted a Heads of Industry Breakfast for local leaders and engaged with the Institute of Healthcare Engineering, Australia to discuss professional connections and collaboration.

Training

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



Coaching and mentoring skills for apprenticeship supervisors
14 May, 1 October

This course is for supervisors and team leaders who support apprentices. It's designed to provide them with the tools, language and confidence to coach, mentor and guide apprentices in workplace settings.

The course will explore how to have better conversations, spot learning moments and support apprentices with the evidence they need for their portfolio. The course also introduces helpful frameworks such as Gibbs' Reflective Cycle and Varcs (what makes good evidence).

It's about helping to create confident, capable apprentices and supervisors who know they're doing a good job and can see the difference they make.
www.cibse.org/training

Building services explained
11–13 May
3–5 August

Introduction to AI for building services engineers
12–13 May
20–21 June
20–21 October

Coaching and mentoring skills for apprenticeship supervisors
14 May
1 October

Commissioning Code M: commissioning management
18 May
8 October

Emergency lighting to comply with fire safety requirements
20 May
22 October

Mechanical services overview
21 May

Introduction to the principal designer and principal contractor roles
22 May
13 July

The importance of energy efficient buildings
26 May

Understanding the law for engineers
28 May
7 July

High-voltage (11kV) distribution and protection
2 June

Mechanical services explained
3–5 June

Low carbon consultant building design
9–10 June

Low and zero carbon energy technologies
11 June

Energy strategy reports
17 June

Overview of IET wiring regulations
23 June

Principals of hydraulics and control of modern heat networks
30 June
16 July

Electrical services explained
1–3 July

Introduction to heat networks
15 July

Understanding the law for engineers
7 July

Energy surveys
17 July

Embodied carbon in MEP design: how to use CIBSE TM65
22 July

Non-potable water systems
5 August

Design of heating and chilled water pipe systems
10 August

Mastering the application of heat pumps
12 August

Standby diesel generator
9 September

Above-ground building drainage
16 November

The annual dinner brought together engineers and Hong Kong government officials

Celebrations at Hong Kong Region annual dinner

Guests hear from Victor Sheung Shing Tai, a leading figure in Hong Kong's housing department

CIBSE Hong Kong celebrated professional achievements, recognised outstanding contributions and strengthened the local engineering community at its annual dinner last month.

The event brought together members and industry figures for an evening of celebration and networking.

CIBSE CEO Ruth Carter, President Vince Arnold and director of membership Richard Goldsbrough attended the event, and enjoyed the opportunity to meet members, hear about their achievements, and reflect on the growth and impact of the profession in the region.

Guest of honour at the dinner was Victor Sheung Shing Tai, Under Secretary for Housing, on behalf of the Secretary for Housing.

His participation highlighted the strong links between the built environment profession and government, and the shared commitment to delivering high-performing, sustainable and resilient buildings across Hong Kong.

The annual dinner not only celebrated the past year's accomplishments, but also reinforced the spirit of collaboration, knowledge sharing and professional excellence that defines CIBSE globally.

In May/June

CIBSE Western Australia: Discover how light performs in the built environment

21 May

Held at the Light Lab, this event will provide the opportunity to explore 250+ luminaires, test ideas, and discover how lighting shapes mood, space and the built environment. The lab goes beyond a traditional showroom, providing a space for testing ideas, exploring lighting technologies and encouraging collaboration.

Heating the future – CIBSE Scotland Conference

27 May, University of Strathclyde, Glasgow

This year's conference explores how innovation and cross-sector collaboration are driving the transition to low carbon heat across Scotland.

bit.ly/CJHTF26

CIBSE Skills and Future Workforce Conference

28 May, CIBSE HQ, 91-94 Saffron Hill, London

Framed by the UK's commitment to achieving net zero by 2025, the conference will look at steps taken to bridge the skills gap. It will focus on renewables, digital tools and sustainability, as well as skills relating to technical knowledge, collaboration, problem-solving and communication.

Launch of TM39 Building metering and monitoring

25 June, CIBSE HQ, 91-94 Saffron Hill, London and online

Lead author Ellen Salazar, CIBSE head of building services engineering, will present the new edition of CIBSE TM39.

Fan Makers winner revealed

Sebastian Taylor Aguilar is the recipient of the Worshipful Company of Fan Makers CIBSE Bursary for 2025/26, recognising his outstanding academic performance and contributions to the building services sector.

The bursary is provided by The Worshipful Company of Fan Makers in a long-standing association with CIBSE.

It is awarded to students who demonstrate strong academic achievement and the potential to make a meaningful contribution to the building services engineering profession.

Aguilar, an intermediate mechanical engineer at MCA Consulting Engineers, is in the final stages of his degree apprenticeship at London South Bank University and is on track to graduate with a first-class degree.


Sebastian Taylor Aguilar is congratulated by CIBSE board member Peter Anderson

Frankham Group to support registration

Frankham Group's MEP division has introduced a structured training and development scheme to support engineers working towards professional registration and Chartered status.

The scheme was developed and led by Kat Lechowska, with the backing of MEP director Adam Watkins.

Early engagement with CIBSE helped shape the framework and ensure alignment with accreditation requirements. A detailed scheme overview was developed, setting out a clear structure based on competency development in line with UK-SPEC.

The scheme received full accreditation from CIBSE in March.

Assuming power

Electrical engineering is being transformed by the urgent need to decarbonise and the profession is now key to helping turn net zero ambition into operational reality, says **Anastasia Mylona**

Decarbonising the built environment is often framed around heat: heat pumps, district heating networks and thermal efficiency measures. Yet behind many of these solutions lies a fundamental shift that places electrical engineering at the centre of the transition.

The profession is being reshaped by the electrification of heat, the expansion of renewable energy, the rise of digital building systems and the need for Grid-responsive demand. Electrical engineers no longer simply design electrical infrastructure within buildings; they enable buildings to function as active components of the energy system.

The shift away from fossil fuels is driving a substantial increase in electrical demand. Heat pumps, electric hot-water systems and electric vehicle charging infrastructure are rapidly becoming standard features in new and existing buildings. At the same time, buildings are increasingly hosting distributed energy resources, including photovoltaic systems, battery storage and advanced control systems.

These technologies change the nature of building electrical design. Instead of a one-directional power supply from Grid to building, engineers must now design systems that can accommodate bi-directional flows, local generation and dynamic load profiles.

This requires a broader systems perspective. Designing resilient and flexible electrical infrastructure is no longer just about capacity; it is about enabling buildings to operate efficiently within a decarbonised energy network.

One of the challenges is managing peak demand. As heating and transport shift onto electricity networks, demand patterns are likely to become more variable and more intense.

Electrical engineers have a key role in enabling Grid flexibility through building design and operation. Smart building management systems (BMSs), load-management strategies, energy

storage and demand-response technologies can allow buildings to adjust their consumption in response to Grid conditions. This concept of the 'Grid-interactive building' is becoming central to discussions about energy system resilience. Buildings equipped with flexible electrical systems can reduce peak loads, integrate renewable generation more effectively and support wider energy infrastructure.

Organisations such as National Grid ESO have emphasised the importance of demand-side flexibility as part of the UK's net zero transition. As a result, electrical engineers working in the built environment sit at the intersection between building performance and national energy infrastructure.

They are also playing an increasingly important role in digitalisation. Integration of sensors, advanced metering, automation and data platforms is transforming how buildings are monitored and controlled. Electrical systems often form the backbone of these digital infrastructures. From power monitoring and smart lighting to integrated BMSs, electrical engineers are enabling the data flows that support performance optimisation.

Digital tools also allow engineers to move beyond design-stage assumptions and into operational performance. By analysing real-time energy data, electrical engineers can identify inefficiencies, optimise system operation and support commissioning activities. In this sense, the profession is becoming more closely linked to building performance engineering, helping ensure low carbon technologies deliver the outcomes expected in practice.

The growing focus on building performance is reinforcing the need for electrical engineers to engage across the entire building life-cycle. Early-stage decisions about electrical capacity, distribution and system integration can have long-term implications for operational efficiency and adaptability.

Electrical engineers play a vital role in ensuring that buildings remain compatible with future energy systems. This includes designing infrastructure capable of accommodating additional renewable generation, energy storage or electrified heating technologies that may be introduced over time.

Commissioning, monitoring and post-occupancy evaluation are also increasingly important. Ensuring that electrical systems perform as intended is essential to closing the performance gap between design and operation.

The decarbonisation of buildings will require coordinated action across multiple engineering disciplines. However, increasing electrification of building systems means that electrical engineers are likely to play a particularly prominent role in shaping this transition. By designing flexible infrastructure, enabling digital performance monitoring and supporting the integration of buildings with wider energy networks, they are helping turn net zero ambition into operational reality.

As the built environment evolves into a more dynamic and interconnected energy system, electrical engineers will not only power buildings; they will power the transition to a low carbon future. ●

● **Dr Anastasia Mylona, is CIBSE technical director**

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Missing jigsaw pieces

The Future Homes and Buildings Standards are broadly welcome, but there are disappointing omissions around energy metrics, performance testing and weather modelling, says **Julie Godefroy**

The Future Homes and Buildings Standards (FHS/FBS) are finally here. For non-higher-risk buildings (non-HRBs), they will come into force in March 2027, with a one-year transition period; HRBs follow six months later. For at least two years, SAP 10.3 and the new Home Energy Model will be available as approved methodologies for homes.

On the whole, the FHS/FBS are in line with consultation proposals, and continue to use primary energy and carbon emissions as metrics. However, we believe total energy use would better represent building performance independently from the system.

In homes, the standards continue to use the Fabric Energy Efficiency Standard (FEES), which is theoretical and cannot be checked against actual performance. (In the recent HEM:EPC consultation **bit.ly/CJHEMsu**, CIBSE expressed opposition to the use of FEES. It proposed that if FEES is used, it must at least incorporate fabric test results within the calculation or as a factor in the confidence rating.) Overall fabric and efficiency services proposals are largely in line with consultation proposals.

As expected, they effectively prevent onsite fossil fuel heating (although there are exemptions, such as backup in hospitals). For buildings connected to heat networks, the implications will be covered in future columns, as they rely on a number of factors, including: the Heat Network Technical Assurance Scheme; the approach to sleeving (how new network capacity is accounted for); carbon factors for technologies such as combined heat and power, and energy from waste; and carbon content of heat limits in heat zones.

An important change is the approach to renewable energy. A new Part L3 introduces a functional requirement for renewable electricity generation for homes; it becomes an objective in itself and cannot be traded against fabric or services efficiency.

The requirement is for an annual output (kWh) and peak power (kWp) at least equal to that of a PV array with an efficiency of 0.22kWp m^{-2} installed over an area equivalent to 40% of the home's ground-floor area, orientated south-east to south-west at 45° and not overshaded. Constraints such as roof design or access can reduce this requirement. Buildings are exempt if constraints cut the generation to less than 720kWh per home, or for HRBs.

CIBSE supports these principles to contribute to Grid decarbonisation and benefit consumers, but the detail will depend on how systems are modelled and how constraints are interpreted. We welcome feedback on whether the requirement is meaningful and has reasonable flexibility. In non-residential buildings, renewables are encouraged through the notional building, with a PV area equivalent to 40% of the foundation area (reduced from 75% on top-lit buildings following consultation).

Other important items are a disappointment for consumer protection and building performance:

Despite strong support (more than 90% of respondents), homes will be modelled using average, rather than regional, weather. This means the same home could comply in the north and south, putting customers in the north at risk of higher energy bills. It is also problematic with heat pumps becoming the norm, as they are more impacted by the weather than boilers.

The government is not yet taking forward proposals encouraging performance testing, even though 90% of respondents supported it. It intends to call for evidence on the performance gap and building performance evaluation, alongside research by the Building Safety Regulator.

In spite of strong backing (nearly 85% of respondents), homes created by material change of use will not yet be subject to whole-building standards – there will be consultations on this.

Looking forward

In 2026, the government intends to review the National Calculation Methodology (NCM). CIBSE has been advocating this for years (see our 2022 evidence submission at **bit.ly/CJNCMCfE**), as the NCM has serious limitations in modelling energy use and driving the right design choices.

There will also be a review of Approved Document O, to examine concerns including overlaps with other Parts. CIBSE recommends further reviewing of fabric and services needs to truly deliver net zero-ready buildings, alongside ventilation systems to address air quality and energy use.

Incorporating embodied carbon needs should also be reviewed, as per the Part Z proposal. This was (again) recommended by the Environmental Audit Committee, to which government responded that it 'rejects the committee's recommendation to introduce mandatory whole life carbon assessments', but 'continues to assess the evidence to consider the best way forward for reducing embodied carbon emissions in new buildings'. ●

● **Julie Godefroy is the CIBSE head of net zero**

Why we must regulate whole life carbon

The government is missing a golden opportunity to reduce carbon emissions by not making whole life carbon reporting mandatory, says **Wranga Wardak**

The government has said it will not mandate Whole Life Carbon Assessments (WLCAs) in building planning applications, contrary to the Environmental Audit Committee's recommendation that assessments should be required for all large projects by 2025.

Instead, a voluntary approach to carbon reporting will be maintained, despite substantial evidence that the industry has the professional expertise and capacity to deliver these assessments.

The methodologies and standards for developing WLCAs have been well established across the building services sector, with the prominence of CIBSE TM65 and RICS whole life carbon assessment.

The UK's annual embodied carbon emissions surpass that of the aviation and shipping sectors combined, and is estimated to be 64 million tonnes[1]. Not addressing embodied carbon missions is a major missed opportunity.

A large part of industry is in favour of the Part Z initiative, a proposal, supported by CIBSE, to amend Building Regulations to require WLCAs and introduce embodied carbon benchmarks. Investors are also increasingly demanding that buildings meet higher environmental, social and governance standards, thereby placing pressure on designers and developers to prioritise and address embodied carbon in their projects.

Local authorities have amplified their efforts to tackle carbon emissions, through increased investment and, for some, encouraging or mandating WLCA assessments in local plans. Incorporating WLCAs in national regulation would streamline processes for local authorities and larger housebuilders who are already addressing embodied carbon, reducing the cost and resource burden for them.

This also applies to international manufacturers, who face increasing pressure to produce carbon assessments of MEP products in other jurisdictions, such as Environmental Product Declarations in the European Union or life-cycle assessments in some US states.

The construction sector has the tools and expertise to lead on embodied carbon reduction, but the absence of policy certainty in the UK risks undermining their efforts. ●

● **Wranga Wardak is a policy and public affairs graduate at Mitsubishi Electric, on secondment at CIBSE**

[1] Call to regulate embodied carbon, UKGBC **bit.ly/CJEmbCal**

Scalable, reliable and sustainable

The new high temperature R290 refrigerant CAHV heat pump makes the perfect boiler replacement, says Mitsubishi Electric's **Graham Temple**

As the electricity Grid gets cleaner and greener, the embodied carbon of the products we use to keep our buildings comfortable matters much more.

The latest innovation in Mitsubishi Electric's hugely popular CAHV range of commercial air source heat pumps (ASHPs) uses R290 refrigerant with an ultra-low global warming potential (GWP) of just 0.02 and reduced embodied carbon. Not only do these new models come with increased performance and benefits, but this switch to a lower-GWP refrigerant has also reduced the product's overall carbon footprint significantly.

The Ecodan CAHV-Z delivers powerful, low carbon heating and hot water, making it perfect for a wide range of commercial applications, such as schools and hospitals. It can operate as a standalone unit or in scalable multi-unit systems. Up to seven units can work together as a single system to deliver up to 280kW (at nominal conditions A7W45).

The CAHV has always been associated with high outlet temperatures and the CAHV-Z takes this to another level by offering 75°C outlet temperatures down to -15°C ambient temperatures, to deliver year-round continuous heating.

In other words, these systems can be installed in place of existing boilers without requiring major changes to the overall heating setup, making it ideal for retrofit.

This is made possible by the wide operating range of Mitsubishi Electric compressors, which can handle higher pressure variations, with the higher outlet temperature creating more design flexibility specifically for retrofit projects.

Key improvements include a 12% increase in heating capacity and the coefficient of performance (COP) at nominal condition is 3.17. Higher seasonal efficiency is also achieved by optimising control to maximise the properties of the R290 refrigerant. The seasonal COP at low temperature is 4.12.

The unit includes built-in leak detection and an explosion-proof relay, providing an added layer of protection and ensuring compliance with BS EN 378.

Our new Ecodan CAHV-Z R290 commercial ASHP is now available for specification on projects, and for installation from this summer.

Visit bit.ly/4sPIjUe

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

MITSUBISHI ELECTRIC

Speaking as one

Researchers, industry leaders and policy-makers at the 2026 CIBSE Technical Symposium highlighted the urgent need for integrated building services, where air quality, safety and data-driven optimisation take centre stage alongside carbon reduction

The diversity of building services engineering was evident in the wide-ranging subjects tackled at the 2026 CIBSE Technical Symposium in March.

Titled *Fit for 2050 – Redesigning spaces for wellbeing, inclusivity and sustainable performance,* the symposium showcased in excess of 80 peer-reviewed research papers to an audience of around 195 at Loughborough University. Topics ranged from the right sizing of heat pumps, to the impact of AI, and the use of yoghurt to prevent overheating.

The dominant theme of the two-day event, sponsored by IES, Design Builder and Strebel, was that building services engineering must evolve beyond energy reduction to master the whole environment.

Keynote speaker Professor Cath Noakes HonFCIBSE, professor of environmental engineering for buildings at the University of Leeds, highlighted the need for integrated thinking to ensure that energy, climate, air quality and safety aren't treated in isolation.

As an expert on the airborne transmission of disease, Noakes was appointed to the government's Covid-19 scientific advisory board, where she highlighted the importance of ventilation in containing the virus. Her 2050 'utopia' is a holistic industry in which health is embedded in career development, practitioners understand the impacts of poor environments and buildings have to visibly demonstrate good health.

Noakes said the pandemic helped raise the profile of ventilation, leading to regulatory changes such as a revised Part F, with explicit higher ventilation rates for infection control, widespread use of CO_2 monitors and sustained research on indoor health. She said communicating the complex, multifaceted nature of building performance and health to decision-makers remained a significant challenge, which required more collaboration. 'If you collaborate, you trust each other; that's when we can do things really well,' said Noakes.

There were a range of papers connected to new heat network regulations coming into force this year, including examples of best practice in new and existing networks.

Speaking on behalf of the Department for Energy Security and Net Zero (DESNZ), Phil Jones explained how the regulations aim to ensure the design and operation of heat networks are optimised. 'We've taken a lot of the lessons from the Building Safety Act to

Keynote speaker Professor Cath Noakes

make the developer, owner and lead designer responsible for the heat network,' he says. 'It puts the onus on all of these people to make it work.' (See panel, 'Laying the groundwork for heat networks').

Right-sizing heat pumps

Several sessions on heat pumps emphasised that, while the technology is efficient, its real-world success depends on moving beyond simplistic, conservative design towards dynamic, data-driven 'right-sizing'.

Phil Tower, energy manager at the University of Huddersfield, highlighted the uncertainty in current methods of sizing, noting that a typical engineer's desire to be conservative leads to massive discrepancies.

'If you ask four engineers to size a heat pump for my house, they will probably give you four different answers. There's not enough awareness about the impact of all the different assumptions,' he explained.

Through sensitivity testing, Tower demonstrated that changing basic assumptions could reduce a required heat pump size from 8.9kW to 3.3kW, and he stressed the importance of sizing. 'We need to rapidly upscale heat pump deployment – all it takes is a couple of poor installations to lose public faith,' he said.

Hoare Lea's Oliver Butcher further critiqued the industry's cognitive bias towards safety margins. In his talk on a new sizing methodology for HVAC in offices, he argued that traditional steady-state modelling 'systematically oversizes HVAC plant', which restricts net zero delivery.

'For too long we've been able to get away with equipment that is too big. We shouldn't say oversizing any more, we should just say this is wrong design,' Butcher said.

Overcoming delivery friction

For retrofits to succeed in historic buildings, they must be more people-centric, says W. Victoria Lee, lecturer in architecture and environment at the University of Edinburgh.

She argues that 'delivery frictions' such as costs, planning, skilled worker shortages and disruption were bigger barriers to retrofit, than technical challenges. 'There are cost and quality risk issues associated with a scarcity of competent tradespeople who specialise in heritage-grade retrofit solutions,' said Lee.

Success is dependent on owner-occupiers taking on the burden of funding, managing and maintaining retrofits, she added. Owners need access to clearer information and realistic decarbonisation pathways. 'Having the right information doesn't always solve the problem, but that is the very first step,' Lee said.

The main symposium auditorium at Loughborough University

In the same session, the University of Manchester's Geoff Levermore spoke about the potential to build new rural renewable energy towns (RRETs) close to the UK's source of wind and solar power.

He noted that, in 2024, up to 70% of the electricity from Scotland's biggest wind farms was wasted because of a lack of local demand and there being no grid connection to England.

Building RRETs close to where energy is produced can limit the need for grid infrastructure and be incentivised with lower-priced electricity, said Levermore. 'The new powerhouses of the world will be in sunny, windy places, offering climate justice to places such as Africa,' he said.

Intelligent by design

Artificial intelligence (AI) had a significant presence at the symposium, in papers on how machine learning and AI are transforming building services engineering.

The final panel discussion of the first day asked whether building services engineers were being replaced, repositioned or reinvented by AI. The panellists largely concluded that AI is a powerful tool that augments, rather than replaces, human judgement, creativity and ethical responsibility.

Speakers described AI's rapid emergence across design, controls and operations, and noted its potential to accelerate modelling, optimisation and fault detection – despite relying on engineers to handle novel problems, trade-offs and context-specific decisions.

However, one audience member said his firm had fewer junior engineers because their tasks were being carried out by senior staff using design software and AI.

Panellist Jon Belfield, managing director at InTandem Systems, said AI could lead to more interest in practical roles, and he had seen an uptick in students attending events promoting T-Level and apprenticeship courses. 'I expect

to see a shift in labour mobility from jobs more directly affected by AI towards more practical skill jobs, where there is a shortage' he added.

Green infrastructure

Integrating green infrastructure (GI) into building design is a fundamental nature-positive shift that requires engineers to 'think about other species, as well as people', said Isabel Why, building physicist at Model Environments, in her paper 'Plant or plants? A cross-disciplinary investigation of GI integration in low carbon healthy design'.

Research presented by UCL's Aohua Yang highlighted the functional power of moss, which possesses a microstructure that has 40 times the leaf area of vascular plants (grass, plants, trees). This allows moss to be 'up to three times more effective than activated carbon' at removing pollutants, offering potential as a 'standalone air purifier' or an 'integrated prefilter of ventilation exhaust', Yang explained.

UK overheating compliance typically excludes vegetation, said Why, and this exclusion can lead to inaccuracies in modelling. Studies have found a '40% discrepancy in heating and cooling calculations' when surrounding plants were omitted, said Why.

By shifting policy and 'accelerating the advent of nature-positive buildings', she said the industry can support biodiversity compliance while providing 'benefits to mood and positivity' for future generations.

Relaxing at the social event afterwards

Best of the best

The symposium concluded with prizes for the best papers, as voted for by delegates. Kevin Lomas won the prize for most Effective Delivery of Material for his presentation based on the paper 'Mitigating future summertime overheating in houses: ventilation strategies and ceiling fans', while Jordan Townsend's paper 'Empirical methods for measuring thermal responsiveness in buildings: Impacts of monitoring design on short-term flexibility assessment' won for its contribution to the art and science of building services engineering. Papers can be viewed at **www.cibse.org/symposium** ●

Laying the groundwork for heat networks

Government and industry speakers tackled the seismic changes to heat network regulations, including the proposed Heat Network Technical Assurance Scheme (HNTAS).

Phil Jones FCIBSE, working for DESNZ, and FairHeat's Ethan St Catherine, technical support to DESNZ, highlighted the draft Metering and Monitoring Standard (MMS), referenced in HNTAS, which is due to come into force in 2027.

They said, historically, metering and monitoring in UK heat networks had been 'poorly considered', resulting in low performance visibility, lack of regulatory enforcement and poor outcomes for customers. MMS would allow reporting of key performance indicators to monitor compliance with HNTAS, they added, providing consumer protection.

'It's important to plan metering and monitoring early in the design process so we know exactly what we expect to be measuring,' said Jones.

DESNZ's Phil Jones

***CIBSE TM39 Building energy metering*, due to be updated this summer, will offer guidance on metering, monitoring and commissioning for heat networks.**

Joel Hamilton, energy, sustainability and decarbonisation specialist at Translating Energy, outlined a strategy for identifying the worst-performing assets in a heat network portfolio when limited data is available. He said operators should prioritise networks with high energy costs and high per dwelling energy costs, and those with failed – or about to fail – equipment.

FairHeat consultant engineer Nina Dungworth and Gateshead Council's Matthew Jordinson described a project that replaced gas boilers in 16 council homes with heat interface units (HIUs) connected to the Gateshead District Energy Scheme network, which uses heat from water in abandoned coal mines 150m below the city centre. The incoming flow temperature was set at 65°C, which meant radiators did not have to be upgraded. HIUs were mounted externally to allow easy access for engineers. Jordinson said the design strategy allowed his team to focus on the speedy decarbonisation of homes at scale and the plan to upgrade 15,000 properties over the next 10 years.

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Heritage first

The office retrofit of Hamilton House shows how thoughtful refurbishment, strong operational performance and targeted optimisation can position historic buildings for 'net zero carbon aligned' status, says Greengage Environmental's **Apeksha Gupta**

A net zero audit of the recently refurbished Grade II-listed Hamilton House, on London's Embankment, shows that heritage office buildings can be early adopters of the UK Net Zero Carbon Buildings Standard (UK NZCBS; the 'Standard'), even if there are no planned retrofit works.

The UK NZCBS pilot version was launched in September 2024, after the refurbishment works of the Victorian office building were completed. Applying the standard retrospectively through a net zero audit provided a structured approach to understanding the building's current position and the practical steps needed to reach net zero.

Although the refurbishment was not guided by the Standard, developer Dorrington's intention to operate Hamilton House as a modern, low-energy, all-electric office meant the building was well positioned for participation in the NZCBS pilot programme.

The audit revealed that Hamilton House had met the 2025 one-go operational energy limit of 105kWh·m^{-2} per year GIA for office buildings (general – whole-building route).[1]

Dorrington acquired Hamilton House in 2018, with the ambition of transforming it into a modern business centre offering flexible workspace, while retaining landlord control of whole-building systems. Between 2020 and 2024, the building underwent a phased refurbishment to accommodate serviced offices, tech-enabled meeting rooms, breakout spaces, tea points, kitchens and focus booths. Amenities such as a gym, cycle storage and showers were added, and large communal terraces were created, overlooking the Thames and Inner Temple Garden, for occupier wellbeing.

Variable refrigerant flow (VRF) systems were installed for heating and cooling, alongside LED lighting and controls, central electric hot-water calorifiers, and a sensor-based energy monitoring system providing floor-level and end-use consumption data.

No fabric upgrades were done because of budgetary and heritage constraints. The building remains naturally ventilated, with no mechanical ventilation introduced. After the works were completed, the building was fossil fuel-free and achieved a significant reduction in energy use intensity, positioning it as a low-energy asset.

This raised some key questions: could Hamilton House achieve 'net zero carbon aligned' status today? If not, then when, and what was additionally required to be implemented – and at what cost?

Greengage was commissioned to do a net zero audit to assess the building's alignment with the Standard and answer these questions.

Hamilton House is naturally ventilated, with no mechanical ventilation introduced during the retrofit

The building's refurbishment story

Designed in 1880 by Sir William Emerson, Hamilton House originally served an insurance organisation and, later, various merchants. By 2018, when Dorrington bought the property, it had become an operational business centre with declining occupancy, low rental values and outdated fit-outs that created dark, disjointed spaces. Heating was provided by gas boilers and there was no cooling – leaving south-facing offices uncomfortably warm in summer.

The building required substantial upgrades to be a competitive workspace. To maintain rental income and minimise disruption, Dorrington opted for a floor-by-floor refurbishment over four years, keeping occupiers in situ. This required careful planning to ensure business continuity and maintain expected service levels.

As layers of previous fit-outs were removed, the project team uncovered original terrazzo floors, cornices and mouldings. Generous floor-to-ceiling heights and original flooring were retained, preserving the building's character and enabling material reuse.

The impressive frontage of Hamilton House, on London's Embankment

VRF systems were installed with exposed cassette units and pipework, improving maintenance access and avoiding the embodied carbon associated with new suspended ceilings. Local controllers were placed in each office suite for occupier control. The gas boiler was decommissioned only after the final VRF system was installed in 2024, ensuring continuous heating availability throughout the refurbishment and enabling the building to become fossil fuel-free.

Meeting the Standard

Hamilton House met several key requirements of the Standard, including operational energy limits, fossil fuel-free operation, water-use monitoring and HVAC energy tracking. Although the VRF systems use R410A refrigerant, they are exempt from the global warming potential limit as they were installed before the NZCBS's release.

The building benefits from robust metering infrastructure, with 33 sensors monitoring floor-level end-use energy consumption, voltage and power factor. This wealth of data provided strong evidence for operational energy performance and electricity demand-management reporting.

As the retrofit is complete and no further works are planned, the 105kWh·m^{-2} GIA per year limit achieved will, once verified, remain fixed for future verifications. The property manager will only need to maintain the existing baseline without capital-intensive interventions.

The net zero audit also identified low-cost building optimisation measures – informed by half-hourly energy, power and voltage data analysis – to further reduce consumption. These fall under non-reportable works, so do not trigger embodied carbon reporting requirements.

The renewable energy challenge

Hamilton House does not currently have solar photovoltaic (PV) installed, so does not meet the Standard's onsite renewable energy target. A feasibility study assessed potential capacity and annual generation, but the output fell short of the requirement. Installation is also subject to planning approval because of the building's heritage status.

The Standard recognises such constraints and allows a reduced onsite renewable target to be proposed during verification. From our experience auditing office buildings in Central London, meeting this requirement is a widespread challenge because of competing roof-space demands – including tenant amenity areas, MEP plantrooms and biodiversity features.

Creative approaches, such as building integrated PV, biosolar roofs or solar canopies, may unlock additional generation, but many heritage buildings in such locations may ultimately need to propose reduced renewable energy targets.

The pilot version of the Standard required reporting of embodied carbon associated with refurbishment works undertaken within the embodied carbon reporting period, even if these works occurred before the Standard's release. Although these works are exempt from meeting embodied carbon limits, gathering the required data retrospectively is challenging (see panel, 'Measuring embodied carbon').

'Net zero carbon aligned' office buildings

The Standard provides a viable framework for existing office buildings to achieve 'Net zero carbon aligned' status. Our audit experience shows that operational energy limits can often be met through low-cost optimisation measures and light-touch upgrades, such as LED lighting, controls improvements, and installation of

Measuring embodied carbon

For Hamilton House, obtaining materials and quantities information about embodied carbon from past contractors proved difficult, particularly where works were delivered under fixed-price contracts.

The Standard provides a data-collection flowchart to support this process, but retrospective reporting will remain a barrier for many buildings. This feedback was shared with the Standard during the pilot testing programme.

For future refurbishments, it is essential to review current design, procurement and construction processes for incorporating mechanisms to collect this data from the outset. Embedding embodied carbon considerations into every stage of refurbishment decision-making will ensure future compliance with the Standard.

building management or energy monitoring systems. Many of these interventions are classified as non-reportable works, avoiding embodied carbon reporting requirements. Where reportable works are required, embodied carbon assessments indicate that meeting the limits is achievable for low- to medium-cost measures.

Because the Standard's limits vary based on the start date of retrofit works, early action is encouraged. Applying the Standard, identifying gaps and undertaking required works sooner allows building owners to lock in a higher operational energy limit that can be maintained for future verifications.

Meeting the Standard in heritage buildings requires careful planning and thoughtful integration of retrofit measures and onsite renewables. Hamilton House demonstrates that it is possible. With Version 1 of the Standard now published, we are reviewing the changes from the pilot and assessing their implications for Hamilton House's potential verification.

Communal terraces overlook the Thames and Inner Temple Garden to aid occupier wellbeing

Launch of the Standard

Version 1 of the UK Net Zero Carbon Buildings Standard was published in March 2026. Following extensive pilot testing and wider industry feedback, the draft version was updated for clarity and usability. It includes additional annexes covering landlord- and tenant-only routes to verification, and an optional verified check at practical completion to determine whether a building is on track. A summary of the changes can be found at www.nzcbuildings.co.uk/resources

Watch a video with UK NZCBS CEO Katie Clemence-Jackson at bit.ly/CJKCJ0226

As more real estate companies commit to organisational-level targets through the Science Based Targets Initiative, the Standard's asset-level limits help bridge the gap and support the sector's net zero transition in the UK.

Achieving the Standard also unlocks valuable co-benefits – from enhanced asset valuation and reduced climate-risk exposure to stronger appeal to 'environmental, social and governance (ESG)-conscious' occupiers, and greater energy independence in today's volatile markets. ●

Apeksha Gupta is principal consultant ESG and net zero at Greengage Environmental

References:

[1] Table OE-2 Energy use intensity limits, Existing Buildings following the one-go route, page 119, NZCBS Version 1, **bit.ly/4td7dhF**

ROCKWOOL helping contractors to meet increased fire safety regulation

Fire safety is increasingly everyone's responsibility, and contractors and building specialists are under immense pressure to be compliant and get it right.

Anxiety around whether every product, detail and installation is safe, meets heightened standards and can be defended to the regulator is keeping building professionals up at night.

The need to design and construct buildings that suppress the spread of fire and help protect life is vitally important as we strive for improved building performance and safety.

The Building Safety Act 2022 and the Fire Safety Act 2021 have introduced stricter regulatory frameworks for the design, construction and management of higher-risk buildings, with particular emphasis on early-stage design.

However, uncertainty around compliance, evidence and traceability, along with the quality of installation and delivery risk, is creating a lack of confidence in a sector that is already under pressure from staff and skills shortages.

The fear of failing to document work properly, installing the wrong system or installing it incorrectly, along with having work rejected for failing to meet regulations – and the reputational risk – is making fire safety a difficult landscape to navigate.

ROCKWOOL recognises the challenge and is providing tangible support through a wide range of solutions, including our new EN-rated fire-stopping range, FirePro®, the launch of a bespoke Training Academy, an interactive fire safety guide, and ongoing expert advice.

With our global centre of excellence for fire-stopping in the West Midlands, we're not only aiming to help those in the sector upskill and meet new fire safety regulations, but we're also focused on helping to improve building performance and safety across the board.

ROCKWOOL's technical training lead, David Steel, who has a long history of working in the sector as a fire-stopping expert, said: 'We know it's not easy for those responsible for fire safety right now.

'The quality of installation is under intense scrutiny and contractors have a huge range of issues to consider to ensure their work is compliant.

'We're here with solutions to support the sector. We've brought high-quality fire-stopping products to the market, alongside in-person training and expertise to boost the capabilities, skills, knowledge and compliance of those using them.'

The full FirePro range is tested and classified to the latest EN fire-resistance standards, with third-party certification under the UL-EU Mark.

The Training Academy combines best-practice classroom learning from our fire-stopping experts, along with practical hands-on training using purpose-built rigs that mirror common building applications, ensuring delegates gain a mix of compliance knowledge and experience of installing correctly and safely.

The Training Academy is already attracting professionals from across the sector, with interest now coming from fire and prison services, architects and large construction companies.

ROCKWOOL's fire-stopping course (**rockwool.link/cibse1**) is a paid-for, professional training course, which can be adapted to suit all levels of experience. Full details and pricing are available on our website.

You can also take advantage of our new technical literature – an interactive Fire-stopping Standard Details Guide, along with a wide range of CPD and e-learning materials on our website: **rockwool.link/cibse2**

● **For more information, visit www.rockwool.com/uk**

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Safety first

Seven industry experts came together to discuss the challenges of the building fire safety regime in *CIBSE Journal*'s latest roundtable, sponsored by BSB Dampers. **Phil Lattimore** outlines the key areas of debate

What are the critical barriers to building fire safety today? That was the question posed to seven industry experts at a recent *CIBSE Journal* roundtable at the Institution's headquarters in central London.

The 2022 Building Safety Act (BSA) introduced a new regime aimed at transforming the building control process to ensure a consistent standard across all building types.

For legal accountability, the BSA created five core 'dutyholder' roles – client, principal designer, principal contractor, designers and contractors – that apply to every project, regardless of the building's height or use. Each of these roles has a separate legal obligation to ensure the building complies with Building Regulations.

A legal obligation for competence, plus requirements to demonstrate this, applies across the board, and a Building Safety Regulator (BSR) has been created to oversee the regime.

Three years on from the BSA's enactment, the roundtable explored some of the challenges emerging from its implementation.

Ceri Roberts, principal fire engineer at Vinci Building, began the debate: 'The Building Safety Act was needed because it had become a race to the bottom in terms of quality and standards, especially producs but it's a challenge,' he said.

Peter Anderson, chair of Troup Bywaters + Anders, who sits on the CIBSE Building Safety working group, stressed the need for the industry to continue to strive for quality, and added: 'The fundamental challenge is how we make everything that's coming through, in terms of legislation and guidance, as straightforward as possible and how we, as leaders, communicate this to everyone who works with us.'

The industry's diminishing capability to cope with BSA requirements was the concern of George Adams, chair of the CIBSE Building Safety working group and member of the Beengineering council for Besa. 'There is a significant shortage of resources – and it seems to be getting worse,' he said. 'Our ability to meet the increased legislation is a real issue.

'My key worry is that the government has never issued guidance for the industry to work to. We've all got to make the best we

The panel

George Adams – chair of CIBSE Building Safety working group
Peter Anderson – chair, Troup Bywaters + Anders; CIBSE board
Russell Cole – director, Arup
David Fitzpatrick – MD, BSB Engineering; chair of CIBSE fire safety working group
Alex Hill – MD, Whitecode Consulting
Giulio Tonelli – Building Regulations principal designer, Buro Happold
Ceri Roberts – principal fire engineer, Vinci Construction

Russell Cole

‘There are legacy projects still grinding through the process’

can of the legislation that’s issued.’

Ceri Roberts was somewhat critical of the guidance surrounding the Act, which he suggested was not offering clear solutions to specific construction issues, not covered in guidance, especially when working on existing buildings. ‘Due to existing non-compliance issues, Tier 1s and its supply chain, are expected to provide the solutions, which does improve the safety of a building, but ergo, may be subject to rejection due to perception of strict compliance.’

Although current guidance surrounding BSA appears very binary at present, there is scope to prove compliance with the functional requirements, says Roberts. However, he says the supply chain is unwilling to make a professional judgement or take responsibility of any required engineered design for fear of future liability.

Insurance

Alex Hill, MD of M&E practice at Whitecode Consulting, identified a significant issue around project insurance relating to potential liability under the new legislation.

‘The problem is that everyone’s so nervous of getting it wrong because of the potential “criminal” liability within the legislation,’ he said. ‘I worry that it might make some projects uninsurable. We can deliver whatever people want, but the question is whether people are prepared to insure it.’

Hill outlined how some firms will not give fire safety advice if it is an interpretation of the standard that may not be approved by building control and, therefore, isn’t economically insurable. ‘Also, that concern about liability is another reason why building regulators are being completely inflexible.’

Peter Anderson

‘We can now demonstrate that everyone across the chain is competent’

The participants agreed that this was a significant issue thrown up by the new regime, and David Fitzpatrick – BSB Engineering MD and chair of the CIBSE Fire Safety group – pointed out: ‘As a manufacturer, we’ve had to look at design insurance, because if we make a recommendation about using a product, are we effectively liable as a designer under the BSA, as it is unclear between technical support and design sometimes?’

Inconsistent interpretation

Hill suggested that the regulator is deterring some clients from building beyond a certain height because this would trigger the time- and resource-consuming gateway process introduced by the BSA.

The aim of the gateways – of which there are three – is to enhance safety standards and oversight for higher-risk buildings (HRBs) in the design, construction and occupation phases.

Gateway 1 focuses on obtaining planning permission by demonstrating that the proposed design meets necessary safety requirements; Gateway 2 involves rigorous inspections during construction to verify adherence to the approved plans; and Gateway 3 ensures that the building is fit for occupation.

The BSR needs assurance that safety issues have been considered at key project stages, and navigating the gateways requires collaboration between building owners, designers, contractors and regulatory bodies. Failure to meet requirements can result in penalties and delays.

Fitzpatrick said the gateway regime had initially caused many projects to be knocked back because of a lack of detail, but that principal designers had learned and adapted their process to comply. ‘They’re understanding that they can’t

just pass that down to the M&E contractor or the fire engineer. They're legally responsible for their obligations, so it requires different behaviours.'

Hill claimed there is inconsistency in the way the regulations are interpreted by the different technical advisers appointed by the BSR as part of the multidisciplinary team reviewing Gateway 2 submissions for HRBs.

Nonetheless, Anderson acknowledged the importance of the BSR in professionalising the fire engineering role in construction. 'The accountable person is responsible for having an up-to-date fire strategy, fire assessment, and so on, and handing that strategy from one person to another is key throughout the life of a building . I've seen buildings where there are three different fire strategies in existence that contradict each other.'

Proving/improving competence

Anderson said another benefit of the regime is that it drove his firm to reflect on competence and ensure it was capable of meeting HRB thresholds. 'We had the knowledge and the culture of [correct] behaviour, but we didn't have a documented form the regime requires. By formalising processes we can now demonstrate that everyone across the chain is competent.'

Giulio Tonelli, principal designer at Buro Happold, agreed. 'One thing that was really needed was encouragement for the industry to better understand the building control process, alongside clearer definition of roles and responsibilities across the various dutyholders.

'The competency element is a positive addition and should not deter people. At Buro Happold, we were competent before the new regime was introduced and we remain competent today. However, the changes have presented a valuable opportunity to reinforce our internal management systems, improve the way we work and, most importantly, when it comes to delivering design and build projects, reiterate that compliance is the responsibility of everyone.'

Early engagement

Whitecode Consulting's Hill said a benefit of the BSA is that designers now have a legally defined role with specific liabilities, so value engineering is

David Fitzpatrick

If we recommend using a product, we are effectively liable as a designer under the BSA

Ceri Roberts

The Building Safety Act was needed because it had become a race to the bottom in terms of quality and standards

Alex Hill

There are a lot more conversations happening earlier about costs, about product selection

George Adams

The industry had to change and this is part of the change process. It's about time it grew up, professionalised and did its job properly

now more difficult. If a contractor wants to change a product that affects safety or the original 'design intent', it may have to go back to the BSR for a major change control approval.

'Value engineering is now very difficult to do if it's gone into the BSR process. So there are a lot more conversations happening earlier about costs, about product selection,' said Hill.

'Another important element is that products selected are now being checked by building control to ensure they have been tested for the application for which they have been designated.'

This is the product and compliance testing verification process, which requires a Declaration of Performance, with a lab report showing the product passing a test in a specific configuration.

Hill believes this could deter innovation on smaller projects, because testing a product for a new application is expensive. However, he said the BSR regime has increased awareness of the need to get it right first time, as it can be costly and time-consuming to correct selection errors.

Buro Happold's Tonelli welcomed the wider awareness of the duties that apply to all projects. 'Everyone is aware of what we should be doing. As a designer, you are aware that no one else should be checking a product you've selected – it's your responsibility to know.'

However, Hill said the gateway system is causing cost pressures that may make certain projects unviable. 'By telling projects they can't proceed past a certain point, there's a drag on the market that will be terminal for the delivery of certain projects.'

Arup director Russell Cole said that the BSR's latest reports indicated that its Innovation Unit was starting to make the process more effective, though 56% of projects were still rejected. 'There are legacy projects that are still grinding through the process, but they are saying the news ones will be going through quicker,' he said.

Giulio Tonelli

As a designer, you are aware that no one else should be checking a product you've selected – it's your responsibility to know

Learning curve

The BSR requires building control professionals to be registered, have independent competency assessment qualifications, and undertake regular training and reassessment every four years.

However, many existing inspectors decided not to take on the additional requirements for the new role, resulting in a shortfall of registered building inspectors and an increase in their workload, contributing to the bottlenecks.

Adams, though, believes this was necessary and will lead to a more professional building industry: 'There has to be a cut-off point, where somebody lays down the law and says, "You've got to pull your socks up",' he said.

There was concern that building control officers are not able to offer solutions that don't align completely with a Building Regulation Approved Document. 'They won't take any responsibility to give a view on the wording that's not in a document,' said Hill.

This is a problem that the industry has to deal with, said Adams: 'It's a painful learning curve, but it's what we have to get through.

'The industry had to change and this is part of the change process. It's about time it grew up, professionalised and did its job properly,' he said. ●

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On track for carbon savings

The award-winning Locomotion New Hall proves that protecting the world's most significant railway heritage doesn't require high-energy HVAC. **Andy Pearson** reports

When the Science Museum Group decided to create a new building for its railway collection at Locomotion in Shildon, County Durham, it set its design team the challenge of protecting its historic railway rolling stock while avoiding the high energy demands associated with more traditional museum environmental control.

The result is New Hall. Designed by Buro Happold working with AOC Architecture, the team has delivered an exceptional, yet simple building that has eschewed complex HVAC systems in favour of a highly insulated envelope, airtight construction and a low-energy heating strategy to maintain the conditions necessary for heritage conservation.

This ambitious approach was recognised at the 2026 CIBSE Building Performance Awards, where the scheme won Public Building of the Year. The judges acknowledged that Buro Happold went above and beyond the brief, describing its solution to balancing the needs of visitors and conservation as 'simple and robust with low energy demand'.

Locomotion is one of several museums operated by the Science Museum Group, including the National Railway Museum in York and the Science and Industry Museum in Manchester (see 'Powered by the next industrial revolution', *CIBSE Journal*, November 2025, **bit.ly/CJNov25PH**).

Locomotion is located beside the route of the world's first public railway, which opened in 1825 with a train hauled by George Stephenson's Locomotion No 1. The steam engine is on display in the Main Hall at Shildon, part of one of the most significant collections of railway heritage in the world. The museum's collection is so large that some of the rolling stock at Shildon has to be stored outside.

The New Hall building needed to preserve the precious exhibits while also allowing the public access to view the unique collection. As a result, its architectural design balances the industrial scale of a railway engine shed with a welcoming visitor experience.

It has a wide, mono-pitch roof supported on a steel portal frame enclosed in high-performance cladding panels. On its west elevation, six giant doors provide access for the rolling stock from the concrete apron outside.

Inside, polished concrete platforms allow visitor access between the six sections of track that accommodate the exhibits. Glazing is confined to the north elevation, to prevent sunlight damaging the exhibits and to limit the impact of any solar gains on the environment in the hall.

Museum environmental control is often associated with highly regulated temperature and humidity delivered through complex HVAC systems. New Hall's engineering team, however, recognised that its function – essentially a large storage building for large

exhibits – allowed for a different approach. Instead of tightly controlling temperature, the project focused primarily on maintaining stable humidity levels. Close collaboration with the collection care team helped define appropriate environmental parameters for rolling-stock preservation.

'Locomotives are made from a mix of materials – steel, wood and other components – and high moisture levels in the air can be problematic,' says Lawrence Williamson, associate mechanical engineer at Buro Happold. 'The key requirement was to protect them by controlling humidity.

'Environmental design criteria were also informed by heritage conservation guidance, including BS 4971, which sets out recommended environmental ranges rather than mandating tight, actively controlled conditions.

'What matters most is avoiding large temperature fluctuations and keeping humidity within a safe range.'

Environmental targets for the hall were to maintain temperatures 'broadly between the mid-teens and mid-20s Celsius, and a stable relative humidity between 35% and 60% that allows for seasonal variation', adds Williamson.

The team focused on ensuring the building itself would stabilise the internal environment. At the heart of the strategy is a relatively high-performance building envelope, designed to minimise heat loss and prevent uncontrolled air infiltration.

'If you get the fabric right, the internal environment becomes inherently stable,' says Williamson. 'Once conditions are established inside the building, they change very slowly.'

Highly insulated panels clad New Hall. Achieving an appropriate level of airtightness required close collaboration between engineers, architects and the contractor, as the manufacturer would only guarantee an air permeability of $3m^3 \cdot h^{-1} \cdot m^{-2}$ @ 50 Pa. Cladding contractor Aspect Facades, working with design and build contractor Nationwide Engineering, set out to improve on this figure for the installation.

The building's six pairs of enormous access doors posed a particular challenge: Locomotion's exhibits have to be moved in and out of the building along rail tracks, which require industrial-scale openings that could easily compromise airtightness.

Originally, the intention was to seal around the doors once the rolling stock was in place. However, an initial air-pressure test showed the doors to be surprisingly airtight, so the decision was made to leave them unsealed. This has the benefit of enabling the museum to easily open the doors to facilitate further vehicle moves when required.

The two visitor entrances incorporate lobbies with sequential opening doors to limit air exchange when people enter the building.

The airtight envelope was key to facilitating Buro Happold's deliberately simple approach to environmental control. Museum buildings typically use large air handling units with heating, cooling and humidification to maintain tightly controlled conditions., but New Hall avoids this complexity. Instead,

Performance data

Total energy use*	**86,801.2kWh per year**
Total floor area	**2,050 NIA**
Onsite renewable PV†	**44,375.6kWh**
PV size	**250m²**
Capacity	**22kW per half hour**
Energy use intensity at design stage	**137kWh·m⁻² per year at RIBA Stage 3**
Energy use intensity: in use‡	**23.8 kWh·m⁻² per year**
Refrigerant emissions	**R407C**

* For period 25/04/2024 to 31/03/2025
† For period 11/03/2025 to 16/09/25 since installation
‡ For period 01/04/2025 to 31/03/26

The doors meet airtightness requirements without the need for sealing

humidity is controlled by an underfloor heating system embedded within the polished concrete platforms that provide visitor access between each of the tracks.

'We essentially removed the middle layer of HVAC,' Williamson explains. 'Rather than heating air through big plant systems, we deliver low-grade heat directly into the building fabric.'

The underfloor heating circuits are supplied by air source heat pumps, operating at a relatively low temperature of 45°C flow and 40°C return. Because the building's heat loss is minimal, the total heating demand is modest, so two small heat pump units are sufficient to serve the entire hall, providing both capacity and redundancy. 'If one unit is down for maintenance, the other can still keep the building stable,' Williamson says.

Unusually, the heating system is not designed to keep visitors warm; it is controlled to maintain the humidity conditions necessary to preserve the collection. 'If humidity rises, gently warming the space lowers the relative humidity,' Williamson explains. 'So the heating system is effectively controlling moisture levels.'

This solution means the heating system may occasionally operate during warmer humid weather. 'The museum made it very clear that conservation comes first,' Williamson says. 'If humidity rises, we'll run the heating system to bring it back down, even if it's a warm day.' In practice, however, the building has maintained stable conditions without a noticeable impact on visitor comfort.

Ventilation requirements for visitors are addressed through a small mechanical ventilation with heat recovery (MVHR) system. This has no heating coil, with the temperature of the fresh air supply tempered through a heat exchanger within the unit. The unit is sized to deliver fresh air for 80 visitors, with CO_2 sensors used to modulate the airflow to ensure energy efficient operation. Importantly, the ventilation system plays no role in environmental control. 'It's purely there for people,' says Williamson. 'The building itself is doing the environmental stabilisation.'

The building services installation is minimal. A compact plantroom houses the MVHR unit, heating circulation pumps and associated equipment. The system uses a thermal store to buffer the heating system and assist with heat pump defrost cycles in cold weather.

Underfloor heating is supplied by air source heat pumps

'Instead of tightly regulating temperature, the project focused primarily on maintaining stable humidity levels'

Elsewhere in the building, services are limited to LED lighting and a small number of ancillary spaces, such as a single toilet, a comms room and storage area – visitor amenities including a café and toilets are all located in neighbouring museum buildings.

New Hall opened in May 2024. Environmental conditions are monitored and controlled through a Honeywell building management system, allowing remote monitoring by the museum's facilities team. This has shown that Buro Happold's approach to New Hall has delivered an exceptional energy performance of 49.7kWh·m^{-2} per year, as shown on the latest Display Energy Certificate. This exceeds the UK Net Zero Carbon Buildings Standard benchmark and surpasses the recommended target for a cultural building holding a collection.

The figure is also a massive improvement on the predicted energy use at RIBA Stage 3 of 137kWh·m^{-2} per year. Williamson attributes this primarily to the contractor achieving an airtightness of 1.45m^3·h^{-1}·m^{-2} @ 50 Pa, which is a significant improvement on the 3m^3·h^{-1}·m^{-2} manufacturer's data allowed for in the initial modelling.

The addition, post-completion, of 268m^2 of photovoltaics on the building's roof has resulted in an energy use intensity of 23.8kWh·m^{-2} per year between April 2025 and March 2026.

By investing in a high-performance envelope and using thermal mass to moderate environmental conditions, the scheme shows it is possible to avoid the energy-intensive HVAC infrastructure often associated with museum buildings.

Its recognition at the CIBSE Building Performance Awards 2026 suggests this approach may offer valuable lessons for other heritage and cultural projects seeking to balance conservation, sustainability and operational simplicity. ●

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Making the moat of it

Do water source heat pumps offer an environmentally friendly, efficient and visually discreet solution for decarbonising heat in historic buildings? A report from Historic England suggests they can, reports **Phil Lattimore**

A report commissioned by Historic England has concluded that closed-loop water source heat pump (WSHP) systems are a viable and readily available way to discreetly decarbonise heating systems in historic buildings.

The report, *Heat pumps in historic buildings. The viability of water source heat pumps in historic buildings* (**bit.ly/4sNEW02**), explores how well-designed WSHP systems perform in practice, and how they can be integrated efficiently with existing pipework and radiators.

Looking at five historic buildings that have had WSHP systems installed, the report sought to identify examples of best practice that have enabled good system performance, as well as common mistakes that have led to poor performance. The intention was to use the findings from the case studies to inform future work and strategy, particularly in identifying the design, control and maintenance factors that determine whether WSHP systems perform effectively in historic buildings.

Visits to the five case study buildings – located in Somerset, Cambridgeshire, Warwickshire, North Yorkshire and Norfolk – took place between February and April 2023, with engineers from Max Fordham carrying out site surveys. They also questioned building users on thermal comfort, noise levels, running costs, control management and maintenance.

With many stately homes built close to a body of water, the report concluded that WSHPs can be particularly suitable, offering a more visually discreet solution than an air source heat pump (ASHP) system and a more straightforward installation than a ground source heat pump.

When used for conservation heating, WSHPs can operate efficiently with existing radiators and pipework, minimising the cost, disruption and visual impact of upgrading.

In terms of effectiveness, the report suggests that issues with system performance are often the result of its configuration rather than the WSHPs themselves. Only one of the five sites in the case study experienced 'significant difficulties' extracting heat from the source water, because of an open-loop setup.

Noise levels were similar to other heating system components (as they are often installed in plantrooms).

Controls were another key factor in optimising the performance of WSHP systems, with the report highlighting the importance of building users having a good understanding of how to use controls to maximise efficacy. However, it found that the availability of skilled maintenance and installation contractors could be an issue. ●

Other Historic England heat pump guides are at bit.ly/CJHEHPs. Read a summary of ASHP studies in large buildings at bit.ly/4tYeEcu

Site 1 Medieval Bishop's Palace outbuildings

This Somerset site used a Dimplex SIH 20TE 20kW WSHP to heat the outbuildings. A closed-loop collector placed within the moat on a sunken platform provided the heat source, so had no visual impact on the building.

Underfloor heating was used in the toilets, learning centre and cafe, while radiators heated the office. A 500-litre hot-water cylinder serves these, and there were no issues with temperatures, apart from in the learning centre, and no noise issues from the WSHP.

An energy management company evaluated the site and found an operating coefficient of performance (COP) of only 0.75. System settings were altered to improve the COP to 2.5, which was still lower than the expected 3.0; suboptimal performance can be caused by the WSHP targeting a high flow temperature, or a large temperature difference across the flow and return for the WSHP, but the cause wasn't clear.

The report states that a WSHP in the main palace would reduce energy use and running costs compared with the current direct electric system.

Engineers' rating

Technology choice ★★

Thermal comfort ★☆

Design/installation quality ★☆

Site 2 Jacobean-style house

In 2018, a 204kW WSHP system replaced the oil-boiler heating system at the Grade I-listed country house in Cambridgeshire, parts of which date back to 1135. It uses six CTC EcoPart 434 WSHPs with an open-loop collector.

The open-loop WSHP system extracts and returns water from a small watercourse on the site. Five 34kW units provide conservation heating and domestic hot water to the main house, and one 34kW unit delivers comfort heating to the staff cottage, with heat primarily delivered through existing radiators in the main house and new radiators in the cottage.

The installation had no visual impact on the building and the basement plantroom produced no noise issues. However, the engineers found that the WSHPs were not working. Although functioning as designed for 12–18 months, a lack of river maintenance, personnel changes and collapsed system maintenance resulted in the submersible pumps and filtration system frequently failing. Locating the pumps under a bridge (to reduce visual impact) made them difficult to maintain, with suspected blocked filters and an airlock in the pipework. Mild steel, rather than stainless steel, components also caused damage. Finding a contractor to fix it proved difficult. The client was interested in converting the open-loop system into a lower-maintenance closed-loop one for this and future projects.

Engineers' rating

Technology choice ★☆

Thermal comfort ☆☆

Design/installation quality ★★

Medieval Bishop's Palace outbuildings

Site 3 Mansion house

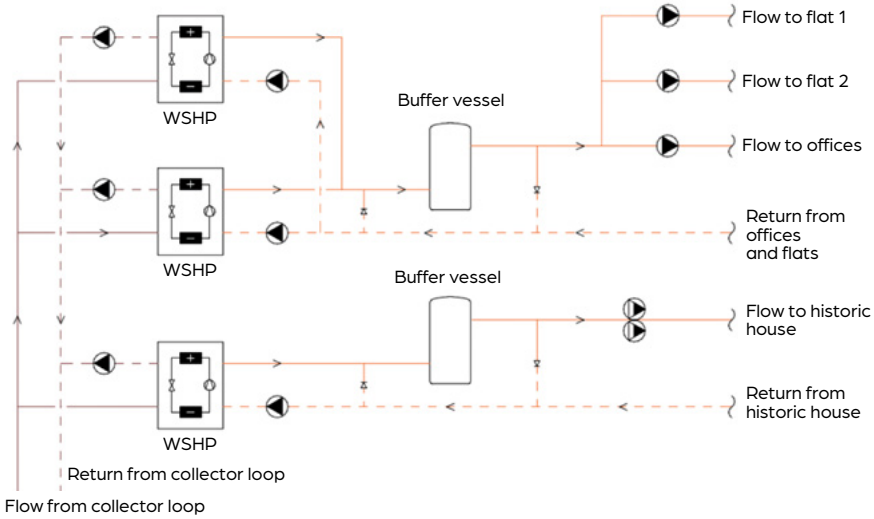
Constructed in 1570, the mansion house has been extensively modified, including significant renovations and extensions in the 1920s and 1930s.

Three Dimplex WSHPs were used to heat the main house, office accommodation and flats on this site, with all three connected to a shared closed-loop collector on a sunken platform in the lake next to the house.

A single 75kW WSHP and a 1,000-litre buffer vessel provided conservation heating to the main house, which used the existing historic radiators to deliver heat. Heating for thermal comfort was provided on separate circuits to the offices and flats, powered by a 40kW and 20kW WSHP sharing a 500-litre buffer vessel. The offices and flats used modern radiators.

The research engineers found the system well designed, but when they compared what had been installed to a schematic of the design, a non-return valve appeared to be missing, reducing the heating system flow temperature by allowing return water to mix with the outgoing flow. This reduced efficiency and meant insufficient heat was delivered to some parts of the building.

Lower-temperature conservation heating allowed existing large, cast



Site 3 Schematic of heating using separate WSHPs for conservation heating and thermal comfort

iron radiators to meet heat output requirements. Separate WSHPs for thermal comfort and conservation heating allowed each to be sized to its purpose, enabling each WSHP to operate at the lowest possible temperature and maximising efficiency.

Engineers' rating

Technology choice ★★
Thermal comfort ★☆
Design/installation quality ★☆

Site 4 Stately home

Construction of the building began in 1699 and was completed in the 1750s, with additions during the 19th century, plus extensive restoration after a fire.

Two 144kW Dimplex SI 100TE WSHPs were installed in 2009, using a closed-loop collector system to collect heat from a pond. They provide heating to all heated areas of the main house and hot water to the west wing.

In 2020, two 73kW Dimplex SI 75TU WSHPs were installed to provide heating to additional areas of the west wing and to accommodate the installation of more hot-water appliances. The total heat pump capacity was 97W.m^{-2}.

There was minimal visual impact from the system installation in the basement plantroom, and no noise issues. Using the historic radiators saved money, but leaks in some needed repair.

The report acknowledges the foresight of ensuring the system is set up to allow more heat collectors to be added. The WSHPs appeared to be in good working order, although the engineers found pipework insulation was damaged in places, potentially leading to condensation, corrosion and leaks.

The report highlights the lack of temperature control, with the pipework configuration allowing it to be set as only one zone for the whole building. Some rooms in the east wing had low thermal comfort levels.

Engineers' rating

Technology choice ★★
Thermal comfort ★☆
Design/installation quality ★☆

Site 5 Stately home

Two Dimplex SI 130 and SI 75TU WSHPs were installed in this Grade I-listed 17th-century stately home in Norfolk in 2016, providing heat pump capacity of 205kW, and extracting heat from a nearby lake in a closed-loop system.

The WSHPs, which deliver 50W·m^{-2} capacity (of usable floor area), provide conservation heating to visitor areas and comfort heating to staff offices and accommodation, using historic radiators that were fed by an oil-fuelled boiler.

The lake's proximity made the water source an excellent choice for high-efficiency heating, with minimal visual impact or noise issues from the plantroom. Thermal comfort was excellent, with staff and volunteers feeling comfortable in all areas. However, the report cites a lack of zoning control of the heating as an issue.

Engineers' rating

Technology choice ★★
Thermal comfort ★★
Design/installation quality ★☆

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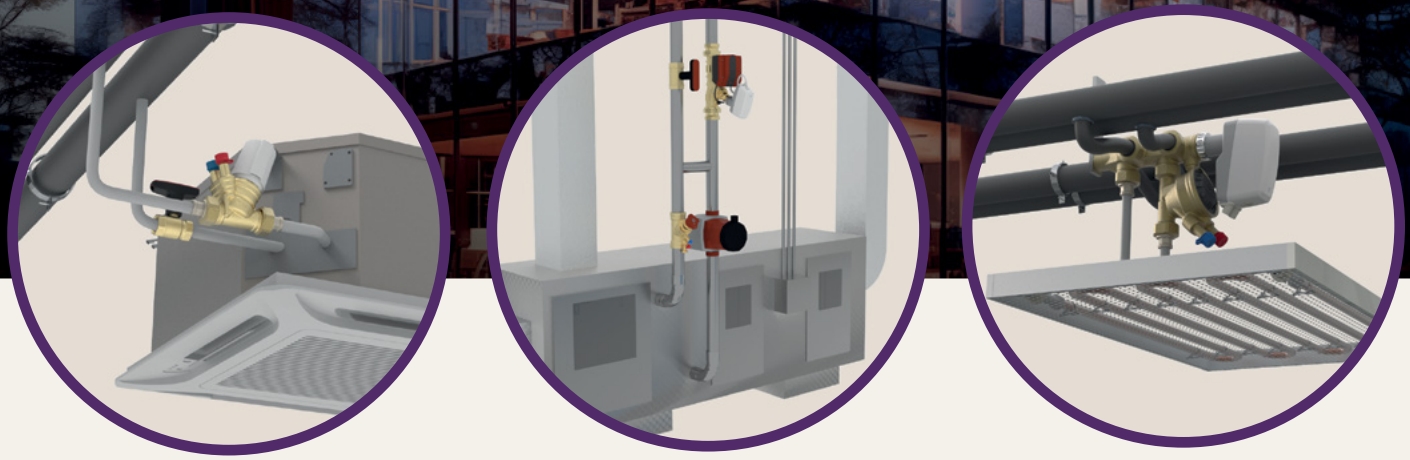

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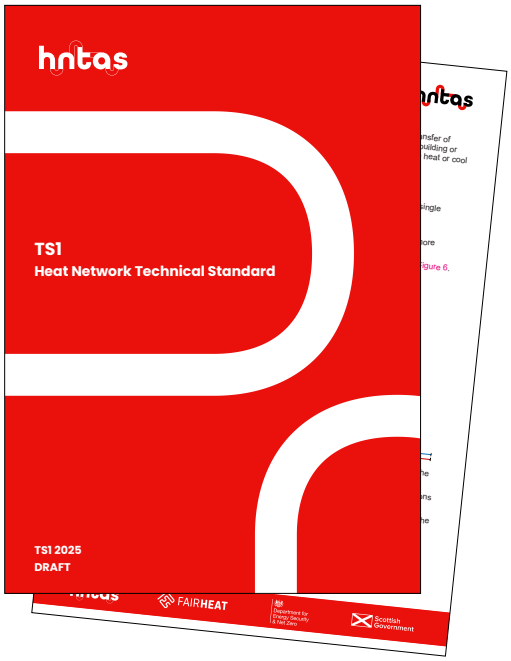
Clarification on HNTAS process



Dear Editor,

We welcome the recent *CIBSE Journal* article 'Preparing for the Heat Network Technical Assurance Scheme' (February 2026) and agree with its overall premise that HNTAS is a necessary and positive step for the sector.

As the technical author responsible for developing HNTAS, we would, however, like to clarify a small number of points where the article may inadvertently have given readers an incomplete or misleading impression of how the scheme will operate in practice.

HNTAS Stage 1 scope and intent

The article notes the increased level of requirement at HNTAS Stage 1. This is intentional and evidence-led. Historic analysis of heat network underperformance shows that fundamental design decisions made at early concept stage are the root cause of many later failures. Stage 1 focuses on ensuring that critical performance-determining choices are sound before they are locked in. This approach is designed to reduce downstream risk, rework and cost, rather than add unnecessary burden.

Stage 1 does not constrain iterative or creative design

The suggestion that HNTAS Stage 1 restricts the iterative and creative nature of RIBA Stage 2 is not the intent of the scheme. HNTAS assessment occurs at the end of each stage, not throughout it. Design teams retain full freedom to iterate, test options and refine solutions in the same way as they do today. The scheme does not interfere with the design process; it simply provides an assurance checkpoint once that process has concluded.

Clarification on progression with nonconformities

The statement in the article that 'projects may not be able to proceed until all... nonconformities are resolved' is incorrect. Projects can proceed through HNTAS stages where:

- The assessor is confident key performance indicators can be achieved
- There are no key failures
- There are no major technical issues outstanding.

This is a deliberate feature of the scheme, designed to avoid unnecessary delay while maintaining performance and consumer-protection outcomes.

TS1 vs CP1 references

The article uses CP1 and TS1 interchangeably. Under HNTAS, TS1 is the correct and sole technical reference. While TS1 builds on CP1, it has been rewritten, tightened and structured to function as a regulatory technical standard. Referring to CP1 risks confusion, particularly given that CP1 was voluntary and interpretive, whereas TS1 is mandatory and assessable.

Use of multiple assessors

This is described as a potential negative. In practice, this reflects standard peer review and ISO-aligned assurance, particularly for complex, safety and consumer-critical infrastructure. It improves robustness, consistency and confidence in outcomes, and is not unusual in regulated technical assurance environments.

We hope these clarifications are helpful. ●

● Tom Burton, member of the HNTAS technical author team, FairHeat

Finsbury flex

Building services engineers at 2 Finsbury Avenue have taken a part-load approach to reflect the reality of flexible working. **Andy Pearson** finds out how Ramboll has engineered a system that aims to optimise efficiency whether the building is hosting a full house of 7,000 or a core team of 70

Expectations for the operational performance of commercial office buildings are set to be redefined by 2 Finsbury Avenue (2FA), in London. When completed in 2027, the scheme – developed by British Land and engineered by Ramboll – aims to achieve Breeam Outstanding, Well Platinum, an Energy Performance Certificate A rating and a NABERS UK Design for Performance scheme 5-star rating.

This established a total building energy target of 90kWh·m^{-2} per year, with landlord energy use targeting 55kWh·m^{-2} and tenant energy 35kWh·m^{-2} per year.

To achieve these goals, Ramboll has taken a holistic approach to the building services design by shifting away from a peak-load approach. Instead, it has engineered and optimised systems for part-load, part-occupancy operation to reflect a post-pandemic world of hybrid working in amenity-rich spaces, with increased focus on health, wellbeing and sustainability.

Ramboll's route to meeting the low operational energy targets began with the building's form and façade design. 2FA, in the City of London's Broadgate campus, is unusual in that it comprises two towers – 37-storey East Tower and 23-storey West Tower – combined at the base by a 13-storey podium.

Early modelling identified peak solar gains would occur during the afternoon. Working with the project architects, 3XN, Ramboll analysed multiple façade geometries and orientations, simultaneously modelling variables such as glazing ratio, daylight availability, solar heat gain, glare risk and the thermal performance of glazing systems.

Its detailed analysis informed the final, optimised façade design, which incorporates saw-tooth modules orientated to maximise daylight while avoiding excessive cooling loads.

The design team adopted what Danny Coleman, technical director at Ramboll UK, describes as a 'pragmatic approach' to the challenge of high-end commercial offices typically generating significant internal gains from occupants, equipment and lighting. 'Over-insulating the envelope would risk increasing cooling demand,' he says, 'so the façade uses double glazing with a low solar G-value of around 0.25, combined with U-values that satisfied Part L energy modelling requirements for planning while avoiding over-insulating.'

The development was designed to operate without fossil fuels, but with a combination of electric heat pumps, boilers and high-efficiency chillers interconnected with sophisticated control algorithms. 'The system can dynamically select the most efficient combination of plant for any given load and weather condition, to maximise operational efficiency,' says Coleman.

The system is designed to provide heat primarily using air source heat pumps (ASHPs), with electric boilers providing additional capacity. Heat pumps are sized to meet the bulk of the heat load. In the West Tower, heating is provided by two ASHPs: one 4-pipe unit and one 2-pipe reversible unit. In the East Tower, heating is provided by three units: two 4-pipe heat pumps and one 2-pipe reversible unit.

Rather than sizing the ASHP system to supply heat for extreme winter design conditions that will occur only rarely, the system incorporates three 750kW electric boilers. These provide top-up heat and additional resilience while minimising the embodied carbon, cost and space associated with redundant heat pumps.

The ASHPs also supply cooling in the West and East Towers. For this system, additional cooling capacity is provided by two water-cooled chillers in the West Tower and three in the East Tower.

A major benefit of this approach is making use of heat recovered from comfort cooling loads, tenant IT cooling, lift motor rooms and electrical switch rooms – which, says Coleman, can meet approximately 40% of the building's demand for space heating and domestic hot water.

'The system can dynamically select the most efficient combination of plant for any given load and weather condition'

2FA's saw-tooth façade is designed to maximise daylight and avoid excessive cooling loads

Optimising part-load performance

Ramboll's engineering design used occupancy and performance data from British Land's existing office portfolio to understand how buildings perform in practice, especially when operating at partial load for most of the year.

Part-load is common in spring and autumn, when loads can be relatively low, and for out-of-hours working, when only parts of the building are occupied. The system needed to accommodate these variations to meet indoor design conditions of 20°C heating and 24°C cooling.

Ramboll's system is so efficient that even under very light loads – potentially as little as 2% of peak capacity – the entire system can, if necessary, operate from a single chiller or heat pump. Or, as Coleman puts it, the building has been 'designed for 7,000 people, but will operate just as effectively for 70'.

Although each tower has its own chilled water and low-temperature hot-water systems, efficient part-load operation is achieved by the two networks being linked via plate heat exchangers in the basement.

'Instead of running multiple machines at inefficient conditions, one piece of plant can serve both towers while operating near its optimal efficiency point,' says Coleman.

The interconnection also enhances system resilience in the event of plant failure in one tower, by providing backup heating and cooling from the other.

Achieving the 5-star NABERS UK rating requested in British Land's brief is dependent on controlling and monitoring the engineering systems. The central plant will be operated using a plant optimisation system, which incorporates performance data for each piece of equipment, including efficiency curves for its operation under numerous conditions. This data helps the control system to select which items should

operate at any given time, improving plant performance significantly compared with conventional building management system (BMS) sequencing.

A comprehensive metering strategy also underpins the NABERS approach. Energy use is monitored across all systems, including tenant systems.

Tenant spaces are connected to the base-build systems via heating and cooling interface units. To maximise heat-recovery opportunities, tenants are required to prioritise use of the building's chilled water system for their IT cooling requirements. Heat rejected from these systems is then captured and reused by the central plant. Similarly, all tenants are required to use heat supplied from the central plant.

Energy consumption in tenant spaces will be metered and monitored to support energy management, and to enable NABERS UK performance verification.

The ventilation system is designed to meet energy and wellbeing objectives, supporting the building's aspiration for Well Platinum certification, and is sized to deliver 16L·s^{-1} per person. Rather than delivering fixed air volumes, the system operates using demand control based on maintaining a CO_2 concentration of approximately 750ppm in each 200m^2 office floor plate control zone.

Ventilation design targets a specific fan power of around 1.2W per litre per second. Oversized duct risers and connections to each of the office floors help achieve this. Duct connections are sized to enable occupancy of one person per 8m^2 in a proportion of zones on each floor, with ventilation plant sized based on a diversified occupancy of one person per 10m^2.

Four large central air handling units (AHUs) – two in the basement and two on the roof of the East Tower – provide the bulk of the fresh air. These serve office areas in the podium and parts of the tower through ductwork distributed in the building cores. In addition, some areas are served by on-floor AHUs, which intake air and exhaust directly through the façade. This allows flexibility while limiting the scale of duct distribution within the towers.

While the building primarily uses mechanical ventilation, the façade has motorised natural ventilators to support passive ventilation. These enable pre-occupancy purge of the office floors and night-time ventilation, allowing warm internal air to be flushed from the building, helping to reduce cooling demand the following day.

'During normal occupied hours, the ventilators are not intended to contribute to thermal conditioning of the spaces, as this would reduce the effectiveness of heat recovery within the mechanical ventilation system,' Coleman explains. The ventilators are operated by the BMS during appropriate weather conditions.

The development also incorporates strategies to reduce water consumption, including low-flow fixtures and fittings, sensor-operated taps, dual-flush WCs, and PIR-controlled washroom systems. A reclaimed water system combines greywater recycling with rainwater harvesting to supply non-potable uses, such as WC flushing. The cooling system also contributes to water efficiency.

The water-cooled chillers reject their heat via hybrid coolers, which combine the efficiency of cooling towers during warm conditions with dry operation during cooler periods. Coleman says this approach 'reduces water consumption while maintaining high cooling efficiency'.

At completion of 2FA, scheduled for June 2027, the brief calls for the building services solution to deliver a landlord energy use target of 55kWh·m^{-2}. Ramboll's modelling is currently showing it to be 36.4kWh·m^{-2} – well below the NABERs target. Coleman says the independent design review required under NABERS has confirmed that the hybrid system design for 2FA should enable it to target the 5-star rating.

The building is 33% pre-let, and once it is 75% occupied, British Land will pursue a formal NABERS In-Use rating. This will verify whether Ramboll's building services solution has delivered real operational performance and set a new benchmark for high-performance commercial offices in the UK. ●

York House won Workplace of the Year – Retrofit at the 2026 CIBSE Building Performance Awards

Building on a performance win

With 2FA set to redefine expectations for the energy performance of office buildings, its developer, British Land, is showing that it is serious about building energy performance. Its head office is in York House, an existing building that it owns and that has already achieved NABERs 4*. The scheme won the Workplace of the Year – Retrofit at this year's CIBSE Building Performance Awards, with the judges saying: 'This project will bring about wider change by providing a blueprint for the developer's wider commercial portfolio and other, similar, buildings.' 2FA is proof that this, indeed, is the case.

Travelodge hotels: driving sustainability with Lochinvar air source heat pumps

Travelodge, one of the UK's largest budget hotel brands, operates more than 600 hotels, with 47,000+ guest rooms, across the UK, Ireland and Spain. As part of its commitment to achieving net zero operations by 2050, Travelodge has partnered with Lochinvar to upgrade domestic hot-water systems across its estate.

Working with trusted installation partners Tech Asset Management and Commercial Maintenance Services, 25 air source heat pumps were installed in the first phase of the programme, at key locations including Stoney Cross, Chelmsford, Ipswich, Peterborough, Reading Whitley, Beckington, Billingshurst, Birmingham Oldbury, Eastbourne, Thorpe on the Hill, Rugby Dunchurch and Thame — with another 25 units in the pipeline.

Objectives

Travelodge's wider decarbonisation strategy focuses on reducing carbon emissions by cutting energy consumption in hotel operations. Key measures include:

- Transitioning to efficient technologies such as LED lighting, smart heating and cooling controls, and solar panels
- Replacing outdated electric boilers with low carbon alternatives to generate domestic hot water
- Delivering consistent guest comfort while lowering the environmental impact of operations.

The aim is to ensure that Travelodge hotels across the network can continue to meet high occupancy demands while aligning with the company's 2050 net zero target.

Solution x25 Amicus AquaStore heat pump water heaters

To meet these objectives, Travelodge selected Lochinvar's award-winning Amicus AquaStore heat pump water heater — an air-to-water system that uses ambient heat from the plantroom to deliver domestic hot water efficiently.

Why Amicus AquaStore was chosen:

- Proven performance in high-demand commercial applications, such as hotels.
- Excellent energy efficiency, reducing electricity consumption significantly compared with older boilers.
- Low carbon technology, supporting Travelodge's sustainability goals
- Reliable hot-water delivery, ensuring guest comfort is never compromised.

With each installation, Travelodge takes another step towards a more sustainable future — reducing carbon emissions, lowering running costs and enhancing operational efficiency across its hotel portfolio.

● For more information, contact Lochinvar: email sales@lochinvar.ltd.uk or call 01295 269981

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Air and water source heat pumps have been installed in the retrofit of the 70,000ft² Omnibus Building in Reigate, Surrey

From performance to practice

What is really limiting heat pump deployment? **Tim Dwyer** looks at barriers and opportunities after considering research and evidence presented at the government's recent heat pump symposium

Heat pumps are no longer an emerging technology. Their thermodynamic performance is well established, their role in decarbonisation is widely accepted and, in many applications, they can deliver high efficiency and low operational carbon.

Yet deployment is well short of policy ambition. The question is no longer whether heat pumps work, but why they remain difficult to implement at scale.

A recent symposium* held in London, drawing on work from the International Energy Agency Heat Pump Technology Collaboration Programme and UK research initiatives, provides a useful lens through which to examine this gap between performance and practice.

From a diverse set of contributions, there is a consistent message. Barriers to adoption are no longer primarily thermodynamic; they lie in acoustic constraints, infrastructure limitations, system integration, user acceptance, and the realities of different building types and ownership structures.[2, 6]

To decarbonise buildings, heat pump deployment must move from incremental growth to industrial scale. Installations worldwide are expected to rise from around 180 million in 2020 to 600 million by 2030. The UK ambition is for 19 million domestic installations by 2050 and a target of 600,000 per year by 2028.[1]

Current delivery falls well short, however. While recent targets implied around 200,000 UK installations in 2024, actual market activity has been significantly lower.[1]

This is not just a funding issue; it reflects a misalignment between technology, buildings, infrastructure, economics and client capability, particularly in smaller non-domestic projects where procurement routes are often informal.[5]

One constraint is noise. Evidence from UK installations indicates that a significant proportion of proposed air source heat pump systems fail to meet planning guidance, often by small margins. As illustrated in Figure 1, differences of around 1dB can determine whether a scheme proceeds, creating a sensitive – and, effectively, binary – compliance regime.[2]

Prediction methods show variability of several decibels, while human perception is influenced by tonality, intermittency and context. As heat pump adoption increases, the cumulative effect of multiple units becomes more important.[2]

The practicalities of delivery are equally significant. Non-domestic buildings account for around 17% of UK energy use.[3] The sector is highly heterogeneous, ranging from large, well-resourced estates to smaller buildings where retrofit decisions are less formalised. In this context, implementation often proves more challenging than the technology itself.

Early engagement with electricity networks is critical, as heat pump

Mitsubishi Electric supplied a 4-pipe heat pump system providing heating and cooling at the Omnibus Building (see page 51)

installations can increase electrical demand significantly. If not addressed early, approval processes can become programme-critical constraints.

A detailed understanding of existing systems is essential. Issues such as plant location, water quality, hydraulic configuration and planning limits all influence feasibility. Where projects are tied to fixed delivery windows, delays in early-stage decision-making can determine whether schemes proceed.[3]

Heat pumps cannot always be treated as direct replacements for existing boilers. They form part of a system that must be integrated carefully. Pre-installation checks, including hydraulic separation where required, are often necessary to avoid inheriting legacy problems.

Commissioning is equally critical. Achieving design performance requires not only water balancing, but also heat balancing under realistic load conditions, ideally during winter operation. Early monitoring data indicates that performance can vary from initial expectations, with commissioning and subsequent optimisation playing a key role in achieving design intent.[3, 4]

Existing building characteristics contribute to the challenge. Many were designed for higher-temperature systems, whereas heat pumps typically operate efficiently at lower flow temperatures. This mismatch can require emitter upgrades or use of higher-temperature systems. Cold and damp conditions can further affect performance through frosting and defrost cycles.[1]

Research is exploring ways to reduce inherent inefficiencies. One example is the quasi two-stage cycle that recovers energy normally lost during expansion and reuses it within the system. By reducing the effective compression lift, this can improve efficiency without additional mechanical complexity. It illustrates a trend towards reducing internal losses rather than always relying on hardware.[1]

The relative cost of electricity and gas, often referred to as the spark gap, continues to influence viability. Where electricity prices are significantly higher, heat pumps must achieve high efficiencies to be cost-competitive. In some non-domestic applications, this has resulted in substantial carbon reductions being accompanied by increased operating costs, reinforcing the importance of performance, tariff structures and renewable integration.[3]

Integrated solutions

Combining heat pumps with onsite renewable generation, such as solar photovoltaics, can improve economics. Alternative delivery models, including power purchase agreements and energy-as-a-service, can also reduce upfront capital barriers. These approaches reflect a shift from viewing heat pumps as individual plant towards considering them as components within a broader energy strategy.[3]

User experience is central. Field trials, particularly of air-to-air systems, show that acceptance depends on comfort, control and perceived performance as much as efficiency. Systems departing from conventional heating models may require behavioural adaptation.[6]

Emerging technologies may help address some constraints. Thermoacoustic and solid-state heat pumps offer alternative architectures that can reduce noise and enable deployment in more constrained settings. Flats and dense urban housing present particular challenges related to space, planning, ownership and disruption, which may require different system approaches. These technologies may expand the range of buildings that can be practically decarbonised.[6]

Subsurface systems, including ground source heat pumps and aquifer thermal energy storage, offer the potential for stable operation and seasonal balancing. However, recent field-scale studies show that subsurface behaviour can differ significantly from design assumptions, with factors such as fracture flow influencing heat distribution. This highlights the importance of site-specific data and ongoing validation. [4]

Across the research landscape, a broader shift is evident. Innovation is increasingly focused on system-level performance and real-world operation rather than individual components. Monitoring and feedback are key, not only to verify performance, but also to support iterative optimisation and

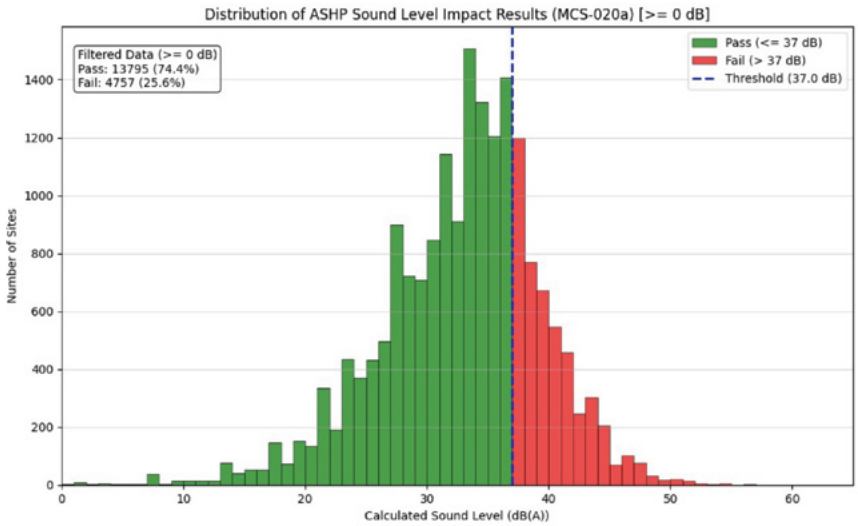

Figure 1: Distribution of predicted ASHP sound levels against the MCS 020a planning guidance limit for domestic installations, showing that a significant proportion of proposed systems fail compliance, often by a very small margin.[2]

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build confidence in future deployment.[3,4]

These insights suggest that the transition to low carbon heat requires a more comprehensive framework for decision-making. Efficiency and carbon must be considered alongside installability, acoustic impact, infrastructure constraints, user acceptance and economic viability. Different building types and contexts will require different solutions.

One response is the use of tools to support early-stage decision-making, particularly for clients unfamiliar with heat pumps (see panel, 'Project 60').

Building services engineering is shifting from optimising components to managing real-world systems in which technical performance, human factors and economic conditions must align. It is within this space, between performance and practice, that the success of heat pump deployment will be determined. ●

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[3] Heat pump deployment in practice, Oakes/PHS (DESNZ–IEA Seminar)
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[5] Project 60: Online interactive guidance tool, IEA Heat Pumping Technologies
[6] Beyond compressors: heat pumps in transition, Dr Jonathan Siviter; and Air-to-air heat pump trials in UK homes, Energy Systems Catapult

Project 60: early-stage guidance for heat pump retrofit

An online tool from the IEA Heat Pumping Technologies programme provides simple decision support for non-domestic building owners considering heat pump retrofit.

Using a structured Q&A format, it helps users identify viable system options, rule out infeasible approaches and highlight missing information before engaging with suppliers. Outputs include shortlists of system types, supported by case studies and indicative comparisons of cost and carbon savings.

The tool is currently in testing and reflects the need to support early-stage decision-making in a sector where procurement routes are often informal and technical expertise may be limited.[5]

*The DESNZ/IEA Heat Pump Research Symposium explored current and emerging research within the IEA Heat Pumping Technologies Technology Collaboration Programme, and included experts from across industry, academia, research centres and government considering cutting-edge UK projects. For details see **bit.ly/CJIEAHPT**

Natural ventilation: from feasibility to physics

The latest update of CIBSE AM10 provides a framework to ensure that natural ventilation is applied appropriately, taking into account overheatingrisk, urban constraints and increasingly complex systems. Co-authors **Chris Iddon** and **Dr Benjamin Jones** provide a summary

Natural ventilation remains one of the most appealing ways to deliver low-energy, comfortable buildings. It is simple in principle, but often difficult to deliver in practice. Designs that look convincing at concept stage can fail once built, leading to overheating, poor air quality, or systems that are difficult to control.

The 2026 edition of CIBSE AM10 responds to these problems. It provides updated guidance on how natural ventilation systems should be designed, assessed and integrated into modern buildings. It does not introduce a new standard or set of targets. Instead, it focuses on helping designers make better decisions, earlier in the process.

The 2026 version of AM10 is designed to sit clearly alongside Building Regulations and other CIBSE documents

What AM10 is... and isn't

AM10 is a CIBSE Applications Manual. Its role is to support design rather than to prescribe compliance. It provides practical design methods, explains physical behaviour and links research to everyday practice.

Importantly, it does not attempt to duplicate material covered elsewhere, which has allowed some streamlining. Detailed approaches to indoor air quality and thermal comfort are addressed in other CIBSE guidance, such as TM57 and TM59, while CIBSE Guides A and B provide information on airflow rates required and how to calculate them. AM10 focuses on what is specific to natural ventilation: how air moves through buildings, how systems are configured and sized, and how they perform in real conditions.

This distinction is a deliberate attempt to make AM10 flexible guidance, rather than a *de facto* standard, and allows it to sit clearly alongside Building Regulations and other CIBSE documents.

Start with feasibility

A central theme of the new edition is that natural ventilation design must begin with feasibility.

Too often, natural ventilation is assumed to be appropriate, and the design process moves directly to sizing openings or selecting components. When problems arise, they are addressed through increasingly complex solutions. In many cases, the underlying issue is that natural ventilation was never a good fit for the building in the first place.

AM10 addresses this with a structured approach to early decision-making. Key questions include:

- Are the spaces suitable in terms of depth and height?
- Is there a clear path for airflow through the building?
- Are there constraints from cold draughts, noise or outside air pollution?
- Can overheating be managed under future summer conditions?

These factors determine whether a building can rely on natural ventilation alone or whether some form of assistance is required. The outcome may be a fully naturally ventilated design, a mixed-mode system or a predominantly mechanical solution.

The key point is that this decision should be made early, when it can still influence the architectural design.

From strategy to system

Once feasibility has been established, the focus shifts to developing a ventilation strategy and translating it into a working system.

AM10 describes common strategies, such as cross-ventilation and stack-driven flow, and how these relate to building form. It then considers the components that deliver these strategies in practice, including windows, louvres, trickle vents and roof ventilators.

A significant addition in the new edition is the treatment of system integration and control.

Natural ventilation systems increasingly rely on automation, with actuators, sensors and control algorithms determining how openings respond to internal/external conditions. In practice, this is where many systems fail. Issues often arise from poor coordination between disciplines, unclear performance requirements or control strategies that lead to nuisance behaviour, such as unexpected opening and closing.

The guidance emphasises clear definition of ventilation requirements, coordination of components and control systems, and the importance of occupant override.

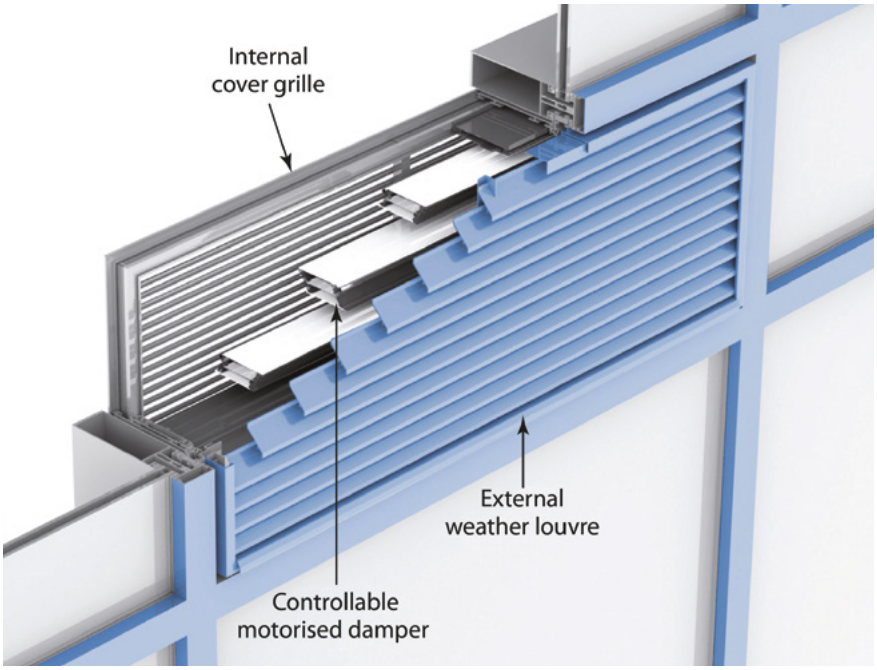
Occupants need to retain some control over their environment. Systems that remove this are unlikely to perform well in practice, regardless of how well they perform in theory.

Design tools and workflow

AM10 also sets out how different design tools can be used throughout a project.

Rather than promoting a single method, it presents a hierarchy of tools, from simple airflow models through to dynamic thermal simulation, computational fluid dynamics and physical testing. The emphasis is on selecting an appropriate level of complexity for the design stage. This is supported by a structured workflow:

1. Feasibility: determine whether natural ventilation is appropriate
2. Strategy: define the intended airflow patterns and integration with heating and cooling
3. Envelope design: size and position openings



Drawing from AM10 showing example of an insulated mechanical damper for a façade

4. Internal environment: assess performance and refine the design
5. Commissioning: ensure the system performs as intended in practice.

This reinforces the idea that natural ventilation design is not a single calculation, but an iterative process that evolves alongside building design.

The 2026 edition also revisits some of the underlying physics used in design.

A long-standing issue in natural ventilation calculations is the definition of opening area. The free area of an opening does not represent the area through which air actually flows. In practice, flow contracts as it passes through an opening, and is influenced by geometry, edges and obstructions, such as insect meshes or louvres.

Traditionally, this has been addressed through discharge coefficients. These can be difficult to apply correctly, however, particularly when opening geometry becomes more complex.

AM10 therefore advocates the effective area as a more direct representation of airflow performance. This is supported by the statistical effective area model, which offers a practical way to estimate effective areas of windows based on opening characteristics.

The aim is not to increase complexity, but to improve consistency. By working with parameters that better reflect real openings, designers can have greater confidence in predicted airflow rates and system performance.

A structured approach

The 2026 edition of AM10 reflects how buildings and expectations have changed since the previous update. It recognises that natural ventilation must be considered in the context of overheating risk, urban constraints and increasingly complex systems.

Its contribution is a clearer structure for decision-making, from early feasibility through to detailed design and operation. It does not replace professional judgement, but supports it with more consistent methods and better representation of real systems.

For practitioners, the message is straightforward. Natural ventilation can still deliver robust, low-energy solutions, but only if it is applied appropriately. AM10 offers the framework to make those decisions with greater clarity and confidence. ●

CIBSE AM10 is available at **www.cibse.org/knowledge**

● **Chris Iddon is chair of the CIBSE Natural Ventilation Group**
Dr Benjamin Jones is associate professor at the Department of Architecture and Built Environment, University of Nottingham

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Asian countries target air conditioning amid energy crisis

Other energy-saving measures include building optimisation and online learning

Governments across Asia are limiting the use of air conditioning in response to the energy crisis caused by the US–Iran war.

Singapore is among the countries to take action, with the Ministry of Sustainability and Environment announcing last month that government employees should set the air conditioning to 25°C and closely manage how long units are in use. Air conditioning is near ubiquitous in the island state, which relies heavily on the Middle East for its gas and oil.

The International Energy Agency is recording governments' responses to the energy crisis in its 2026 Energy Crisis Policy Response Tracker **bit.ly/CJIEAtr**

The tracker reveals that as well as Singapore, air conditioning limits have been set in Bangladesh (25°C), Cambodia (24–25°C in public buildings), Malaysia (encouraging local councils to limit air conditioning to 24°C), Sri Lanka (26°C) and Thailand (encouraging limit to 26°C).

Other measures include energy-saving strategies in offices, government buildings and colleges, such as optimising building energy use (Malaysia), restricting non-essential electricity use in swimming pools and decorative lighting (Mauritius), limiting commercial and public lighting, and closing shops from 9pm and 10pm at weekends (Egypt).

In Europe, The Netherlands has started phase 1 of the national oil-crisis plan, scaling up structural energy efficiency measures for households and businesses.

A number of countries, including Peru, Pakistan, Sri Lanka and Bangladesh, have shortened school weeks or switched to online learning.

Fan coils reused in office decarbonisation project

4-pipe heat pump system replaces gas boilers in Reigate

Gas boilers in a 70,000ft^2 office building in Surrey have been replaced with heat pumps after existing services neared the end of their operational life.

Two Climaveneta air source heat pumps, offering simultaneous heating and cooling, and three Climaveneta water source heat pumps (WSHPs) were installed at Omnibus, Reigate, alongside WizardX-G07 E-OU air handing units, which are fed heating or cooling from six Mr Slim air conditioning systems.

Decarbonisation specialists International Environments decided that a 4-pipe heat pump, providing simultaneous heat and cooling, would be the optimal solution for the building owner, the Skelton Group.

The 4-pipe heat pump chillers supply heated water at a 45°C flow temperature and chilled water at a 6°C flow temperature. Thermal modelling was carried out to show that a temperature of 45°C will heat the offices using existing fan coil ceiling units when the ambient temperature is around 6–7°C and above. On colder days, the high-temperature WSHPs boost the water temperature from 45°C to 75°C.

Reusing the fan coil ceiling units, which were in good condition, meant the building could remain occupied during the retrofit.

Resilient data centre chiller launched by Carrier

Carrier's new AquaEdge 19MV4 variable-speed centrifugal chiller for data centres is designed to safeguard high-density operations under extreme thermal stress, and delivers 2.1MW to 3.3MW of cooling capacity.

The chiller runs with chilled-water temperatures up to 35°C and condensing temperatures up to 55°C. It supports direct-to-chip liquid cooling and rear-door heat exchangers. To help prevent overheating risks in high-density chips, the chiller restarts within 150 seconds of a power outage.

Carrier says the AquaEdge 19MV4 achieves a coefficient of performance of up to 6.75 and noise operation below 80dBA. It uses F-gas compliant, low-global warming potential refrigerants R1234ze and R515B.

BESA updates TR19 air ventilation guide

An update to *TR19 Air – Specification for internal cleanliness and hygiene management of ventilation systems* has been published by BESA.

The March 2026 update has details on post-clean reporting in a new section 9. Changes have been made to reflect the recently issued update to BS EN 15780 and details have been added on ductwork sensors. TR19 Air now also references the requirements of the Ventilation Hygiene Register.

Changes have been made to sections 4, 8.9 and 11, and Appendix A (to reflect changes to Appendix F of BS EN 15780).

To see the updated document, go to bit.ly/CJTR19

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Transcritical CO_2 heat pumps for commercial buildings

This module explores why transcritical carbon dioxide refrigerant heat pumps have emerged as a low-GWP option in commercial heating and domestic hot-water applications

Decarbonising heat in commercial buildings has become one of the central challenges for the built environment. Heating and domestic hot water (DHW) remain major contributors to operational carbon emissions, particularly across large public-sector estates, hospitality, healthcare and education facilities that rely on fossil-fuel boilers.

The UK's legally binding commitment to achieve net zero greenhouse gas emissions by 2050 is accelerating the transition away from gas-based heating systems. Electrification of heat is widely recognised as a primary pathway to achieving this transition, particularly as the UK electricity Grid continues to decarbonise through increasing renewable generation.

Heat pumps play a central role in this shift. However, conventional heat pumps using hydrofluorocarbon (HFC) refrigerants can face limitations in commercial retrofit applications. Many existing buildings operate heating systems designed around high water temperatures, often exceeding 60°C. These temperatures are typically required for legacy radiator systems or for large DHW demands in buildings such as hotels, hospitals and leisure centres. Conventional heat pumps may struggle to achieve these temperatures efficiently without system redesign.

At the same time, regulatory pressure is reshaping refrigerant selection. European and UK F-gas regulations are progressively phasing down high-global warming potential (GWP) refrigerants, reducing the availability of many synthetic HFCs. This has increased industry interest in natural refrigerants that offer both lower environmental impact and long-term regulatory certainty.

Carbon dioxide (CO_2), also known as refrigerant R744, has emerged as a promising option. CO_2 has a GWP of 1 and zero ozone depletion potential, and is classified as an A1 refrigerant, meaning it is non-flammable and of low toxicity.

CO_2 heat pumps typically operate using a transcritical cycle, which differs fundamentally from conventional vapour-compression systems. This cycle allows the production of high-temperature water, often more effectively than conventional systems in uses with large temperature lifts, making the technology particularly attractive for commercial heating and DHW applications.

Thermophysical properties of CO_2

The behaviour of a refrigerant within a vapour compression system is governed by its thermophysical properties. CO_2 differs significantly from conventional synthetic refrigerants, and these differences strongly influence system design and operation.

Figure 1 is a phase diagram for CO_2 at temperatures from -80°C to 80°C. The diagram is divided into regions representing solid, liquid, gas and supercritical states, separated by phase boundaries where transitions occur. Overall, the diagram illustrates that the state of CO_2 depends on both temperature and pressure, and highlights the absence of a liquid phase at low pressures, and the emergence of supercritical behaviour at higher temperatures and pressures.

One of the most important characteristics of CO_2 is its low critical temperature of approximately 31°C, combined with a critical pressure of about 73.8bar. In many heat pump applications, the temperature at which heat must be rejected exceeds this critical temperature. When this occurs, the refrigerant cannot condense regardless of pressure. Instead of operating as a conventional subcritical cycle with condensation, the system operates in a transcritical cycle.

The critical point is the highest temperature and pressure at which a pure material can exist in vapour/liquid equilibrium. In transcritical operation, the high-pressure heat-rejection process occurs above the critical point. Rather than condensing, the refrigerant passes through a gas cooler, where it remains in a supercritical state and cools sensibly.

During this process, the refrigerant temperature decreases continuously rather than remaining constant, as it would during condensation. This produces a temperature glide along the heat exchanger. The glide

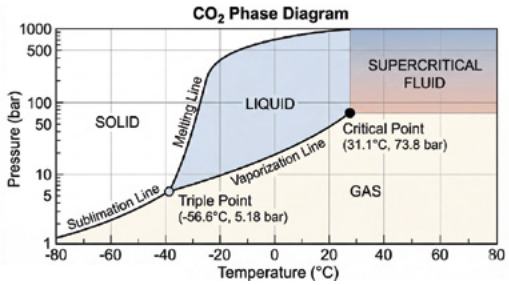

Figure 1: Phase diagram for CO_2 at temperatures from -80°C to 80°C. The triple point (-56.6°C, 5.18bar) marks the condition at which solid, liquid and gas can coexist. The critical point (31.1°C, 73.8bar) defines the upper limit of the liquid-gas boundary. Above this temperature, CO_2 cannot become a liquid regardless of pressure. Instead, it exists either as a gas at lower pressures or as a supercritical fluid at higher pressures, where there is no distinct separation between liquid and vapour

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allows the refrigerant temperature profile to more closely match the temperature rise of the water being heated, reducing temperature differences and improving heat-transfer effectiveness.

Several additional thermophysical characteristics reinforce these advantages. CO_2 has a high vapour density and volumetric heating capacity. This enables the same heating capacity to be achieved with smaller compressors and significantly reduced pipe diameters, which can be advantageous in plantrooms where space is constrained. The refrigerant also exhibits low viscosity and high thermal conductivity, resulting in high heat-transfer coefficients and allowing heat exchangers to be relatively compact.

Another important characteristic is the triple point of CO_2, occurring at approximately -56.6°C and 5.2bar.[1] If pressure falls below this level, CO_2 can solidify into dry ice. System safety design must therefore ensure that pressure relief and venting arrangements prevent conditions that could allow solid CO_2 to form and block discharge paths, particularly during rapid depressurisation or maintenance conditions.

While these properties create engineering challenges, they also enable a distinctive heat-rejection process that is well suited to high-temperature heating applications.

Thermodynamic operation of the transcritical CO_2 cycle

The key feature that distinguishes CO_2 heat pumps from conventional systems is the transcritical vapour compression cycle. While the basic components remain similar to other heat pump technologies – compressor, heat rejection heat exchanger, expansion valve and evaporator – the behaviour of the refrigerant differs because the high-pressure side of the system operates above the critical point.

The thermodynamic cycle is typically illustrated on a pressure–enthalpy (p-h) diagram – see Figure 2. In a transcritical CO_2 system, the high-pressure section of the cycle lies entirely above the saturation dome, reflecting the fact that the refrigerant does not condense during heat rejection.

Although the overall cycle resembles a conventional vapour compression system, several important differences influence how CO_2 heat pumps operate and how their performance should be assessed.

Compression (1 → 2)

The cycle begins with low-pressure vapour leaving the evaporator and entering the compressor at point 1.

The compressor raises both the pressure and temperature of the refrigerant. In typical commercial systems, the pressure increases from around 20–45bar at the evaporator outlet to approximately 80–120bar at the compressor discharge.[2]

During compression, the refrigerant passes through the critical point and enters the supercritical region. Above this point the refrigerant no longer exists as a distinct liquid or vapour phase, but behaves as a dense fluid with properties of both.

One practical implication is the high discharge temperature produced by the compressor, often exceeding 100°C[2] – this being system-dependent and can be lower with optimisation. This enables the heat pump to deliver high-temperature water suitable for space heating or DHW applications.

Gas cooling (2 → 3)

After compression, the high-pressure refrigerant enters the gas cooler, where heat is rejected to the building heating system.

In conventional refrigerant heat pumps, heat rejection occurs through condensation at a constant temperature. However, because the CO_2 is above its critical temperature, it cannot condense. Instead, it cools while remaining in a single supercritical phase.

As the refrigerant flows through the gas cooler its temperature decreases continuously. This produces a temperature glide along the heat exchanger, rather than the constant temperature profile associated with condensation.

For building services engineers, this behaviour is important because it allows the refrigerant temperature to follow the temperature rise of the water being heated. The result is often a closer temperature match between the two fluids, which reduces temperature differences within the heat exchanger and improves heat transfer effectiveness.

This characteristic is one reason why CO_2 heat pumps can effectively produce high outlet water temperatures, particularly when heating cold water streams such as DHW supplies.

Expansion (3 → 4)

After leaving the gas cooler, the refrigerant passes through an expansion valve.

The valve reduces the pressure of the refrigerant from the high gas-cooler pressure to the much lower evaporating pressure. This throttling process occurs without any useful work being recovered, making it inherently irreversible.

As pressure falls rapidly, the refrigerant temperature also drops and part of the fluid flashes into vapour. The mixture leaving the valve therefore consists of both liquid and vapour.

In CO_2 systems, the pressure difference across the valve is particularly large, so a relatively high proportion of flash gas is produced. Flash gas refers to vapour that forms immediately during expansion rather than within the evaporator, which reduces the useful evaporator heat uptake/cycle efficiency of the system. For this reason, the expansion process represents one of the largest sources of thermodynamic loss within the transcritical cycle.

Evaporation (4 → 1)

The low-pressure refrigerant mixture then enters the evaporator, where it absorbs heat from the source medium.

Depending on the system configuration, this source may be ambient air, water, ground loops or waste heat streams. As heat is absorbed, the remaining liquid refrigerant evaporates.

Unlike the gas cooler process, the evaporator operates below the critical pressure, so the refrigerant behaves like a conventional boiling refrigerant. The mixture gradually becomes saturated vapour and is typically slightly superheated before returning to the compressor at point 1.

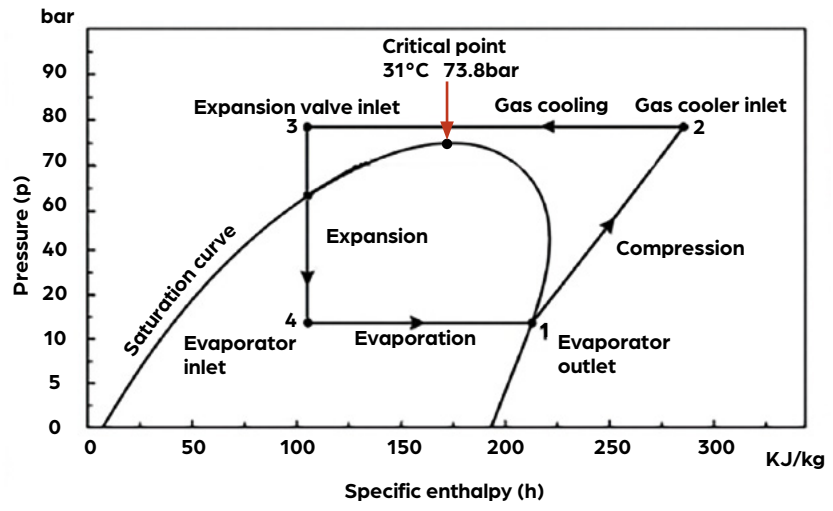

Figure 2: Illustration of the transcritical cycle of a CO_2 heat pump on a pressure–enthalpy (p-h) graph

Architecture and key components

The transcritical cycle leads to a system architecture that differs from conventional HFC heat pumps. While the main components are similar, they must be designed for higher pressures and specific control requirements.

The compressor draws low-pressure vapour from the evaporator and compresses it to the high pressures required for transcritical operation. Reciprocating compressors are commonly used in commercial CO_2 systems because they can reliably handle large pressure differentials and dense refrigerant. High-pressure scroll compressors are increasingly used in smaller systems. Variable-speed drives are frequently incorporated to match heating output to building demand and improve part-load efficiency.

In place of a condenser, transcritical systems use a gas cooler to reject heat to the heating circuit. Gas coolers may be air-cooled finned heat exchangers or water-cooled plate heat exchangers. In many commercial systems the gas cooler is optimised for domestic hot-water production, allowing cold mains water to be heated from around 10°C to 60–70°C in a single pass.[3]

CO_2 systems typically use electronic expansion valves rather than thermostatic valves. These regulate refrigerant flow while also controlling the high-side pressure required for optimal system performance. Rapid electronic control allows the system to adapt continuously to changing operating conditions.

Because of the high operating pressures involved, pipework and components must be constructed from pressure-rated materials and installed using specialised joining techniques. However, the high pressure elements are generally contained within the monoblock unit, which will have been manufactured to the Pressure Equipment Directive regulations.

Performance characteristics

The coefficient of performance (COP) of a CO_2 heat pump depends strongly on system design and operating conditions.

A key difference between transcritical and conventional heat pump cycles is that the high-side pressure is not fixed by a condensing temperature. In a subcritical heat pump, the condensing pressure is directly related to the temperature at which condensation occurs. In contrast, the gas cooler pressure in a transcritical CO_2 system can vary independently of temperature.

For any given operating condition there is, therefore, an optimum gas cooler pressure that maximises the heating capacity while minimising compressor power. Modern CO_2 heat pumps continuously adjust this pressure using electronic expansion valves and control algorithms. By optimising high-side pressure in response to changing heat source and heat sink conditions, the system can maintain the best possible coefficient of performance.

Return water temperature

The efficiency of the cycle is strongly influenced by the temperature of the water entering the gas cooler. Because the refrigerant rejects heat sensibly rather than condensing, the ability to cool the refrigerant within the gas cooler strongly affects efficiency. Increasing the inlet water temperature to the gas cooler has been shown to reduce COP by up to around 6%[4] in experimental studies of transcritical CO_2 heat pumps.

If the return water temperature is low, the refrigerant can be cooled more effectively before it reaches the expansion valve. This increases the useful heating capacity of the cycle and improves overall efficiency. Conversely, if return temperatures are high, the refrigerant cannot be cooled sufficiently in the gas cooler. This reduces the available enthalpy difference across the heat exchanger and increases losses during expansion. For this reason, CO_2 heat pumps perform particularly well in applications where cold water is heated through a large temperature lift, such as DHW production.

These characteristics explain why CO_2 heat pumps perform especially well in DHW applications. Heating cold mains water from approximately 10°C provides ideal conditions for cooling the refrigerant in the gas cooler, enabling efficient operation even when delivering water temperatures above 70°C.

Conversely, systems connected to legacy heating circuits with high return temperatures may experience reduced efficiency because the refrigerant cannot be sufficiently cooled before expansion.

CO_2 heat pumps can be used for space heating in new builds, where a return temperature of 30°C is possible using small diameter pipes. Low pumping demands make this efficient in operation, but designing, installing and commissioning such a system will require specialist technical input.

Ambient conditions also affect performance. At low outdoor temperatures, air source systems may experience reduced capacity and require periodic defrost cycles. High ambient temperatures can also reduce efficiency because heat rejection becomes more difficult.

Part-load performance is another important consideration. When heating demand falls below the minimum heat pump capacity, frequent start–stop cycling can reduce efficiency and increase compressor wear. To mitigate this, systems commonly incorporate variable-speed compressors and thermal buffer storage.

With appropriate design and control strategies, commercial CO_2 heat pumps can achieve seasonal COP values in the range of 2.5 to 3.5, with higher values achievable in optimised DHW applications, where the COP can exceed 3.5.[3]

Applications in commercial buildings

The thermodynamic characteristics of transcritical CO_2 heat pumps make them particularly well suited to applications requiring high-temperature hot water.

DHW production is one of the most common uses. Buildings such as hotels, hospitals and leisure centres often require continuous hot-water supply at temperatures suitable for thermal hygiene and legionella control. CO_2 heat pumps can produce water temperatures typically 60–80°C (with higher temperatures achievable in specific applications) without supplementary electric heating, making them well suited to these uses. Designers should note that where secondary circulation systems are included, these may need a small electric heater and/or a preheat tank to account for standing losses.

Another emerging application is waste-heat recovery, particularly in data centres. CO_2 heat pumps can simultaneously provide cooling for IT equipment while upgrading rejected heat to useful hot-water temperatures for building heating or district heating systems.

Emerging developments

Recent technological developments aim to improve the efficiency and operating range of transcritical CO_2 systems.

Parallel compression is one approach that separates flash gas generated during expansion and compresses it using a dedicated compressor stage. This avoids unnecessary recompression through the main compressor and can improve system efficiency.

Another innovation is ejector technology, which recovers some of the expansion energy normally lost during throttling. By entraining low-pressure vapour and partially compressing it, ejectors reduce compressor workload and improve cycle efficiency.

Future developments could also include integrated systems capable of simultaneously providing heating, cooling and heat recovery. Combined with advanced digital control systems that optimise gas cooler pressure in real time, these developments are improving seasonal efficiency and expanding the range of suitable applications.

Growing regulatory pressure to reduce carbon emissions and phase down high-GWP refrigerants is accelerating the adoption of alternative heating technologies in commercial buildings. Transcritical CO_2 heat pumps offer a low-GWP solution capable of delivering high-temperature heat while supporting the electrification of building heating systems.

Module 263

May 2026

1. Why is the 'temperature glide' in a CO_2 gas cooler advantageous for commercial heating applications?

- ☐ A It allows the refrigerant to condense at a constant temperature, matching legacy boiler performance
- ☐ B It prevents the refrigerant from entering the supercritical region, reducing system pressure
- ☐ C It allows the refrigerant's temperature profile to closely match the rising temperature of the water being heated
- ☐ D It eliminates the need for an expansion valve by cooling the gas sensibly
- ☐ E It reduces the discharge temperature of the compressor to below 60°C

2. Which thermophysical property of CO_2 allows for the use of smaller compressors and reduced pipe diameters?

- ☐ A Low thermal conductivity and high viscosity
- ☐ B High vapour density and high volumetric heating capacity
- ☐ C A high triple point that prevents the formation of dry ice
- ☐ D A critical temperature that is higher than most synthetic HFCs
- ☐ E Low operating pressures compared with conventional R134a systems

3. What occurs during the 'Expansion' (3 → 4) stage of the transcritical CO_2 cycle?

- ☐ A The refrigerant recovers useful work through a hydraulic turbine
- ☐ B The refrigerant temperature rises as it reaches the triple point
- ☐ C High-pressure supercritical fluid is compressed further into a solid state
- ☐ D Pressure is reduced, causing a significant portion of the fluid to 'flash' into vapour
- ☐ E The refrigerant absorbs heat from the source environment at constant pressure

4. How does the return water temperature (inlet to the gas cooler) impact the efficiency of a CO_2 heat pump?

- ☐ A High return temperatures improve COP by reducing the workload of the evaporator
- ☐ B Low return temperatures are detrimental as they may cause the CO_2 to reach its triple point
- ☐ C Return water temperature has no impact because the high-side pressure is independent of temperature
- ☐ D Efficiency remains constant as long as the water is heated to at least 70°C
- ☐ E Lower return temperatures allow for better refrigerant cooling, increasing heating capacity and efficiency

5. Which technological development aims to improve efficiency by recovering energy normally lost during the throttling/expansion process?

- ☐ A Variable-speed drives (VSD)
- ☐ B Reciprocating compressor stages
- ☐ C Ejector technology
- ☐ D Thermal buffer storage
- ☐ E High-pressure scroll technology

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[1] National Institute of Standards and Technology (US Department of Commerce) NIST WebBook, SRD 69, **bit.ly/CJMay26CPD1**

[2] Evapco Systems LMP, CO_2 *Transcritical Systems Training Manual Revision 2*, March 2023, **bit.ly/CJMay26CPD2**

[3] The Renewable Energy Hub, *Guide to high temperature heat pumps*, UK 2026, **bit.ly/CJMay26CPD3** – accessed 1 April 2026.

[4] Parham Eslami-Nejad et al, Detailed theoretical characterization of a transcritical CO_2 direct expansion ground source heat pump water heater, *Energies* 2018, 11(2), 387, **doi.org/10.3390/en11020387**

Additional reading

- *CIBSE Journal* February 2022: Turning to CO_2 refrigerant in large-scale retrofits **www.cibsejournal.com/technical/turning-to-co2-refrigerant-in-large-scale-retrofits**

Vent-Axia makes climate commitment

Ventilation specialist Vent-Axia has signed up to Beama's 2050 Connected Climate Commitment, joining organisations from across the UK's energy transport and built environment supply chains in a framework for Science Based Targets and circular economy principles.

Vent-Axia aims to achieve net zero by 2040 by hitting targets including 75% of sales revenue from low carbon products and 90% of plastic from recycled sources in its manufacturing.

Marketing director Joe Brawn (above) said: 'Beama's commitment closely aligns with the sustainability direction our business has been progressing towards for many years.'

● **Visit www.vent-axia.com**

Future Homes Standard a 'significant step'

Vent-Axia has welcomed the Future Homes Standard as another 'significant step on the road to net zero'.

The new benchmark – alongside *Building Regulations Approved Document Part F (Means of Ventilation)*, which will ensure installations meet requirements and are completed by a registered competent person – will provide welcome 'clarity' for housebuilders, says Joe Brawn, marketing director.

The standard is expected to deliver homes that produce 75–80% fewer carbon emissions compared with those built in 2013.

● **Visit www.vent-axia.com**

EPD for Advanced's fire alarm panel

Advanced's MxPro 5 4-loop fire alarm control panel has become the first in the industry to hold an Environmental Product Declaration (EPD).

This provides independently verified data on the product's environmental impact across its full life-cycle, from raw material extraction to end-of-life treatment.

Advanced said the EPD will enable consultants, designers and building owners to 'consider fire alarm systems as part of a wider, more sustainable building strategy'.

● **Visit advancedco.com/product/advanced-mxpro-5**

Optimising water quality in closed-loop heating systems

Magnetic International offers a solution for optimised heating water quality in closed-loop systems that is suitable for new plant or maintaining existing assets.

Water condition is critical to efficiency, reliability, and compliance with manufacturer and industry guidance, such as VDI 2035 and upcoming BSRIA guide BG89, focusing on a chemical-free approach to heating water treatment that also complements BG29 and BG50.

Magnetic's premier-class filling stations enable in-operation desalination (demineralisation), providing accurate electrical conductivity readings, integrated digital water metering and modular scalability for larger heating systems.

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Ideal Heating launches commercial service division

Ideal Commercial Heating has launched a new commercial services division aimed at providing faster response times, greater efficiency and high standards of technical expertise for its customers.

Through a network of skilled engineers, the new service offers commissioning, warranty, servicing and breakdown for Ideal Commercial Heating's customers.

They can now rely on next-day breakdown response under warranty, says the company, supported by a 90% first-time fix rate on condensing commercial boilers, which keeps downtime to an absolute minimum.

Reporting has also been streamlined, with commissioning and service documentation delivered within three working days, according to the manufacturer of boilers and heat pumps.

'Our industry-leading products are now backed by an industry-leading, dedicated, nationwide service delivered by highly experienced and skilled professionals,' says Darren Finley, managing director for commercial products at Ideal Heating. 'The launch of this division is a major step forward, enabling us to deliver a stronger, more consistent, best-in-class service experience for every customer.'

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

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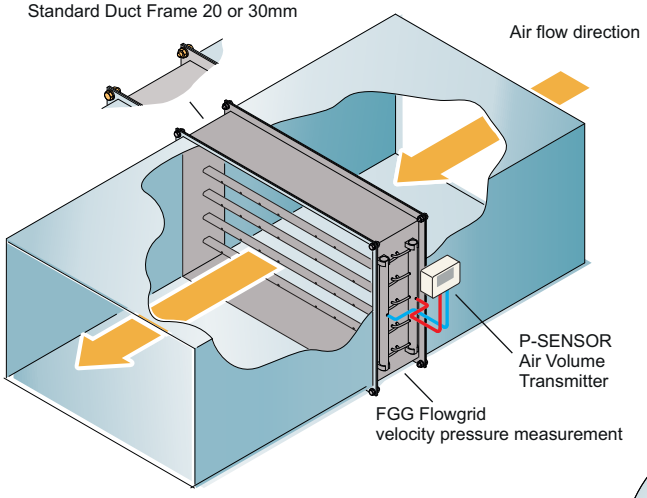

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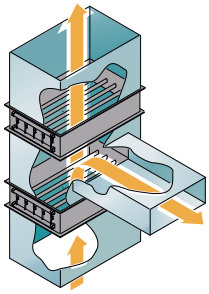

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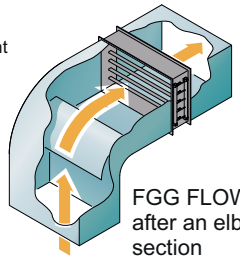

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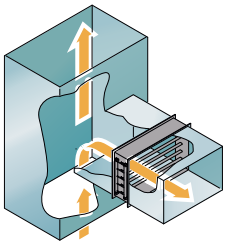

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