CIBSE JOURNAL

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December 2023 www.cibsejournal.com

OCTOPUS PROMISES ZERO ENERGY BILLS FOR HOMES

CIBSE BUILDING PERFORMANCE AWARDS SHORTLIST REVEALED

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

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

Climate crunch

The outcome of the UN Climate Change Conference, COP28, in Dubai, will be pivotal in determining whether nations can set themselves on a common trajectory towards lower greenhouse gas emissions and the limiting of global warming to 1.5°C above pre-industrial levels. With wars and political tension splitting countries and continents, however, it will be harder than ever for nations to come together and agree climate plans.

Reports published in the run-up to COP28 highlight the danger of not doing anything. The latest emissions gap report from the UN Environment Programme says predicted 2030 greenhouse gas emissions must fall by 42% if we are to keep on a pathway to limiting the global temperature rise to 1.5°C. That's not where we're headed at the moment. The report adds that current government pledges will result in a rise of between 2.5°C and 2.9°C this century.

CIBSE has a key role to play in providing the guidance and expertise necessary to cut carbon in the built environment. President Adrian Catchpole will be in Dubai, drawing attention to the importance of assessing embodied carbon in building services and making sure buildings are resilient in the face of climate change. This is particularly the case with overheating, where designers have to take into account future weather patterns when designing for thermal comfort.

For members of the CIBSE UAE Region, COP28 is a home fixture. They are marking it with the launch of an addendum to TM65, the calculation methodology used to estimate the life-cycle embodied carbon of products used in building services. It will be published in early 2024 and will be the second TM65 addendum, after the one for Australia and New Zealand released a year ago. It won't be the last.

Minimising embodied carbon was on the minds of designers of the Black and White Building in London, which won the UK Innovation category at the CIBSE Façade 2023 Design and Engineering Awards. The building is clad in timber, with floor-to-ceiling glazing supported by a glulam composite timber/aluminium curtain wall, so the project team had to work closely with the client, fire engineer, building control body, product suppliers, and contractors to alleviate potential fire risks.

Similar levels of collaboration will be needed on higher-risk buildings seeking design approval from the Building Safety Regulator (BSR). As Hywel Davies explains on page 15, the new building control regime requires the approval of design before construction begins. It will no longer be acceptable to leave some design elements to be assigned to contractors, as it will be impossible for the BSR to assess compliance. Nothing will be allowed to be left to chance.

ALEX SMITH, EDITOR asmith@cibsejournal.com

CONTRIBUTORS

Hywel Davies
What the BSR is expecting to see before allowing construction of higher-risk buildings to begin

Annie Marston
How optimising the BMS of a Croydon office block resulted in a cut of energy costs by £171,000 in only nine months

Chris Worboys
The challenges and benefits of electrification, and the importance of smart technology in the energy transition

Tim Dwyer
CPD module on reducing fit-out waste and the carbon footprint of fan coil unit installations

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Thank you for being part of the CIBSE community this year and helping us shape the future of the industry. We look forward to welcoming you in 2024.

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FOR CIBSE

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

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

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IN BRIEF

Digital map uncovers utilities underground

A new digital map of underground pipes and cables for many parts of England has been created.

The National Underground Asset Register includes data from energy and water providers, telecoms firms, transport organisations, and local authorities. It currently covers the South East, South West, North West, Yorkshire and the Humber, and the East of England.

The map is projected to contribute £5bn to the economy over a decade, and aims to enhance construction efficiency, reduce damage to infrastructure, and minimise public disruption.

Oil and gas industry faces moment of truth

A new International Energy Agency (IEA) report has found that oil and gas producers account for only 1% of clean energy investment globally, with more than 60% coming from just four companies.

The oil and gas industry in net zero transitions analyses the challenges and opportunities that would arise for the industry from stronger international efforts to reach energy and climate targets.

The report states that demand for oil and gas is set to peak by 2030 and would fall 45% below today's levels by 2050 if governments stick to their national climate pledges.

IEA executive director Fatih Birol said: 'The industry needs to commit to genuinely helping the world meet its energy needs and climate goals – which means letting go of the illusion that implausibly large amounts of carbon capture are the solution.'

Hydrogen has heating role, says Rumford Club speaker

Hydrogen for home heating is new, exciting and logical, says Tommy Isaac

Using hydrogen for heating is logical, according to a guest speaker at the latest Rumford Club dinner held last month in London.

In a heated debate, Tommy Isaac, former head of hydrogen research at Progressive Energy, and now at KPMG Energy, said hydrogen was a significant player in the energy mix and had a number of benefits.

He added that the UK has a great geological advantage, with a huge capacity to convert onshore gas storage to hydrogen, and emphasised hydrogen's potential as a storage medium for large-scale industrial use.

Isaac told the audience: 'There aren't many options on the table; hydrogen is the conclusion with the most logic. The hydrogen industry is already pretty big, but hydrogen for home heating is new and exciting.'

However, dissenting voices in the audience expressed reservations about hydrogen's inefficiency and low energy density, storage challenges, and the environmental costs associated with its production and disposal.

One member raised concern about the oil and gas industry's influence on hydrogen schemes and was suspicious of its short-term profit motives. He called for a focus on developing better technologies instead of investing in what he deemed a distraction.

Isaac said consumer choice and commercial frameworks would ultimately drive the balance between hydrogen and electricity.

He emphasised the need for a diverse energy mix and the importance of keeping all options on the table until there is sufficient evidences.

The Rumford Club holds engineering debates and dinners throughout the year.

Rijnen replaces Boswell as Baxi MD

Jan Rijnen

Karen Boswell OBE stepped down as managing director of Baxi Heating UK & Ireland at the end of November.

During her three-year spell at the helm, she led Baxi through considerable reorganisation and consolidation in the UK and Ireland, the Covid pandemic, and major supply chain challenges in 2022. The company also said that Boswell has driven significant improvements in Baxi's sustainability and safety performance.

Boswell will continue in her role as chair of the Heating and Hotwater Industry Council, which she took up earlier this year.

She will be replaced at Baxi by Jan Rijnen, former CEO of insulation specialist De Isolatieshop.

He previously worked for Bosch, and was managing director and a board member for Nefit-Bosch, one of the Netherlands' largest central heating manufacturers and supplier.

Heat pump distance rules set to be scrapped

Autumn Statement looks to free up planning regime for green infrastructure

The government has pledged to investigate scrapping rules that stipulate heat pumps must be located a metre from a property boundary, but has been criticised for not taking more action to tackle energy efficiency in its Autumn Statement.

Chancellor of the Exchequer Jeremy Hunt announced plans to consult on introducing new permitted development rights that would end the 'blanket restriction' on heat pumps being one metre from a property boundary in England.

This move, which is designed to reduce delays in installing heat pumps, is part of a wider package of measures announced to ease the planning regime for low carbon infrastructure.

The statement outlines the government's response to National Infrastructure Commissioner Nick Winser's review of transmission network planning, published in August.

And it proposes implementing the former National Grid CEO's recommendation to offer energy bill discounts and packages of community benefits to those most affected by the construction of new transmission infrastructure.

The government's response to Winser's review also kick-starts work on drawing up a spatial plan for the nation's energy infrastructure.

Other measures included a pledge to amend the National Planning Policy Framework to prioritise the rollout of electric vehicle chargepoints, including charging hubs.

Josh Emden, senior research fellow at the left-of-centre IPPR thinktank, said there was 'nothing new' on funding for energy efficiency or clean heat, despite the UK having some of the worst housing stock in Europe.

Juliet Phillips, senior policy adviser at E3G, said 'major gaps' remained in energy efficiency and clean heat policy with private renters having drawn the 'short straw' after the Prime Minister's decision not to implement regulations requiring upgrades of privately rented homes.

Government failing to tackle 'catastrophic' energy waste

The government has been accused of failing to match its rhetoric on tackling long-term challenges in the King's Speech by not bringing forward measures to deal with 'catastrophic' energy waste from UK buildings.

UK Green Building Council head of policy and public affairs Louise Hutchins said: 'The government claimed to set out an agenda to tackle the long-term challenges facing the UK, yet introduced no legislation or proposals to address the catastrophic levels of energy waste from homes and buildings that are fuelling the cost-of-living and climate crises.

'Formally pulling the plug on minimum energy efficiency standards for private rented homes will condemn millions of people living in fuel poverty to continue enduring cold, mouldy homes.

'As we hurtle towards climate disaster, opening up new oil and gas extraction, while failing to deal with the huge demand from gas heating in buildings will only take us further off course from the net zero future we so desperately need.'

Rowley is new housing minister

Lee Rowley has been promoted to Minister of State for Housing, after spending the past year overseeing building safety at the levelling up department. Rowley replaced Rachel Maclean as Housing Minister as part of a wider reshuffle of the government that also saw Therese Coffey make way for Steve Barclay as Secretary of State for the Environment.

IN BRIEF

Third of properties failing to meet MEES standard

Less than one third of the UK's office stock currently meets the Minimum Energy Efficiency Standards (MEES) required to be lettable from 2027, according to Carter Jonas. The property consultancy says only 31.6% of the stock is band C or better, the proposed MEES standard by 2027. And just 8.3% of the stock would satisfy the proposed MEES requirement of EPC band B from 2030. Given the proposed tightening of the MEES regulations, it warns that a 'substantial proportion' of office buildings will be unlettable by 2027 if upgrades are not carried out.

Ceiling price for offshore wind projects raised

The government has dramatically increased the ceiling price for its flagship renewable power support scheme after this year's auction failed to attract any offshore wind bids. The Department for Energy Security and Net Zero announced on 16 November that strike price on offer for offshore wind projects in next year's Contracts for Difference Allocation Round 6 has been increased by 66% to £73/MWh. The strike prices for floating offshore wind, geothermal, solar and tidal projects have also received big increases. A surge in the cost of delivering offshore wind meant that the £44/MWh offered by the government this year for fixed bottom generation was too low to attract bidders.

Skills shortage key barrier to green energy growth – IEA

A 'growing number' of energy industries are citing skilled labour shortages as a 'key barrier' to ramping up activity, according to a new report. The worldwide survey of 160 energy firms, carried out by the International Energy Agency, finds the number of workers pursuing degrees or certifications relevant to jobs in the sector is not keeping pace with growing demand. These shortages are particularly strong for vocations such as electricians specialised in energy-sector work, as well as professionals in science, technology and engineering, it says.

IN BRIEF

Grants for heat pumps jump to £7,500

The government has increased the grants available under its Boiler Upgrade Scheme (BUS) for installing heat pumps to £7,500. The Department for Energy Security and Net Zero confirmed last month that it is taking forward Prime Minister Rishi Sunak's pledge – made in his 10 Downing Street net zero speech in September – to increase the size of BUS grants by 50%. The government said the grants and additional discounts offered by energy suppliers meant the typical cost of buying and installing an air source pump could now be less than the £2,500-3,000 sum for a new gas boiler.

Construction output growth sluggish

Quarterly construction output increased by just 0.1% in the third quarter of this year, according to new official figures. There was a 0.4% increase in construction output in September, according to the Office for National Statistics. After two months of falls, this increase helped output to record growth of 0.1% in the three months from July to September. The increase in September came solely from a growth in repair and maintenance (2.1%), partially offsetting a 0.8% decrease in new work over the month. The annual rate of construction output price growth was 3.9% in the 12 months to September 2023. This was a slowdown from the record annual price growth recorded in May 2022 (10.4%).

Delayed projects to lose place in Grid queue

New rules aim to speed up connections for 'ready to go' projects

The energy regulator has unveiled tough new rules to speed up electricity Grid connections for viable generation and storage projects, and prevent 'zombie' schemes from blocking the queue to access the transmission network.

Under existing rules, Grid connections are awarded on a 'first come, first served' basis. This has led to the Grid being oversubscribed, with a long queue of energy projects that would be sufficient to generate almost 400GW of electricity – several times the 65GW that the UK currently needs. The National Grid Electricity System Operator (ESO) estimates that between 60% and 70% of these projects will fail to materialise, and some energy developers have been offered Grid-connection dates as far away as 2037.

The new queue-management milestones will be implemented by the ESO from 27 November 2023, and will be introduced for existing and future Grid-connection agreements. Stalled or speculative projects that are blocking the queue for high-voltage transmission lines will be terminated to enable the fast-tracking of generation and storage that is ready to go. The first terminations are likely to happen as early as 2024, according to energy regulator Ofgem.

Julian Leslie, chief engineer and head of networks at the ESO, said: '[We] will be uncompromising in our approach to driving out projects that cannot meet their connection date, paving the way for more viable projects that have a real chance of plugging into the Grid, energising the UK economy.'

The ESO has recently concluded an amnesty for projects that were willing to give up their place in the queue.

Oxford aiming for net zero by 2025

Oxford City Council has unveiled plans to force all new buildings in the city to be zero carbon from 2025.

The authority's draft Local Plan 2040, which was published for consultation on 10 November, includes a requirement for all new homes and businesses in Oxford to be zero carbon from the timetabled adoption date of the blueprint in 2025. This includes a requirement that no fossil fuels be directly used in the operation of new housing or commercial developments – for example, no gas for heating or cooking.

Under the authority's existing local plan, new residential developments should be zero carbon from 2030, with interim emission-reduction targets that go beyond those set by the government.

The new policy is designed to deliver Oxford's goal of becoming a net zero carbon city by 2040. The council aims to deliver nearly 10,000 new homes by the end of the 2030s.

The new report says GHG-reduction measures must be 'ramped up'

Planet facing three degrees of global warming this century

Stark warning from UN as countries meet at COP28 climate conference in Dubai

Greenhouse gas (GHG) emissions must fall by 42% worldwide by 2030 to meet the temperature goals in the Paris agreement, a new United Nations (UN) report has warned.

The latest emissions gap report from the UN Environment Programme, *Broken record*, says current government pledges and policies put the world on track for a temperature rise 2.5- 2.9°C above pre-industrial levels this century.

Released ahead of the 2023 climate summit in Dubai, United Arab Emirates, the report calculates that predicted 2030 greenhouse gas emissions must fall by 42% to prevent temperatures rising above 1.5°C – the goal set at the 2015 COP in Paris. To limit the temperature rise to 2°C, emissions need to fall by 28%.

'Significantly ramping up' implementation of GHG-reduction measures in this decade is the only way to avoid 'significant overshoot' of 1.5°C, says the report. Unless emission levels in 2030 are reduced further than governments are currently pledging, it will become 'impossible' to establish low-cost pathways to limit global warming to 1.5°C.

Taking such steps will facilitate more ambitious targets for 2035 in the next round of carbon-reduction pledges and increase the chances of meeting net-zero pledges.

The report authors also say higher-income and G20 countries must take on a greater share of the responsibility for curbing emissions because of their greater contribution to the problem in the past.

António Guterres, secretary-general of the UN, said: 'We know it is still possible to make the 1.5-degree limit a reality. It requires tearing out the poisoned root of the climate crisis: fossil fuels. And it demands a just, equitable renewables transition.'

Relax heat pump noise and distance restrictions, say acoustic experts

Noise restrictions on air source heat pumps could be relaxed during daytime hours, as could the minimum distance from other properties that devices can be located, a new paper has recommended.

The report, commissioned by the Welsh government and produced acoustic consultants, says heat pumps would typically need to be installed 4m from neighbours to meet existing noise guidance.

Complaints about heat pump noise are currently at a 'low level', 'very likely' because installations are being carried out in areas with low housing densities. This could change, however, as the UK government's Boiler Upgrade Scheme encourages heat pump uptake in suburban and urban areas.

The paper recommends that existing noise limits could be preserved between 11pm and 7am, and relaxed during daytime hours, when the devices are operating harder. It also recommends that the minimum distance of heat pumps from boundaries – which is set at 1m in England and 3m in Wales – could be relaxed where the device is located next to a substantial barrier, such as a brick wall.

In his Autumn Statement Chancellor of the Exchequer Jeremy Hunt announced plans to consult on introducing new permitted development rights that would end the 'blanket restriction' on heat pumps being one metre from a property boundary in England (see page 7).

IN BRIEF

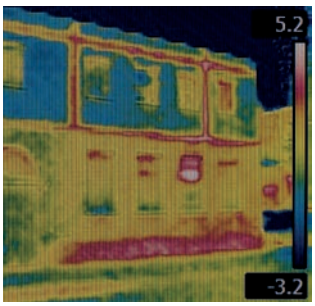
AI model identifies homes most in need of energy improvement

Researchers in the University of Cambridge's Department of Architecture have developed an artificial intelligence (AI) model that can identify 'hard to decarbonise' properties with 90% precision. This proportion is expected to rise as they add more data – work that is already under way using open-source data.

The 'deep learning' model – outlined in a new study published in *Sustainable cities and society* – also helps authorities to understand the geographical distribution of hard-to-decarbonise properties.

The researchers trained their AI model using data for Cambridge, feeding in information from Energy Performance Certificates, as well from street-view and aerial-view images, land-surface temperature, and building stock.

In total, the model identified 700 hard-to-decarbonise houses, and 635 that are not.



Government releases RAS guidance

The Department for Levelling Up, Housing and Communities has published guidance on its Responsible Actors Scheme (RAS).

The scheme is designed to prohibit developers from securing planning permission if one of their schemes falls foul of the government's new building safety regime, which has been introduced following the Grenfell Tower fire tragedy. The guidance includes examples of model 'stop' and 'planning contravention' notices, which councils can issue to prohibited developers that apply for permission.

CIBSE updates Climate Action Plan to include net zero CPD

CIBSE has updated its Climate Action Plan, mapping current and planned activities in areas where it deems it has a duty and the ability to act to make a difference.

To translate this pledge into practice, CIBSE first produced its Climate Action Plan in 2019, to map current and planned activities, which included a commitment to review the plan regularly. This will be the fourth annual update.

The 2023 updates include: mandatory CPD on sustainability and net zero, starting 1 January 2024 for all corporate members of CIBSE; continual development of guidance and training on net zero carbon buildings; active involvement with the Net Zero Carbon Buildings Standard; introduction of a draft 'Mirror Climate Action Plan' for individuals and organisations in the CIBSE community, to suggest actions and commitments; progressing the office move to a new London location, with net zero and sustainability an important part of the brief.

CIBSE is inviting comments and feedback on its draft Mirror Climate Action Plan. The draft is available to view in the Climate Action Plan, and comments should be sent to: jgodefroy@cibse.org

To read the updated Climate Action Plan visit: **bit.ly/CIBSEClimateActionPlan**

Team Xavio Design's double delight at Ready Steady Light

The Ready Steady Light competition welcomed 15 teams of lighting designers, manufacturers and students to Rose Bruford College, Sidcup, in October.

There were three awards; Team Arup won the Technical Award, while Team Xavio Design won the Artistic Award and the Peer Award, judged by the contestants taking part.

The annual Society of Light and Lighting event, which is run in association with Rose Bruford College and the International Association of Lighting Designers (IALD), challenges teams to design an external lighting installation using limited equipment in 180 minutes. The competition provides a space for creativity and a return to the basics of design and engineering.

Congratulations to all who entered, and thanks to those who donated equipment, the judges, Rose Bruford College, and the IALD. For more information, see **bit.ly/ReadySteadyLight23**

CIBSE receives HRB registration licence

Institution approved to assess competence of engineers working on higher-risk buildings

The Higher-Risk Buildings (HRB) Register, developed by the Engineering Council, provides clients, residents, employers and regulators with a higher degree of confidence that engineers are competent to work on higher-risk buildings.

Those working on HRBs with duty-holding responsibilities must now demonstrate that they are competent to undertake their roles.

CIBSE worked closely with the Engineering Council to develop the competences required. The Institution has now been approved to offer assessment against the requirements of the UK Standard for Professional Engineering Competence and Commitment Contextualised for Higher-Risk Buildings (UK-SPEC HRB) and the building services discipline annexe.

UK-SPEC HRB sets out the competences and commitments expected of engineers and technicians. Being on the register provides assurance to building owners and occupants that engineers and technicians are competent to carry out work that complies with Building Regulations, and are committed to practising ethically and in accordance with their institution's code of conduct.

For further information and to view the competence requirements for UK-SPEC HRB, visit the Engineering Council's HRB webpage.

CIBSE will be running a pilot scheme for HRB assessment, with the aim of opening to general applicants in early 2024. To find out more and register your interest, visit **www.cibse.org/hrb**

SLL transforms Leeds Minster

Illumination part of Light Night Leeds

In association with Light Night Leeds 23, members of the Society of Light and Lighting (SLL) illuminated Leeds Minster on 12 and 13 October.

Lighting design workshops were delivered to pupils at Alder Tree Primary, Leeds, and students at Leeds West Academy over the summer. Participants created designs on the themes of cultural diversity, religion, music, and the environment. From these submissions, five were selected to light up Leeds Minster.

During the two evenings of the event, the display attracted more than 6,000 people, delighting the volunteers and the team at Leeds Minster.

CIBSE extends a thank you to all the volunteers who supported this event and to all the companies that donated equipment. For more information about the event, visit **bit.ly/LightNight23**

The Google Bay View campus, in California, took the award for international new build

Innovation and energy saving to the fore at Façade 2023 Awards

Groundbreaking projects and exceptional design and performance recognised

The Façade 2023 Design and Engineering Awards highlighted groundbreaking projects that focused on innovation, carbon savings, and refurbishment.

Organised by the Society of Façade Engineering (SFE) and CIBSE, the awards sponsored by Reynaers, recognise excellence and achievements in façade engineering. The winners shared a common goal of designing high-performing buildings with energy savings and consideration of whole-life and embodied carbon.

The UK Project of the Year winners were: The Parcels Building and Arup for sustainability; Battersea Power Station and seele for refurbishment; WilkinsonEyre and Buro Happold for new build; and Paddington Square and WSP for innovation.

In the international categories, the winners were: Beeah Headquarters and Buro Happold for sustainability; Luxottica Digital Factory and Deerns Italia for refurbishment; Google Bay View Campus and Arup for new build; and Google Mass Timber 1 and Eckersley O'Callaghan for innovation.

The iconic Battersea Power Station renovation was recognised for the enormous undertaking to transform the brick landmark, which included the reuse of rexisting strucks, saving over more than 36,000 tonnes of CO_2e of legacy carbon.

The Black and White Building in London's Shoreditch area was recognised for its full-timber construction, which has an A+ rating against the LETI criteria. The façade's timber system was calculated as having embodied carbon 40% lower than an equivalent aluminium system (see page 22).

Exceptional design and performance were also seen among the international winners. The Beeah Headquarters in Sharjah's Al Sajaa desert, United Arab Emirates, achieved Breeam Outstanding and Leed Platinum.

The Google Bay View Campus, in California, features curved bays clad with dragonscale photovoltaic shingles that supply roughly 40% of the building's annual energy needs, and has achieved Leed Platinum certification.

Chris Macey, chair of the awards judges, said: 'The engineering innovations on display within these winning projects, together with the skills and talent of those involved, are testament to the essential contribution façade engineering plays to final building performance and outcome.'

Product of the Year – UK went to AGC Europe, for Fineo, a coating-on-demand service that allows engineers to develop tailored coated glass products for façades and windows.

Voltin took the International Product award for its digital assessment system of a building exterior capable of detecting building defects. Rocco Boselli, from Eckersley O'Callaghan, was named Young Façade Engineer of the Year, beating 12 others to the title.

A Lifetime Achievement Award went to Dr Bill Wolmuth for his outstanding contribution to the façade industry, while Chris Aspinal, vice-chair of the SFE was awarded a presidential commendation from CIBSE President Adrian Catchpole.

The awards took place on 8 November, at the Hilton Park Lane, London.

● Visit: **bit.ly/FEA23**

IN BRIEF

Yorkshire chair Pritpal Jandu receives President's commendation

CIBSE Yorkshire chair Pritpal Jandu has been awarded a President's commendation for his contribution to organising the pioneering 'Ey up' series of CPD events across the region. CIBSE President Adrian Catchpole said: 'This is just one example of how he has gone above and beyond as chair of the Yorkshire region, tirelessly championing CIBSE initiatives and expanding the horizons of CIBSE's reach there.'

CIBSE secures grants for heat networks training

CIBSE Training are pleased to have announce they have secured grant funding from the Department for Energy Security and Net Zero for its heat network training. Each delegate can get £500 off the cost of either the one-day Introduction to Heat Networks and Code of Practice course, or the two-day Heat Networks Code of Practice (CP1) full course.

The details of both of these courses can be found at **www.cibse.org/training**. The grants will be awarded on a first come, first served basis and are only available to delegates that are living in England. To apply, email **training@cibse.org** and provide us with proof of address.

Experts wanted to deliver training

CIBSE Training is recruiting trainers on an ongoing basis, to write and deliver online and face-to-face public and corporate courses, for groups of up to 25 paying delegates. If you are an expert in building services engineering and have experience in delivering training, fill in the application form at **bit.ly/CBSETrainer**

New members, fellows and associates

FELLOWS

Beard, Mathew
Chertsey, United Kingdom

Brittle, John Paul
Nuneaton, United Kingdom

Clements, Paul
London, United Kingdom

Doda, Anri
London, United Kingdom

Dunne, Gabriel
Tempo, United Kingdom

Fletcher, Adam Lee
Earl Shilton, United Kingdom

Greaves, Robert James
Chorley, United Kingdom

Lai, Chun Wai
Ngau Tau Kok, Hong Kong

Rabot, Karl
Horsham, United Kingdom

Ruane, Vincent Antony
London, United Kingdom

Sui, Wing Man
Kwun Tong, Hong Kong

Tighe, Paul
Lucan, Ireland

Wildesmith, Lucy Joanne
Dunstable, United Kingdom

MEMBER

Anastachas, Anastasios
Shoreham-by-Sea, United Kingdom

Au, Kai Sun
Hong Kong, Hong Kong

Bottomley, Michael
Halifax, United Kingdom

Cheung, Ka Kin
Sham Tseng, Hong Kong

Cho, Ka Ming
New Territories, Hong Kong

Donoyan, Hratch
Metn, Lebanon

Howden, Colin Douglas
Kirkliston, United Kingdom

Khan, Imtiyaz
Al Hamra, Saudi Arabia

Kwok, Tsz Lok
Kowloon, Hong Kong

Labeeb, Ahmed
Dubai, United Arab Emirates

Lamm, Po Ling
Hong Kong, Hong Kong

Lau, Wai Kit
Hong Kong, Hong Kong

Lee, Ho Leung
Tung Chung, Hong Kong

Lee, Chun Pong
Hong Kong, Hong Kong

Lee, Ka Wai
Hong Kong, Hong Kong

Li, Nga Wai
Hong Kong, Hong Kong

Li, Calvin Koon Tung
Hong Kong, Hong Kong

Li, Yuen Shan
Tsuen Wan, Hong Kong

Liu, Chun Wa
Hong Kong, Hong Kong

Marini, Claudio
London, United Kingdom

McGuirk, Liam
Castleblayney, Ireland

Meloni, Nicoletta
London, United Kingdom

Mian, Furqan Ijaz
Al Quoz, United Arab Emirates

Mutuku, Douglas Mulandi
Westlands, Kenya

O'Brien, Killian
Dublin, Ireland

So, Ho Pong
Kwun Tong, Hong Kong

Tam, Wai Sze
Hong Kong, Hong Kong

Tse, Kam Chung
Kwai Chung, Hong Kong

Ukaigwe, Chiedozie Innocent
Manchester, United Kingdom

Yeung, Wing Kin
Lantau Island, Hong Kong

Yeung, Ka Hing
Kowloon, Hong Kong

Yiu, Sze Wan
Kowloon, Hong Kong

Yunis, Anas
London, United Kingdom

ASSOCIATE

Citrone, George
Stone, United Kingdom

Kerai, Vijay
Harrow, United Kingdom

Kimberley, Sean
Birmingham, United Kingdom

May, William
London, United Kingdom

McGinn, Callum
Colchester, United Kingdom

LICENTIATE

Barton, Gage
Bristol, United Kingdom

Bogachuk, Kyrylo
London, United Kingdom

Brunyee, Mollie
Bristol, United Kingdom

Chorlton, Ryan
York, United Kingdom

Coleing, Spencer
Solihull, United Kingdom

Eales-Pollard, Louise Ann
Newton Harcourt, United Kingdom

Fleming, Lewis
London, United Kingdom

Foudy, Patrick
Northfleet, United Kingdom

Gamble, Alfie
Leeds, United Kingdom

Ganderson, Megan
Huntingdon, United Kingdom

Gearey, Ryan
Manchester, United Kingdom

Goodwin, Samuel
Plymouth, United Kingdom

Hannan, Dylan
Middlesbrough, United Kingdom

Harris, Conor
Wembley, United Kingdom

Higham, Joseph
Solihull, United Kingdom

Hobbs, Adam
Bury, United Kingdom

Hoque, Mohammed
Oxford, United Kingdom

Hudson, Harvey
Burnley, United Kingdom

Jarvis, Emma
Plymouth, United Kingdom

Jones, Ryan
Coldfield, United Kingdom

Kirkland, Elaloise
Wolverhampton, United Kingdom

Leeming, Matthew
Bradford, United Kingdom

Lismore, Sean
London, United Kingdom

Macdonald, Andrew
Dundee, United Kingdom

Malone, Liam
Chorley, United Kingdom

Miller, Jon
Bristol, United Kingdom

Panchuk-Yavnyy, Antony
London, United Kingdom

Parkes, Crisjen
Bexleyheath, United Kingdom

Parrish, James
London, United Kingdom

Pinnells, Stephanie
Haywards Heath, United Kingdom

Sidat, Muhammad
Blackburn, United Kingdom

Singh, Suraj Jay
London, United Kingdom

Sisk, Andy
Devon, United Kingdom

Tucker, Matthew
London, United Kingdom

Wolstenholme, Joseph
Plymouth, United Kingdom

SFE NEW MEMBERS

FELLOWS

Britz, Perry

MEMBER

Berenjian, Armin

Huber, Markus

Kaleta, Wieslaw

Korch, Eugene

Lilli, Lorenzo

Makkada Yuvaraj, Dwarakanathan

Mauri , Serenella

Montali, Jacopo

Newall, Daniel

Nkandu, Mumba

Romero, Claudio

ASSOCIATE

Mecid Siddiki, Abdul

Shakespeare, Emma

Dubai is hosting COP28, where CIBSE President Adrian Catchpole will speak

CIBSE President to focus on embodied carbon at COP28

Adrian Catchpole will also highlight the importance of climate resilience

Climate resilience and embodied carbon are the two key themes to which CIBSE President Adrian Catchpole will draw attention in his presentation at the 2023 United Nations Climate Change Conference, COP28.

COP28 takes place in Dubai, in the United Arab Emirates (UAE), from 30 November to 12 December, when 70,000 delegates will come together to assess the progress being made towards the landmark Paris Agreement, which pledged to keep the global average temperature rise to 'well below' 2°C.

Catchpole will talk about the climate resilience of buildings and say that the building services industry, while continuing to decarbonise building stock, must also assess the risk of climate change to buildings and put in place adaption plans to protect the built environment.

His speech will call for a step change in the way carbon emissions are calculated in buildings and state that there now needs to be as much focus on embodied carbon as operational.

CIBSE's work on the TM65 embodied energy calculation methodology for building services will be highlighted, and Catchpole will explain its growing significance around the world as new versions are created for different regions.

Local TM65 addenda are imminent for America and the UAE, and the latter will be launched by the UAE CIBSE Region as part of COP28 (see story below). A new Hong Kong addendum is expected in 2024, while the Australia and New Zealand version was published in late 2022.

TM65 is the first step to promoting transparency in the supply chain, and Catchpole will advocate strongly for the methodology to enable engineers to produce comparable carbon metrics using a consistent set of rules.

IN BRIEF

Every sector covered by CIBSE UAE Awards

The CIBSE UAE Awards, taking place on 7 December during COP28, will feature 25 categories, covering every sector in the region.

There are six individual awards – two executive accolades and one each for the mechanical, electrical, plumbing, and sustainability engineers of the year.

The project categories are for engineering, sustainability, plumbing, and retrofit, and there is the Gulf Cooperation Council Project of the Year, plus a University Award for most sustainable initiative. An Embodied Carbon Initiative of the Year category reflects the growing importance of measuring whole life carbon.

The awards take place at the Palazzo Versace in Dubai. For details of the shortlist, visit: **bit.ly/CJUAESL23**

Children's book launch at Dubai conference

A new children's book on climate change is being launched at COP28.

Mission Zero: a race to save the planet features best-practice sustainabililty projects in the UAE and Middle Eastern countries, and is co-authored by Farah Naz FCIBSE and CIBSE UAE Awards judge Nahla Nabil, sustainability expert at Etihad Rail.

The book aims to make children aware of the latest changes in climate science and innovative green technology.

What TM65 will mean for the UAE

Isaac Coker, chair of the CIBSE UAE Technical Committee, explains how a new addendum to TM65 will work

Development of the TM65 local addendum for the Middle East and North Africa (MENA) region (United Arab Emirates chapter) is being undertaken by authors Dr Francisco Sierra, of the University of the West of England (UWE), Balsam Nehme, of Dar Al-Handasah, and Ahmed Hagras, of UWE.

In the UAE, buildings consume 70% of the energy produced in the country, leading to substantial carbon emissions. Until now, the focus has been on reducing operational carbon. As a result, there is a lack of embodied carbon calculations for construction products in the UAE and the MENA region. This lack of Environmental Product Declarations (EPDs) is even more pronounced for mechanical, electrical, and plumbing (MEP) products.

CIBSE TM65 is used to estimate the embodied carbon for building services equipment where an EPD is not available. So, the addendum will be a crucial resource for manufacturers in the UAE to understand and reduce the embodied carbon in their products. The working group has established a comprehensive inventory of carbon coefficients specific to the UAE, providing accurate and relevant data to the UAE context.

This is the first comprehensive local inventory of its kind, and is a significant contribution to the calculation of embodied carbon and to the creation of embodied carbon data points for MEP products, such as boilers, chillers, mechanical ventilation systems, and air conditioning units.

This inventory should also serve as a valuable resource for conducting embodied carbon assessments for other types of products and life-cycle analysis for construction projects.

TM65 is also aimed at raising awareness in the UAE about the need to reduce operational emissions, and transform the construction industry into a more sustainable sector. It wants to be an important component of the UAE's efforts to achieve zero carbon emissions.

Help us help those in need

The CIBSE Benevolent Fund supports CIBSE Members and their families during times of hardship and ill health. To ensure there are enough funds for the increasing number of people who need help, a new scheme is being launched. Chair of the fund **Kevin Kelly** explains how Members can help

Imagine losing your partner and, with them, your financial security, while you have three young children to raise. This was the situation for one person whom the CIBSE Benevolent Fund was able to help, when their partner, a CIBSE Member, died suddenly.

In another case, a member had fallen ill with a serious disease, meaning they were no longer able to climb stairs. The Benevolent Fund helped cover the cost of converting a downstairs room into a toilet and shower room.

Each year, CIBSE Members and their dependents are supported through the CIBSE Benevolent Fund. As it celebrates its 90th year, the Fund is keen to ensure that it is in a position to continue supporting as many people as possible.

The Benevolent Fund is a registered and separate charity from CIBSE. It was set up by members to operate in parallel with CIBSE for members, former members and dependants who have fallen on hard times and have significant need.

Last year, there was a drop in income – as 28% of members donated when renewing their membership, down from 37% in 2020 – against an increase in expenditure, because more people were seeking out the Fund for assistance.

Supporting the CIBSE community

Kevin Kelly, chair of the Fund, said: 'We're really pleased to be reaching more people who are in need of help, and have increased the grants we are offering because of increasing needs around inflation and rising living costs.'

In 2022, of the fund's £63k expenditure, £58k went directly to help members.

The Fund is managed entirely by unpaid volunteers, and supported by CIBSE staff, with a minimal overhead of 8%, which is mainly attributed to auditing and administrative charges.

As well as donations from members at renewal time, the Fund receives dividends from investments, plus one-off donations from members, regions and CIBSE events.

Fortunately, the Fund has been able to maintain the services it offers, but wants to increase the number of people it is able to help.

Clearly, this won't be sustainable in the long term, so the Fund needs to increase donations and is seeking support from members to help with this.

'CIBSE is a community and, as such, we should support and be there for each other. This is at the heart of the Fund's work,' says Kelly.

'We are asking members to support the community in two ways. First, by helping us identify members, former members or their dependants who may be in need, and putting them in touch with the local branch almoner. Second, by helping us increase our income by ticking the Benevolent Fund box at renewal time, and considering becoming a Sustaining Member.'

The Fund is launching a new Sustaining Member scheme next year, and invites CIBSE Members to pay an annual donation of £50 – slightly higher than the voluntary donation included with membership renewal payments. Employers make an annual contribution of £100 to the Fund in the Sustaining Employers scheme.

Please ask your employer to consider becoming a Sustaining Member. Contact **kevintkelly54@gmail.com** or **benfund@cibse.org**. You can become a sustaining member by visiting: **bit.ly/benfundhelp**

Alternatively, in the same way as in previous years, you will have the option to donate £10 to the Benevolent Fund with your renewal. **The Fund is asking you to tick this box to ensure it can continue to help those who are struggling.**

Almoners

Each CIBSE Region has one or more almoner. They act as the first point of call for any requests for support, and meet with trustees on a quarterly basis to review cases, share concerns, and decide how best to support clients. Each current and new case is discussed quarterly, and decisions are made with regard to appropriate funding. Feedback and issues raised by clients are also prioritised.

There are vacancies in some regions, so if you have some time, and like meeting people, this could be a very rewarding way to help. For a full list of almoners and how to contact them, visit **bit.ly/CJBfund**

HOW THE FUND HAS HELPED:

Moving back home

A member – who had been in the industry since the 1930s, a member of CIBSE for more than 50 years, chair of his region's committee for four years, and actively fundraised for the Benevolent Fund – sought out the Fund's assistance as his health deteriorated. His wife was in a nursing home, while he was living at home with a carer, and he wanted his wife to move back home with him. The Benevolent Fund helped him achieve his wish by widening the doorways in their home, to allow wheelchair access.

New bathroom

A member contracted a serious disease, resulting in them being unable to climb the stairs in their home. The Fund helped with the cost of converting a downstairs room into a toilet and shower room, and – as they were unable to work – it supported them financially with regular grant cheques.

Illness support

The Fund was able to provide support for an individual who, because of ill health, was no longer able to work, and whose spouse was also seriously ill. The individual had significant additional expenses because of their illness, and the Fund was able to provide a quarterly grant and some one-off expenses.

Bereavement help

- A member died after a serious illness and his widow was left in financial difficulty. The Fund assisted until she no longer needed support.
- A client in Australia lost her husband, a long-standing CIBSE Member, and was left as a single parent to three school-age children. The Fund supported her with a quarterly grant.

Financial aid

A member struggled to maintain his business because of difficulty in obtaining payment for his work, and lost the family home. Citizens Advice recommended he contact CIBSE and the Fund supported him with a standard quarterly grant.

Falling donations

Overall number and % of CIBSE members who donate

Year	Total renewed	Total donated	% donated
2019	14,584	4,788	33%
2020	14,706	5,424	37%
2021	14,502	4,964	34%
2022	14,533	4,123	28%

List of almoners

Region	Almoner
East Anglia	Jim Stocker
East Midlands	Alan McWilliam
HCNE	Ray Gooding
HCNW	Vacancy
HCSE	Peter Raynham
HCSW	Vacancy
Merseyside & N Wales	Stephen Wynn
North East	John Sproxton
North West	Chris Sealy
Northern Ireland	John Davidson
Scotland	John McLean
South Wales	Keith Patterson
South West	David O Bryan
Southern	Ken Beecroft
West Midlands	Alan McWilliam
Yorkshire	Steve Sutcliffe
Australia & New Zealand	Ian Small
Ireland	Paul Martin

If you would like to become an almoner in any of the two regions with vacancies, contact **benfund@cibse.org** or your local regional branch.

Shaping engineering in the Hong Kong region and beyond

CIBSE's influence in Hong Kong is growing thanks to an extensive programme of activities. Alex Smith speaks to CIBSE region chair Gary Chiang about recent achievements including recognition by Hong Kong's Property Management Services Authority

Ruth Jones, centre right, and Gary Chiang, second from right, meet officials from the PMSA

CIBSE's Hong Kong Region (HKR) is one of the Institution's biggest, with around 2,800 members. It hosts a wide range of activities, and publishes guidance and best-practice literature. It is also keen to promote CIBSE in the region and raise its professional profile.

A joint symposium took place in November, focused on the Greater Bay Area, and the annual CIBSE Hong Kong Awards are scheduled for 8 December.

There was also a CIBSE Membership Cocktail Evening last month, for young engineers preparing for MCIBSE and CEng. The idea was for them to meet interviewers and other professionals, to gain advice and alleviate any fears they may have about the interview process.

Hong Kong chair Gary Chiang says the region is keen to attract more young engineers and the cocktail event is designed to encourage young engineers to gain chartership through CIBSE.

'We invite 20-30 people who are ready to file their application. We reassure them by answering their questions directly, and dispelling any rumours they might have heard about the pass rate being low, or having to go the UK for the interview,' says Chiang, who is principal manager – business development and support at CLP.

The reception was also aimed at those who might be over-confident. 'Some people are naive and think the process is easy. We make it clear they need to prepare,' says Chiang.

Another event aimed at promoting CIBSE to young people was a career-development session at the Department of Building Environment and Energy Engineering (BEEE), Hong Kong Polytechnic University.

Hong Kong Joint Symposium

The theme of last month's symposium was 'Shaping the future: Trend and insights for tomorrow's technologies development in the Greater Bay Area' – a regional megalopolis of around 71.2 million people, consisting of Hong Kong, Macao, and nine cities in South China. CIBSE is a co-organiser of the one-day event, alongside the Building Services Division of the Hong Kong Institution of Engineers, ASHRAE's Hong Kong Chapter, and BEEE.

There were four sessions grouped around the themes of: codes and guidance; design and research; operation and application; and maintenance and performance. In addition, there were keynote speeches by CIBSE president-elect Fiona Cousins FCIBSE, Francis Mills, FCIBSE MASHRAE, and CIBSE CEO Ruth Carter.

There are three Project of the Year categories at the third CIBSE Hong Kong Awards: commercial/industry; public use building; and retrofit building. There is also a Facilities Management Team Award and Best Digital Innovation accolade.

One key goal of HKR is to raise CIBSE's professional status in the region. One recent success was being recognised as a professional body by the Property Management Services Authority (PMSA), which regulates property management services in Hong Kong. This means that CIBSE HKR Members now meet the professional qualification, a key criterion, of becoming a licensed Property Management Practitioner (PMP) (Tier 1). Apart from the professional qualification, work experience in property management and academic qualification are also part of the requirements to become a licensed PMP (Tier 1).

A licensed PMP is responsible for all elements of a building, including customer service, safety, operation, and finance. 'They are the gatekeeper of the property, and they will have the final say over the management of the property,' says Chiang.

As a result of the recognition being awarded to CIBSE, Chiang says that the Hong Kong Region will offer more CPD sessions on facilities management, particularly around CIBSE's new *Guide M: Maintenance engineering and management* (2023).

CIBSE CEO Ruth Carter; Chiang, and Vincent Ma, past chair of CIBSE HKR, met with officials from the PMSA on 23 November, to understand the authority's work. There are 750 property management firms in Hong Kong and more than 13,000 PMPs providing services to nearly 2.2 million properties. Alan Siu, CEO of the PMSA, said: 'They are a huge professional team, which is an asset and invaluable resource for driving the future development of the community in Hong Kong.'

For more information on the CIBSE Hong Kong region, visit **cibse.org.hk**. For details of the CIBSE Hong Kong Awards, visit **cibsehka.org.hk**

The narrow gate

Higher-risk building projects are now subject to a new building control regime, overseen by the Building Safety Regulator. Hywel Davies explains what the new 'Gateway 2' process for approval of design before construction requires

A key provision of the Building Safety Act 2022 is the new procedure for obtaining design approval for work to higher-risk buildings (HRBs). Now, an 'application for building control approval' must be accepted by the Building Safety Regulator (BSR) before work can lawfully start. This is prompting questions about what information the BSR will require before giving approval. Its recent guidance gives very clear indications.

First, the application must contain sufficient information to show how the building will satisfy all applicable functional requirements of the Building Regulations. These requirements must be satisfied with justification for why the evidence of compliance is relevant, not a list of which parts of the Approved Documents (ADs) or other standards or guidance have been followed.

The application must also demonstrate how construction activity will be managed, to give the BSR confidence that what was designed and approved is what will be built. It will expect to see sufficient credible evidence captured during construction to demonstrate this and to support the building completion certificate application when construction is finished. A rigorous change control process must also be followed for any changes to the approved design on site, with major changes requiring reapproval by the BSR. Documents submitted and approved previously must be updated to reflect changes, as part of the golden thread.

Any application for building control approval must be signed by the applicant. If the application is made by a representative, on behalf of the client, the client must provide a signed statement confirming agreement to the application being made and its contents.

A number of supporting documents will have to be supplied, as listed in the Building Regulations (Higher-Risk Building Procedures) (England) 2023. These include a competence declaration, Building Regulations compliance statement, fire and emergency file, construction control plan and change control plan, and a mandatory occurrence reporting plan. Where the building is to be built in phases and completed in stages, the application also requires a partial completion strategy.

The competence declaration must confirm that the client is satisfied that the principal designer, principal contractor and any other person appointed to the work are competent to carry out their roles. It must provide a written record of the steps the client has taken to be satisfied of their competence. The BSR will not examine conclusions, but if it later transpires that these checks are insufficient, enforcement action may follow.

"In RIBA Plan terms, Stage 4 needs completing before application for approval of full plans at Gateway 2"

The Building Regulations compliance statement is intended to demonstrate how the planned building work will comply with all functional requirements of the Building Regulations, with relevant reasons for why it complies. This must be considered carefully and demonstrated before construction starts to obtain Gateway 2 approval. The statement should reference specific guidance, standards and design codes, or detail individual compliance solutions, supported by relevant design details, calculations, specification, and other pertinent information, often developed during the contractor design phase.

The BSR notes that '*following ADs is a common means to try to ensure building work complies with Building Regulations*'. But, it adds, '*while this approach may be entirely appropriate for typical building work scenarios, it does not guarantee compliance, as the ADs are not relevant to all situations*'. Dutyholders must consider how they comply with Building Regulations appropriately for specific projects. Each project must show how the functional requirements are met, and the compliance statement must give evidence of this for each requirement.

The regulator is looking for detailed evidence of compliance with the functional requirements via design solutions, not just plans or setting out drawings. It is clearly not going to accept elements of the design being assigned to contractor-designed portions, as it will be impossible to assess compliance.

This requires a significant change of approach to designing HRBs, with detailed consideration of all aspects of compliance and detailed planning of the construction phase. In RIBA Plan terms, Stage 4 needs completing before application for approval of full plans at Gateway 2. Given the government's acceptance of Dame Judith Hackitt's findings, the only real surprise about Gateway 2 is that so many seem surprised by it.

DR HYWEL DAVIES
HonFCIBSE is chief technical officer at CIBSE. He chaired the Building Regulations Advisory Committee golden thread working group.

SETTING THE STANDARD

The 2024 Building Performance Awards finalists have been announced across 18 categories. **Molly Tooher-Rudd** spoke to the judges about the impressive level of innovation and creative thinking seen throughout the entries


1


2

There was a record number of entries for the 2024 CIBSE Building Performance Awards – with the expert panel of judges, led by chair Hywel Davies, rigorously evaluating projects across 18 categories, each representing a vital aspect of the built environment and emphasising an evolving commitment to holistic performance (see page 20 for the full list of finalists).

Project of the Year was divided into six awards, and showcased a diverse range of entries. There was an emerging theme of prioritising wellness within buildings, plus a heightened awareness of climate change impacts. Judges observed a commendable understanding of the challenges faced by the sector, saying that projects are 'extending their focus beyond just the energy performance, to a space where building performance becomes far more holistic'. In particular, Project of the Year – Retrofit drew attention for its emphasis on embodied carbon conservation, highlighting the crucial need to retrofit older buildings to meet net zero targets.

The judges were impressed by how these standout projects exemplified effective solutions, showcasing a positive shift towards sustainable building practices. Similarly, in the Project of the Year – Commercial and Offices, the judges saw an impressive amount of innovation and creative thinking.

A new category, Project of the Year – Leisure, was introduced, acknowledging a number of exceptional projects that delivered on their buildings for leisure through a spectrum of servicing methods – from passive to highly complex and efficient systems – with the building's purpose being a priority.

The Best Digital Innovation Award, introduced last year, proved highly competitive, with more than 20 entries of 'exceptional quality'. Judges noted a prevalent theme of decarbonisation and a significant shift towards incorporating machine learning into real-world applications.

The inclusion of robust data across various categories, including Best Digital Innovation, was praised, emphasising the importance of tangible performance metrics as a key way of visualising performance. However, judges for the Project of the Year – Residential category expressed a desire for more data-centric schemes, signalling a potential focus area for future innovations in the industry.

Facilities Management (FM) emerged as a standout category this year, with a robust field of entries. The judges commended the 'positive impact FM can have when it takes an active role in engaging with building users, especially in the context of decarbonisation and energy management'. Collaboration and knowledge sharing across the entire value chain were highlighted as promising trends.

The Building Performance Consultancy award was divided into categories based on employee count, to recognise outstanding

1 The Catalyst building – Max Fordham
2 Ravelin Sports Centre – Max Fordham
3 York Guildhall – SGA consulting
4 Hackbridge Primary School – Introba/Architype
5 Ross Lucas Medical Sciences Building, University of Lincoln – BAM Design & Yonder

practices that excel in collaboration, innovative protocols, and inclusivity.

In the category for firms with up to 50 employees, the judges saw some 'stunning entries' from consultancies engaging in best practice, knowledge sharing and wellbeing. 'We're seeing companies that are really focusing on the humans who actually work for them – it's great,' the judges remarked.

The 51-300 employees category highlighted the importance of inclusivity, but called for more innovation. The 300+ employee category demonstrated significant improvements from the previous year, showcasing a clear commitment to addressing the climate challenge through extensive knowledge-sharing initiatives and upskilling programmes. Training and development of young staff was key for many of the firms shortlisted.

The CIBSE President's theme of engineering leadership was evident in the Engineer of the Year category. Judges noted a clear ability among contenders to embrace knowledge sharing and a genuine willingness to develop others. They were also pleased to note the diversity of candidates from across building services, with the pandemic cited as improving our ability to communicate with anyone, wherever they may be in the world.

Similarly, the Learning and Development category showcased strong entries that focused on the dissemination of knowledge throughout the industry, with an emphasis on areas that have the most impact on building performance. Peer-to-peer learning was highlighted as an important mechanism for transferring specialist knowledge to others.

> "We are seeing companies that are really focusing on the humans who actually work for them – it's great"

The Collaboration Award demonstrated the industry's recognition of the critical role collaboration plays in achieving optimal outcomes, with a noticeable trend towards using data analytics for enhanced decision-making. The entries demonstrated the 'art of the possible, and where we all need to get to', said the judges.

Embodied carbon was another key theme throughout the categories. The Embodied Carbon Award highlighted the industry's commitment to reducing embodied and operational carbon, with a growing awareness of end-of-life emissions. The judges were impressed by the sector's dedication to practicing circular economy principles.

A commitment to meeting net zero goals was showcased in entries for Product or Innovation of the Year, which was divided into air quality, thermal comfort and wellbeing categories. A wide range of products was seen in the air quality section, including for refrigeration, water heating and ventilation. Entries showed an understanding of the need for flexibility of application, as well as maintaining regulatory standards. 'The range of innovations demonstrates that the innovation doesn't need to be epic to be influential and beneficial,' the judges said.

The winners will be announced at the awards ceremony at Park Plaza Westminster Bridge, London, on 29 February 2024. To book a table, visit **www.cibse.org/bpa** CJ

THE JUDGES

Claire Aizlewood, head of sustainability, CIBSE
Jan Artemenko, senior associate, Stantec
Jon Belfield, managing director, InTandem Systems
Emma Bushell, energy and carbon manager, City of London Corporation
Maria Benazzo, mechanical engineer, Arup
Carl Collins, Head of Digital Engineering, CIBSE
Darren Coppins, director, Built Physics
Hywel Davies, chief technical director, CIBSE
Kathryn Donald, digital design and building performance modelling director, Max Fordham
Sally Godber, director, Peter Warm
Julie Godefroy, head of net zero policy, CIBSE
Rob Griffiths, AtkinsRéalis
Joanna Harris, UK&I hard FM ambassador, Sodexo
Jeff House, external affairs and policy director, Baxi
Aidan Kelly, senior mechanical engineer, digital lead, CIBSE heat networks consultant, XCO2
Laura Mansel-Thomas, senior partner, Ingleton Wood
Anastasia Mylona, technical director, CIBSE
Ted Pilbeam, building services and sustainability director, Volker Fitzpatrick
Michael Powers, director, Clancy Consulting
Rob Redfern, group energy manager (renewables & LZC), Tesco
Craig Robertson, head of sustainability, Allford Hall Monaghan Morris Architects
Peter Thorns, head of strategic lighting applications, Thorn lighting
Fabrizio Varriale, place and space analyst, RICS
Jon Saltmarsh, Chief Technology Officer, Energy Systems Catapult

CIBSE BUILDING PERFORMANCE AWARDS 2024

Join us for the Awards Celebration on **Thursday 29 February 2024** at **Park Plaza Westminster Bridge, London**

BEST DIGITAL INNOVATION

- BL:Connected' British Land's smart building platform - British Land
- BTune - Beca
- Decarbonomics™- AtkinsRéalis
- Glaucon - An Experiential Collaborative XR Toolset - Foster + Partners
- Hybrid System Wizard - Ariston Group
- Nuada.CFD - SimScale GmbH
- OCEAN - AECOM
- Pollination - Ladybug Tools

BUILDING PERFORMANCE CONSULTANCY (UP TO 50 EMPLOYEES)

- Bennett Freehill
- BSE 3D
- Cyclone Energy Group
- Energenz Consulting (NV5 Net Zero)
- FairHeat
- grfn
- Inkling
- Lawler Group
- Ruane Construction Design & Consultancy
- S I Sealy & Associates
- SRE
- Sustainable Construction Services
- Twenty One Engineering
- Xburo UK

BUILDING PERFORMANCE CONSULTANCY (51 - 300 EMPLOYEES)

Sponsor: Airflow Developments

- chapmanbdsp
- Design2Occupancy
- Harley Haddow
- XCO2

BUILDING PERFORMANCE CONSULTANCY (OVER 300 EMPLOYEES)

Sponsor: ABB

- AECOM
- AtkinsRéalis
- Buro Happold
- Hoare Lea
- Introba

CIBSE EMBODIED CARBON AWARD

Sponsor: CMR

- Construction Carbon
- EGG Lighting
- Hydrotec (UK)
- Signify
- Whitecroft Lighting

COLLABORATION

- Decarbonisation via Data-Driven Collaboration - Smart Managed Solutions & Savills
- One Piccadilly Gardens (OPG), Manchester- Hoare Lea
- Sky Innovation Centre - Arup

ENGINEER OF THE YEAR

Sponsor: Ideal Heating Commercial

- Abdul Zameer Ahamed Sab, Technical MEP Manager - Ashghal/Dar Al Handasah
- Kartik Amrania, Head of Building Sustainability - Sweco
- Philip Draper, Managing Director - Twenty One Engineering
- Stephen Clarke, Managing Director - Stephen Clarke Consulting
- Stephen Joseph Page, Associate Mechanical Engineer - AtkinsRéalis

FACILITIES MANAGEMENT

Sponsor: Gratte Brothers Group

- Broadgate - British Land
- Cadent Gas – 14forty
- Cannon Bridge Properties - BNP Paribas Real Estate
- Decarbonisation via Data-Driven Collaboration - Smart Managed Solutions & Savills

LEARNING AND DEVELOPMENT

- Creating a pathway to build skills for the future - Group Horizon
- Environmental Sustainability in constrAction: eco-design, decarbonisation and circular economy (Environmental Snacks) - Webuild S.p.A.
- Heat Network Optimisation Guidance - FairHeat
- Unlocking Potential: CSA's Commissioning Management Training & Development - Commissioning Specialists Association

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PRODUCT OR INNOVATION OF THE YEAR - AIR QUALITY

- Daikin VRV 5 Heat Recovery - Daikin UK
- Distributed Air Purification System: Innovation Energy Saving for Buildings - Healthy Air Technology
- Link Vent 4000 - Glazpart
- Vent-Axia Sentinel Apex - Vent-Axia
- VLR 70 L Trend - Stiebel Eltron UK
- WZA – Decentralized School Ventilation Unit – Kampmann UK

PRODUCT OR INNOVATION OF THE YEAR - THERMAL COMFORT

- BL:Connected - Fan Coil Unit Optimisation - British Land
- Link Vent 4000 - Glazpart
- Mixergy Smart Hot Water Cylinder - Mixergy
- New Modular Highline 235 Fan Coil Range - Diffusion
- NIBE S735 Exhaust Air Heat Pump - NIBE Energy Systems
- Sintra MIX-IND® Pulsion - Cross Refrigeration

PRODUCT OR INNOVATION OF THE YEAR - WELLBEING

Sponsor: Tamlite Lighting

- Clarence System - Remote Water Monitoring - Angel Guard
- GEM Smart - GEM Environmental Building Services
- Link Vent 4000 - Glazpart
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- SceneCOM Evo - Tridonic UK

PROJECT OF THE YEAR - COMMERCIAL AND OFFICES

Sponsor: Crane Fluid Systems

- Hodge House, Cardiff - Hoare Lea
- Sky Innovation Centre - Arup
- York guildhall - SGA Consulting

PROJECT OF THE YEAR - INTERNATIONAL

Sponsor: Crane Fluid Systems

- Foodstuffs North Island Support Office - eCubed Building Workshop
- Kyoto City Hall Annex Building - Nikken Sekkei
- Narbo Via - Foster + Partners

PROJECT OF THE YEAR - LEISURE

Sponsor: Crane Fluid Systems

- Contact Theatre - Max Fordham
- Narbo Via - Foster + Partners
- Ravelin Sports Centre - Max Fordham

PROJECT OF THE YEAR - PUBLIC USE

Sponsor: Crane Fluid Systems

- Catalyst Building - Max Fordham
- Hackbridge Primary School - Introba/Architype
- Ravelin Sports Centre - Max Fordham
- Ross Lucas Medical Sciences Building, University of Lincoln - BAM Design & Yonder
- York guildhall - SGA Consulting

PROJECT OF THE YEAR - RESIDENTIAL

Sponsor: Crane Fluid Systems

- Bryn Bragl - Hoare Lea
- District heating upgrade for Southwark residents - J&E Hall and ICAX

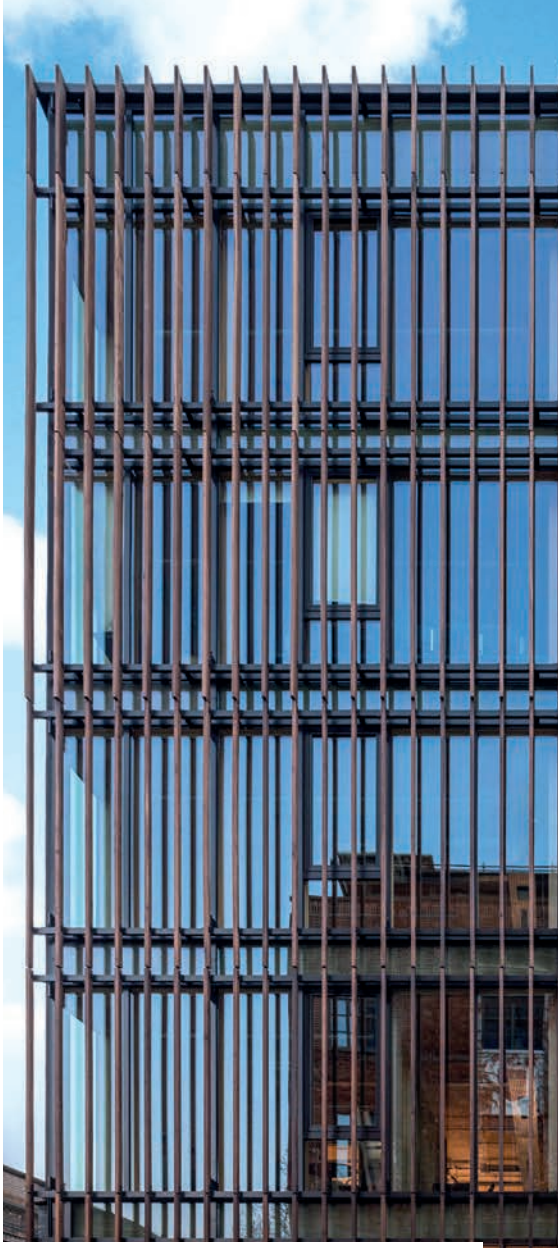
PROJECT OF THE YEAR - RETROFIT

Sponsor: Crane Fluid Systems

- Astor College POE - Buro Happold
- Contact Theatre - Max Fordham
- Hodge House, Cardiff - Hoare Lea
- York guildhall - SGA Consulting

REACHING NEW HEIGHTS

A six-storey timber façade at the Black and White office building in London helped slash embodied carbon and won its engineer a SFE Façade 2023 Design and Engineering Award. **Andy Pearson** finds out how the winning design was engineered while alleviating safety risks



The Office Group's brief for the Black and White Building, a six-storey commercial office development in London's Shoreditch, was for it to be an exemplar of timber construction. It does not disappoint.

Designed by Waugh Thistleton Architects working with structural and façade engineer Eckersley O'Callaghan (EOC), the 17.8m-high building features a hybrid beech laminated veneer lumber structural frame, with a core, the floorslabs and staircases all built entirely from cross-laminated timber (CLT).

More impressive still is the façade. Designed by ECO, this is also constructed from timber. It features floor-to-ceiling glazing supported by a glulam composite timber/aluminium curtain wall, complete with external timber louvres to provide solar shading.

The façade's size and innovative use of timber makes it unique in the London office market, an achievement recognised by the judges of this year's Façade 2023 Design and Engineering Awards, run the by Society of Façade Engineering (SFE), at which the scheme won the UK Innovation category.

'Despite initially considering an aluminium façade, in line with typical office buildings in London, we carried out a comparative analysis of embodied carbon and façade-profile depths structurally required to achieve the spans for both timber and aluminium options,' says Ben Buckley, senior engineer at Eckersley O'Callaghan. 'Ultimately, timber proved to have significantly lower embodied carbon content than aluminium, while maintaining a comparable profile depth, which maintained the net internal floor areas.'

One of the biggest challenges in attaching a timber façade to a timber building is the need to accommodate movement from the timber swelling and shrinking in response to changes in moisture. With the superstructure constructed from timber, it is lighter, and prone to greater movement from wind loads and occupancy, than if it had been built with a concrete frame.

Fortunately, EOC was also the project's structural engineer, so façade engineers were able to work with their structural engineering colleagues to predict structural movement during construction and when occupied, to ensure these could be accommodated. 'Early coordination enabled stringent deflection criteria to be specified and designed to minimise the risk of design changes once contractors were appointed,' explains Buckley.

The curtain wall spans CLT floor slab to CLT floor slab, with differential movement accommodated through the connecting brackets. 'To accommodate the larger, long-term deflections of the timber structure compared with a concrete structure, we also designed a thicker horizontal transom to accommodate the movements,' says Buckley.

> "The project demonstrated impressive architecture and innovative design while ensuring sustainability was at the centre of every decision"

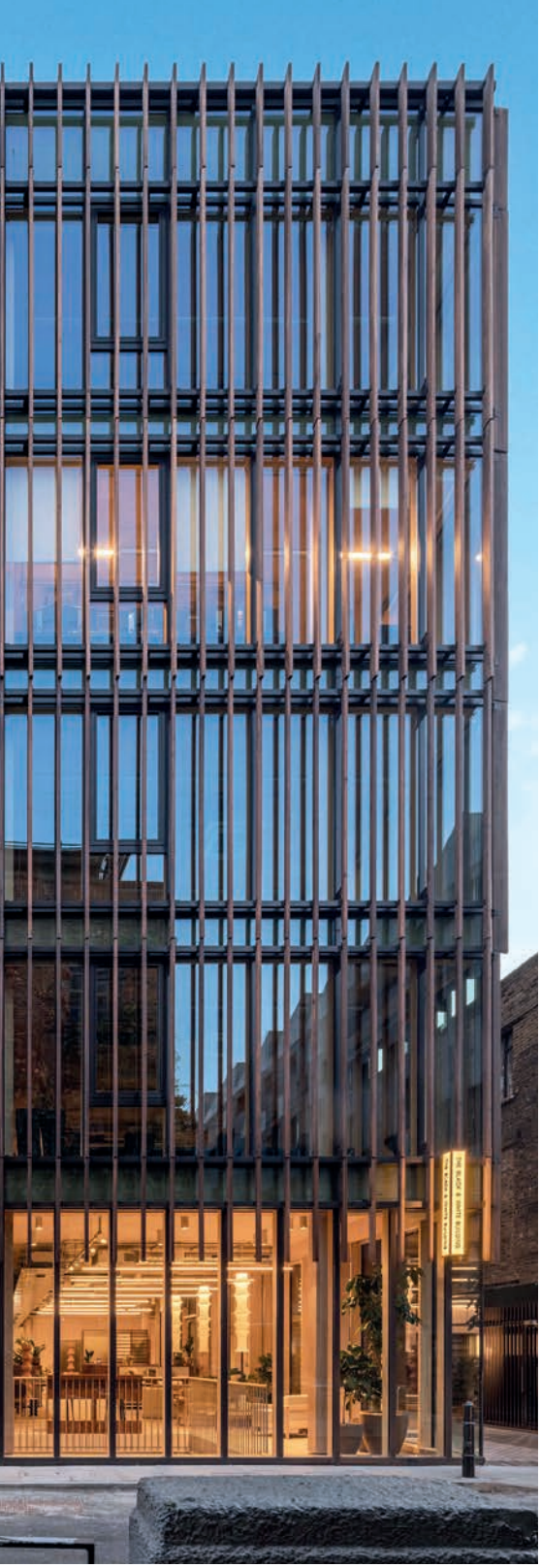
EMBODIED CARBON

The fully engineered timber superstructure makes a powerful sustainability statement, with claims that it contains one-third less embodied carbon than a comparable six-storey structure. Only the basement box and integral ground-floor slab are constructed in concrete.

The building's embodied carbon is calculated to be 410kgCO_2e·m^2 (modules A1-A5, excluding sequestration), compared with that of a conventional building of around 670kgCO_2e·m^{-2}.

Impressively, the timber structure is bolted together to enable it to be dismantled easily and reused at the end of its life. If its timber is reused, then the sequestered carbon for as long as it is in (re)use lowers the building's embodied carbon figure still further, to just 180kgCO_2e·m^2, below the LETI 2030 target for office buildings

For the façade alone, the use of an aluminium/timber hybrid was calculated as having 40% less embodied carbon than the equivalent aluminium system if sequestered carbon is included.



The louvre timbers are positioned vertically on the east and west façades and horizontally on the southern façade

The floor-to-ceiling glazed panels that enclose the floor plates are punctuated with inward-opening casement windows to enable the workspaces to be naturally ventilated as part of a mixed-mode ventilation strategy.

ECO's façade engineers engaged with the building's MEP engineers, EEP, to refine the shading solution of timber louvres. Parametric modelling was used to determine the layout and form of the louvres to enable solar control and to maximise daylight on the floor plates, to minimise the need for artificial light. It was also used to meet the daylight levels required for Well and Breeam certification.

The resulting timber louvres run from street level to the roof; they are positioned horizontally on the southern façade, and vertically on the east and west façades. Spaced at 375mm centres, the louvres increase in depth as they ascend the building. A secondary structure supports the timber fins to transfer loads to the 1,200mm-spaced mullions.

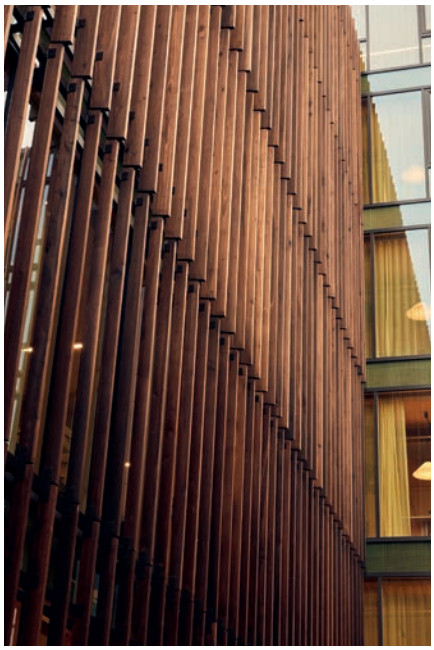
Tulipwood, a readily available hardwood from the USA, has been used to craft the louvres. For this project, it has been kiln heat-treated to enhance its stability and durability, thereby extending its service life. As the building has been designed to be demountable, the louvres can also be removed and repurposed at the end of the scheme's life.

It is one of the first times wood from this tree species has been used in the UK, so EOC had to work with the American Hardwood Export Council to obtain the appropriate testing, strength and durability information.

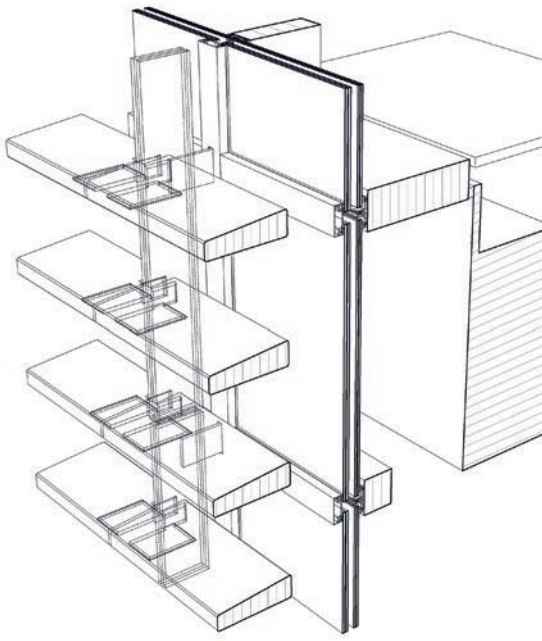
The louvres' fire performance was also enhanced. The European standard EN 13501 defines the reaction-to-fire performance of construction products. To enable the louvres to meet the Class B reaction-to-fire performance, the timber fins are impregnated with a fire-retardant resin to ensure they only make a 'limited contribution to fire'. As there was no UK fire test data available for tulipwood, EOC had to organise for a fire-testing body to undertake testing before the fins were procured.

For this pioneering building to comply with the fire regulations, and to respond to insurance company concerns post-Grenfell, detailing on this project was developed with the client, fire engineer, building control body, and product suppliers and contractors to alleviate all potential risks. Fire performance is further enhanced by having sprinklers throughout the building. As the awards judges recognised, the engineering of the Black and White Building is highly innovative and proof that carbon-minimal construction can be achieved through clever design. It is the tallest mass-timber office building in central London, and its innovative façade sets a new precedent for contemporary low carbon architecture. **CJ**

The floor slabs and staircases are all built from CLT



The louvres increase in depth as they ascend the building



View of the curtain wall with horizontal fins

TAKING THE HEAT OUT OF DECARBONISATION

Eight industry experts came together to discuss the challenges of decarbonising heating in *CIBSE Journal*'s latest roundtable. **Amanda Birch** sums up the main points of debate

Our recent roundtable, on ensuring a balanced and responsible approach to decarbonisation of heating, generated a lively discussion on the challenges of targeting net zero carbon while providing comfortable, cost-efficient buildings.

Factors such as insufficient space for air source heat pumps (ASHPs), oversizing of equipment, noise, vibration, the importance of controls, and inadequate legislation were highlighted as key issues. The event, sponsored by Baxi and held in London, explored ways of optimising heating systems.

The participants began by describing their decarbonisation projects and challenges. Mathew Stark, a senior mechanical engineer at Hoare Lea, cited a current refurbishment scheme. 'We wanted to remove the gas boilers and use an all-electric system with ASHPs, but planning restrictions wouldn't allow anything too tall on the roof,' he said. 'The cooling system uses air cool condensers on the roof and chillers in the basement. Instead, we changed it from a constant air volume to a variable air volume system so we could at least make the system more efficient and decarbonise in that way.'

Simon Wyatt, partner at Cundall and chair of the CIBSE Knowledge Generation Panel, said many building owners are struggling with the best way to decarbonise existing buildings. They question whether they should do minor works now or carry out a deep retrofit over a phased period. Wyatt is involved in decarbonising many existing buildings. His dilemma is whether to try to keep a high-temperature heating system or upgrade the building's fabric.

'The cost of electrification and heat pumps is expensive, but it's a drop in the ocean compared with the cost of upgrading the fabric,' he said. 'If you want to hit those energy intensity targets, this is a real issue and there's no coherent solution.'

Richard Brimfield, associate at Ridge and Partners, and founding committee member of the CIBSE HVAC Group, argued that some of the obvious challenges are finding external space for heat pumps and boreholes, identifying the heat requirement for existing buildings, and

THE PANEL

Richard Brimfield, associate at Ridge and Partners
Jason Donoghue, head of marketing at Baxi
Louis Kimber, mechanical engineering technician at AtkinsRéalis
Ryan Kirkwood, engineering solutions manager at Baxi
Jeremy Owen, principal mechanical engineer at SVM Building Services Design
Daniel Skidmore, director of building engineering at Aecom
Mathew Stark, senior mechanical engineer at Hoare Lea
Simon Wyatt, partner at Cundall and chair of CIBSE Knowledge Generation Panel

BAXI
Roundtable sponsor

"I have more confidence in reducing the size of plant by the methods we use to do space heating calculations" – Richard Brimfield

"Baxi is supplying heating products to a full hydrogen residential trial in Redcar" - Jason Donoghue

simulating how a heat pump operates. He said a current project had hugely oversized existing boilers.

The participants agreed that oversizing is a big problem. Ryan Kirkwood, engineering solutions manager at Baxi, asked whether there is now better guidance on the correct sizing of equipment within the industry. 'Personally, I have more confidence in reducing the size of things by the methods we use to do the space heating calculations,' said Brimfield. 'However, we're still oversizing things; we're never going to get everything perfect.'

Wyatt said that CIBSE is considering producing guidance on efficient sizing. Although there seems to be more confidence in sizing central plant, he agreed that people are still oversizing significantly, partly because of build quality. He cited schools where there is a lot of leakage because of poor airtightness and air permeability, resulting in oversized radiators.

Daniel Skidmore, director of building engineering at Aecom, echoed these views. He highlighted the BBC, one of Aecom's biggest clients, which wants to decarbonise much of its estate. Some difficulties encountered with this project, he said, include how flow temperatures with hot water generation are used, roof-plant acoustics and vibration, and long lead times on plant, and how this can affect the project's planning and timing.

Jeremy Owen, principal mechanical engineer at SVM Building Services Design, said the company is installing ASHPs for a major supermarket. The noise and vibration produced by the heat pumps has been a significant problem given the proximity of housing, he added, so – at some stores – a two-storey gantry has been built above the plantroom where the ASHP and new air handling unit (AHU) are located. »

"When I suggest things such as getting rid of boilers and installing PVs, not only are costs increasing, but embodied carbon is going up too, which really concerns me" – Louis Kimber

Noise and vibration produced by ASHPs is an issue that some manufacturers and noise specialists have said is often overlooked. Hoare Lea has an acoustics team that assesses the operation of the ASHP, and it advises architects on the type of materials and vibration mounts that should be used. 'A lot of the kit we're using with ASHPs is a set size, but massive generation packages are needed on site, so there are space constraints,' said Stark. 'The acoustics are achievable, but the space needed is challenging. So, before we even involve an acoustics specialist, we allow enough space for these packages for all residential projects, because we know we will need it.'

Owen's other main complaint relates to the Building Regulations. 'If we want to decarbonise, the regulations need to be amended to make it work and enable the best technologies to be put forward,' he said, citing a frustrating experience he had with a residential new build. To achieve the SAP calculation, he had to install gas combination boilers with photovoltaics instead of heat pumps. 'This is not right, because the SAP calculation looks at affordability,' said Owen. 'An ASHP is given a C rating because it's less affordable, while a gas combi boiler with PVs gets an A rating; it's ludicrous.'

Louis Kimber, mechanical engineering technician at AtkinsRéalis, said embodied carbon is a growing issue. He has been working with the Government Property Agency's (GPA's) UK sites and exploring what can be done to decarbonise.

'Embodied carbon is not a criterion required by the GPA,' said Kimber. 'But when I'm writing the reports and suggesting things such as getting rid of boilers and installing PVs on the roof, not only are the costs increasing, but the embodied carbon is going up too, which really concerns me.'

Kirkwood said it was refreshing to hear his own concerns echoed. 'We find there is a great deal of confusion and people are often looking for a quick fix,' he added. 'Engineers need time to engineer, to survey and to monitor. As an industry we've almost engineered that out and we need to engineer it back in.'

To optimise heating systems, Skidmore recommended metering be installed in existing buildings, to help understand heating use. An existing system with lower temperatures should be run to see how it behaves. Suggested improvements, he

"Engineers need time to engineer, to survey and to monitor. As an industry, we've almost engineered that out" – Ryan Kirkwood

added, have included upgrades to building fabric, the introduction of ventilation, using domestic hot water with AHUs, and providing enough space for airflow in heat pumps, as correcting flows can be a problem.

Skidmore also recommended using high-efficiency chillers to take the rest of the cooling, instead of implementing a blanket approach. In buildings that have a 24/7 operation where there is a constant cooling demand, he has taken advantage of the waste heat element of ASHPs. However, he argued that ASHPs are the biggest offenders in terms of energy consumption, because they are not being controlled properly.

'We often find that buildings aren't running as smoothly as they should. They are sometimes running at night when they shouldn't and not ramping down enough when they should,' said Skidmore. 'The controls element has been as much a culprit as the plant. We often find that there has been a lack of engagement with the facilities management [FM] team regarding the controls. There have also been

"If we want to decarbonise, the regulations need to be amended to make it work and enable the best technologies to be put forward" – Jeremy Owen

issues with the FM team's expertise of optimising and running the buildings after we've done the work.'

To optimise heating systems in a supermarket, Owen said they rely on a packaged plant, which is a refrigeration integrated heating and cooling system. It takes the heat of the cold aisles and puts it back into the store, and there are a couple of heating coils in the AHU.

It was agreed that education would help in situations where a setting has been changed after it was established to optimise heat rejection. Wyatt added that the design performance assessment will possibly shed light on this issue; however, many of his clients don't take this assessment seriously enough. 'We have 30-odd projects that have gone through design performance assessments and got their energy target rating,' said Wyatt. 'But not one will get anywhere near those targets. The assessment is a de-risking exercise with multiple future scenarios. It's not like an energy performance certificate, where once you've passed it can be forgotten.'

Brimfield then raised the importance of controls and the role artificial intelligence (AI) may have. Wyatt suggested there are two schools of thought: take the fully automated AI path, which seems to be the direction industry is taking, although its complexity and cost can be a barrier; or keep things as simple as possible.

The event concluded with a discussion on hydrogen being piped through the gas grid and the possibility of having localised gas storage. Skidmore said Aecom is focusing on the big district heating schemes and rolling out large projects with low carbon distribution, but he doesn't predict hydrogen playing a major part.

Baxi has developed and tested 100% H2 boilers, and the tests prove they work just fine said Kirkwood. He says that when there a wide availability of H2, production will start. 'We have hydrogen boilers installed in a variety of demonstration projects across the EU and UK proving that the technology is a viable solution,' he added. 'We're doing what we believe is the right thing, but we're not hanging our hat on that. We see a blended source of solutions, including heat pumps, heat networks, and, if required, hydrogen.'

Jason Donoghue, head of marketing at Baxi, said the company had launched two more residential projects, and Baxi will be supplying hydrogen boilers to a new residential trial in Redcar. Kirkwood added that he would like to see a greater focus on heat networks. 'One of the challenges we face is the medium-temperature heat networks,' he said. 'We have a huge number of heat networks sitting on the Grid that are not low carbon. Systems operating beyond where current heat pump trajectory is in terms of performance will be challenging. There's a dichotomy between heat pumps and heat networks – they are not well suited, which is why we are investing in thermal storage research and development.'

Skidmore argued that it can be challenging to drive heat network improvements, and Wyatt agreed, adding: 'District heat networks for existing high-density urban environments have a place, but in low-rise density, heat networks are not always the right solution.' CJ

"The cost of electrification and heat pumps is expensive, but it's a drop in the ocean compared with the cost of upgrading the fabric" – Simon Wyatt

"A lot of the kit we're using with ASHPs is a set size, but massive generation packages are needed on site, so there are space constraints" – Mathew Stark

"The controls element has been as much a culprit as the plant. We often find that there has been a lack of engagement with the facilities management team regarding the controls" – Daniel Skidmore

GOING WITH THE FLOW

Traditional roofs in Japan were designed to deflect rainwater away from a building and these types of roof forms are an elegant and sustainable alternative to the pipework and guttering used now. **Jake Cherniayeff** says a performance-based design approach can achieve similar drainage strategies on modern buildings

Art Gallery of New South Wales Sydney Modern Project has a large glass entrance canopy that allows rainwater to freely drain off the roof into the stormwater system via a purpose-made fabricated steel 'raincatcher' located in the landscaping below

The general purpose of a roof on top of a building or internal space is to keep the weather out, with windows and doors providing an opportunity to let the weather in – mainly daylight and fresh air.

Many traditional roof-construction techniques consist simply of a roofing material over a structure that allows rainwater to collect and run off the side of the building into the landscaping. This traditional technique is still common in countries such as Japan, where, often, less is more in architecture, and the built environment strives for minimal impact on the natural watercourse.

Through early advancement of building techniques, some countries adopted gutters and downpipes in the early 19th century. These were used to convey roof rainwater in a controlled manner to points around the building. Gutters and downpipes can be used around the whole roof perimeter, or local to building openings and awnings where free-draining rainwater might cause a nuisance. Today, gutters and downpipes are necessary to collect rainwater in a central point for harvesting and re-use – let's park this thought for now.

In Australia, our National Construction Code provides the overarching requirement for building rainwater designs to keep water out of the building during a one-in-20-year and one-in-100-year storm. It then refers us to *AS3500.3 Plumbing and drainage – Stormwater drainage* for a guide to achieving this overarching requirement; by following this code, you may produce a 'deemed to satisfy' design.

AS3500.3 is not a one-size-fits-all approach to every building. For example, the charts within this standard limit the flow to any single downpipe to 16l/s. In some instances, this is not appropriate for a building, so the hydraulic design may choose a 'performance-based pathway' for compliance using other recognised standards or calculation methods.

This same performance-based approach can be applied to allow a roof to drain freely, like the traditional Japanese roof structure. A canopy at the Art Gallery of New South Wales Sydney Modern Project is one example (left and below right). The reasons for doing this may be an architectural vision, cost benefits, materials reduction, or a landscape strategy to return rainwater directly to the earth.

When looking to adopt this design philosophy, there are a few considerations that need to be addressed – all of which go back to our overarching requirement to keep water out of the building.

Wind-driven rain and water ingress

Wind has a huge influence on the path of travel for a drop of rain. The dynamic relationship between wind, rain and buildings is complex and challenging to predict without detailed site-specific wind analysis by a wind engineer.

In most cases of building design, wind and rain are intensely affected by the immediate surroundings and topography, and their estimation is limited to environmental data available at that location.

Despite myriad research into wind-driven rain within the built environment, its behaviour is still ambiguous. Also without a body of sound equations available to apply to roof and façade drainage designs, understanding rain behaviour will be on a case-by-case basis.

We know the behaviour is influenced by the local wind climate, the velocity of rainwater as it leaves the roof, height of the roof and distance before a water stream separates into droplets, rain droplet size, and intensity.

Wind experts suggest the angle between the roof and the maximally deflected stream of ejected water is 30°. Using simple trigonometry, we can then calculate the horizontal deflection at ground level.

This can help reduce the risk of wind-driven rainwater ingress. Door and airlock configurations and threshold façade drains should also be considered. Where there is a risk of water entering a critical space, a wind engineer should be consulted.

"The dynamic relationship between wind, rain and buildings is challenging to predict without site-specific wind analysis"

Drip-line effects

Disturbance of hardscaping or landscaping below the drip line could be damaging to a building's reputation or how it is viewed upon approach. It is not uncommon to see building entry-way awnings with a free-draining rainwater approach result in unsightly staining of tiled finishes below the drip line.

Similarly, concentrated flows directed into soft landscaping can result in erosion and disruption of landscaping over time. To overcome this issue, hard landscaping, alternative tile finishes, rockeries, or even drainage features could be considered.

Traditional Japanese building where rain runs off the roof onto the landscape

Overcoming rainwater contamination

As water scarcity becomes more of an issue across the globe, engineers are increasingly including water harvesting – and the reuse of black water, grey water and, more commonly, rainwater – in designs.

Traditionally, harvesting groundwater for local reuse on site has been ignored because of increased levels of organic contaminants risking bacteria growth within stored water supplies, and tannins leaching into the groundwater as it passes through soil and decaying vegetation. This gives the collected water an earthy odour and brownish colour, which can cause staining on fixtures, fittings and fabrics.

Overcoming these challenges is straightforward with filtration, but comes with an increased cost. The actual contamination risk needs to be known, as does the water-quality requirement at the point of use.

If the harvested water is being used for underground drip landscape irrigation, the risk is low and particle filtration may suffice.

However, if the water is for toilets and urinal flushing, where occupants and building owners are at risk of being exposed to waterborne droplets created during flushing, a more robust filtration configuration of particle filtration, UV disinfection or reverse osmosis may be considered. This would also eliminate the risk of staining of fixtures.

With the right approach, a free-draining roof scheme can be an elegant solution, reducing the impact of visible pipework and gutters, and accentuating roof lines and views of the building.

When called on as engineers, we should support architectural expression rather than hide it.

Often, the challenges can present opportunities for alternative performance-based design solutions that allow engineers to show their true value. CJ

JAKE CHERNIAYEFF is Arup's hydraulic and fire services leader, Australasia

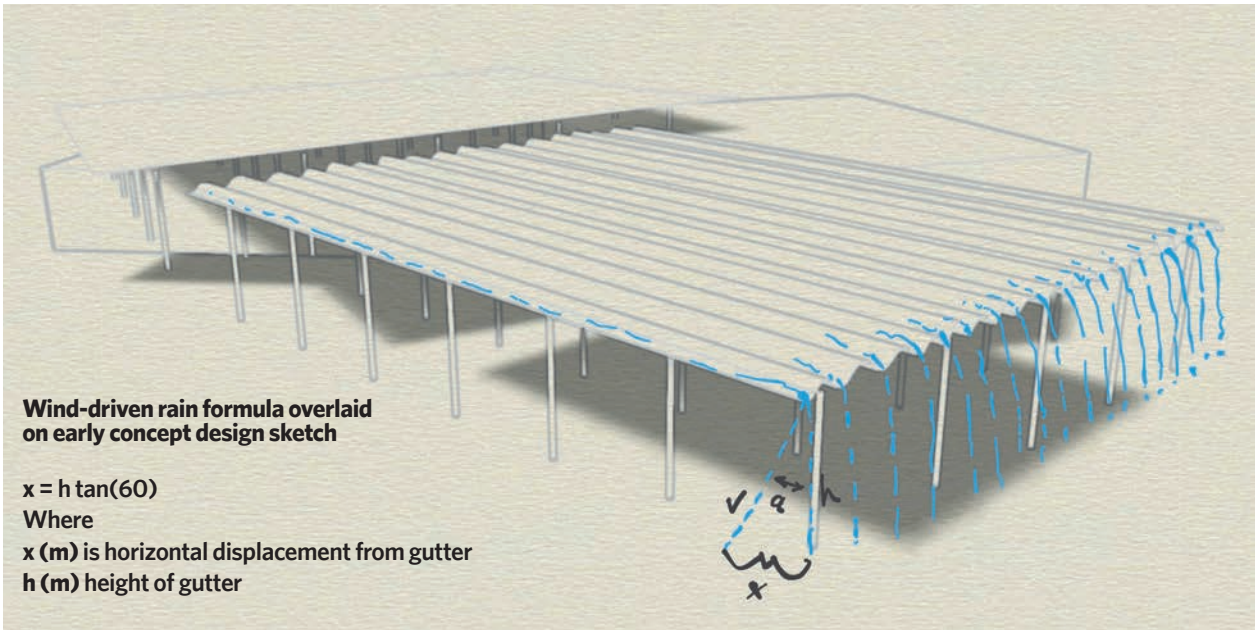


Figure 1: Calculating horizontal deflection of rainwater at ground level for the Art Gallery of New South Wales Sydney Modern Project designed by SANAA/Architectus/Arup

TM66 circular economy guidance and building competence take centre stage at Light2Perform

CIBSE's circular economy guidance TM66 and building competence around emergency lighting are two key areas being tackled at Light2Perform by headline sponsor Tamlite Lighting. The event takes place at ExCeL London on 5 and 6 December, as part of CIBSE Build2Perform Live

Light2Perform, organised by the Society of Light and Lighting with support from headline sponsor Tamlite Lighting, is taking place as part of CIBSE's flagship Build2Perform Live event at London's ExCeL on 5 and 6 December.

Tamlite's presence at the two-day event is centred on two of the most significant drivers for change impacting the lighting industry: CIBSE's *TM66 Creating a circular economy in the lighting industry* guidance, and building competence levels in the design and specification of emergency lighting.

Focus on TM66

With a focus on tools for sustainability, Light2Perform is the perfect platform to explore TM66, which has emerged as a groundbreaking initiative within the lighting industry by promoting circularity and sustainable practices. By providing a standardised framework for verifying the circular credentials of lighting products, TM66 enhances transparency, credibility and trust within the industry.

Tamlite Lighting is a founding member of the TM66 Assured Beta team for circular economy luminaire assessments.

Product verification

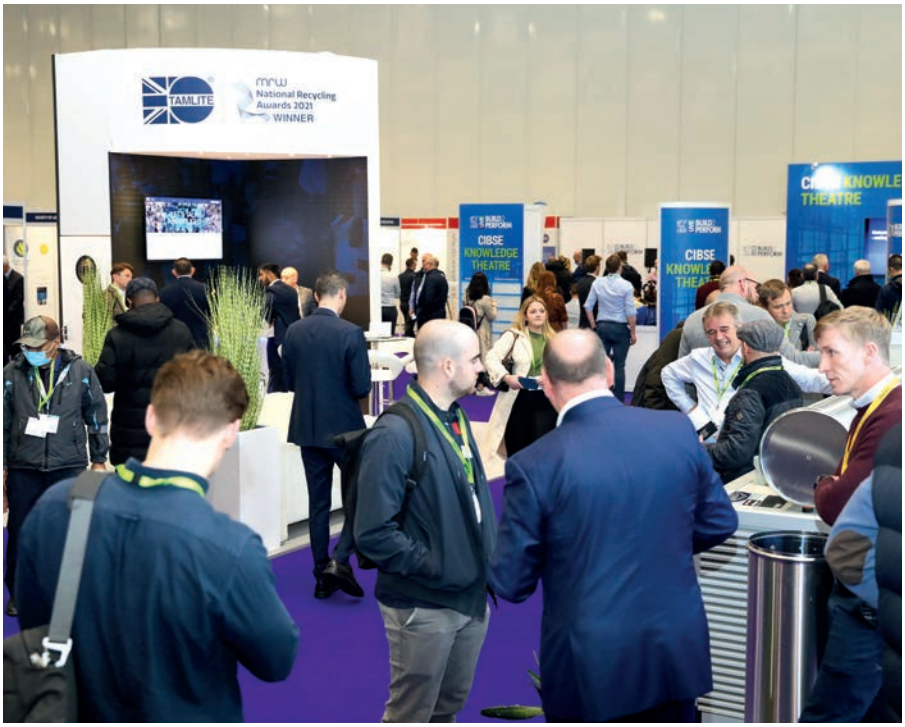
The TM66 scheme is playing a vital role in revolutionising the lighting industry and driving it towards a more circular and environmentally responsible future. Launched in 2023, the TM66 Assured Product Verification Scheme is an initiative developed and fulfilled by the Lighting Industry Association (LIA), and endorsed by CIBSE. The scheme provides an additional layer of credibility and verification to the already comprehensive TM66 toolkit.

To date, Tamlite has achieved TM66 Assured Product Verification on more than 20 of its products, including the Revo Sport, a high-output luminaire for sports halls that achieved one of the highest scores awarded by the LIA.

Debbie-Sue Farrell, head of wellbeing and marketing manager at Tamlite Lighting, sees TM66 as central to the company's focus on sustainable solutions: 'By actively participating in the TM66 scheme, Tamlite is demonstrating its commitment to advancing the adoption of environmentally friendly practices in the lighting industry. The aim is to assist consultants and specifiers in making informed choices when it comes to selecting sustainable luminaires.

'We are delighted to support Light2Perform, which provides a vital platform for professionals to build their understanding of circularity, responsible specification, and good practice.'

Visitors to Light2Perform can learn more about TM66 and Tamlite by booking a place on **Tamlite's Circular Economy CPD**, which takes place on day two. **See bit.ly/CJTamB2Pcirc**



Emergency lighting

Emergency lighting is in the spotlight following recent changes to the Building Safety Act. Right across the supply chain – from lighting designer, architect and consultant to electrical contractor, facilities manager and building manager – professionals need to stay fully up to speed with the latest guidance and regulations in this area, as well as demonstrate competence.

To support specifiers, Tamlite is presenting its CIBSE-approved CPD module, *Common pitfalls with emergency lighting compliance,* at Light2Perform. This session covers best practice, current regulations and standards, and system design and types. See **bit.ly/CJTamB2Pel**

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CIBSE JOURNAL

LIGHTING SPECIAL

LETTING IN LIGHT AT THE NATIONAL PORTRAIT GALLERY

CALCULATING EMBODIED CARBON IN LIGHTING

Glacial beauty

Juxtaposition of light and steel creates stunning backdrop to Norwegian rest stop

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EDITORIAL

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

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Tel: +44 (0)1223 378000.
www.cplone.co.uk
1 Cambridge Technopark, Newmarket Road,
Cambridge CB5 8PB.

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

Lighting innovations

In the dynamic field of lighting design, it is crucial for industry professionals to stay abreast of exciting technologies and sustainable practices.

Circular lighting has taken centre stage recently, incorporating environmental and life-cycle analysis into design. CIBSE's *TM66: Creating a circular economy in the lighting industry* is an accessible toolkit for assessing the circularity of luminaires (see page 33).

There is also growing recognition of how control systems are now integral to lighting schemes, enhancing energy savings and wellness, as highlighted in the updated *LG14: Control of electric light* (page 34).

New methodologies for preserving lighting quality and reducing energy use must be embraced. A project at the National Portrait Gallery in London used advanced lighting control techniques to reintroduce daylighting into the gallery without causing damage to the exhibits (page 40). It is an example of how natural light can be harnessed to lower both operational and embodied carbon.

Combining natural and artificial light, an award-winning low-energy lighting scheme in Norway has created a stunning building inspired by the surrounding landscape (page 38).

Molly Tooher-Rudd, junior reporter for the *CIBSE Journal*

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Taking the circular stage

Light2Perform takes place as part of Build2Perform Live this month, and Tamlite Lighting is headline sponsoring again. We have our own presence at the two-day event, centred on two of the most significant drivers for change impacting the lighting industry: building competence levels in the design and specification of emergency lighting; and CIBSE's *TM66 Creating a circular economy in the lighting industry*.

TM66 is central to Tamlite's focus on sustainable solutions. By actively participating in the TM66 scheme, we are demonstrating our commitment to advancing the adoption of environmentally friendly practices in the lighting industry. The aim is to assist consultants and specifiers to make informed choices when it comes to selecting sustainable luminaires.

We are delighted to support Light2Perform, which is a vital platform for lighting professionals to build their understanding of circularity, responsible specification and good practice. With a focus on tools for sustainability, it is the perfect event to explore TM66, which has emerged as a groundbreaking initiative within the lighting industry by promoting circularity and sustainable practices. In providing a standardised framework for verifying the circular credentials of lighting products, TM66 enhances transparency, credibility and trust within the industry.

Tamlite Lighting is a founding member of the TM66 Assured Beta team for circular economy luminaire assessments.

Join us as we deliver two important CPDs at Light2Perform – *Towards a circular economy for luminaires* and *Common pitfalls with emergency lighting compliance*.

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

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Navigating the circular maze

How are the new CIBSE/SLL circular tools measuring up? Nulty's Gary Thornton discusses plotting a path to sustainability from a lighting designer's perspective

The path to sustainability is a well-used phrase, but navigating this ever-evolving issue feels more like a maze. Facing up to this has led to a realisation that we can't wander along aimlessly or take shortcuts.

Fortunately, the lighting industry has been working tirelessly to put tools in place to help designers find their way.

We're now starting to see the influence of *TM66: Creating a circular economy in the lighting industry*, which establishes an accessible methodology for assessing the circularity of luminaires.

It's still early days for TM65.2, the lighting addendum to the *TM65 Embodied carbon in building services* calculation tool, but it's a toolkit we must embrace as we're at the cusp of understanding the embodied carbon emissions associated with a light fitting.

Pre-TM66, the lighting industry was pulling away from a linear model of take, make, use and dispose, but recycling had become our safety net, and the circular economy was an aspirational concept.

At Nulty, we were trying to include environmental and life-cycle analysis research on our specifications. It was progress of sorts, but with everyone starting to create their own metrics, there was no easy way to compare results and make like-for-like comparisons between specifications.

"With everyone starting to create their own metrics, there was no easy way to compare results and make like-for-like comparisons between specifications"

TM66 changed this by giving us CEAM-Make and CEAM-Specify, two metric-driven tools that created a base line from which to compare and appraise luminaires. It enabled us to hold ourselves accountable as a practice.

In April 2023, we embedded the TM66 methodology into our design process and set ourselves a target of achieving a two or above score for 50% of specified luminaires across all projects over six months. Our goal was to establish a minimum threshold and make circularity a non-negotiable attribute in our design specifications.

It's has been a big learning curve. Projects come with a challenging mix of constraints, so adding circular principles into the mix is not easy, especially as we operate in a time-sensitive industry with demanding project programmes. It takes time to pull in the data. Manufacturers need a few days to respond to TM66 requests and we have to plan ahead to populate our specifications. There's also work to be done to achieve the depth of detail required. The majority of TM66 scores that we received over the past six months came via the CEAM-Specify triage tool; in some instances, we had to give products a 0 score when manufacturers couldn't provide the information we asked for.

All of this shows us that the circular economy is a proposition in its infancy. We need widespread adoption of TM66. Lighting designers can help by advocating the need for data to back up decision-making. It should be our responsibility to encourage manufacturers to adopt TM66, and clients to invest in sustainably viable luminaires by using the data from TM66 to safeguard our specifications.

Like the rest of the built environment industry, we have a lot to learn about calculating the embodied carbon emissions associated with a light fitting. TM65.2 is relatively uncharted territory for us all, so it's important that we use this tool to accelerate learning. It establishes a framework for assessing the embodied carbon values in the short term, to give manufacturers the time they need to dig into the seemingly infinite layers of detail around materials, processes and supply chains.

In its current iteration, TM65.2 can give us indicative estimates of embodied carbon emissions, which will help to improve our knowledge on a holistic level and create a context in which more informed decisions can be made. It's a work in progress, and we're a long way off the tipping point where we can affect the design process, but TM65.2 can be an educational tool to move things along.

The lighting design industry should also improve its definition of the term net zero. We need to move away from separating embodied and operational carbon when we assess project carbon footprints. We need to widen the scope to consider how that building performs over time, how it's dismantled, and how it's repurposed after use.

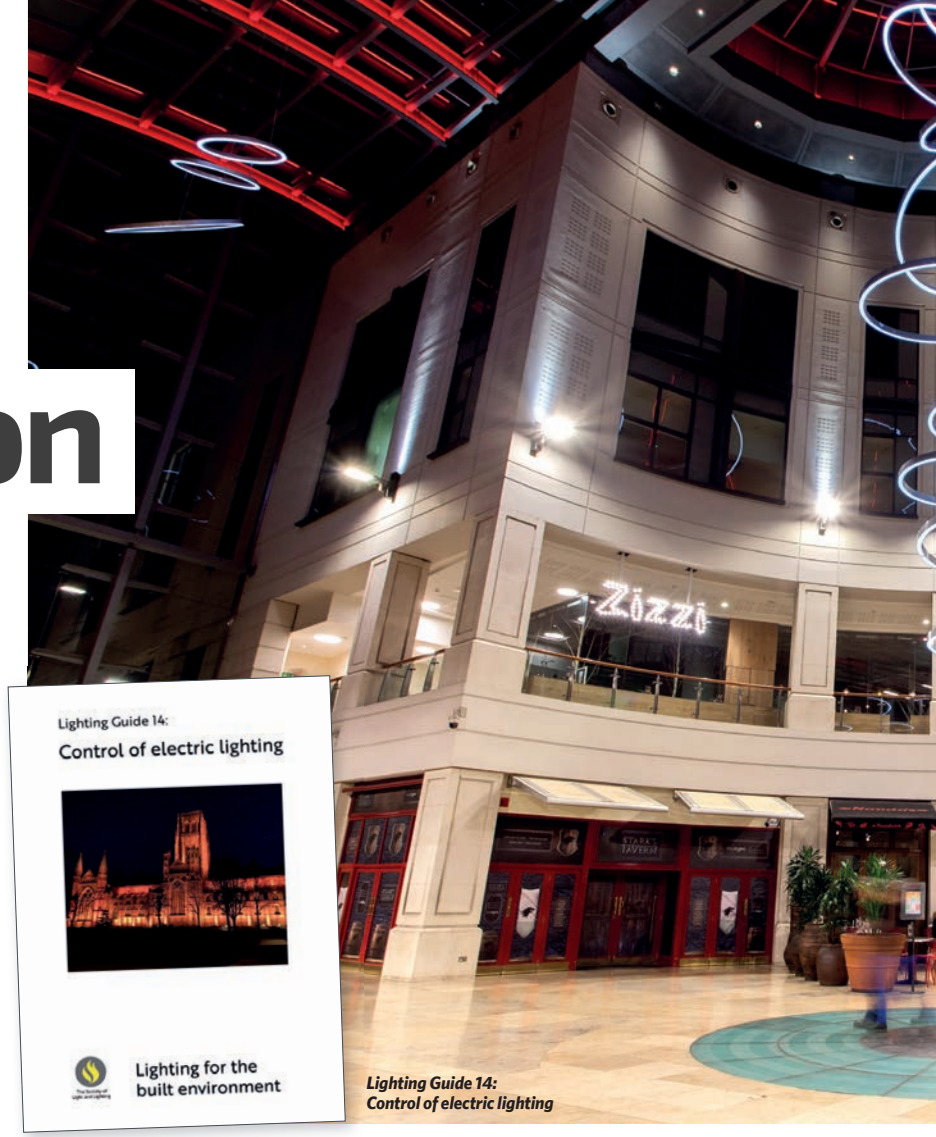
Whole life carbon calculation is the direction in which we should be pointed – we need to make this term an instinctive way of thinking, as it will make sustainability easier to navigate in the long run. It's one thing to design a carbon-neutral lighting scheme, but another thing entirely to deliver a carbon-neutral project.

TM66 and TM65.2 are available at **www.cibse.org/knowledge**

GARY THORNTON
is an associate lighting designer at Nulty

Control explosion

No longer an optional extra, control systems have become an integral component of lighting schemes. Jill Entwistle talks to Sophie Parry about the Society of Light and Lighting's updated guide to an increasingly important field



Lighting Guide 14: Control of electric lighting

It isn't that long ago that control systems for architectural lighting were regarded as a bolt-on, rather than an integral part of a lighting design. From a budgetary point of view, they could be easily lopped off as an unnecessary extravagance.

They were regarded as somehow arcane and complicated. Anecdotal evidence suggested that, where they were installed, they might be left on a default setting or manually overridden, because no one really understood how to operate them.

Lighting Guide 14: Control of electric lighting, first published in 2016, was an indication that things had changed. 'A decade ago, it was quite common for lighting controls to be seen as an optional extra to schemes, and they would often be "value engineered" out of a project,' says Sophie Parry, author of the first LG14 and the new update.

'The aim of LG14 was to demystify, as far as possible, the subject of lighting controls, and allow informed and objective decision-making for the application of controls to lighting projects.

'In the eight years since LG14 was conceived, the industry has evolved to the extent that automatic lighting controls are now an essential and integral part of the majority of lighting designs. The key reason is the versatility of LED light and its easier controllability.'

As a result, there has been a sharpening of purpose and a notable rise in the use of lighting controls in applications such as energy reduction, wellness, and exterior lighting. See panel, 'Why lighting control is becoming critical'.

What's new in LG14

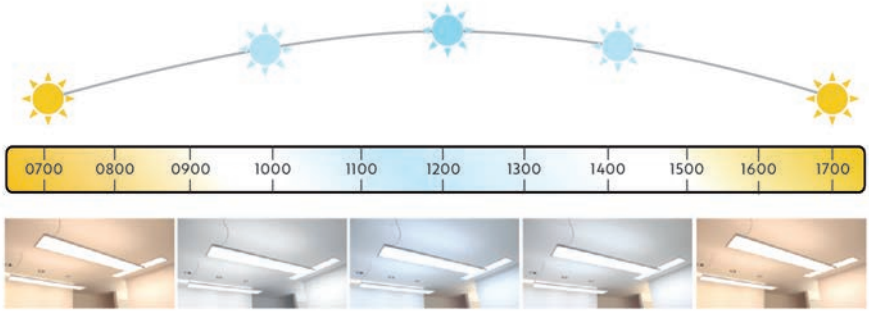
The first chapter is an overview of advances in lighting control technology and applications since the first edition was launched in 2016, while the following chapter looks at the significant updates in terminology and acronyms used.

'I have noticed that specifications often ask for certain aspects of lighting control performance on projects where the specification author is not entirely clear what the terminology means,' says Parry. 'There is, therefore, information on less-than-obvious terminology and its application.'

Chapter three focuses on how to design and manage clients' expectations. 'The best approach is to design the lighting and specify the luminaires to be used, then determine, with the client, how the lighting should be controlled to suit requirements,' says Parry. 'These will include meeting legislative or performance-related energy saving stipulations, in addition to the client's needs.'

Once performance criteria are established, the correct lighting controls can be selected. 'It's also a good idea, at this stage, to revisit the luminaire schedule, to ensure that the luminaires contain – or can be supplied with – compatible control gear, to ensure correct operation with the lighting control system,' says Parry.

The fourth chapter focuses on the human factor and the impact lighting has on the people using the spaces. This includes examining typical spaces where different modes of lighting control are known to be most effective. Considerations should include whether absence or presence detection is necessary, for instance – or if a risk assessment shows that automatic lighting controls that suddenly switch the lights off unexpectedly could be a health and safety risk.



Integrative (or human-centred) lighting, showing how colour temperature mimics natural daylight

Left: A lighting installation where controls provide an hourly show. The combination of LEDs and control systems has allowed a more theatrical element in architectural lighting

Chapter five covers the use of lighting controls for creating visual interest and visual comfort. Correct luminaire control gear and compatible lighting controls will be required for the operation of integrative (human-centric) lighting schemes.

Energy reduction is one of the key applications for lighting controls, and is the focus of chapter six, which particularly looks at legislative requirements.

LG14 uses Approved Document L of the Building Regulations, Vol 2, for England as the basis of discussion. Approved Document L also includes the lighting energy numeric indicator (Leni) calculation method in its simplest form. This is reproduced with additional commentary in the second edition of LG14.

Leni is derived from BS EN 19193-1 *Energy performance of buildings – Energy requirements for lighting* and is considered the most accurate method of predicting lighting energy usage. It also allows for the benefits of lighting controls to be calculated. The output of the calculation is expressed in $kWh{\cdot}m^{-2}$ per annum.

'This means that the projected cost of lighting energy and the carbon footprint can be calculated easily,' says Parry. 'If factoring in, or factoring out, the energy-saving benefits of lighting controls, the lighting design starts to get interesting.'

This exercise can make two points, according to the guide:

- The annual energy savings as a return on making the investment in automatic lighting controls, as opposed to not using automatic lighting controls
- That the inclusion of automatic lighting controls might make the difference between compliance or non-compliance with Approved Document L.

'That said, lighting designers often shy away from using Leni, because it can seem daunting and time-consuming,' Parry adds. 'However, as the industry moves towards a net zero carbon future, designers will have to embrace new design methodologies for preserving the required lighting quality and using less energy.'

WHY LIGHTING CONTROL IS INTEGRAL TO GOOD DESIGN

- **Energy reduction: the cost of energy has risen significantly, and controls can deliver an annual financial saving on energy costs of at least 20-30%, in addition to the savings made with LED lighting. Daylight linking, dimmability, and presence and absence control are all key facilities in reducing energy use.**
- **Wellness: the growing recognition of the importance of wellness in the workplace has meant a newer role for control systems. Both daylight and electric light play their part in this area – they need to work in harmony to deliver good-quality illumination that considers photopic and melanopic light.**
- **Exterior lighting: there has been a significant rise in the use of external lighting that goes beyond just providing functional night-time illumination. Many external lighting schemes now use coloured light, and will often have the ability to create different lighting scenes to suit particular events and occasions. The flip side is that night-time light pollution has increased. However, in addition to good luminaire and lighting design, lighting controls can reduce light pollution and save operational energy and reduce operational carbon.**

The next section discusses data sharing and the role played by lighting control systems in smart buildings.

Information on room occupancy status provided by networked lighting control systems was already possible when LG14 was first published. The most common example at the time was to share room occupancy data in real time with the building management system to optimise the performance of HVAC systems.

There has been a marked increase in the use of controls to automatically test and generate fault and test reports for emergency lighting.

'The use of the lighting control network with auxiliary sensors to collect additional useful data – such as lighting energy and maintenance, temperature, humidity, and air quality – makes it possible to create a more pleasant environment for the end user,' says Parry. 'It also enables more informed decision-making relating to building comfort, wellness, FM, and energy costs.'

However, she points out that the innovative technology also brings new engineering and design challenges, including cybersecurity considerations, which are explored in this section.

Chapter eight covers commissioning and handover, which, says Parry, 'should be the most obvious subject, but sadly, in practice, it is not the case. Often, the more simple lighting controls installations are not fully commissioned and tested, which means they are not likely to deliver the design intent.'

LG14 recommends that commissioning should include a handover process, usually to FMs. It should involve an explanation of what can be done to effect maintenance or system changes, and be provided in layman's terms. 'Typical examples might include how to use a scene-setting switch in the conference room,' says Parry.

The chapter also makes reference to CIBSE Commissioning Code L: Lighting, which was revised in 2018. 'This provides the means of developing a commissioning method statement for a lighting installation project where the luminaires, controls, emergency lighting, and auxiliary data interfaces with other services form the basis of a common lighting design,' says Parry.

The guide concludes with case studies of lighting control installations in places of worship, education and offices. CJ

- ***Lighting Guide 14 (LG14): Control of electric lighting (2023)*** is available at **bit.ly/CEL23CIBSE**
- **SOPHIE PARRY** FSLL is head of the Trilux UK Akademie. and chair of SLL's technical and publications committee. The article is based on one in *Light Lines* July/August 2023
- **Case study contributors:**
  DAVID HOLMES MCIBSE HonFSLL;
  SIMON ROBINSON FSLL, technical director at WSP

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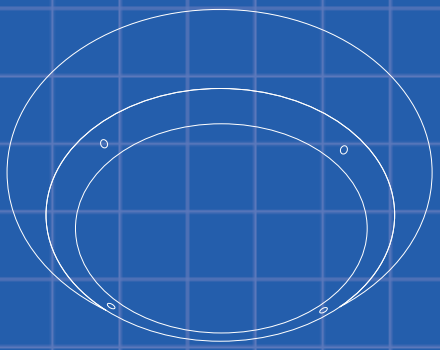

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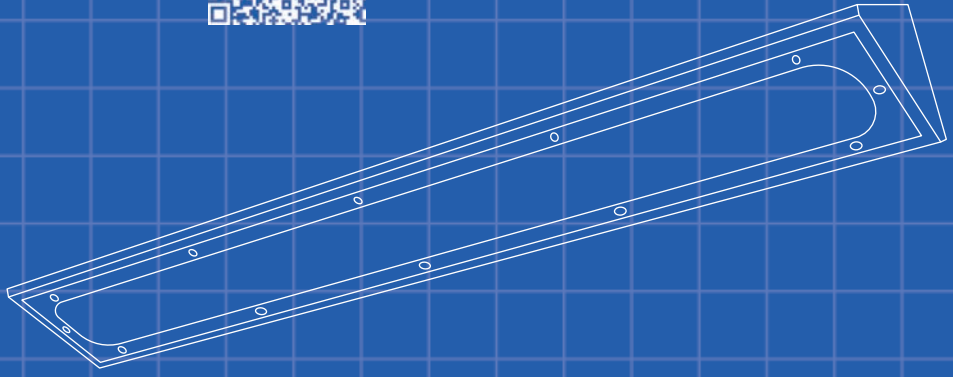

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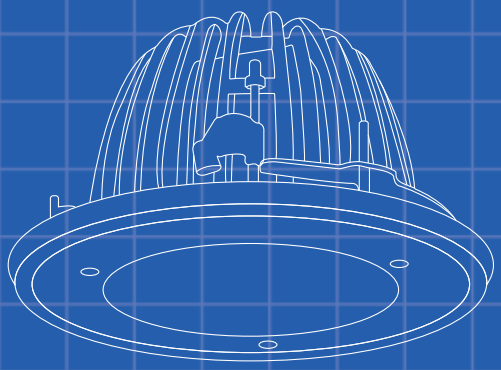

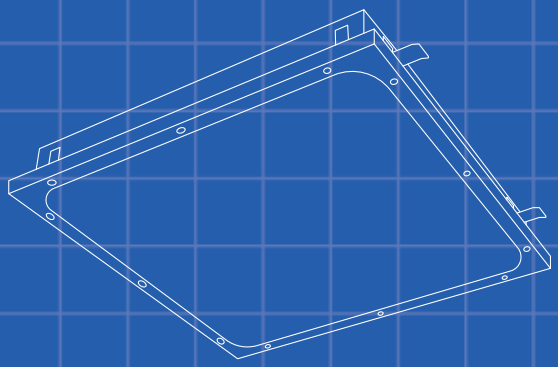

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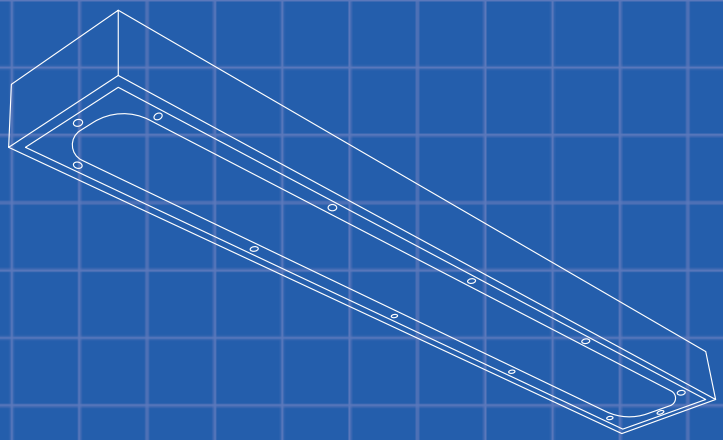


Glint of steel

An award-winning low-energy lighting scheme tuned into the stunning natural backdrop of its Norwegian landscape for inspiration. Jill Entwistle speaks to the designers behind the Espenes scenic rest stop

Espenes is a rest stop on a scenic route along Sørfjorden, a 38km-long fjord on the road between Kinsarvik and Odda in northern Norway. Designed by Code Arkitektur as part of the Norwegian Scenic Routes initiative, the new structure for hikers and visitors sits in a powerful landscape with a stunning view of the fjord and mountains.

Measuring 64m long and 4m wide, and with 12 roof modules of varying heights, the stainless steel structure houses toilets and seating. The elegant, simple geometry of the design is unashamedly contemporary, but created to complement, rather than compete with, its surroundings.

'The double-curved roof construction has a horizontal roof line, which is a reference to the fjord, and an undulating roof line, which is a reference to the mountainsides,' says Code Arkitektur. 'When you rest under the vaults, you experience different sections of the landscape space, together with the changing reflections of the light in the steel.'

The lit effect at night follows similar principles. 'We set out to create a visible landmark after dark, in tune with the local landscape,' explains Light Bureau's UK design director, Arve Olsen. 'Our lighting design is inspired by the location and the surrounding nature: the cool moonlight that illuminates the mountain tops and the nearby glacier, in contrast to the warm, human light.'

The roof and wall surfaces are shaped by hand and welded together from 6mm-thick steel plates. The steel walls are kept free of equipment and all technical installations are cast into the concrete deck. Cool and warm light is used to create a clear distinction between the indoor and outdoor spaces, the columns, in cool light, framing the view towards the toilet, in warm light.

'The cool light of the outer walls is designed to contrast with the warm interior,' says Olsen. 'As lighting designers, we aimed to accentuate the sculptural shape through an interplay of light, darkness and contrast in the colour temperature.'

The lighting of the ceiling surface is asymmetrically designed to give two different visual impressions depending on the direction from which it is viewed, while

> "The intensity of the light on the steel wall had to be experienced visually. Therefore, tests were crucial"

The roof and wall surfaces are made from 6mm-thick steel plates

The rest stop is designed to both integrate and contrast with nature

the reflections in the steel create a play of light. 'The intensity of the light on the steel wall had to be experienced visually,' explains Olsen. 'Therefore, tests were crucial, to ensure good detailing and to see the actual effects of light.'

The luminaires are discreetly moulded into the deck and integrated into door frames. To achieve functional lighting in the toilets, each cubicle is equipped with a special bollard, in steel and acrylic – produced by the metal workshop Størksen in collaboration with UK company Stoane Lighting – which acts as a floor lamp and provides a soft light in the room.

The light from the bollard balances with the light in the door frame, which is made of steel and hardened glass. The lighting is controlled by sunrise and sunset times, as well as sensors in the lock box on the toilet doors, so that the light intensity increases when the toilet is in use. 'This limits energy consumption and unnecessary lighting when the rest stop is not in active use, and lets the fjord and mountains set the stage,' says Olsen.

The light levels are generally dimmed to limit the impact on the surroundings and local ecology, and to minimise glare, preserving the view from the rest stop. The remaining architectural lighting is balanced against the dimly lit roof – less than 40W is used to illuminate the 50m-long roofline.

In fact, the scheme is as much about what is not lit as what is. The road that leads to the rest stop is not illuminated and the lighting of the rest stop area is limited to the construction, with darkness also maintained in the car park and access road.

Designed to attract visitors to remote destinations in the country, Norwegian Scenic Routes is a cultural project that unites architects, artists, designers and craftspeople with a common goal of creating destinations across the country through architecture. Along the routes, architectural structures are designed to both integrate and contrast with nature. CJ

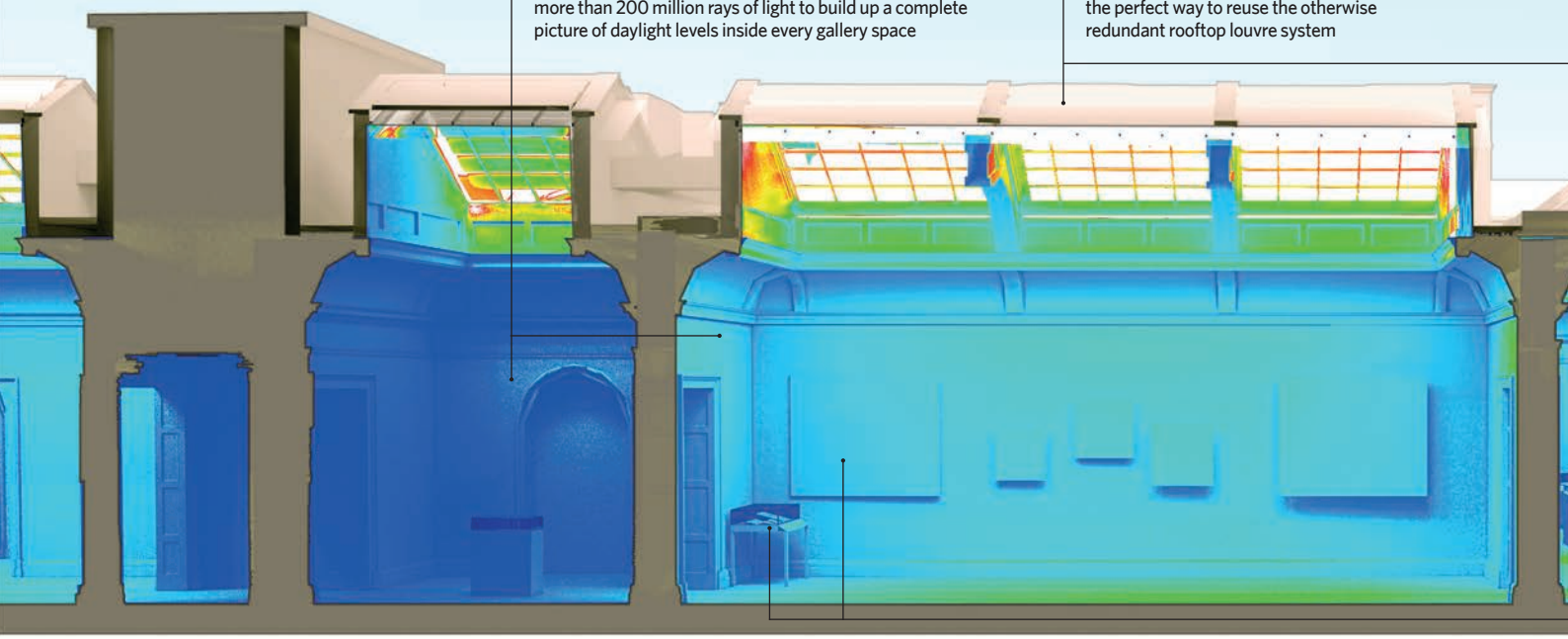
- The Espenes rest stop won an IALD Award of Excellence 2023, and Platinum and Green in the Build Back Better Awards 2023.

The cool light of the exterior walls contrasts with the warm interior light

The undulating roofline is a nod to the surrounding mountains

PROJECT TEAM

Lighting design: Light Bureau
Architecture: Code Arkitektur
Key suppliers: LightGraphix, Stoane Lighting, Fagerhult, iGuzzini



Max Fordham used a digital twin during the renovation of the National Portrait Gallery

The digital twin was able to calculate the distribution of the sun and skylight inside the National Portrait Gallery every 15 minutes across the course of a test year, accurately tracing more than 200 million rays of light to build up a complete picture of daylight levels inside every gallery space

Different options for daylight control were tested using the digital twin, with parametric optimisation employed to discover the perfect way to reuse the otherwise redundant rooftop louvre system

Lighting up the gallery

Advanced techniques in lighting analysis are allowing designers to reintroduce daylighting into galleries without damaging the exhibits or causing visual discomfort to those viewing them. Max Fordham's Nick Cramp highlights the benefits

There are many benefits to bringing daylight into museums and galleries – from improving the quality of lighting and saving energy and emissions, to providing a healthy environment that fights the 'gallery fatigue' visitors can otherwise face.

Though many of our museums and galleries were designed to be lit primarily, or even exclusively, with daylight, those openings have often been blocked up over the years because of concerns over conservation and light damage. The unintended effect of these measures has been to lessen the connection with the outside, making orientation more difficult and depriving occupants of the wider benefits of natural light.

Max Fordham is routinely tasked with safely reintroducing daylight into existing galleries and museums, as well as ensuring that we make the best use of natural light and views in our new-build projects. The challenge is to create beautifully day-lit spaces that maintain the standards of conservation needed for the utmost care of precious exhibits.

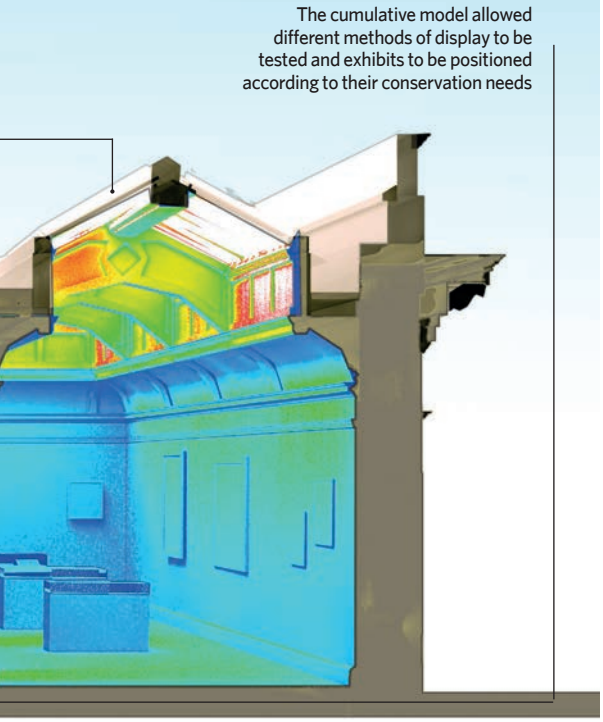
Our constantly changing climate means daylight levels are inconsistent and we need to aggregate them over a long period of time to understand them properly. The technology needed to undertake these kinds of virtual studies, as well as to validate them through long-term onsite monitoring, has only been developed recently, and is allowing us to use daylight much more extensively.

A good example of this is at the Hayward Gallery on London's South Bank, where we were able to restore the iconic roof pyramids and return daylight to the galleries after an absence of 30 years.

Advanced analysis techniques now allow us to understand more precisely the distribution of natural and artificial lighting in every space, and we are able to give curators a much larger display area without increasing the size of the building. This, in turn, lessens our reliance on energy-intensive conditioning systems and allows us to greatly reduce the embodied carbon emissions of museum projects, through reuse and restoration, rather than demolition and rebuilding.

In the Queen's Diamond Jubilee Galleries at Westminster Abbey, our detailed daylight modelling enabled the exhibits to be carefully placed around the path of incoming daylight. They filled previously unused spaces at balcony level and created a whole new gallery without the need for an extension.

Max Fordham built on this experience and created a digital twin of the National Portrait Gallery during its recent renovation, simulating the contributions of sunlight and skylight to the internal spaces over the course of a test year, using existing measured and future climate data. To achieve this, we generated 8,000 simulations, each requiring the accurate tracing of more than 200 million rays of light.



Cumulative exposure (klux hours)

The National Portrait Gallery is now 'reconnected with its surroundings'

> "A well day-lit gallery needs complementary artificial lighting, bringing flexibility, mood changes, and the ability to focus light onto exhibits"

The design team then used the lighting model to plan exhibitions, design the artificial lighting, and test different approaches to window and rooflight treatments. The outcome has been a gallery reconnected with its surroundings, where visitors and staff can easily find their way about, and where the subtle changes in natural light over the course of each day offer a uniquely healthy and stimulating visual environment.

We also used the digital twin to repurpose the redundant system of rotating sun louvres – installed on the roof at the turn of the millennium – into new fixed shades. This eliminated the need to power them all day or to replace them as they fail. All the site team had to do was rotate each of the louvres to their perfect pitch to allow the natural light in the galleries to vary in close communion with the outside world, while the artworks remain safely within current conservation limits.

A well day-lit gallery needs a complementary system of artificial lighting, bringing flexibility, changes in mood, and the ability to focus light onto exhibits, as well as the facility to use the institutions outside daylight hours.

The key trends in exhibition lighting at present follow those of the wider construction industry, with an increasing emphasis on human wellbeing, inclusivity and sustainability. In lighting terms, this means ensuring that the installation addresses the specific needs of different groups, such as: older people, who require more light to see clearly; those on the autism spectrum, who can be more sensitive to glare and for whom adaptable lighting with breakout spaces can offer respite; and people with dementia, who can be helped by designing away dark corners and sharp contrast within the galleries. Our aim is to achieve these goals using the minimum amount of energy and resources.

A thoughtfully designed artificial lighting installation can support the efforts of curators who are trying to create a more inclusive narrative in their museums and galleries. This means providing lighting for a much wider range of objects in a single space, often including those that may reveal a broader section of our history, but which are more sensitive to light – such as old photographs and letters.

The recently reopened National Portrait Gallery is a good example of this approach. Flexible, Bluetooth-controlled lighting structures enabled us to carefully position objects with different conservation needs in the same space, while still allowing views out and an overall feeling of brightness and clarity.

Advances in lighting controls and colour management mean we are able to design whole systems that can be adjusted for tone and colour temperature, allowing us to tune the lighting to each object so that they can be revealed to visitors in the best way possible.

At the Southbank Centre in London, all the lighting is digital multiplex (DMX) controlled and red, green, blue, white (RGBW) enabled, so each space can be put to many different uses, such as live music in the foyers and club nights in the café.

In summary, museums and galleries can benefit greatly from the judicious use of daylight, especially when coupled with a dynamic and flexible artificial lighting scheme. By combining advanced simulation techniques with the latest technologies in lighting and glazing, we can deliver cultural projects that are healthier, more engaging, more inclusive, and lower in both embodied and operational carbon. **CJ**

NICK CRAMP is a partner director of Light + Air at Max Fordham

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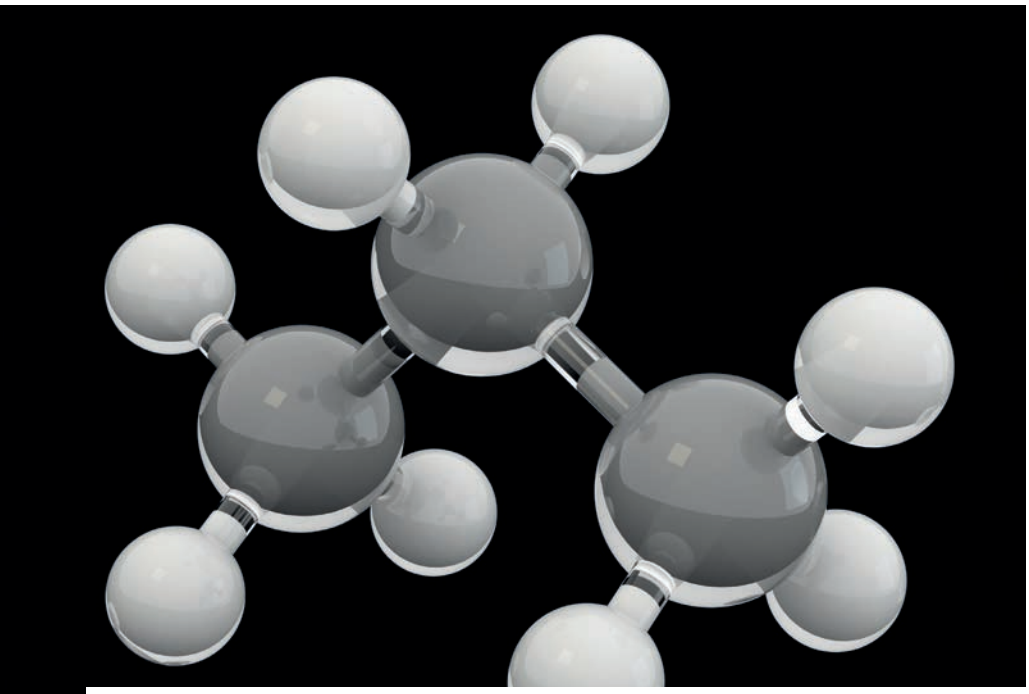

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Propane refrigerant for heat pumps and air conditioners

This module considers challenges and developments in the use of propane refrigerant for building services applications

It is seven years since *CIBSE Journal* produced a CPD article specifically on the application of refrigerant R290 – propane – that, at the time, was likely seen by many as an outlier in the refrigerant marketplace. Over the intervening years, the relative benefits, challenges and opportunities of using such refrigerants – one of the 'natural' refrigerants – have moved on significantly. This CPD will highlight the continuing challenges, and consider the changes that appear to be ushering in the new era of propane-charged heat pumps and chillers.

The quest for more environmentally benign refrigerants gained international prominence when it was discovered that the synthetic refrigerants chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) were adversely impacting the global ozone layer. Under the 1987 Montreal Protocol,[1] many countries agreed to phase out CFCs and HCFCs. This accelerated the application of hydrofluorocarbons (HFCs) that – although exhibiting zero ozone depletion potential (ODP) as they have no chlorine content – were subsequently associated with global warming. The 2016 Kigali Amendment set a schedule for countries to gradually reduce HFC consumption, initially with developed nations taking the lead, and now recognised by 155 countries.[2] The global initiatives to reduce the use of high-global warming potential (GWP) refrigerants have a significant focus on the reduction in the use of fluorinated HFCs and hydrofluoroolefins (HFOs). In Europe the F-gas regulation,[3] initiated in 2016, set the pace, and this has provided the basis of the subsequent UK F-gas regulation.

Recently, in October 2023, revisions to the EU F-gas regulation were provisionally agreed[4] to accelerate the implementation of measures towards the phasing out of HFC consumption by 2050, with the production of HFCs phased down to a minimum (15%) from 2036. A full ban was provisionally agreed, commencing in 2027, for specific chillers, small (<=12kW) monobloc heat pumps, and air conditioning with F-gases with a GWP >= 150, with complete F-gas phase out in 2032. For split air conditioning and heat pumps that contain F-gases, the agreement was for a full ban starting in 2035, with earlier deadlines for systems with higher-GWP refrigerants. There was some wriggle-room included to support the aspirations of the EU to significantly increase the adoption of heat pumps – most of which currently use HFCs.

However, the suggested revisions will have a very significant impact on the selection of refrigerants and systems. Notably, the revisions also introduce certification schemes covering the safe handling of natural refrigerants. Simultaneously, the US Environmental Protection Agency[5] announced enhanced provisions for the reduction and reuse of HFCs that will apply to products both produced in the US and imported. This will undoubtedly influence the global marketplace.

Separately, a recently completed consultation[6] by the European Chemicals Agency considered proposals to restrict the use of per- and polyfluoroalkyl substances (PFAS) across the EU. The inclusion in the potential banned list of single component gases R125, R134a, R143a and the HFOs R1234yf and R1234ze(E) affects virtually all new and current lower-GWP HFC/HFO refrigerant blends.[7] This has excited a huge response, including from trade organisations representing the refrigeration and air »

» conditioning sector, who claim that the timeline of proposed reductions is practically impossible to meet.

As reported[8] recently by the UK Committee on Climate Change (CCC), following the UK's commitment to the 2008 Climate Change Act[9] and the 2015 Paris Agreement,[10] the UK government aims to reduce F-gas emissions to less than 3.4MtCO_{2e} by 2035, from 11Mt in 2021, with most of the planned reduction coming from the UK F-gas regulation. UK F-gas emissions have fallen over the past few years, decreasing by 6% in 2021; however, emissions remain higher today than in the early 2000s, and only 26% lower than 1990 levels. The CCC has determined that the consumption of HFCs must decrease to 15% of 2015 levels by 2035 to meet the UK government's target. The UK F-gas regulation provides the mechanism to reduce this if, as CCC notes, it is successfully enforced. The CCC also recognises the risk that emissions may increase with the roll-out of heat pumps, which currently mostly use F-gas refrigerants, unless the UK government takes action to ensure that there is a shift to non-F-gas refrigerants (such as propane, R290 and CO_2, R744). Although the UK government has committed to reviewing the UK implementation of the F-gas regulation, there is, as yet, no clear legislative timeline, and no indication as to whether it will follow the lead in the recent provisionally agreed changes to the EU F-gas regulation

However, industry has not stood still. There has been a significant transition away from the use of R-410A (that was originally developed to displace the high-ODP refrigerants, such as the lower-pressure HCFC R22, chlorodifluoromethane) to HFC R32 and the HFO/HFC blends, such as R454B. The synthetic HFOs typically have a 100-year GWP of between just 1 and 4. R32 (difluoromethane) had a previously accepted GWP of 675, but this has recently risen to 771, while R454B has a GWP of 467 (see boxout, 'The changing GWP'). One of the key goals is to produce refrigerants that have favourable thermodynamic properties, including relatively low saturated vapour pressures. Many very closely emulate the historically favoured refrigerant HCFC R22, as illustrated in Figure 1.

Although these are all energy-efficient refrigerants, most have other less welcome attributes that are likely to limit their eventual application in building services. The recent report[13] from UK government confirmed that there has already been a significant transition away from the use of R410A to R32 and HFO/HFC blends, noting

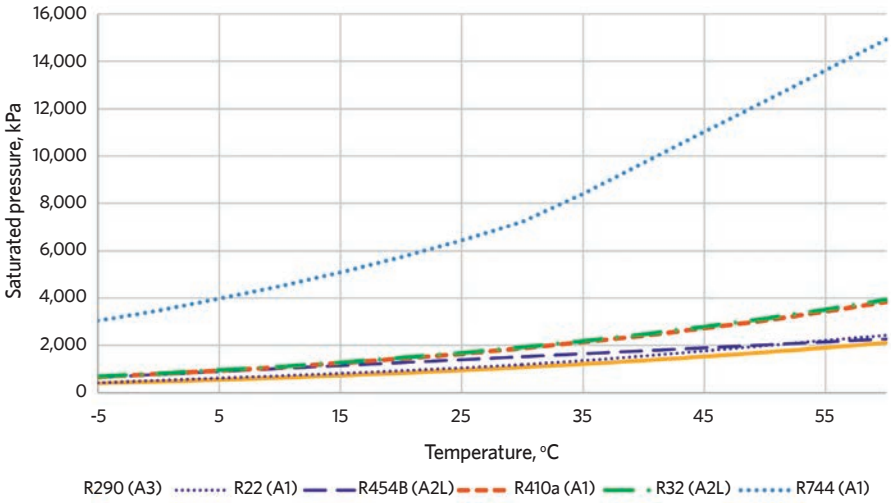

Figure 1: Comparative saturated vapour pressures for R22, R32, R410A, R290, R454B and R744

that R32 has proved to be an important alternative, with similar characteristics to R-410A, apart from it being a 'lower flammability' refrigerant – designated as A2L under BSI ISO 817.[14] (R410A is designated as an A1, non-flammable refrigerant.) The F-gas regulation contains an upcoming ban on small split air-conditioning systems with less than 3kg charge using F-gases with a GWP of 750 or more, from 1 January 2025.

Although the UK report indicates there is already some use of propane, it is very limited. However, there is a significant upturn in major manufacturers' interest in 'natural' refrigerants – which includes propane, as well as CO_2 and potentially ammonia (R717) – for use in new air conditioners and heat pumps. This is motivated by the deleterious environmental impact of many synthetic refrigerants and the lower GWPs of propane and CO_2 and, pragmatically, has been accelerated by regulatory requirements.

As discussed more fully in the *CIBSE Journal* CPD Module 99 from December 2016, propane (as well as other HCs) typically exhibits low pressure drops and achieves system efficiencies that are equal to – or exceed – those of synthetic alternatives. The latent heat of vaporisation of propane is twice that of the most common HFC refrigerants, so providing a higher cooling/heating effect for the same refrigerant mass flow.[15]

Work by the Fraunhofer Institute and a group of manufacturers[16] has determined that heat pumps are practically operable with a refrigerant charge of about 10g of propane per kW, as compared with about 100g of propane per kW required with typical designs. Systems are already evolving to reduce refrigerant use – the example of the monobloc heat pump in Figure 2 has a 14.3kg charge to provide up to 195kW of heating and about a quarter of the refrigerant mass required for comparable R410A units. The thermodynamic qualities of propane enable operation at low evaporating temperatures and high condensing temperatures, allowing it to provide water temperatures beyond 65°C (at sub-zero

THE CHANGING GWP

The recent IPCC Sixth Assessment report[11] (AR6) includes the official GWP figures for R290. The 20-year GWP20 of 0.072 and the 100-year GWP100 of 0.02 are somewhat lower than the traditionally applied GWP of 3 that had been assumed. Previous estimations were related to the formula for propane (C_3H_8) that assumed the three carbon atoms would combine with oxygen (O_2) in the atmosphere to produce three CO_2 molecules, hence a GWP of 3. However, the much lower GWP now estimated by IPCC results from propane's short atmospheric lifetime, with a temperature dependent half-life of about 14 days, as it breaks down into carbonyl compounds (carbonyl compounds do not, in themselves, contribute any significant GWP). The decomposition of propane into carbon dioxide is a lengthy procedure and would take many weeks to complete,[12] by which time most of the propane would have already broken down.

In that same report, R32 had its GWP100 updated to 771 (from 675) by the IPCC. This will also make a small impact on the GWP of HFO/HFC blend refrigerants.

external temperatures) with COPs that could go as high as 4.5 (but are practically somewhat lower than that at the higher temperatures).

Propane is a colourless, odourless gas with a very low GWP (see boxout 'The changing GWP'), an ODP of 0, and low toxicity (designated 'A' under BS ISO 817). Most propane is produced from liquid components recovered during natural gas processing and during crude oil refining (alongside other chemicals including ethane, methane and butane). Although the amounts are relatively small, 'renewable' propane is also produced from biomass-based feedstocks, including used cooking oil, animal fats, or dimethyl ether (which is also one of the original 19th-century refrigerants). At atmospheric conditions, propane is a gas that is denser than air. Propane is easy to procure and relatively cheap in price; however, the greatest weakness of propane, as with all HCs, is that it is highly flammable and so designated a '3' under BS ISO 817. Flammable hydrocarbons require careful consideration of safety when applied in systems, and any installation should meet the requirements of standard BS EN 378-3.[17] Units are constructed to stringent guidelines, employing ATEX ('Atmosphere Explosive' EU Directive 2014/34)-rated components and segregated electrical compartments to prevent spark risks. Dedicated leak-detection systems are used to monitor levels of propane that provide purging to outdoors, employing ATEX-rated extract fans, to ensure that the levels do not rise to approach the lower flammable limit (LFL) of propane (2.1% by volume of air – compared with 1.4% for petrol and 5% for natural gas) (see boxout 'Igniting propane'). Being denser than air, any leaked gas has the potential to pool at low level and so systems should not be sited near drains or pits. Although not toxic, propane has caused deaths through asphyxiation.

Following an extensive review process, IEC 60335-2-40[18] – which deals with the safety of heat pumps – was revised in 2022 to increase the refrigerant charge limit in standard split air conditioning applications for use inside the buildings (it is currently under BSI review). The limit for R290 was increased from 340g to 988g in new equipment so long as it incorporates additional safety requirements to provide the same level of safety as equipment using non-flammable refrigerants. The new limits could allow more than 13kW of heating from split units.

The UK government's assessment of the HFC phasedown[21] suggests a struggle to meet the required reductions and timeframes. The marketplace for air conditioning and heat pumps is predicted to change significantly over the next 25 years, as shown in Figure 3. This emphasises the importance of a swift roll-out of efficient, low-GWP refrigerants for residential and commercial applications.

The regulatory authorities are enthusiastically promoting the practical use of R290 with increases in allowable refrigerant charges, while researchers and manufacturers are creating systems with increasing efficiencies and reducing refrigerant charges. With installations designed, installed and operated to meet stringent safety requirements, prospects appear to be good for a massive expansion in the number of propane heat pumps and air conditioners that can provide increasingly effective systems with low operational environmental impact.

Turn to page 46 for references

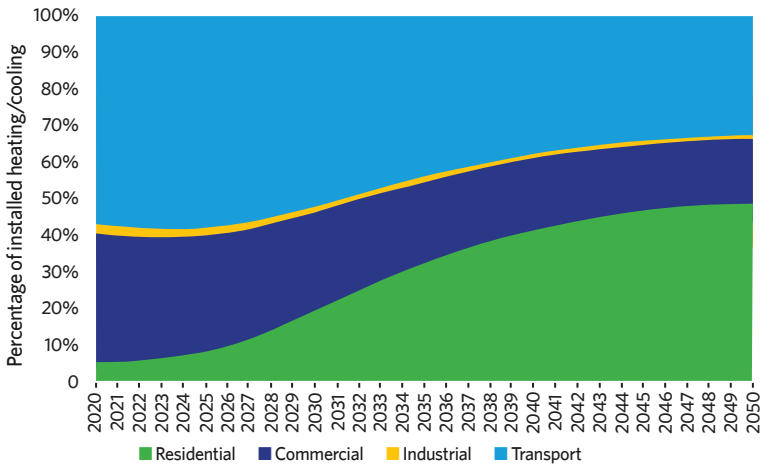

Figure 3: Percentage installed comfort cooling/heating capacity (MW) in UK (Source: DEFRA[21])

Figure 2: Commercial, monobloc heat pump with a 14.3kg charge of R290 (propane), to provide up to 195kW of heating (Source: Swegon)

IGNITING PROPANE

Propane does not spontaneously ignite below a temperature of about 470°C. Assuming the presence of air (and hence oxygen), three conditions must coincide to ignite R290:

- **The concentration of the R290 in the air must range between the LFL and upper flammable limit (UFL). As an indication, in a fully enclosed room of 30m² this would mean leaking between approximately 1kg and 6kg of R290, which equates to a concentration in volume ranging between a LFL of 2.1% and UFL of 9.5% (it's unlikely to mix fully and 'pool' at low level). Outside this range, the mix does not propagate the flame: it is not flammable.**
- **The refrigerant must be introduced into a flow of air with a velocity three or four times slower than the burn velocity, as greater air velocities prevent the flame from getting ignited. As its burn velocity for R290 is 46cm·s^{-1}, combustion will not occur if introduced into an air velocity above 15cm·s^{-1}, even if the refrigerant concentration is correct for combustion. For comparison, the average walking speed of a person is 134cm·s^{-1} (approximately three miles per hour), air in a ventilated room is considered 'stagnant' at under 50cm·s^{-1}, and air speed in 'light wind' conditions is greater than 300cm·s^{-1}.**
- **A source of ignition must be available, as referenced in the information in standard BS EN 378-2,[19] Annex K. The minimum ignition energy (MIE) for propane[20] is tiny at 0.48MJ, which could readily be produced by an arcing electrical switch, static discharges or potentially the dropping of a steel tool onto a hard surface.**

Combustion products are mainly carbon dioxide and water and are, in themselves, harmless.

Module 226

December 2023

1. In the recent provisional agreement of the EU F-gas regulation, what GWP would be allowable in new monobloc heat pumps under 12kW from 2027?

- ☐ A Under 50
- ☐ B Under 100
- ☐ C Under 150
- ☐ D Under 200
- ☐ E Under 250

2. Which of the following is not included in the current discussions to restrict the use of PFAS across the EU?

- ☐ A R1234yf
- ☐ B R1234ze(E)
- ☐ C R134a
- ☐ D R143a
- ☐ E R32

3. By how much does the CCC determine that the consumption of HFCs must decrease by 2035, compared with 2015 levels, to meet UK government targets?

- ☐ A 5%
- ☐ B 15%
- ☐ C 25%
- ☐ D 35%
- ☐ E 45%

4. For the illustrated monobloc heat pump, how much propane refrigerant is used compared with a similar unit charged with R410A?

- ☐ A Around a quarter the mass of refrigerant
- ☐ B Around a third the mass of refrigerant
- ☐ C Around a half the mass of refrigerant
- ☐ D Around three quarters the mass of refrigerant
- ☐ E Practically the same mass of refrigerant

5. Which of these is not an attribute of propane?

- ☐ A Colourless
- ☐ B Low GWP
- ☐ C Low toxicity
- ☐ D Not flammable at room conditions
- ☐ E Odourless

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Manufacturers unveil propane heat pumps

Major players in the heating industry are introducing both commercial and domestic propane heat pumps

Some of the biggest names in heating and cooling have launched new propane heat pumps, significantly lowering levels of embodied carbon in HVAC equipment.

R290 is a natural propane refrigerant with a global warming potential (GWP) of 3 (the R32 refrigerant common in heat pumps has a GWP of 677). A lower GWP reduces the embodied carbon of air source heat pumps (ASHPs) significantly, as refrigerant leakage over the lifetime of a unit can result in significant carbon emissions (TM65 assumes 2% annual leakage in ASHPs). Assuming higher annual leakage of 6%, Green Gauge estimates carbon emissions of 0.487CO_{2e} tonnes over 15 years for a R32 ASHP, compared with 0.00054CO_{2e} tonnes for a R290 equivalent.

Mitsubishi Electric has launched the domestic Ecodan R290 heat pump, which claims to achieve high water temperatures up to 75°C. The range guarantees operation down to -25°C ambient temperature and is advertised as having ultra-low noise levels. It is available in 5kW, 6kW and 8kW outputs.

Viessmann has expanded its 150-A/151-A domestic propane ASHP range, with 4kW, 6kW and 8kW models. to add to the existing 10kW, 13kW and 16 kW outputs. Both the wall-mounted Vitocal 150-A and the floor-standing Vitocal 151-A have an integral 190-litre domestic hot water cylinder, and a maximum flow temperature of 70°C.

The Samsung EHS Mono R290 heat pump has been launched for homes and is available in 5, 8, 12, and 16kW outputs.

Panasonic has expanded its propane heat pump portfolio with the ECOi-W Aqua-G Blue R290 air-to-water reversible heat pump. This is suitable for multi-dwelling and commercial applications, with capacities ranging from 50kW to 480kW, and can be equipped with a variable speed pump

Baxi's new range of heat pumps includes a commercial high-temperature propane heat pump, which will launch in the UK soon (see below).

Baxi to launch commercial heat pump range from Spanish factory

Baxi will shortly introduce a new propane commercial heat pump range from its factory near Barcelona, Spain.

The Remeha Effenca series has been designed and produced at the 7,000m^2 facility in Vilafranca, and is currently undergoing final testing. It includes high-temperature R290 refrigerant and will have Environmental Product Declarations.

Baxi, which is owned by the BDR Thermea Group, hosted the first official visit to its €13m commercial heat pump factory recently. The factory has R&D and laboratory facilities, and has increased production of heat pumps by 50% in the past 12 months. There are plans to triple output in the next five years with the development of new commercial heat pump solutions.

Harriet Evans, renewables director at Baxi, said: 'Heat pumps, which decarbonise heating at the point of use, are a big part of how we are supporting our commercial and residential customers through the energy transition.'

BDR Thermea's heat pump and air conditioning business development unit is divided between the Vilafranca site and its twin residential facility in Mertzwiller, France. It also has manufacturing facilities in Italy and is opening a factory in Slovenia next year.

Samsung partners with ABB in smart home initiative

A scheme to provide up to 2,000 homes with smart systems has been launched by Samsung Electronics, in partnership with ABB and SMA.

A 500-house estate in Brobyholm, Sweden, is expected to be completed by 2025, with plans to expand to up to 2,000 smart homes by 2028. The properties will feature Samsung's SmartThings Energy, which allows users to control and monitor the energy consumption of home appliances. The technology has been awarded Smart Home Energy Management Systems (SHEMS) certification by Energy Star, the US government's energy efficiency programme.

The homes' lighting and HVAC systems are connected to a weather station via SHEMS, which uses active and predictive data to control heating and cooling through the heat pump and via adjustment of blinds and shades. Adapting to the occupants' habits, SHEMS learns when they return home each day and pre-heats or pre-cools the building accordingly.

The system takes into consideration the current (and predicted) availability of photovoltaic (PV) power and then prioritises using available (and cheap) shared PV power (or battery-stored PV power) for heating and cooling. This is controlled and levelled-out in accordance with the overall energy usage, to avoid energy peaks.

Ventive gets funding for heat pump development

Ventive has secured a new round of funding, led by EMV Capital, to propel development of its all-in-one heat pump technology.

The investment will support and accelerate completion of the design-and-test phase for the modular heat pumps, alongside a dedicated factory build. It will also help enhance the passive ventilation product range and expand marketing and sales efforts.

The funding will be used alongside the £1.5m Department for Energy Security and Net Zero grant secured in 2022, and a recently awarded £100,000 UK government grant focused on 'net zero HVAC' systems.

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Octopus Energy will guarantee zero energy bills for five years in Bellway Homes' scheme

SMART HOMES, ZERO BILLS

Octopus Energy is offering a partnership with housebuilders that guarantees zero energy bills for occupiers using its Kraken technology platform. **Andy Pearson** speaks to Nigel Banks about the company's first pilot and a 200-home scheme planned with Bellway Homes

Reports that energy bills in Britain are predicted to rise by 5% next year will have come as worrying news to many households... but not all.

Zero Bills is an initiative by Octopus Energy. It is marketed as 'a world-first smart proposition that allows customers to move into homes that have no energy bills for at least five years, guaranteed'. The claim is that Zero Bills households will save around £1,800 on energy bills compared with those on a standard variable tariff, based on current energy rates.

To date, close to 1,000 homes across the UK have been accredited under the initiative by Octopus Energy, through contracts with developers and housing providers. That number is set to escalate with news that Bellway Homes, one of the UK's major housebuilders, has agreed a long-term partnership with the energy provider to deliver 'Zero Bills' homes at scale (see panel, 'A bellwether for zero energy bills homes?').

To sign up for the scheme, a house must be off the gas grid, be heated by an electric source – such as a heat pump – be kitted out with solar PV and a battery, and have a broadband connection. These technologies are then optimised by Kraken, Octopus Energy's technology platform, to put power on to the Grid, as well as pull it from the Grid.

'Effectively, we're looking to generate more energy than the house is expected to typically use, through smart control of the equipment, so homes will be operationally zero carbon on an annual basis,' says Nigel Banks, technical director Zero Bills and low carbon homes at Octopus Energy.

This will involve charging the battery at night, when energy is cheap, or using free electricity generated by the solar panels during the day.

'We'll have the ability to export solar from the roof and from the battery, so we can generate revenue from exporting that free energy, which is how we can make Zero Bills commercially viable,' Banks explains.

To be accredited as suitable for the scheme, a housebuilder must confirm a home's expected heating and hot water consumption, along with its expected solar-generated power. According to Banks, Octopus Energy will 'use its data' on the amount of energy used for unregulated »

"To be accredited as suitable for the scheme, a housebuilder must confirm a home's expected heating and hot water consumption, along with its expected solar-generated power"

» appliance and cooking use. 'From that information, we will define an agreed specification with the housebuilder, which it then builds so we can accredit it as a Zero Bills home,' he explains.

Octopus acknowledges that geographical location will have an impact on eligibility. Homes in Scotland are likely to need a larger solar array and better thermal insulation to be eligible. If, having run its analysis, a plot is found not to meet the scheme's criteria, the energy provider will recommend design changes to 'unlock eligibility'.

Approved suppliers

The home's heat pump and battery must be able to integrate with Octopus Energy's technology, so the energy provider can optimise and control its operation, says Banks. 'We don't tell housebuilders which model or type of kit to install, but it does have to be from our list of integrated suppliers, so we can optimise the equipment's operation remotely,' he adds. 'This includes most of the main air source heat pump brands, along with GivEnergy batteries.'

Typically, a battery will need to be sized to provide between 10kWh and 14kWh of power, while the PVs will be expected to deliver between 8kW$_p$ and 12kW$_p$ – which, Banks admits, is 'quite a lot'. Generally, this will require housebuilders to fit PVs to both sides of a home's roof to generate sufficient power.

Zero Bills is not, in theory, confined to new-build homes. Octopus Energy says it is happy to assess any housing stock for compatibility. In practice, however, this means the thermal characteristics of existing homes must be at least as good as current new-build regulations.

Anyone purchasing a Zero Bills home will have Octopus Energy as their default supplier. To benefit from the guarantee of zero energy bills for five years, the customer will have to agree to the energy provider's terms and conditions. 'That means allowing Octopus to control the battery and heat pump settings in their home while they live and heat their home normally,' says Banks. If customers are not happy, they are free to leave before the end of the five-year term.

Octopus Energy's research facility in Slough

Heating from an electric source must be specified

Banks insists that handing over control of a home's battery and heating to the energy provider is not as onerous as it might sound.

'The home owner sets the programmer on their thermostat as normal,' he says. 'In the background, we are looking for full optimisation control on the battery to deliver the heat temperatures at the times customers want – but we may choose to optimise when the heat pump is heating the domestic hot water, for example, and we may run the heating cycle slightly earlier if it is much more cost-effective to do so.'

By signing up for the Zero Bills scheme, householders are forfeiting the opportunity to earn revenue from their PV-generated electricity. 'Effectively, it is zero pence per kWh export, zero pence per kWh import, with a zero standing-charge tariff – so you will not get paid for the energy »

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» exported, but then you are not paying for imported energy either,' says Banks.

Fair-use policy

For customers who might think that signing up for Zero Bills is an opportunity to be profligate with their energy use, Octopus Energy's terms and conditions include a 'fair usage' policy, which is currently set at double the consumption for a typical home.

Above this threshold, consumption is charged at Octopus Energy's standard rate. Another caveat is that electric vehicle (EV) charging is not included in the Zero Bills scheme because, Banks says, an EV 'can effectively double a home's electricity consumption'.

In addition to helping eliminate stress and anxiety around the payment of household energy bills, which are typically around £1,800 per year, Banks says another benefit of the Zero Bills initiative is that it can be factored into mortgage lenders' affordability calculations. This may allow home purchasers to borrow more money than they would otherwise be able to do.

'One of the biggest barriers to adopting higher energy performance standards is that it costs money to increase the fabric spec and install additional kit,' explains Banks. 'Because we are guaranteeing zero bills, some lenders are willing to include that in their affordability calculation, to enable a customer to borrow more money'.

PVs will be expected to deliver between 8kWp and 12kWp

As more and more renewables are connected to the Grid, the time at which homes use energy will have a big impact on the carbon footprint and cost of that energy – which, Banks says, will be 'almost as big as the amount of energy being used'.

The need for demand flexibility and energy storage to manage the intermittent renewables will only continue to increase.

Banks says: 'It is the smart control of demand management behind Zero Bills that will minimise the infrastructure upgrades required on the Grid and help bring down everyone's costs, so this really does work for everyone'. CJ

A BELLWETHER FOR ZERO ENERGY BILL HOMES?

Bellway Homes is partnering with Octopus Energy in anticipation of being able to deliver Zero Bills homes on its developments. Initially, it is starting small: the housebuilder is trialling the Zero Bills scheme on three test homes, which it has built to the expected Future Homes Standard, at its Victoria Gate development in Stafford.

From 2024, however, Bellway plans to build a further 250 Zero Bills homes at a development in Bedfordshire, with the potential for more sites to follow.

'We're working with Bellway to see how many of the homes it has already designed will be suitable for Zero Bills accreditation on its upcoming sites,' says Banks.

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*Graham Jones, Customer Service Manager

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BACK IN CONTROL

The optimisation of HVAC controls for a Croydon office has reduced energy use by 28% over nine months, resulting in a £171,000 saving in operational energy costs. REsustain's **Annie Marston** describes how CO_2 was slashed for a minimal capital cost


Knollys and Stephenson House

As concern grows over climate change and our ability to meet our environmental, social and governance targets, we often overlook our existing building stock. We tend to assume that improving this stock will be prohibitively expensive and disruptive.

Without attention, there is a risk that these sites will become stranded assets (buildings that the owners will no longer be allowed to sell or rent). Frequently, it is assumed that once a building management system (BMS) has been installed or upgraded, the site will run efficiently. This is usually not the case, however.

Often, these systems are not programmed correctly or are adjusted over time and rarely recalibrated as the building evolves.

As part of the solution to making sure our buildings are fit for purpose five to 10 years down the line, we need to make the building truly smart, using automated continuous control optimisations with regular seasonal recalibration via the BMS. If we do, we can reduce the carbon emissions associated with each building, typically by 20-60%.

This case study covers work done by REsustain with Feldberg Capital on Knollys and Stephenson House, a 17,600m² (net lettable area) office building in Croydon, built in 1967.

The continuous control optimisations were implemented from 1 October 2022, remotely via a gateway to the BMS. From October 2022 to July 2023, these improvements have provided 28% energy savings, avoided the need to emit 232tCO_2 into the atmosphere, and saved £171,000 in operational energy costs over the nine months (see Figure 1).

The building

This multi-tenanted building is heated and cooled using the original variable air volume reheat system that has been adjusted over the years. The chiller and cooling towers have been decommissioned, and variable refrigerant flow (VRF) systems have been installed in individual offices to cool them in the summer. The building was using approximately 215kWh·m^{-2} (gas and electricity together) each year, which corresponds to emissions of 1,110tCO_2 and an operational energy cost of around £26/m².

A data gateway was deployed in April 2022, and has been streaming to the REsustain platform since then. To make the most of the polled values and to fully understand the building, a full-calibrated dynamic thermal model of the building was created. This includes principal HVAC specifications and control patterns. The building geometry was modelled in DesignBuilder v7 and then transferred to the EnergyPlus v9.4 calculation engine.

The internal gains were based on site visit information, and the annual pattern of occupancy, lighting and plug load in the spaces were taken from standard ASHRAE

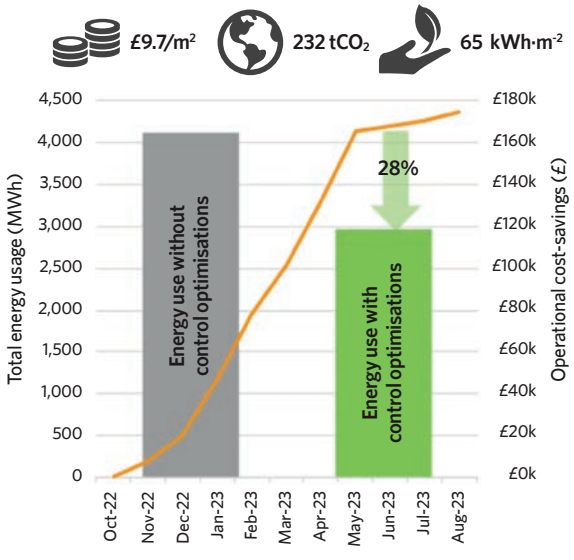

Figure 1: Savings after nine months of optimisation

profiles for an office building. The building was assumed to be occupied for eight hours a day, five days a week, except for one floor that was known to be occupied 24 hours a day. The actual tenant-occupancy numbers were also included in the model.

The HVAC system was modelled as is and was matched to utility bills to ensure alignment between assumptions in the model and real-life operation. These details were taken from documentation obtained from site visits. The energy usage was calibrated to the utility data using the international performance measurement and verification protocol methodology, allowing for a maximum 15% error on the root mean square error, as stated in ASHRAE guideline 14-2014 (see Figure 2).

The rules engine then ran through all of the data and identified the following groups to be controlled throughout the year.

1. **Ventilation load to be reduced at certain times.**
2. **Fans to have a stricter schedule to reflect operational times of the building.**
3. **Eliminate simultaneous heating and cooling.**
4. **Ensure the boiler plant is operating only when necessary.**

The optimisations were implemented in the energy model to forecast the potential energy, carbon and cost savings. It was estimated that the building could potentially save 26% energy usage, £140,000 of annual operational cost, and reduce carbon emissions from 1,110tCO_2 to 900tCO_2 per year – a 210tCO_2 reduction (see Figure 3).

Implementation of controls optimisation

In October 2022, the implementation of the controls' optimisation began. Because of a milder autumn, the VRFs in the office spaces were able to maintain comfortable temperatures, so the boilers remained turned off for the months of October and November. This meant that only the ventilation control strategy and fan control strategy were implemented in those months.

This was not straightforward. When trying to implement the strategy it was not possible to move the outdoor air dampers via the BMS because, as a result of their age, they were now stuck. Instead of moving the dampers, the control strategy was applied to the fan. The flowrate was reduced to 30%. It was thought that to reduce the fan to a lower flowrate could cause it to fail, so this was deemed to be the low limit.

The central boilers were turned back on in

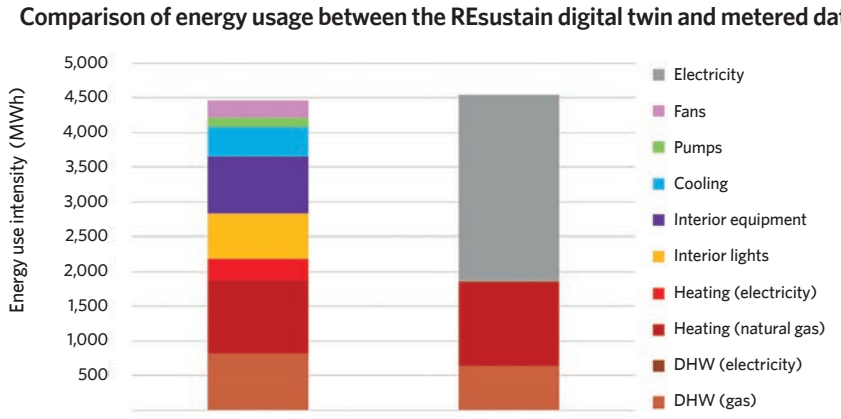

Figure 2: Calibrated model vs metered data

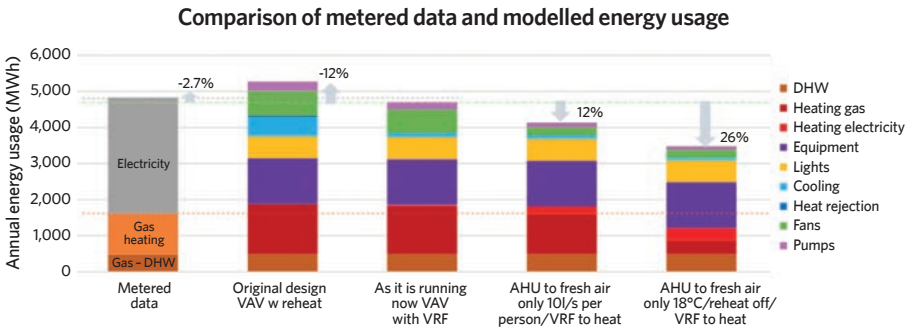

Figure 3: Energy reduction forecast from controls optimisations and the addition of a runaround coil

December 2022. At this point, the simultaneous heating and cooling elimination strategy was implemented. There were reheat coils in the four ducts leading from each air handling unit. The initial plan was to close these. However, it was found that the reheat coil valves had corroded, stuck at their 100% open position, so an alternative was found.

In this case, a decision was made to turn the hot water temperature setpoint down from 70°C to 60°C, with a weekly pasteurisation cycle. It was hoped that the hot water temperature could later be dropped further to 50°C. It was also suggested to the facilities manager that variable speed drives be put on the low temperature hot water pumps to allow the circuit to be more controllable. These were not added; instead, the pumps were controlled on a daily/weekly basis to reduce heating energy consumption.

To understand how much energy is being saved as a result of these optimisations, the calibrated energy model is updated monthly using BMS data, weather data, any changes relating to tenancy or retrofit, and the utility bills. Once this calibration has been verified, the control optimisations in the model are removed and the model is rerun for the previous month, then compared with reality to measure what effect the changes have had.

The optimisation of the services at Knollys and Stephenson House proves that – by making buildings smarter and constantly analysing control patterns – it is possible to make existing building stock considerably more efficient without any significant capital expenditure or the need to add any further embodied carbon into the building. CJ

ANNIE MARSTON is chief product officer at REsustain

This article is based on a paper presented at the CIBSE Technical Symposium 2023 titled *A comparison of forecast energy reduction through control optimisation in an existing building with actual data from the optimised building*

The 2024 CIBSE Technical Symposium will be held on 11-12 April 2024, at Cardiff University, Welsh School of Architecture. **www.cibse.org/symposium**

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Reducing fit-out waste and the carbon footprint of fan coil unit installations

This module explores the fit-out process for FCUs and how to improve the environmental and financial impacts of satisfying new tenant needs

As a new tenant takes over a section of a commercial building, whether a new construction or an existing tenanted premises, it is very likely that their specific requirements will require a reconfiguration and refitting of the space to suit their particular needs. This process, known as a 'fit-out', can result in significant expense both financially and environmentally, as hardware such as partitions, furnishings, fixings, lighting, IT, and environmental systems that were previously useful assets to the previous tenant are variously altered, removed or replaced. One common element that contributes to this potentially profligate process is the fan coil unit (FCU) (see boxout 'AHU or traditional FCU?'). This CPD will consider the fit-out process, and assess some options that may improve the environmental and financial impacts of fitting out commercial buildings to satisfy tenant needs.

According to the Royal Institution of Chartered Surveyors (RICS),[1] around 11% of total construction expenditure in the UK is allocated to fit-outs. RICS suggests that buildings may undergo as many as 30 to 40 fit-outs over their life-cycle. For a new building shell, or one that has been completely refurbished, the Cat A fit-out will typically include essential elements necessary for occupancy but still provide a 'blank canvas' ready for the tenant to individualise it. It would normally encompass elements including basic (infrastructure) electrical, plumbing and mechanical services, raised access flooring, finished wall coverings and suspended ceilings, and encompass the provision of hallways, staircases, lifts, and toilet facilities. Air conditioning may be included during this phase. In the commercial sector, there are several heating, ventilation, and air conditioning (HVAC) solutions available, but FCUs are a common choice because of their ability to offer tenants zoned control over the indoor temperature. During this stage, open-plan areas are typically extensive and require the selection of large and powerful FCUs to meet the demand for conditioned air. FCUs serving areas near glazing around the building's perimeter are sized to handle both heating and cooling requirements. In central areas where heat loss is minimal, FCUs are often specified for cooling purposes only.

After the property space has been leased, the Cat B fit-out customises the area to suit the specific needs of the tenants. This involves reconfiguring the interior layout to create working spaces, reception areas, kitchen facilities and meeting rooms. It also includes the installation of all the necessary IT, audio-visual equipment and lighting systems. These alterations can have an impact on the heating and cooling requirements, and it is common for the original placement of the FCUs from the Cat A fit-out to no longer be optimal for serving the requirements of the new layout. The larger FCUs originally installed may now be inappropriate to condition the air in what is likely to be collection of smaller spaces. Most FCUs are typically selected to operate at about half fan speed to allow some variation above and below to cope with fluctuations in demand. However, FCUs do not operate most effectively at low speeds, so with prolonged »

» operation at very low speeds (to meet the smaller load) they will not operate with optimum performance.

As a consequence, some of the larger FCUs may be removed during a Cat B fit-out and possibly replaced by smaller FCUs that are better suited to cater to the requirements of the updated layout. These larger FCUs could potentially find use elsewhere in the project but, in many cases, they are no longer needed. The manufacturers typically do not accept these units for return, since they have been previously installed, commissioned, and have already been in operation during the Cat A phase – essentially rendering them second-hand. Contractors might choose to retain the large FCUs and store them for potential use on other projects; however, it is likely that a significant proportion end up as scrap for metal recycling. The process of removing the original FCUs not only consumes time and money but also generates additional embodied carbon and waste. At the conclusion of the lease period, new tenants may require modifications to the layout, necessitating the repositioning of existing FCUs or the acquisition of new ones to effectively manage the heating or cooling demands of the space. In certain cases, particularly when disputes between landlords and tenants lead to lease terminations, landlords might insist on restoring the building to its original condition. This typically involves the removal of the FCUs and the installation of new, larger FCUs according to the building owner's original specifications. However, these larger FCUs might be considered as somewhat temporary and may be replaced when the space is leased again. This cycle further exacerbates carbon emissions and contributes to construction waste.

There are several options that could help prevent this wasteful – and likely repeated – cycle of FCU removal and replacement, as discussed below.

The first option is that the project could bypass the Cat A stage and proceed directly to the Cat B phase. However, this approach demands a high level of collaboration during the design phase, and is only feasible when the ultimate client for the building has been identified. This scenario becomes possible when, for instance, a large corporation makes the decision to both construct and occupy a building or commits to a long-term lease of the property. While this does occur, it remains uncommon and not without its challenges. The Cat B specification must be fixed relatively early in the project and, consequently, any design modifications necessitated by shifts in the company's strategy, structure or size can introduce their own set of issues if not carefully managed.

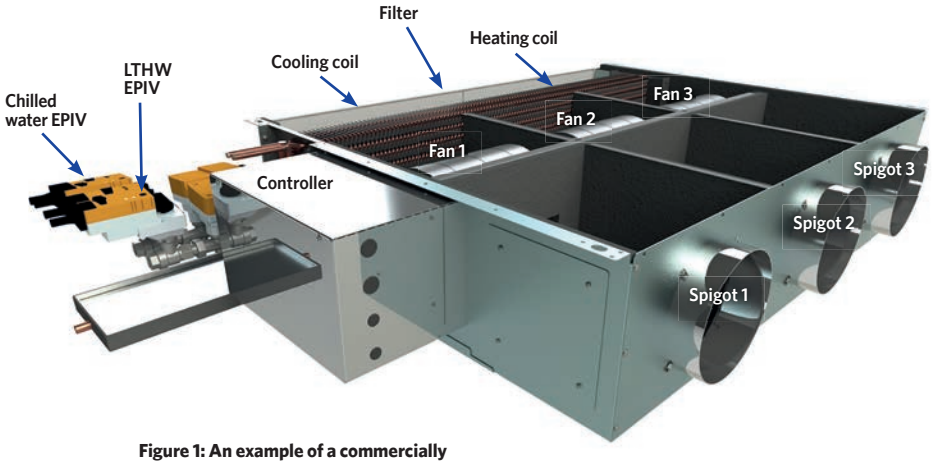

Figure 1: An example of a commercially available multizone FCU that is capable of supplying one, two or three different zones

Alternatively, an option is to utilise a greater number of smaller FCUs, offering enhanced inherent flexibility and potentially decreasing the waste generated during removal and replacement that might otherwise be needed. Nevertheless, while this approach could diminish the likelihood of having to revisit the FCU strategy during the Cat B phase, it would lead to increased costs for the building owner while reducing the tenant's Cat B expenses. Each smaller FCU would also involve the installation of a controller, valve set, pipework and electrical connections. Increased numbers of FCUs will also add to the complexity of structural coordination when setting out a reduced size zone (or 'bay'). While the use of smaller FCUs can enhance the property's appeal and make it more attractive to prospective tenants, the initial cost linked to procuring and installing additional FCUs may pose challenges when justifying this expenditure to the building owner.

A more radical option, for larger multi-floor projects, is to fit-out only some

MULTIZONE FCU

Advances in the design of compact digitally controlled electronically commutated (EC) motor-driven fans enabled the development of a single FCU housing that incorporates multiple, partitioned, independently controlled direct-drive EC fans, which supply separate zones, drawing from a common plenum of treated (cooled/heated) air (as illustrated in Figure 2).

The units typically contain a multi-row cooling coil and a heating coil. The speed of the fans may be individually controlled by the integrated controller that interrogates all the separate zone temperature sensors and assigns a priority zone. This will be the zone that is furthest from its set-point and, for example, could require cooling. With the multizone FCU unit in cooling mode, the priority space receives the full design air volume flowrate, with other cooling zones receiving proportionately the air flowrate they need to satisfy their lower cooling requirements. Any space that requires heating at that time has its fan stopped and no air is delivered. Once the cooling demands have been satisfied, and if there is still a need for heating, then the cooling coil valve closes and after a purge period the cooling zones fans stop. The heating coil valve is opened and the heating zone(s) fans activate. Once the heating requirement is settled, the unit will revert to cooling mode and the cycle may then continue. The multizone unit would typically be located to serve similar thermal zones. The FCU integrated controller optimises the cooling and heating water flowrates and the individual fan speeds to deliver the required zone temperature control in the most energy-efficient way.

In the unit illustrated in Figure 1, the heating and cooling control valves are electronic pressure independent valves (EPIV). The EPIV provides the same function as a pressure independent control valve (PICV), as discussed in *CIBSE Journal* CPD Module 140; however, the EPIV achieves this with a close-coupled temperature compensated, inline ultrasonic flowrate meter that provides a signal of the water flowrate to the valve actuator controller. The required flowrate is determined and sent to the actuator by the FCU integrated controller. This allows the valve to continuously modulate to provide the correct water flowrate. An EPIV will operate at lower pressures than that required by a PICV – typically from 1 to 15kPa, depending on the system peak load (compared with 20-30kPa for a typical PICV). The signals from the EPIVs and the fan speed controllers can, through the integrated FCU controller, provide information to the building energy management systems (through protocols such as BACNet) for monitoring, recording, optimisation and preventative fault diagnosis.

AHU OR TRADITIONAL FCU?

An air handling unit (AHU) and a traditional, single-fan or multi-fan FCU will both typically include at least one filter, a cooling coil (with condensate collection and drain), a heating coil (in most FCUs), a single supply fan and access panels to allow servicing. The AHU often incorporates full humidity control, is likely to supply (at least a proportion of) outdoor air, and would typically benefit from heat recovery from extracted vitiated air. The main difference is that an AHU is a centralised system that can condition air for multiple zones in a building, while a traditional single-fan FCU is a decentralised system that would condition recirculated air to control the temperature for a single zone. FCUs are often used to provide localised single-zone cooling and heating in conjunction with a centralised AHU that supplies tempered outdoor air to, and removes vitiated air from, the zone.

floors as Cat A and fit-out the remainder of the floors to Cat B once tenants are secured. However, a direct Cat B fit out may then require the complete infrastructure pipework, ductwork and wiring to be installed so the tenant may have a longer wait to make proper use of their space. This may deter some clients for whom time is of the essence. However, it is a likely to provide a more sustainable, and potentially cost-effective, approach.

The final option, to be discussed in this article, provides a novel FCU system that can be installed to fully meet the needs of Cat A and then be adapted to allow reuse (with, mainly, ductwork and diffuser alterations) to completely satisfy tenant requirements at Cat B. A 'multizone' FCU – which is described more fully in the boxout 'Multizone FCU' and pictured in Figure 1 – can supply up to five zones, each of which may be operating with different temperature setpoints and have different load profiles. Although similar in external appearance, this is quite different to a traditional single-fan or multi-fan FCU with multiple spigots, as that will offer no opportunity to continuously control the proportion of the total flowrate to the separate outlets.

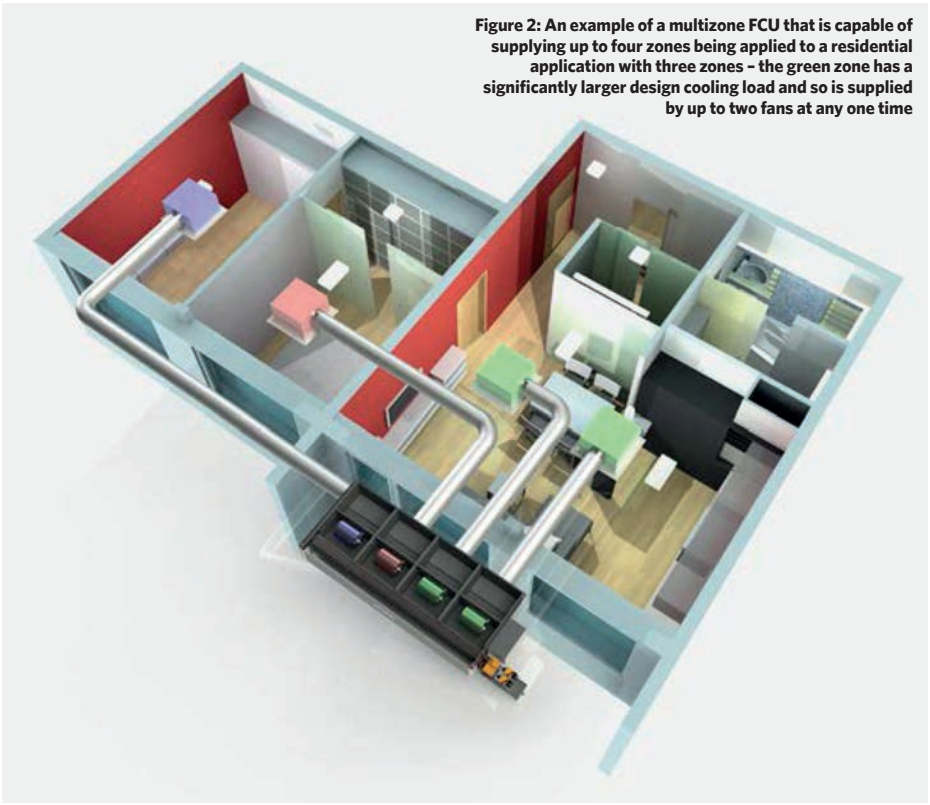

Figure 2: An example of a multizone FCU that is capable of supplying up to four zones being applied to a residential application with three zones – the green zone has a significantly larger design cooling load and so is supplied by up to two fans at any one time

The single-unit multizone FCU requires just one set of pipework and wiring, compared with the network of connections to multiple traditional FCUs, and significantly reduces the cost and environmental impact of installing and otherwise potentially replacing traditional FCUs.

Multizone FCUs reduce technology waste not just for the first Cat A to Cat B transition but also for all the ones that will follow, as tenants leave, and can provide significant saving in cost, time, and waste. This negates the need for replacement FCUs that will otherwise add more embodied carbon and increase the building's whole-life carbon footprint. A single multizone unit can be installed as part of Cat A fit-out and initially used so that all the fans and outlets work in unison to serve the large undivided space – known as multizone-ready. This would be positioned so that it is likely to eventually serve zones with similar thermal load profiles. During Cat B, the ductwork can be reconfigured to serve diffusers in each of the newly partitioned spaces. The multizone FCU may be located outside of the controlled zones allowing, for example, higher ceilings in the remaining areas, with fewer access panels and less space needed. The control arrangements for the rooms serviced by a multizone FCU are flexible, ranging from individual controls in each zone through to being centrally set through the building management system (BMS).

The traditional cycle of fit-outs is inherently wasteful. Establishing the demands of at least a proportion of the initial building tenants can provide opportunities for a reduction in the amount of Cat A fit-out that is then subsequently replaced and potentially wasted. If the building environmental systems are designed to be readily adaptable to accommodate a wide range of building uses, this will not only reduce the scale of necessary modifications but also potentially ease the transition between tenants. Assessing the application of adaptable multizone FCUs at the early stages of the systems design could endow future building tenants with a cost effective, efficient, and flexible cooling and heating solution that can also significantly reduce the lifetime embodied carbon compared with maintaining a fit-out cycle of removing and replacing traditional FCUs.

- This article has drawn extensively from the white paper *Reducing waste in development fit outs through effective fan coil solution design,* produced by Ability and independent consultants.
- Turn to page 60 for references.

Module 227

December 2023

1. According to RICS, what percentage of the total construction expenditure in the UK is allocated to fit-outs?

- ☐ A 1%
- ☐ B 6%
- ☐ C 11%
- ☐ D 16%
- ☐ E 21%

2. Which of these is least likely to be found in a traditional FCU?

- ☐ A Cooling
- ☐ B Condensate collection
- ☐ C Filter
- ☐ D Heating
- ☐ E Multizone control

3. In the article, what is given as a particular example driving a landlord to request restitution of original FCU provision?

- ☐ A Changes to the windows creating bigger perimeter zones
- ☐ B If the landlord wishes to sell back the previously redundant and stored FCUs
- ☐ C If there is a new requirement for outdoor air
- ☐ D There is a need for humidification control
- ☐ E When disputes between landlords and tenants lead to lease terminations

4. What does the term 'multizone-ready' indicate in this article?

- ☐ A A traditional FCU with multiple spigots
- ☐ B Building is built with different aspects that will be divided into multiple zones
- ☐ C Building that is yet to be segmented into zones at Cat B
- ☐ D Multiple traditional FCUs controlled in unison with air supplied from centralised AHU
- ☐ E Multizone FCU being used so that all of the fans and outlets work in unison to serve a single zone at Cat A stage

5. What does the 'E' stand for in EPIV?

- ☐ A Electronic
- ☐ B Encrypted
- ☐ C Enhanced
- ☐ D Extendible
- ☐ E External

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References:

1 bit.ly/CJDec23CPD21 – accessed 6 November 2023.

Products of the month

Rinnai's new CPD on heat pump seasonal performance factors approved

CPD explores new methodology for evaluating efficiency of heating systems

Rinnai has unveiled a CIBSE-approved CPD on seasonal performance factors (SPF) for heat pumps. Presented by Sean Ehlen MEng, the CPD explores a new methodology for evaluating the efficiency of commercial heating and hot water systems.

A focus group of consultants, systems designers and contractors delved into the potential of SPF, marking a significant step toward transparency, cost-effectiveness, and performance expectations in the industry.

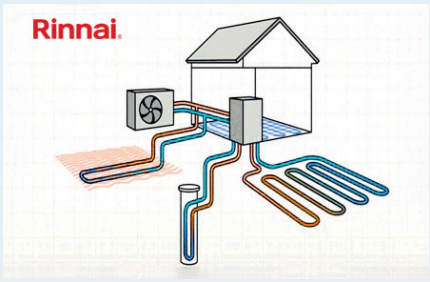
The CPD started as a comprehensive white paper by Ehlen, which serves as a guide to understanding the intricacies of SPF. It is available to view for free on Rinnai's website, **www.rinnai-uk.co.uk**. The goal of this resource is to empower professionals and end-users with a deeper understanding of the efficiency metrics that drive decision-making in commercial heating and hot water systems.

The focus group was an interactive platform for introducing an alternative evaluation methodology: SPF. Ehlen, as the presenter, talked about the nuances of this new approach and fielded questions from the engaged audience. The consensus was unanimous – SPF offers a superior level of transparency, giving customers a clearer view of system performance, associated costs, and expected outcomes.

The white paper highlights the limitations of traditional manufacturer-issued efficiency measures, such as coefficient of performance (COP) and seasonal coefficient of performance (SCOP), particularly in the context of heat pumps. Typically, manufacturers gauge the efficiency of heat pumps using COP, a metric that measures the ratio of useful heat energy produced to the electricity consumed under specific external air temperature conditions. SCOP extends this assessment to cover the entire heating season.

However, the white paper contends that relying on COP and SCOP to assess the efficiency of heat pumps can be limiting. Notably, these metrics primarily measure the efficiency of the heat pump unit itself, potentially overlooking the broader system dynamics. The implications of this oversight are significant, as it may lead to misaligned system expectations and, ultimately, impact the anticipated carbon reductions.

To address these limitations, Rinnai



proposes the SPF as an alternative evaluation methodology. This approach expands the evaluation scope to encompass all energy-using components within a commercial hot water system. By doing so, it offers a more comprehensive understanding of the system's performance, going beyond individual components to consider the entire system's efficiency.

Rinnai's aim of presenting this white paper to customers through their CPD is to provide customers with accurate and relevant information that enables a precise assessment of commercial hot-water heating performance. In a landscape characterised by economic constraints and escalating energy costs, Rinnai is looking to equip the UK market with the tools necessary for making informed decisions aligned with the ambitious net zero goals.

In addition to advancing efficiency metrics, Rinnai has made significant strides in the field of decarbonisation with its H3 range of products. This comprehensive line-up includes hydrogen/BioLPG-ready technology, hybrid systems, low global warming potential (GWP) heat pumps, and solar thermal solutions. Among the standout features within the H3 range are the Infinity hydrogen blend-ready and BioLPG-ready continuous flow water heaters, designed to deliver longevity, robust performance, customer satisfaction, and enhanced energy efficiency.

The H3 range caters for residential and commercial applications, offering a diverse portfolio of efficient, robust and affordable decarbonisation options. It covers a broad spectrum of fuels and appliances, including electric, gas, hydrogen, BioLPG, DME, solar thermal, and low GWP heat pumps.

Within the H3 range, the H1 series has a strong focus on hydrogen, anticipating its growing relevance in the energy market. Rinnai's hydrogen-ready water heaters are prepared to handle 20% hydrogen blends, showcasing the world's first 100% hydrogen-ready hot water heating technology.

The H2 series simplifies decarbonisation with renewable gas-ready units, solar thermal, and heat pump hybrids, offering a practical and cost-effective option for specific sites.

Rinnai's H3 range, featuring low-GWP heat pump technology, addresses the growing demand for efficient and environmentally friendly solutions. Appliances range from 4kW to 115kW, use R32 refrigerant, and have favourable COP and SCOP.

For more information, visit www.rinnai-uk.co.uk

Products of the month

Rinnai offers next-day delivery for full product range

Manufacturer guarantees next-day delivery for hot water heating unit models

Rinnai has made a significant announcement regarding its commitment to ensuring full product availability 24/7, particularly for its 48-58kW range of continuous flow N Series commercial hot water heating products and systems.

The company is not only emphasising guaranteed product availability, but also looking to ensure swift delivery, with all orders dispatched within 24 hours on a next-day service.

In addition to rapid delivery, Rinnai provides an option for same-day or night shipping via a priced-in special courier, delivering directly to any site in major towns and cities across the UK. This comprehensive approach extends to offering direct delivery to site in one complete system consignment, encompassing the entire product range, including hot water heaters, electric cylinders, hybrid hot water tanks, heat pumps, flues, accessories, and fittings.

Chris Goggin, operations director, says: 'We are here to help and serve the marketplace. It is a totally integrated part of our operation – our answer is 'yes' to any supply and shipment question to anywhere on mainland UK.'

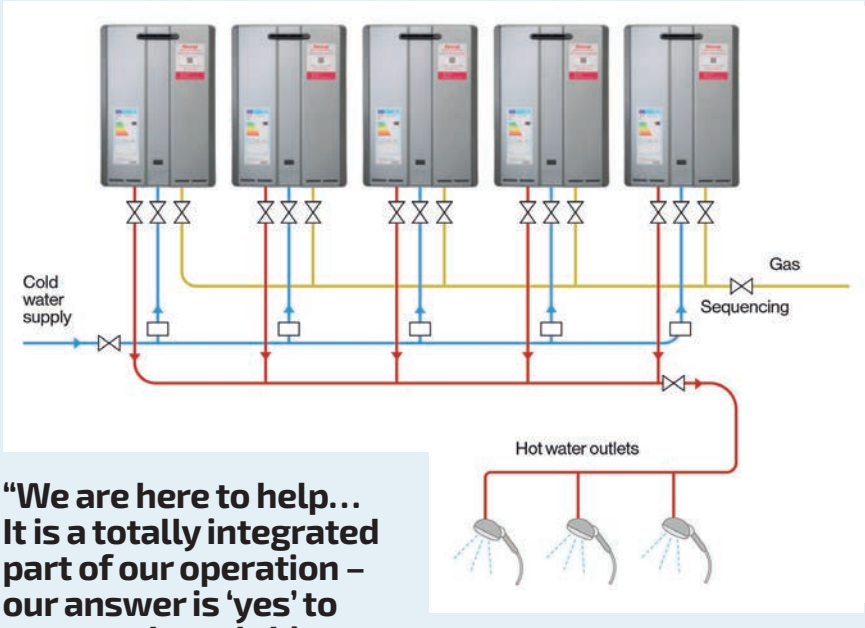
Rinnai's continuous flow hot water heating units and systems ensure limitless hot water supplies to any site, as long as there is a constant supply of gas and water. This includes a guarantee to provide temperature-controlled and usable hot water in unlimited quantities for all hygiene regimes across various sites.

The Rinnai hot water heating unit models offer savings of:

- **20% reduction in operating expenditure**
- **30% reduction in initial cost**
- **15% reduction in carbon**
- **75% reduction of space**
- **85% less weight.**

The company is not only focused on product delivery, but also on comprehensive support, offering 24/7 technical service, product availability, and spares. Digital technology aids, such as the 'Help Me Choose' facility on the Rinnai UK website, enhance the customer experience further.

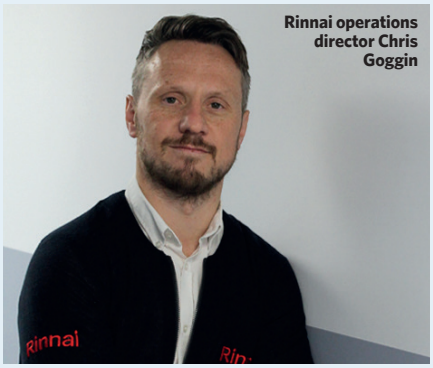
Alongside this, Rinnai is contributing to low carbon pathways by introducing a 12-year warranty on all fully certified I2HY20 continuous flow hot water heaters, suitable for standalone installation or as part of hybrid hot water systems supporting solar thermal or heat pump technology.



"We are here to help... It is a totally integrated part of our operation – our answer is 'yes' to any supply and shipment question to anywhere on mainland UK"

The Rinnai Specification and Design Team also provides installation schematics that adhere to legislative design considerations, ensuring best practices for hygiene standards and compliance issues. This will combat challenges such as legionella, G3, and a host of onsite obstacles.

Rinnai's commitment to decarbonisation is evident in its H3 range, which includes hydrogen/BioLPG-ready technology, hybrid systems, low-GWP heat pumps, and solar thermal solutions. It caters for residential and commercial applications, offering contractors, consultants and end-users efficient, robust and affordable decarbonising appliances.



Rinnai operations director Chris Goggin

Rinnai's H1, H2 and H3 series cover various fuels and appliances, including electric, gas, hydrogen, BioLPG, DME solar thermal, low-GWP heat pumps, and electric water heaters. The company anticipates the international relevance of clean hydrogen fuels and has designed its H1 water heaters to be hydrogen 20% blends-ready, including the world's first 100% hydrogen-ready hot water heating technology.

Rinnai produces more than two million hot water heaters annually, operating on all five continents. The brand has established a reputation for high performance, cost efficiency, and extended working lives. Its continuous flow water heaters provide instantaneous temperature-controlled hot water, aligning with present and future energy sources, including condensing water heaters compatible with existing fuel or hydrogen gas blends.

Rinnai products are UKCA certified, boast A-rated water efficiency, and are accessible through multiple fuel options, available for purchase 24/7, 365 days a year.

The company also offers carbon- and cost-comparison services, system design assistance, comprehensive training courses, and technical support, emphasising its commitment to providing reliable and sustainable solutions in the water heating industry.

For more information visit www.rinnai-uk.co.uk

Elco heat pumps installed at Staffordshire secondary school

Six Aerotop air source heat pumps have been installed at Staffordshire Academy secondary school by Elco Heating Solutions. The project involved the deployment of five Aerotop L65 units and one Aerotop M model, which were integrated into the existing system in a hybrid setup, to provide reliable and energy-efficient heating and hot water for the school's 1,300 students, aged 11 to 18.

Managed by Lord Combustion Services, the installation included new circuits to connect decommissioned plantrooms to the hybrid system. Additionally, advanced BMS control systems were implemented, offering features such as weather compensation, optimisation, and operational control, to allow the school to plan and set system levels in advance of special events.

Stuart Smith, managing director of Lord Combustion, emphasised the project's success in modernising the heating and reducing the school's carbon footprint, resulting in greater control and lower utility costs. The academy's director of estates also expressed satisfaction.

The models offer efficiency and sustainability year-round, contributing to cost savings and environmental responsibility.

Visit www.elco.co.uk

New CPD and white paper set out the roadmap to decarbonisation

The launch of two new resources from Hamworthy Heating is another step towards the decarbonisation of heat. 'CIBSE-accredited CPD course 'An introduction to heat pumps' provides specifiers and installers with insights into heat pump operating principles, system design considerations, and market drivers.

Complementing this, the 'Hamworthy roadmap to decarbonisation' white paper delves into the challenges of transitioning to low carbon heating, spotlighting the Tyneham monobloc air source heat pump as a key player. Hamworthy, dedicated to service excellence, supports customers with CPD seminars and product training courses, demonstrating a commitment to innovation and environmental responsibility.

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

New guide from Condair to aid in dehumidifier specification

Condair has released a comprehensive 10-point guide for specifying dehumidifiers, covering system design, product sizing, drying psychrometrics, and energy-saving aspects. The free guide aims to be a valuable resource for HVAC consultants, installers and facilities managers, offering unbiased advice on desiccant and condensing dehumidifiers.

Dave Marshall-George, sales director, emphasises the guide's accessibility, with its easy-to-follow format. Produced by experts in the field, it provides assistance for complex dehumidifier projects by addressing various parameters and considerations.

Visit www.condair.co.uk/dehum-guide

Aermec promises up to 50% energy savings with Aersave compressor technology

Aermec has announced the Aersave, a pioneering technology for scroll compressors, to combat escalating energy costs. The Aersave smart compressor controller can convert any 3-phase fixed-speed compressor on various chiller brands to a variable-speed compressor, offering energy savings of up to 50%.

Compressors on chillers are significant energy consumers, but Aersave is an alternative to replacing entire systems to combat this. Compatible with all refrigerants and BMS systems, the Aersave enhances reliability, reduces noise levels, and ensures precise temperature and humidity control.

Comprising two sensors instead of pressure transducers, Aersave's unique control system calculates optimal compressor speed and capacity based on real-time data, contributing to increased performance and longevity. With multiple dip-switch settings and compatibility with various compressor types, Aersave aims to stand out as a versatile and retrofit-friendly solution for air conditioning and refrigeration engineers.

Call +44 (0) 203 008 5940 or visit www.aermec.co.uk

Hamworthy Heating simplifies boiler choice with new system selector

Hamworthy Heating has introduced the Stratton mk3 System Selector, streamlining product selection for its Stratton mk3 wall-hung condensing boiler range. Designed for cascade arrangements, the tool accommodates up to six boilers, enhancing flexibility to meet building demands. Wall-hung cascades offer increased turndown ratio and redundancy, and have gained in popularity in the past decade, .

The System Selector identifies products needed for an efficient system. With outputs from 40kW to 150kW, the Stratton mk3 boasts a 5:1 turndown ratio, pre-mix burner tech, and compliance with Part L Building Regulations.

Call 01202 662 552 or visit hamworthy-heating.com/Stratton-mk3-system-selector

Pump Technology celebrates SoPHE Annual dinner success

Pump Technology and Jung Pumpen would like to express their gratitude to guests for attending the SoPHE Annual Dinner, hailing it an excellent evening.

Key discussions centred on Pump Technology's Rain Forest Trust sponsorship linked to Jung Pumpen DrainMinor and DrainMajor wastewater systems with recyclable tanks, as well as the new pop-up reception area exhibition scheme.

The team wishes all a happy Christmas and anticipates reconnecting in the new year.

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

Modutherm launches new CPD on heat pumps for low temperature heat networks

A new CIBSE-approved CPD has been launched by Modutherm. 'Incorporating heat pumps into low temperature heat networks' focuses on the seamless integration and optimisation of heat pump performance within low-temperature networks, and addresses key aspects such as terminal unit matching.

The session discusses evolving system designs, current regulations, and the upcoming 2024 heat network zoning regulations. The hour-long CPD is available online or in person.

Email enquiries@modutherm.co.uk or visit www.modutherm.co.uk

Ideal heating launches new information hub

Ideal Heating Commercial has introduced a new net zero information hub as part of its Join the Net Zero Journey strategy.

The hub offers real-time insights into the UK's mission to decarbonise commercial heating by 2050. Ideal Heating presents compelling case studies – including schools, housing developments, and offices – illustrating the impact of low carbon heating solutions.

Customers can explore a range of technologies, from heat pumps to hydrogen-ready boilers, with informative white papers and guides.

Visit idealcommercialboilers.com/net-zero

DIRECTORY

Your guide to building services suppliers

Photovoltaics are part of the solution for the transition from fossil fuels to electricity

Chris Worboys

The smart route to electrification

The challenges of electrification are surmountable by managing demand and optimising energy use. Chris Worboys, with help from Luke Osborne, explains how, ahead of their presentation at CIBSE Build2Peform Live

The electrification of buildings is vital if the UK is to meet its carbon-reduction targets. Visitors to CIBSE Build2Perform Live on 5-6 December can find out what this means for building design by attending a session led by Chris Worboys, senior sustainability consultant at Etude, and Luke Osborne, deputy technical director at Electrical Safety First. Here, they answer questions on the transition from fossil fuels to electricity.

What are the biggest challenges to electrification?

One of the biggest is culture. Design teams often use solutions with which they are familiar, as there is risk and effort associated with new approaches. Air to air heat pumps are huge in Europe because they have high efficiencies and offer a cheap entry point into low carbon heating, yet they remain a niche product in the UK.

Lack of understanding of tariffs is also a problem. Grid imports can range from negative during periods of excess renewable generation to multiples of the average price at peak times, while onsite solar is a fantastic source of cheap electricity. This means electric heating can be much cheaper than fossil-fuel heating, but a building's systems need to be designed in specific way to achieve this.

Another challenge is the endless promotion of hydrogen for heating by the gas industry, despite an almost total lack of independent evidence that this is a sensible pathway. There is a point at which it becomes necessary, as professionals, to call out technologies that have questionable fundamentals.

How do we avoid being constrained by Grid capacity as we move to electric vehicles (EVs) and heat pumps?

By minimising and managing demand, and investing in the network. Fabric efficiency is vital for new buildings because it reduces electrical demand, but it is difficult and expensive to improve at a later date. There is also good potential to reduce demand through better design and optimisation of building services. For example, by designing systems with domestic hot water storage to reduce peak demands, and space heat distribution that allows heat pumps to operate with load and weather compensation, which can increase efficiency.

Designers need to think carefully about EV charging requirements. For many buildings, a charging rate of 7kW or less may be adequate, while it doesn't make sense to specify a 50kW DC fast charger for a long-term parking bay.

What can building services engineers do to contribute to electrification?

Projects need engineers who know these systems inside out; who can design systems that run efficiently, with low losses, while using cheap intermittent renewable energy from on- and offsite sources. Training is a big one. Smart control options are developing fast, so designers must establish close relationships with manufacturers to understand the latest technology and what's coming next.

How important is smart technology?

We are moving to an energy system where demand needs to be scheduled to match supply, rather than supply being scheduled to meet demand. National Grid has been clear that smart technology is vital to manage demand. For a building owner, smart technology is key to accessing cheap and plentiful renewable electricity. Buildings with better fabric efficiency, higher thermal mass, hot water storage, and smart controls will be better able to use onsite solar energy when it is available, and to access offsite renewable energy from the Grid at very low prices.

How do we electrify existing buildings?

In a block of flats, for example, the easy approach might be to use a communal heat pump instead of a gas boiler, but that could mean the system has to operate above 60°C all year to provide domestic hot water. This removes the option of load and weather-compensated flow temperatures, and storing domestic hot water at lower temperatures with sterilisation cycles. These are the main strategies used to maximise the efficiency of heat pumps. Using individual heat pumps, whether standalone or linked to an ambient loop, could operate much more efficiently, and would allow occupants to take advantage of time-of-use electricity tariffs.

- Register for the free to attend Build2Perform at **www.build2perform.co.uk**

EVENTS AND TRAINING

NATIONAL EVENTS AND CONFERENCES

CIBSE Build2Perform Live and Light2Perform
5-6 December, London ExCeL
Build2Perform Live is the meeting place for forward-thinking industry professionals, visionary speakers, leading industry exhibitors, and young talent. It is the must-attend event in the building services sector.
www.build2perform.co.uk

CIBSE Building Performance Awards 2024
29 February 2024, Park Plaza Westminster Bridge, London
Booking is now open for the Building Performance Awards, the only industry accolades that focus on actual, measured performance outcomes, and not just design intent or performance specifications. Entries are open to any organisation or individual, within the UK or internationally, that is responsible for the design, commissioning, construction, installation or operation of low-energy buildings, and the manufacturers whose products enable efficient energy consumption. Book your place to celebrate with the industry at **www.cibse.org/bpa**

CIBSE Technical Symposium
11-12 April 2024, Cardiff University
With the theme 'Fit for 2050 – Delivering buildings and defining performance for a net zero built environment', the 2024 symposium will have a range of peer-reviewed papers and presentations outlining the latest developments in practice, technology and policy. It will also highlight the latest guidance for building services engineers.

CIBSE REGIONS AND GROUP EVENTS

Check the website for up-to-date information on regional and group meetings, webinars and podcasts; visit **www.cibse.org/events**

East Midlands: Legionella risk assessments and BS8580-1:2019, do your risk assessments comply?
9 January
This online briefing will reiterate the need for legionella risk assessments and how they are required under the Regulations and Guidance documents. Register at **bit.ly/LRA9Jan**

MEMBERSHIP WEBINARS

CIBSE Membership hosts a free, two-part webinar series to support members with applications for the Associate and Member grades and registration with the Engineering Council at Incorporated and Chartered Engineer level. For upcoming dates and register visit **bit.ly/CJMar23memwebs**

CIBSE JOURNAL PODCASTS

The latest *CIBSE Journal* podcast, sponsored by Daikin, titled 'Tackling whole life carbon in air conditioning', is now available. The podcast features CIBSE's Carl Collins, Daikin's Matteo Dall'Ombra, Introba's Clara Bagenal George, and Andrew Mitchell, from Mace. Listen on Apple and Spotify or on CIBSE's SoundCloud at **bit.ly/CJMay23PC1**

On-demand training

CIBSE has a portfolio of on-demand courses that contain interactive online content, with quizzes and additional resources to support your learning. See **go.cibse.org/training-mycibselearning**

Benefits include:

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

CIBSE JOURNAL WEBINAR

The latest *CIBSE Journal* webinar, sponsored by Daikin, is now available on demand. This webinar, titled 'Our sustainability journey', explores how the HVAC market needs to adapt to meet the UK's ambitious environmental targets, and how Daikin is working to lead the way.

All previous *Journal* webinars are also available on demand at **www.cibsejournal.com/webinars**

TRAINING IN 2024

The 2024 Training Programme is now available. It offers a diverse range of courses to meet the evolving needs of professionals in the building services sector. CIBSE is here to support you at every step of your professional development journey. Book before 31 December 2023 to receive 10% off using the code EARLY2024. CIBSE members receive an additional 20% membership discount on individual bookings.

New for 2024: Commissioning Code M: Commissioning Management – this training offers a comprehensive overview of the commissioning management process.

Download the 2024 training brochure here: **www.cibse.org/training**

TRAINING COURSES

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

Mechanical services explained
5-7 December, remote
30 Jan – 1 February, remote

Low carbon consultant building operations
5 December, London
31 Jan – 1 February, London
6 February, remote

Fire safety Building Regulations: Part B
18 January, London
27 February, remote

Heat networks Code of Practice
11-12 December, remote
6-7 February, remote

Building services explained
12-14 December, remote
23-25 January, remote

ISO 50001:2018 Energy management system/ low carbon consultant
16-17 January, remote
19-20 March, remote

CIBSE Training

The 2024 CIBSE Training Programme has landed

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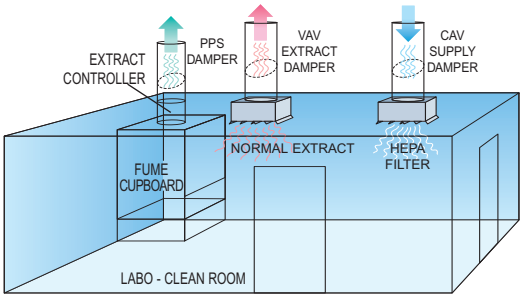

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