

CIBSE JOURNAL



#Build2Perform

February 2021

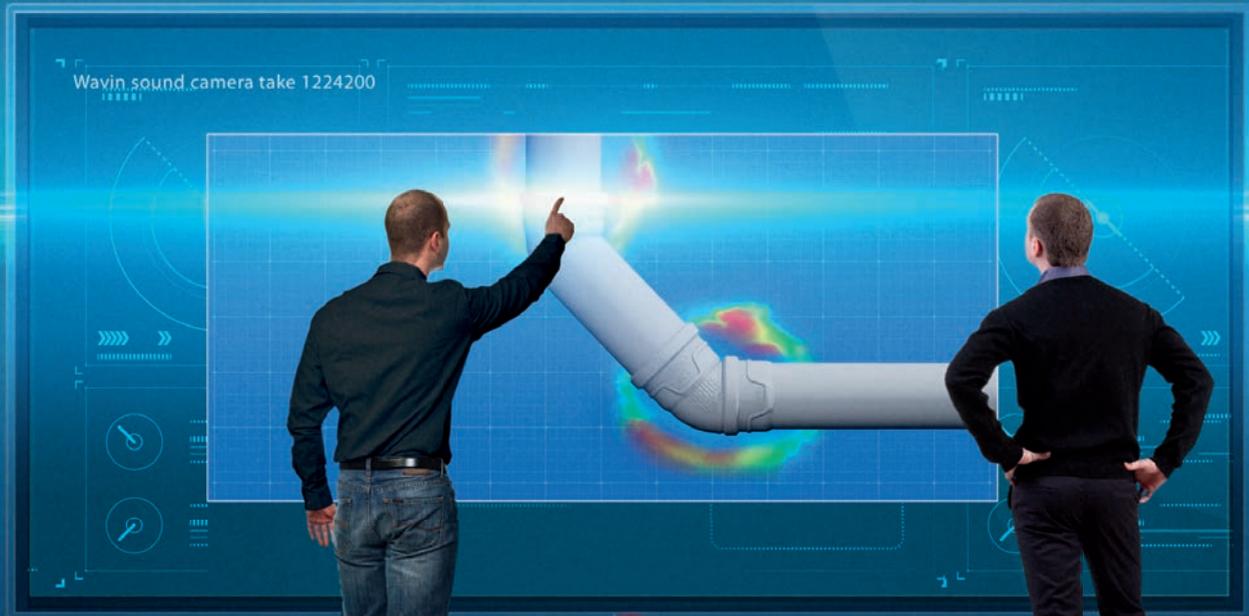
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WELCOME TO THE TEAM

How companies are integrating new starters into engineering positions during lockdown



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Staying connected



While mass vaccination against Covid-19 offers some hope of a return to normality in 2021, for now, the UK is experiencing the worst ravages of the disease, with nearly 2,000 people dying every day.

The majority of the country is in lockdown until the scientific experts give the all clear. While construction workers are allowed to continue on site, for most building services professionals the workplace is their spare bedroom or kitchen nook.

Keeping employees engaged and motivated while working remotely has been a challenge for employers for 10 months now. Providing a strong sense of connection between the employer and graduates and

apprentices starting out on their careers has become key; new starters are missing out on the social interaction and mentoring enjoyed by previous cohorts.

On page 22, we speak to employers about how they are managing to foster a sense of culture and learning. Interactive platforms are part of the answer, but one-to-one relationships are also important, with employers such as Sweco and Arup pairing graduates with buddies who were lucky enough to join the industry before Covid-19.

The 2021 Hays Salary Survey reveals that, despite Covid-19, salaries continued to rise last year. Companies are also upbeat about the future, with 89% believing their organisation's activity levels will increase, or at least stay the same, in the next year.

Industry leaders will be buoyed by the government's commitment to zero carbon buildings in the Future Homes Standard, published last month, which will put engineers at the forefront of the challenge to build ultra-sustainable homes. Under the Standard, new homes must produce 75-80% fewer carbon emissions than they do under current Building Regulations by 2025.

On the same day as the Standard was published, there was a sobering reminder of current failings in the construction industry. The government announced that a national construction products regulator will be established to address the issues uncovered by the Hackitt Review. The regulator will have the power to remove any product from the market that presents a significant safety risk and prosecute companies who flout rules on product safety.

The announcement follows recent testimony to the Grenfell Inquiry, which the government said 'shone a light on the dishonest practice by some manufacturers of construction products, including deliberate attempts to game the system and rig the results of safety tests'. It is clear that the government feels manufacturers can no longer be relied upon to police the safety of their own products. That is a highly damning verdict for our industry.

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Tackling the energy performance of privately rented homes and why the government could do more



Tim Mitchell

Why designers should now be considering the embodied energy of refrigerants used in HVAC



Tim Dwyer

The CPD explores key areas covered by CIBSE TM61: Operational performance of buildings



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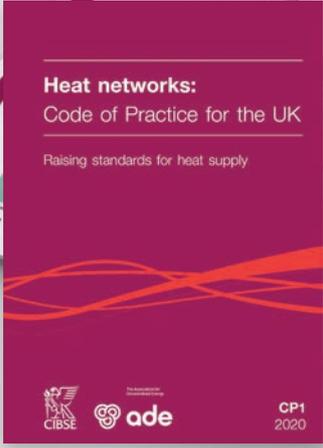
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US REJOINS PARIS AGREEMENT HOURS AFTER BIDEN IS SWORN IN AS PRESIDENT



President Biden gets to work in the Oval Office

Joe Biden has moved to reinstate the US to the Paris climate agreement, just hours after he became the 46th President of America.

His administration has put climate change high on its list of immediate priorities. It says it will take 'swift action to tackle the climate emergency and ensure it meets the demands of science, while empowering Americans to lead a clean-energy revolution'.

Donald Trump withdrew America from the accord in 2017, saying it would 'decapitate' the US coal industry.

Biden is also set to scrap an agreement to build the Keystone XL pipeline, which would bring oil from Canada to the US.

Government confirms net zero new homes by 2025

Tough targets set for new homes in the Future Homes Standard

The government has confirmed that all new buildings will be zero carbon by 2025.

Responding to a consultation on the Future Homes Standard – the first part of a two-part consultation on Part L and Part F of the Building Regulations – it said that new homes would be expected to produce 75-80% fewer carbon dioxide emissions compared with those built to current Building Regulations. The government has also published 2021 Building Regulations for new dwellings, which will force new homes to reduce carbon emissions by 31% this year, as a stepping stone to the 2025 target.

CIBSE supported some of the proposals, such as the retention of the fabric efficiency standard, but said it had concerns about other proposals, including unambitious airtightness targets.

Housing minister Christopher Pincher MP said: 'The radical new standards will not only improve energy efficiency of existing homes and other buildings, but will also ensure our new homes are fit for the future by reducing emissions from new homes by at least 75%.'

The government announced a consultation on higher performance targets for non-domestic buildings (the second consultation on Part L and F) with the goal of making them zero carbon-ready by 2025.

Its plans include additional ventilation and indoor air quality monitoring in high-risk non-domestic buildings, such as offices and gyms,

and a new overheating mitigation requirement in the Building Regulations.

The proposals contain recommendations that CIBSE made last year, including retaining local authorities' right to set energy and carbon standards that go beyond Building Regulations. They also accelerate the development of the Future Homes Standard (due for publication in 2023) and omit proposed technology factors that would have allowed heating emissions to be 45% higher for heat networks.

CIBSE said the draft specification for airtightness in new homes should have gone further. Its technical manager, Julie Godefroy, said that the target of $5\text{m}^{-3}\cdot\text{h}^{-1}\cdot\text{m}^{-2}$ for airtightness would lead to levels of energy efficiency that 'were far from world class'.

Compliance targets are still proposed to be set by comparison with a notional dwelling. Godefroy said: 'This means little in real life, prevents verification in use, and does not drive passive design. We recommend moving to simpler, more effective and trackable targets, such as Energy Use Intensity.'

She added that measures to address the performance gap during in-use operation were not addressed and should now be looked at through another regulatory instrument such as the wider regulatory regime created in response to the Hackitt Review.

■ To access the policy documents and respond to the consultations on higher performance targets for non-domestic buildings visit www.cibse.org/News-and-Policy/Policy

Climate conference to focus on buildings

The COP26 climate summit, to be hosted by the UK in November, will include a major focus on architecture and building engineering after its president, Alok Sharma, announced plans to include a 'built environment day'.

In a letter to the World Green Building Council, Sharma said that 'action to decarbonise the buildings and construction sector is critical to meeting our Paris Agreement goals'.

The conference, which was postponed from last year, will be held in Glasgow and is on track to be the largest summit ever hosted by the UK, with representatives from more than 200 countries.

ASHRAE publishes aerosol guidance

ASHRAE has published new guidance covering the control of airborne infectious aerosol exposure.

'Core Recommendations for Reducing Airborne Infectious Aerosol Exposure' summarises the main points found in the detailed guidance documents produced by the ASHRAE Epidemic Task Force. They are based on the concept that ventilation, filtration and air cleaners can be combined flexibly to achieve exposure reduction goals subject to constraints that may include comfort, energy use and costs.

'This guidance outlines a clear approach for lessening the risk of infectious aerosol exposure for building occupants,' said taskforce chair William Bahnfleth.

IN BRIEF

5G to drive site productivity

A £1.7m project to improve construction productivity using digital tools driven by 5G is being trialled by BAM Nuttall, in partnership with AttoCore and the Building Research Establishment.

The 5G AMC 2 (Accelerate, Maximise and Create for Construction) project has received £846,000 from the government to help it explore how 5G can enable the use of data to improve construction processes. It will trial 5G-powered cameras, drones and sensors at Scottish sites in Kilsyth, Glasgow and Shetland.

BAM is setting up a private 5G network at its regional office in Kilsyth and at a construction project in Shetland.

'I look forward to seeing how this new era of mobile technology can empower firms to work smarter, shorten delivery times and cut costs,' said digital infrastructure minister Matt Warman.

Report shows fossil-fuel demand could peak in 2027

Fall in global energy demand during pandemic brings date forward

The Covid-19 pandemic has accelerated electrification and energy efficiency, bringing forward the date of peak fossil-fuel demand, according to a report from the consultancy McKinsey & Company.

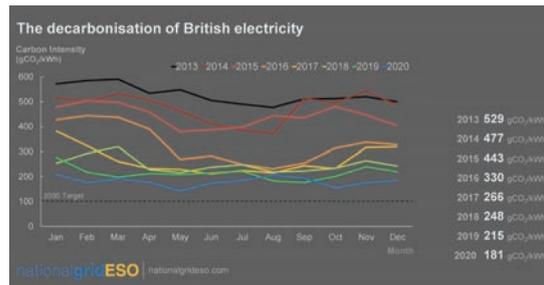
It says global energy demand will not reach

pre-Covid-19 levels for at least another year, with demand for electricity and gas rebounding more rapidly than oil. This could lead to all fossil-fuel demand peaking in 2027, instead of sometime in the 2030s, as previously predicted.

The report analysed four possible scenarios with, at one extreme, countries moving quickly to align with the Paris Agreement targets and, at the other, short-term job creation being prioritised over long-term decarbonisation to speed recovery from the pandemic.

McKinsey took an average outcome across all four scenarios, which shows oil demand peaking in 2029. Peak gas could be delayed to 2037 because of longer-term issues with upgrading heating systems in buildings. The report also predicted that hydrogen would become cost-competitive with gas by 2030.

In 2020, the UK National Grid continued to decarbonise, with carbon intensity falling by 15% from 215g/CO₂/kWh to 181g/CO₂/kWh.



The carbon intensity of the UK National Grid continued to fall in 2020

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National regulator to ensure safe construction materials



Authority has power to test materials and prosecute firms breaking rules

A new national regulator has been established by the government to ensure homes are built from safe construction materials and products.

The regulator will operate within an expanded Office for Product Safety and Standards, and will be given £10m of funding for the construction role. It will work with the Building Safety Regulator and Trading Standards to encourage and enforce compliance.

An independent review to examine weaknesses in previous testing regimes, and recommend how abuse of the testing system can be prevented, has also been commissioned.

The new regulator will have the power to remove products from the market that present a significant safety risk, and prosecute

any firms flouting rules on product safety. This follows recent testimony to the Grenfell Inquiry that shone a light on dishonest practice by some manufacturers of construction products, including deliberate attempts to rig safety-test results.

The regulator will be able to conduct its own product testing when investigating concerns. Businesses must ensure their products are safe before being sold, in addition to testing products against safety standards.

Housing Secretary Robert Jenrick said: 'The Grenfell Inquiry has heard deeply disturbing allegations of malpractice by some construction product manufacturers and their employees, and of the weaknesses of the present product-testing regime.'

'We are establishing a national regulator to address these concerns and a review into testing to ensure our national approach is fit for purpose.'

On the independent review, Hywel Davies, CIBSE technical director, said: 'If the government is serious and wants to minimise risk of unsafe products, there must be a thorough look into how initial testing is done, what level of third party intervention and control is required, and how manufacturers are held to account to show that production meets the specification that passed initial tests.'

The regulator marks the next major chapter in the government's overhaul of regulatory systems. Progress on regulatory reform includes the publication of an ambitious draft Building Safety Bill and a new Building Safety Regulator, which is already up and running in shadow form.

Kwarteng leaves construction post

Kwasi Kwarteng has become the shortest-serving Construction Minister, leaving the post a mere one month after being appointed.

The job, which has gained a revolving-door reputation since Nick Raynsford held it for four years under Tony Blair, has now been taken up by Anne-Marie Trevelyan.

Kwarteng was almost instantly promoted to Business Secretary after succeeding Nadhim Zahawi, who was Construction Minister for just over a year and is now overseeing the Covid-19 vaccine programme. Alok Sharma, the previous Business Secretary, is now concentrating full-time on the UN COP26 climate conference, which takes place in Glasgow in November.

As a result, Kwarteng has overtaken Lord Henley (October 2017 to January 2018) as the shortest-serving Construction Minister.

The new incumbent, Trevelyan, is a chartered accountant, and has been MP for Berwick-on-Tweed since 2015. She was previously Secretary of State for international development and on the public accounts committee. She will continue in her role as the 'UK's International Champion on Adaptation and Resilience' for the COP26 presidency, a role described as supporting countries vulnerable to climate change to adapt to its impacts and build resilience.



Anne-Marie Trevelyan

IN BRIEF

Green skills plan targets one million

Energy provider Drax has unveiled a plan to invest in the 'green skills, education, employability, and opportunities' of a million people from disadvantaged backgrounds, and in under-invested areas of the country over the next five years.

It said it was 'determined to bridge the opportunity gap' through a programme of apprenticeships, community outreach programmes, and education sessions. This is also part of its plan to be 'carbon negative' by 2030.

Clare Harbord, Drax director of corporate affairs, said: 'This will make the energy sector stronger and able to make a more significant contribution to the UK's green recovery from Covid.'

The 'Mobilising a Million' goal is part of social mobility action campaign led by former Education Secretary Justine Greening.

Consumer risk from smart tech flagged

Consumer protection organisation Citizens Advice has raised concerns about the financial risk faced by owners of so-called 'smart' homes.

In conjunction with Energy UK and the Association for Decentralised Energy (ADE), it has launched an initiative to improve protection of homeowners using clean energy technologies, such as batteries, heat pumps, smart appliances, and electric vehicles.

Citizens Advice has produced a 'risk register' for demand-side response services, to identify issues with home energy flexibility technologies and tariffs.

'For the transition [to net zero] to be successful, people will need the confidence to make these major adjustments. This means identifying and addressing early any potential gaps in consumer protections,' it said.

Bids invited for £7bn education programme

The government is inviting bids for projects in its four-year schools and colleges building programme for England. The 22 lots are divided into geographical areas. High-value projects are split North and South, medium-value into eight regions; and low-value cover 12 parts of the country. Procurement documents are available free from bit.ly/CJFeb20News1

Builders confused by green home scheme

Builders and installers are turning their backs on the government's flagship policy to kick-start a makeover of UK homes. A survey by the Federation of Master Builders (FMB) found that the industry is confused about how to deliver projects through the Green Home Grant scheme and consumers are finding it hard to access the finance on offer.

The scheme aims to upgrade thousands of homes to EPC rating C by 2035, but 26% of respondents to the FMB survey complained about the lack of a 'clear pipeline of work'. Poor levels of consumer awareness were also a barrier to the scheme, along with a 'lack of capacity and skills in the construction workforce'. Just three out of 250 builders who had expressed an interest in the scheme had been able to complete the registration and training.

'Builders don't yet have the confidence they need in the domestic energy efficiency market to invest in their businesses and start offering these services to homeowners,' said FMB chief executive Brian Berry.

Air con gases blamed for truck explosion

An Australian truck driver has been seriously injured by an explosion thought to have been caused by flammable refrigerant gas incorrectly used in his vehicle's air conditioning system.

The accident took place in a Queensland mine in January and the force of the blast blew out the truck windows. The driver suffered severe burns to his face and hands. Initial findings indicate that the air conditioning was designed to operate using the HFC gas R134a, but had been recharged with a mix of the hydrocarbons (HCs) propane and isobutane.

The incident has added impetus to calls in Europe for the inclusion of mandatory training and certification of engineers working with HCs and other HFC 'alternatives' in the current review of the F-Gas regulations.

CLC fears rise in contract disputes during 2021

Tighter finances caused by pandemic likely to lead to an increase in claims

The Construction Leadership Council (CLC) has urged companies to act in a 'fair and reasonable' way and avoid 'costly and long-running disputes' sparked by the Covid-19 crisis, Brexit and other commercial pressures.

'There remains a real concern that... as we reach the completion of projects

entered into pre-pandemic and the end of financial/tax years, businesses will become embroiled in costly and long-running disputes over the effects of Covid-19 on projects,' it said in its latest briefing note.

'Indications were that 2021 may bring the perfect storm of: a negative economic environment; EU exit; reduced construction market activity; the end of government business support schemes; the introduction of reverse-charge VAT; and a significant increase in the number of claims across the supply chain.'

The CLC said it was aware of a rise in the number of claims being rejected because of the pandemic. It urged the industry to work together to resolve 'all contractual disputes arising from the pandemic'.

It expects to see more 'formal disputes', adding that without 'fair and reasonable administration of construction contracts, Covid-19 could have a significant and detrimental effect on the industry'.



New minister praises construction

Business Secretary Kwasi Kwarteng has praised the construction industry for its 'hugely valued and critical contribution' to the country during the current lockdown. In an open letter, written shortly after taking up the position last month, Kwarteng reiterated that construction supply chains should carry on despite current restrictions. 'It is vital that construction continues... you are making a major contribution to the economic recovery following Covid-19,' he wrote.

However, industry bodies have urged their members to review site safety to reflect updated Site Operating Procedures produced by the Construction Leadership Council (CLC). CLC chair Andy Mitchell urged firms to 'critically challenge what works can genuinely not be done at home' and called on those travelling to sites 'to minimise their use of public transport'.

BESA chief executive David Frise warned against complacency. 'It will only take a few "rogue" sites or workers not abiding by the rules to spoil things for everyone,' said Frise.

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Air quality group calls for ‘Ella’s Law’

Legislation would replace Clean Air Act and include explicit action on indoor air quality

Momentum is building behind a campaign for new legislation to give local authorities the power to enforce better clean air standards. Named after Ella Kissi-Debrah, the first person in the world to have her death attributed directly to air pollution, ‘Ella’s Law’ would explicitly include action on indoor air quality.

Poor air quality is estimated to contribute to the deaths of up to 36,000 people in the UK every year and more than seven million worldwide, but Ella was the first person to have it stated on her death certificate after a landmark ruling at Southwark Coroner’s Court in December. Ella’s Law would replace the Clean Air Act, which has not been updated since 1993.

The campaign group Clean Air in London and Harrison Grant Solicitors have drafted an outline of the law. ‘We need new duties and powers for the government, metro mayors and local authorities to... reduce air pollution... and take action when [it] exceeds World Health Organization guidelines,’ said Simon Birkett, founder and director of Clean Air in London.



Parliament ‘decant’ project is abandoned

The £500m Northern Estate programme being developed by BDP to provide temporary accommodation for MPs and parliamentary staff during the restoration of the Palace of Westminster has been shut down.

BDP had around 250 people working on a plan to convert nearby listed buildings into temporary homes for MPs, and to relocate the House of Lords to the QEII Conference Centre. However, the team overseeing the £4bn revamp of the Palace buildings said it was now looking for a ‘more agile set of projects’.

They added that a review had established that taking a phased approach would reduce the amount of time MPs would need to remain away from the House. This includes the possibility ‘of accessing the Palace from the river to carry out work before and after decant, and close coordination with the in-house teams to maximise the benefits from any early works’.

Restoration of the Palace is considered urgent because of safety risks posed by falling masonry, outdated heating, ventilation, water and electrical systems, and thousands of ventilation shafts that need upgrading to protect the building from fire.



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IN BRIEF

CIBSE leads heat pump collaboration

CIBSE has appointed Arup as the technical author for the *Good practice design guide for residential heat pumps*, recognising the urgent need to develop guidance on the design, installation, operation and maintenance of heat pumps in multi-occupancy residential buildings.

The new guide is intended to bring together best practice and industry-wide advice for practitioners. It will also address the issue of user guidance for a technology that offers a very different experience for residents compared with traditional systems.

Arup will work under the direction of an expert CIBSE Technical Steering Group, and publication is due in late spring.

Hopton and Noakes to speak at Building Performance Awards

Professor Catherine Noakes and Tom Hopton have been announced as speakers at the Building Performance Awards 2021.

Noakes, a professor of environmental engineering for buildings at the University of Leeds, is an expert in airborne infection transmission, and was made an OBE in 2020 for 'services to the Covid-19 response'.

2020 CIBSE Engineer of the Year Hopton, an associate at Buro Happold, has been a lead engineer for many award-winning projects.

The CIBSE Building Performance Awards take place on 25 February and are free to attend. The awards include the new Covid-19 Achievement Award.

To view shortlists, and book your place, visit www.cibse.org/bpa

A career in public health engineering

A new blog entry is available as part of CIBSE's Career in Building Services series. The latest post is from Ben Goodfellow, a public health engineer at WSP and chair of the Society of Public Health Engineers Young Engineers Network (SoPHE YEN). He discusses why it is such an important career and who it would be suitable for, and talks about SoPHE YEN. Visit www.cibseblog.co.uk to read the post.

Remembering Liz Peck FSLL, 1974–2021

Past SLL President Liz Peck was highly influential among the lighting community

It is with great sadness that the Society of Light and Lighting (SLL) can confirm the death of Liz Peck, past president, former secretary and a Fellow of the society. Liz died in January at the age of 46.

Liz joined the lighting industry in 1999, taking a customer service role with Concord Lighting. Working alongside Mike Simpson, she moved from Concord to Philips, becoming a senior lighting designer while undertaking the Bartlett MSc in light and lighting. Liz was named the Worshipful

Company of Lightmongers Student of the Year in 2003 and graduated in 2004.

In 2007, Liz set up her own independent lighting consultancy, LPA Lighting. She also provided training for CIBSE and the Lighting Industry Association.

Liz's projects include Dover Castle and, more recently, the Iron Bridge in Telford, a project that she worked on with current SLL president Bob Bohannon, winning the Outdoor Lighting Project of the Year at the Lux Awards in November 2020.

In 2008, Liz was awarded the SLL Lighting Diploma and, before being elected to the SLL executive committee, was the society's secretary. She became SLL President in 2015, the Unesco International Year of Light.

In her presidential year, Liz was one of the instigators and project leads of the first SLL Night of Heritage Light. Embracing and celebrating the International Year of Light, SLL members lit nine Unesco World Heritage sites across the UK on 1 October 2015. Liz was also named Lux Person of the Year 2015.

Liz was an active member of the society's technical and publications committee, contributing to several SLL Lighting Guides. After moving from Brighton to Leeds, she started the Northern Lights initiative, which gave light-minded people in the north of England the chance to socialise and discuss the topics of the day.

A great champion of the lighting community, Liz felt strongly about supporting and encouraging those within it. She was very passionate, hardworking, and committed to the lighting profession.



Liz Peck was SLL President in 2015

New LG20 lighting guide helps FMs reduce energy consumption

A new publication setting out lighting-related tasks that need to be considered or undertaken by facilities managers (FMs), has been published by the Society of Light and Lighting (SLL).

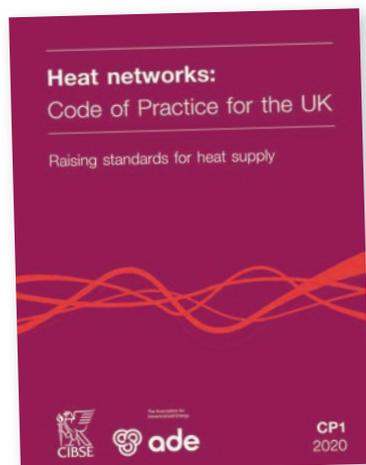
LG20: Lighting and facilities management is designed to help FMs who are required to maintain, modify and update electric lighting installations. It sets out relevant lighting tasks, ranging from lamp replacement to procurement or turnkey supply for upgrading lighting installation.

Facilities managers may also be responsible for energy monitoring within a building, so will need to be aware of the energy performance of a lighting installation so they can identify how energy savings can be achieved while maintaining appropriate light levels.

As stated in the publication introduction: 'It is about providing the right amount of light in the right place for the right amount of time.'

● *LG20 Lighting and facilities management* is available on the CIBSE Knowledge Portal at www.cibse.org/knowledge

Code is step to quality assurance scheme



Significant CP1 update focuses on verification of network performance

CP1: Heat Networks Code of Practice (CP1) has had a major update to reflect feedback from the industry, changes in regulation, and results from research projects.

The new edition is a significant update on the 2015 version, which was successful in establishing minimum standards to improve the

quality of district heating projects and in influencing the procurement of heat networks.

The updated code now makes compliance with CP1 easier to verify and check, with a series of fully integrated checklists providing a more structured and robust toolkit. It is hoped that it will support the development of a wider heat networks quality assurance scheme, and contribute to the regulation and decarbonisation of the heat sector.

Phil Jones, chair of the CP1 steering committee and CIBSE CHP and District Heating Group, said in the introduction: 'There is a clear need to gather a more detailed evidence base and much more work is needed to develop further guidance and verification in the long term.'

- CIBSE has produced a complementary training course covering the code. For dates, visit www.cibse.org/training
- CP1 (2020) is available on the CIBSE Knowledge Portal at www.cibse.org/knowledge
- See page 33 for more on the code.

Teambuild announces winners of 2020 virtual competition

Teambuild, the UK construction industry competition, moved online for its first virtual contest.

The event, supported by CIBSE, took place at the end of 2020. Competitors undertook real-life challenges faced by construction industry professionals, particularly at this time of coronavirus restrictions.

Teams were set three tasks around a major development site by St Edward Homes, called Green Park Village, in Reading. The winners were Team JT2, featuring Thomas Cunningham and Tobias Mackrill, both of Hawkins Brown, Katherine Dauncey, of BDP, and Clare Timpani, of Motionspot.

Teambuild UK chair of trustees Patricia Newton, said: 'We were absolutely delighted that committed new professionals have benefited from the training and expertise that Teambuild has to offer, despite the difficulties we, as an industry, have faced this year.'

Richard Brindley, who chairs the Teambuild Working Party, said: 'The challenges are realistic and it makes sense this year that participants face the additional challenges of communicating and preparing materials that can be shared through virtual channels.'

Now in its 31st year, Teambuild is a multidisciplinary, team-working competition that aims to promote understanding and cooperation between young professionals in the construction industry.

Prizes were sponsored by the Worshipful Company of Constructors and Worshipful Company of Chartered Architects. For more information, visit www.teambuilduk.com

Nominations for officers, board and council

New CIBSE officers, board members and council members take office each year from the AGM in May. Officers and board members serve on the board, the Institution's governing body, which comprises the seven officers (President, president-elect, three vice-presidents, honorary treasurer and immediate past president) and five board members.

All candidates for officer and board member vacancies arising at the AGM must be considered by the Institution's nominations panel, to which all sections of the Institution are invited to suggest candidates for consideration. The panel seeks to reflect Charity Commission guidance by nominating a range of candidates with the skills and experience required to fulfil the board's role as the governing body of a significant registered charity. It also seeks to ensure that the board includes a balance of representation from different sectors of the industry.

Having considered the advice of the panel, the board then nominates candidates for president-elect and board member vacancies. Any eligible candidates who were proposed for consideration by the nominations panel but not nominated by the board may also choose to put their names forward for election; on this occasion, however, there were no other such candidates. The board's candidates will, therefore, be declared elected at the AGM in May 2021 as follows:

President-elect: Kevin Mitchell CEng FCIBSE
Member of the board: Laura Mansel-Thomas CEng FCIBSE

The board also appoints three vice-presidents and the honorary treasurer, normally from those who serve - or have served - on the board. All those below are current officers or board members. The board's appointments to take office in these roles from May 2021 are:

Vice-presidents: Fiona Cousins CEng FCIBSE
Susan Hone-Brookes CEng FCIBSE
P L Yuen FCIBSE
Honorary treasurer: Adrian Catchpole CEng FCIBSE

The council is a larger consultative body that advises the board on Institution policy. It includes representatives of Regions, Societies, Groups, Networks and Standing Committees, and elected members, who serve a three-year term. The board has agreed to operate a similar procedure for election as that for board members, and two corporate, and one non-corporate, positions are available for election each year. The board nominated the following individuals. There were no candidates suggested by the panel but not nominated by the board, so the following will be declared elected at the AGM in May 2021:

Members of council: Colin Ashford LCIBSE (Corporate)
Andrew Bott (Non-corporate)
Dimple Rana CEng MCIBSE (Corporate)

Time to prepare

This is a pivotal year for the global response to climate change, although some still question the need or the expense. Hywel Davies considers the cost of not preparing

The world is still focused on Covid-19, with new variants emerging and the steadily mounting economic cost grabbing much attention. But the ongoing crisis also provides lessons and insights on the continuing work to address another global issue that threatens huge upheaval: climate change.

The recent appointment of Alok Sharma as full-time president of COP26 ups the tempo and interest in this major global event. With a new US administration seeking re-engagement in the Paris Climate agreement, it is worth recalling a pivotal speech on climate change given by Margaret Thatcher at the UN in 1989. She called for a



global commitment to prepare the 1992 Earth Summit – a salutary reminder for us today to prepare for COP26.

Margaret Thatcher was a trained chemist, the only scientist to have led the United Kingdom in the past 150 years. By 1986, she realised that the emerging data on atmospheric carbon dioxide (CO₂) levels confirmed the 19th-century hypothesis of Svante Arrhenius, a Swedish chemist, that increasing CO₂ levels would lead to a rise in global average surface temperatures. Arrhenius showed that an

increase in global CO₂ levels would lead to temperature rises remarkably similar to those observed in the past three decades.

Using evidence emerging from such data series as the atmospheric CO₂ measurements at Mauna Loa, in Hawaii, and Arrhenius's predictions, Thatcher saw very early the challenge of climate change. It is also worth noting that this realisation was quickly understood by one of her then ministers, John Gummer, who now – as Lord Deben – chairs the Climate Change Committee.

What can we learn from the current pandemic response that might help us more effectively to address climate change?

First, the global response to Covid-19 shows that, when the world is faced with a real crisis, it can act. Many governments have reacted with extraordinary measures and uncharacteristic speed. Some changes were so quick and necessarily aggressive that they came with significant economic cost – but it has shown that, where there is agreement that action is needed, it can be delivered fast.

Second, the Covid-19 response had to be informed by science and engineering principles, from medical sciences to fluid dynamics. The prominence of medical and scientific advisers shows the importance of policy being informed by relevant scientific and engineering expertise. This applies just as much to the climate challenge – policy responses need to be informed by scientific principles and use the science and engineering expertise available. It is also worth noting this reliance in relation to the government's announcement of a new construction products regulator, who will need a very clear understanding of the science and engineering of the products we use in our buildings.

Third, the pandemic has forced change. Running a business for a year without staff attending the office or being in the same room might have seemed insane just 12 months ago. Suggesting cutting business travel by 90% would have been called mad. But we have!

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Alok Sharma has been appointed full-time president of COP26



“As we have learned the hard way with this pandemic, having a plan and implementing it may cost money, but not having a plan costs a great deal more”

We need to look at how we have responded, and learn from it – we should not restart high-carbon behaviour patterns in an unthinking ‘back to normal’ response. We should think hard instead.

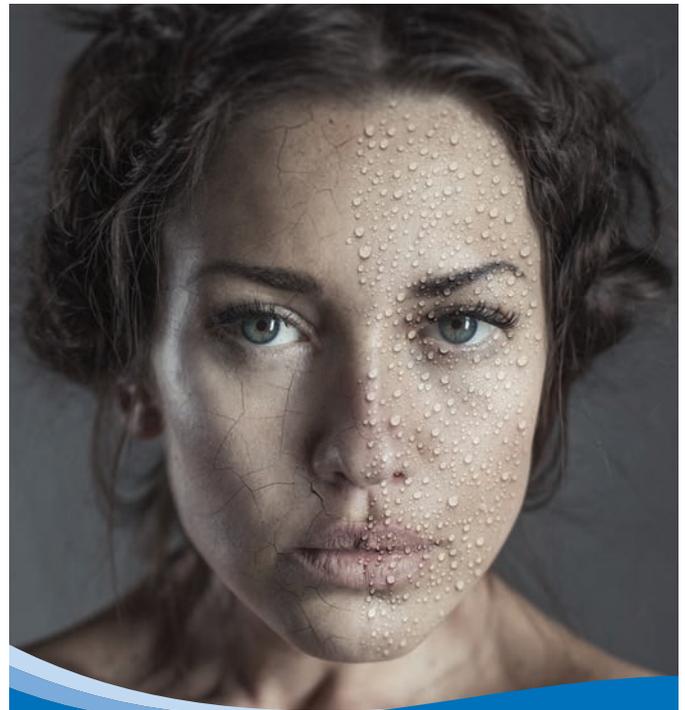
Finally, the pandemic is so bad because we ignored the warning signs, over two decades, from SARS, MERS and Ebola, and were woefully unprepared. If we had had a plan to address pandemics, as the World Bank and others – such as Bill Gates – had urged, things would still be bad, but not nearly so destructive.

The warning signs for climate change have been emerging clearly for more than 35 years. The mechanisms may not be simple, and there are complex interactions between atmospheric chemistry, oceanographic trends, meteorology and climate. But as we have learned the very hard way with this pandemic, having a plan and implementing it may cost money, but not having a plan costs a great deal more.

That is why the current consultations on energy, climate change and even overheating in homes are so vital, and we need to invest time, effort and expertise in responding to them (see page 7).



DR HYWEL DAVIES
is technical director at CIBSE
www.cibse.org



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Renewing rented homes

The UK lacks a coordinated UK retrofit strategy, while the consultation for improving private rented homes contains some flaws, says Julie Godefroy

Despite numerous reports calling for it, there is still no clear national retrofit strategy from government. The 10-Point Plan is, for the building sector, merely a small list of mostly existing policies, not a comprehensive strategy. If Boris Johnson is, as he recently said, ‘more and more obsessed’ with climate change, this would be a good place to prove it and start work.

Government is not short of advice: the Climate Change Committee (CCC) makes a number of recommendations in its 6th Carbon Budget, and the Construction Leadership Council has published a national retrofit strategy for consultation.

In the meantime, government departments are consulting on a number of individual policies to improve the existing building stock, including one on private rented sector (PRS) homes.

Tackling privately rented homes

The *Improving the energy performance of privately rented homes* consultation proposes amending the PRS regulations to improve energy performance and, in doing so, improve residents’ comfort and health, and develop retrofit supply chains. This is significant: PRS represents 4.8 million – or 20% – of households in England. Properties are typically in a worse condition, and fuel poverty much more prevalent, than in owner-occupied and socially rented homes.

The government’s preferred proposals are to require a minimum EPC rating of C (currently E), phased from 2025 to 2028. This would be subject to a £10,000 cap, so landlords would be exempt from meeting the rating if they could show work to achieve it would cost more than this cap.

An alternative government proposal would require a dual rating of EPC C and an Environmental Impact Rating (EIR) – a CO₂ rating – of C. This would be subject to a £15,000 landlord cap. Its aim would be to drive the low



“CIBSE supports the ambition to start the huge task of improving the existing housing stock”

carbon heat transition, as EPC ratings – despite being called energy efficiency ratings – are, in fact, cost-related. At current prices for electricity, compared with fossil fuels, they can actually favour continued fossil-fuelled solutions.

CIBSE very much supports the ambition to start the huge task of improving the existing housing stock. Currently, EPCs are not the right tool. First, because in-use energy data from large-scale housing samples shows some correlation between improved EPC ratings and actual energy use, but nowhere near the scale required; energy savings are too small and energy use levels of the best-rated properties are far higher than needed. Second, because of their inability to drive heat decarbonisation through the use of a cost rating.

Ultimately, it would be more effective to reform EPCs to be based on energy use. This could be coupled with a space-heating indicator to drive fabric improvements – for example, space-heating demand as in Passivhaus, or heat transfer coefficient (HTC) if the

BEIS Smart Meter-Enabled Thermal Efficiency Ratings (Smeter) trials conclude that HTC measurements are possible in a reliable, cheap and non-intrusive way.

Heat decarbonisation should be addressed separately – for example, by capping maximum EPC ratings if fossil fuels are used, and through regulations to phase out fossil-fuel installations. This has also been noted by the CCC, which says that improving the existing stock means ‘reforming EPCs to make them fit for purpose’.

The consultation also includes a number of valuable proposals to improve compliance and enforcement and drive high-quality works. It would be useful to link PRS requirements to the use of PAS 2030/5 to improve quality, evaluate outcomes to reduce the performance gap and avoid unintended consequences, such as poor air quality, overheating or fabric degradation.

Much-awaited: Part L and F

MHCLG has just published its response to the Part L & F 2020 and Future Homes Standard consultation for new dwellings, and the consultation on the remaining elements (overheating, and Part L and F for existing dwellings and new and existing non-domestic buildings). See page 7.

- All current and past consultations and CIBSE responses are at: bit.ly/CJFeb20JG
- Send comments on any of these consultations to Julie Godefroy JGodefroy@cibse.org

DR JULIE GODEFROY
is technical manager at CIBSE

Upcoming consultations

Consultation	Deadline for sending comments to CIBSE
BEIS, Improving home energy performance through lenders	5 February 2021
Welsh Government, Review of Welsh Building Regulations Part L and F	10 February 2021
Construction Leadership Council, National Retrofit Strategy	24 February 2021
BEIS, Transforming public procurement	26 February 2021



Making the green supply chain Esy!



How we can move from energy efficient building design to thinking about how to also use buildings more efficiently after hand over?

Our product selections can help supply chains target **ZERO CARBON**



Does the responsibility for sustainability and efficiency stop with the building design or could we give more thought to how buildings are utilised after hand over?

We know how supply chains impact the carbon footprint, after all, warehouses need heating, cooling, air conditioning and lighting. Not to mention the ongoing impact of transportation and materials handling. It's estimated that the transportation sector accounts for a quarter of the global CO2 emissions.

We are aware that the products we choose to use in building services design are an important part of this battle from a performance point of view. However there are other aspects of product design that can directly impact the carbon footprint.

One aspect of product design that can help is to incorporate modularity. When we define modularity we mean detachable modules that can be manufactured, assembled and serviced separately. Ideally we think of products that lend themselves to multiple solutions using only a few component parts. We think of easy installation, easy service, easy storage and easy transportation, with the lifecycle clearly in mind these products should also be easy to recycle.

Modularity means using less storage space and reducing the impact of unnecessary transportation. Portability improves along with product availability and serviceability. Instead of stocking multiple products for multiple solutions we can solve multiple problems with a few products.

The impact of DAB Esyline products

DAB Pumps award winning Esybox and its associated components was designed with these principles firmly in mind. Esybox is a completely self-contained, WRAS approved, variable speed single pump booster set in a box that becomes a modular element of a wider system. It provides an extremely flexible solution that can meet those ideals of solving multiple problems using only a few component parts.

These are some of the design benefits of the Esybox system. Single pump or multiple pump options, modular water storage, reduced acoustic impact (45dB) due to water cooling and insulation, self-priming to 8M,

reduced space requirement, built in frost protection, numerous flexible configuration choices, easy to carry and rapid installation. Esybox has wireless communication and is IoT ready. It is fast and easy to service, all internal components are modular and simple to change over.



Esybox a launchpad to further innovation

Following the highly successful launch of Esybox DAB Pumps continued to invest in research and design with the intention of expanding the number of Esy solutions available.

Not long after the introduction of Esybox came the Esybox Mini, a product solution designed for single domestic properties.

Looking to the future, 2020 has seen the launch of the Esybox Diver. With Esybox Diver the Esyline concept became submersible! This addition to the family is a fully variable speed, packaged booster set that can operate under water. Used in a storage tank it can provide all the benefits of a space saving booster set without the need for inverter installation outside of the tank. Esybox Diver can be submerged, partially submerged or even operate out of water all together without issue.

Moving forwards Esybox Max completes the circle, an Esybox solution for medium and large building applications.

To learn more about the way DAB Esyline products can enhance a building design follow the link below;

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ZERO PRESSURE

ASHRAE set a challenging budget and timetable for the renovation of its new headquarters building

Turning a leaky old office building into an exemplar net-zero headquarters for a high-profile organisation is always challenging – but even more so when that organisation is ASHRAE. **Andy Pearson** explains the approach Integral took to deliver for its knowledgeable client

‘We knew the Integral team and architects were going to have to be on their A-game, because we had a very educated client,’ says Stanton Stafford, principal of Integral Group.

He is talking about the renovation of a 6,000m² office building in Atlanta, Georgia, USA. The task was to turn this energy-consuming, 1970s building into a net zero energy, global headquarters fit for its client – ASHRAE, CIBSE’s transatlantic sister organisation. In addition to net zero energy consumption, ASHRAE wanted its new HQ to exceed the provisions of its own indoor air quality standards and to deliver a maximum demand-side energy use intensity (EUI) of 67.5kWh·m⁻² per year (21.4kBtu·ft⁻² per year), a figure consistent with the society’s Advanced Energy Design Guide for zero energy office buildings.

ASHRAE set a challenging construction budget of \$8.57m (£6.3m) for the works and an even more challenging completion date of October 2020, 18 months after it purchased the building. ‘Our goal was to renovate this building to turn it into a high-performing, net zero-ready facility in a cost-effective method that can be replicated in industry,’ says Ginger Scoggins, chair of ASHRAE’s committee responsible for commissioning the new headquarters.

The building ASHRAE purchased was a typical out-of-town office, comprising two rectangular, three-storey blocks to the east and west of a glazed, barrel-vault atrium linking the two. A cast-in-situ concrete frame supports the building above a large basement, which includes plant space, and it was clad in alternate rows of precast concrete and glazing.

Stafford, the project’s mechanical engineer of record, says the design team’s approach to delivering a net zero energy solution was based on the following guiding principles:

- Use climate and place to inform the design by focusing on passive solutions
- Use daylight as a primary lighting source to minimise reliance on electric light
- Expand the width of the thermal comfort temperature band
- Assess which mechanical systems are most appropriate to deliver comfort with the least amount of energy in use.

ASHRAE wanted its design team to decide how best to allocate funds to upgrade the building's envelope and to select the most energy efficient mechanical systems to service the building. 'We tried really hard not to drive the train when it came to the design concept; we let the design team make recommendations to us on systems and equipment,' says Scoggins. Stafford agrees: 'ASHRAE was not prescriptive in how it wanted us to achieve these goals – it wanted the combined creativity of Integral, McLennan Design and Houser Walker Architecture to bring our ideas to the table.'

Before the team could table any potential solutions, however, it had to understand how the existing building envelope was performing, to decide how best to upgrade it.

Building surveys revealed the seals on many of the double-glazed units had failed, while a thermal analysis showed that energy was 'seeping' out of the building just below the roof, through thermal bridging and gaps in the façade. 'When you poked your head above the ceiling, you could see holes in the façade,' says Stafford.

The extent of the energy seepage was revealed when the building was pressure tested. 'The blower tests showed an air leakage equivalent to a 10m² hole in the side of the building,' explains Stafford. In addition, the building had a high window-to-wall ratio, which meant that solar gains were a potential issue in summer.

Armed with the survey data, the team undertook a sensitivity analysis to determine how to target the envelope upgrade. 'We worked out what U-value reductions would give us the best value before we reached the point of diminishing returns,' says Stafford. 'You could pay for more insulation, but it would not net that much more benefit from a thermal point of view.'

The building's energy use was characterised to see where most energy was being used. The climate in Atlanta is cool winters – with a December to February minimum of -13°C – and warm, humid summers, with a May to September maximum of 37°C. The exercise showed that cooling used the most energy and solar gains were the biggest component of the cooling load, while Atlanta's relatively benign winters and shoulder seasons meant that heat losses through the fabric were much less of an issue.

As the building's orientation was fixed, the exercise highlighted the need to strike a balance with the envelope upgrade – between minimising solar gains in summer and harvesting solar heat in winter. Working with the architect, the team modelled various envelope modifications and daylight strategies, including changing the window-to-wall ratio and adding skylights over the circulation routes to allow natural light into the top-floor offices. The existing ribbon windows provided very little light to the building's core.

The team also analysed whether a natural ventilation solution could be made to work by using the building's inherent thermal mass and night-purge ventilation. However, the limited length of the shoulder season, high levels of tree pollen in Georgia, and additional expense of actuator-controlled opening windows meant this was unviable.

The final outcome of the analysis was to add 90mm of expanded polystyrene insulation to the outside of the building, as part of a new >>

"The glazed, arched atrium roof was causing the space to overheat, turning the atrium into a greenhouse. It was replaced with a flat, opaque roof, which also increased the area available to mount solar panels"

PROJECT TEAM

Design team: Houser Walker Architecture; McLennan Design; Integral Group
Project management: Collins Project Management
Construction manager: Skanska
Commissioning agent: Epsten Group

Before the retrofit the building was a typical out-of-town office complex





“The limited length of the shoulder season, high levels of tree pollen in Georgia, and additional expense of actuator-controlled opening windows meant a natural ventilation solution was unviable”

» cladding system, and 100mm of insulation to the underside of the roof. The new cladding was also used to infill some of the glazed openings and partially infill others, to reduce the window-to-wall ratio from 70% to 40%.

The envelope refurbishment also included new energy efficient glazing, an additional 300mm of shading, and 18 new skylights. Analysis showed the fabric improvements would transform the building’s EUI from 133 kWh·m⁻² per year to 70 kWh·m⁻² per year.

The glazed, arched atrium roof was a casualty of the analysis. Modelling showed it was causing the space to overheat, turning the atrium into a greenhouse. As a consequence, the arched element was replaced with a flat, opaque roof, which had the added advantage of helping increase the area available on which to mount solar panels. The exercise showed that the works needed to bring the building envelope up to scratch were far more extensive than had been anticipated and would cost significantly more.

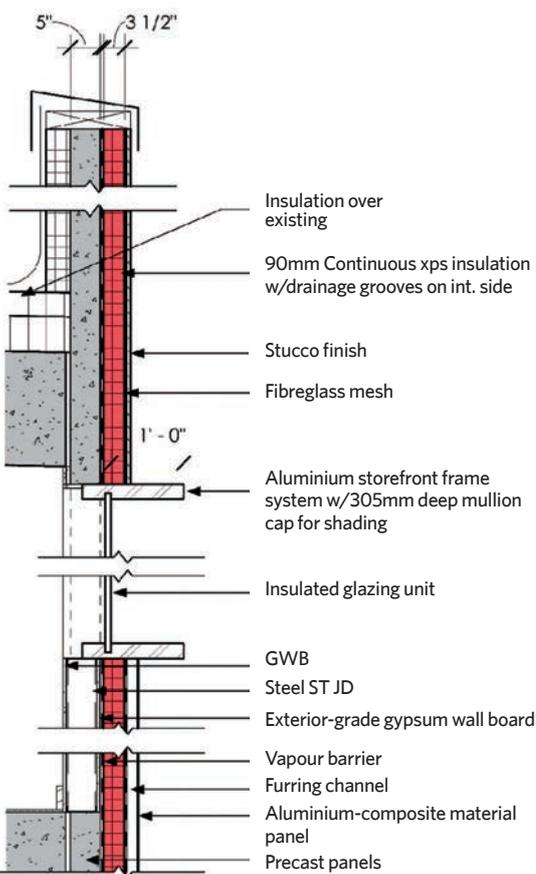
Having used extensive modelling to optimise load-reduction modifications of the building envelope, the focus turned to the HVAC systems. ‘The passive design, climate, programme and envelope strategies got us pretty close to ASHRAE’s target EUI, so we needed to decide on a high-efficiency HVAC solution to provide comfort and flexibility to shift uses over time,’ says Stafford.

Experience of having completed more than 100 net zero energy schemes in various US climate zones was applied to whittle down the final choice of HVAC systems to two: an all-air solution and a hydronic solution incorporating radiant panels. ASHRAE’s requirements were to provide 30% more outside air to the building than the minimum ventilation rates required in ASHRAE Standard 62.1 – *Ventilation for acceptable indoor air quality*. As a consequence, both solutions incorporated a dedicated outdoor air system (DOAS) with enthalpy heat recovery and demand-controlled ventilation, to handle both the latent and sensible loads from conditioning the ventilation air.

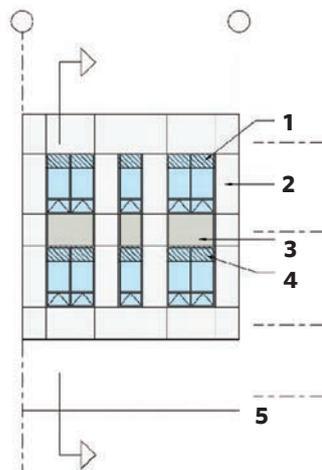
The all-air solution paired the DOAS system with temperature zoned, packaged rooftop air source heat pumps, to supply cooling air through ducts to handle the peak sensible loads. In addition, the scheme featured bi-directional, high-volume, low-speed, ceiling-mounted room fans, openable windows, and fan-assisted night-flush ventilation.

By contrast, the hydronic system combined the DOAS unit and the bi-directional, high-volume, low-speed, ceiling-mounted room fans with ceiling-mounted radiant panels. The radiant system is designed with perimeter

Exterior insulation



Option to enlarge windows



Plans to raise window height to allow more light into plan did not go ahead due to cost

- 1 Area of precast panel cut and removed
- 2 Stucco finish
- 3 Infill wall with aluminium-composite panel finish
- 4 Area of precast panel cut and removed
- 5 Note, colours indicate insulation type within wall assembly

■ Continuous extruded polystyrene insulation

The building envelope refurbishment included energy-efficient glazing, additional shading and new skylights

A DIGITAL LIVING LABORATORY

ASHRAE’s new headquarters building is intended to function as a living laboratory to demonstrate how existing buildings can be renovated and upgraded to turn them into high-performing ones. ‘We are going to make this building transparent, so the world can see, online, how it is performing – so we needed to build a digital twin of it,’ says Charles E Gullledge III, ASHRAE President for 2020-21.

Creation of a digital twin aligns with Gullledge’s presidential theme of digital transformation and Industry 4.0. The headquarters building incorporates several digitally connected solutions, such as remote monitoring and analysis of building performance, with online dashboarding for transparency and integration of the building automation system with other systems, including the meeting reservations systems.

While the digital twin webpage has yet to be launched, the model is being used ‘to collect data and to mine it, to help understand the transient patterns to improve performance’, Gullledge explains.

The digital twin will feature on a large touchscreen installed in the building’s lobby. ‘It will have the thermal comfort on every floorplate, an environmental health index, energy meters and water meters to capture and display resource usage, and occupant comfort in real time,’ Gullledge says. Watch this space....



Left: The glazed, barrel-vault atrium was replaced with a flat, opaque roof

volume, low-speed, ceiling-mounted room fans was to create air movement in the space to keep occupants feeling comfortable while mixing the air to improve environmental comfort. The improved comfort created by the moving air also enabled an increase to the cooling set point, to reduce the demand for cooling.

In addition to the radiant system, the building incorporates a displacement ventilation system to promote improved air quality in the large conference and meeting rooms, and water source heat pumps for the partially below-grade basement storage spaces, to enable the air to be cooled and dehumidified.

The building opened in November 2020 and, now that it is occupied, its building services are being fine-tuned. It is a long way from being a net zero energy building, however, because the photovoltaic (PV) panels have yet to be installed. ‘You have to get your energy consumption down as low as possible, and then move forward with renewables to get you to net zero,’ says ASHRAE’s Scoggins.

Calculations showed that enough sunlight hits the site to enable PV panels to be used to meet the building’s forecast energy consumption. Even with the addition of the flat roof to the atrium, however, there was insufficient space on the roof to fit all the PV panels needed to deliver a net zero energy solution, so additional panels will be mounted on the ground adjacent to the building.

According to Scoggins, the building’s electricity supplier, Georgia Power, has a net metering limit of a 250kW (AC) export power to the local grid. ‘ASHRAE maximised the size of the PV system to meet the Georgia Power limit, to offset as much energy use as possible,’ she says.

Fortunately, the energy harvested by the PVs is calculated to be sufficient to offset the building’s EUI of 63kWh-m² per year (20kBtu-ft² per year). Design of the PV system is under way, with installation scheduled for March 2021, after which the building should be on target to achieve its net zero energy target. **C**

panels that incorporate heating and cooling, and interior panels that are cooling only. The hydronic system is connected to a modular outdoor air source heat pump chiller with staged pumping.

The air delivered by the DOAS is supplied at a neutral temperature through fabric ducts running at high level in the spaces. ‘We’re depressing the dew-point temperature at the DOAS and then using modulating hot gas reheat to bump the air temperature back up to a neutral condition, so as not to overcool any space,’ says Stafford.

ASHRAE opted to go with the hydronic system because it was more energy efficient, had acoustic benefits, and would demonstrate that it was possible to use radiant cooling in Atlanta’s warm, humid summers. ‘This option was more expensive, but the team felt it pushed the envelope for Atlanta, the south-eastern US and, hopefully, hot, humid climates globally,’ adds Stafford.

Integral’s rationale in combining radiant ceiling panels with bi-directional, high-

Diagram showing all hydronic system options considered

DOAS

With enthalpy heat recovery and DCV

Chilled water terminal unit options

Radiant ceiling panels were chosen. The other option was sensible fan terminal units

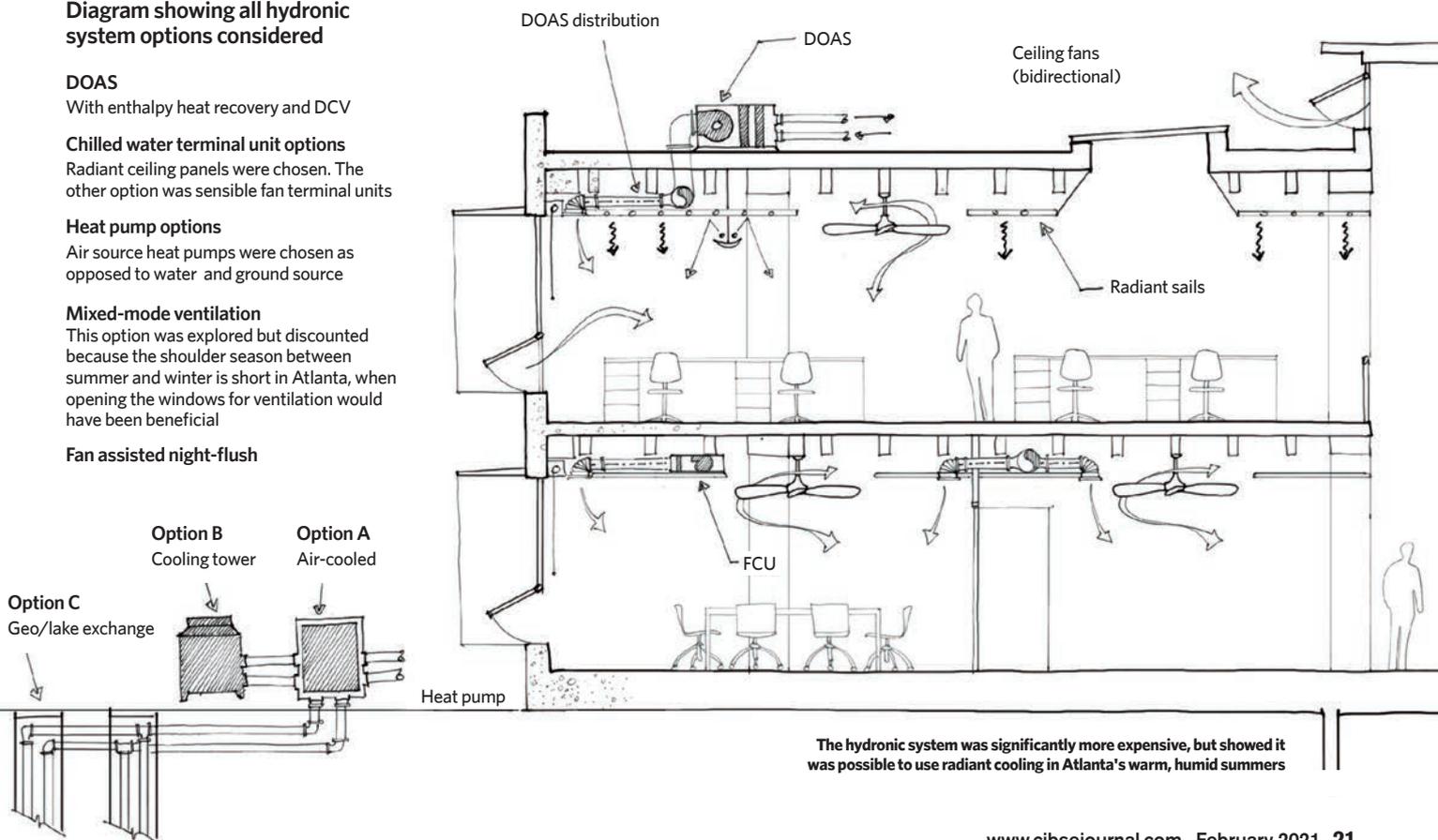
Heat pump options

Air source heat pumps were chosen as opposed to water and ground source

Mixed-mode ventilation

This option was explored but discounted because the shoulder season between summer and winter is short in Atlanta, when opening the windows for ventilation would have been beneficial

Fan assisted night-flush



The hydronic system was significantly more expensive, but showed it was possible to use radiant cooling in Atlanta’s warm, humid summers

The Covid-19 pandemic has meant graduates and new starters no longer have the opportunity to learn from colleagues and mentors in the real world. Firms have adapted by instigating remote online sessions, but what is the best way to replicate real-life learning?

Phil Lattimore reports

SCREEN TEST

Covid-19 has forced thousands of employees in building services to swap comfortable offices for spare bedrooms and kitchen tables in their own homes. Working from home has the biggest impact on new company starters and graduate trainees, who miss out on the opportunity to meet and get to know colleagues in a physical work environment.

Over the past 10 months, companies have had to adapt existing schemes, and use technology to deliver training at home and integrate newcomers into a workplace culture. They have had to come up with new ways to welcome and train engineers who are starting out on their careers.

Graduate recruits

Building services consultant Sweco has recently integrated six new graduate trainees remotely. Peter Holmes is an associate who leads the graduate recruitment and development schemes.

'One of the challenges has been to help them feel part of the company's identity and community when they're not, initially, physically in the office,' he says. 'When we have had it open, we've worked really hard to create an engaging environment – but, for a new joiner, it is a challenge, and we've had to work hard on integrating them.'

As well as the challenges of moving to an online learning model, the lack of informal office interaction that facilitates the exchange of ideas and knowledge – and which supports new graduates – is something that has also been difficult, says Holmes.

'Having some of those discussions that happen when you go for a coffee – those are important, and elements that we do miss,' he says.

Sweco has provided young mentors for graduates who



have started their engineering career under lockdown, in an effort to pass on what the mentor learned during their first months at the company (see panel, 'Online mentoring').

Aecom also has an online mentoring scheme for its graduates and apprentices. 'Training people virtually when they're at the start of their career is particularly challenging,' says Sarah Hodgens, early careers manager at Aecom. 'We're currently creating peer-to-peer mentoring groups and buddy systems for new starters, to help build our virtual community and mirror some of the interactions these groups would usually experience face to face.'

This, she adds, builds on an Aecom event for 400 new graduates and apprentices in January 2020, which provided the opportunity for peer-to-peer interaction before the pandemic.

Covid-19 meant Arup had to shelve its week-long residential inductions for around 300 graduates and apprentices. 'As a result, we designed a pre-employment engagement strategy, coupled with a comprehensive onboarding plan,' says Kamila Kaczowska, the company's senior learning manager (technical learning).

The content was made available to newcomers through a customised version of Arup's Moodle learning platform (see screenshot on page 24), and connected them with their teams and buddies earlier than usual.

Work culture

Getting new starters integrated into the culture has been an issue most organisations are keen to address. For Aecom, it meant offering them a virtual version of the firm's cultural initiatives, such as its Freedom to Grow campaign, which encourages employees to find a working style and balance that suits them best.

Kaczowska says Arup made sure its new intake had an extensive programme of virtual and online activities, which allowed them to meet their teams and interact with each other at office, regional and cross-discipline levels. 'Various modules and events have been organised to



ONLINE MENTORING



Toby Crofts

Toby Crofts joined Sweco as a graduate in 2018 and recently completed the scheme. He is a mentor to Alex Clay, a graduate who joined the company in October 2020, and his experiences have provided useful insights into what his mentee may be missing.

'What I learned a lot from being in the office is who's good at what - who you should talk to about certain things, who's the resident expert on a subject; picking up things like that.

'You overhear conversations and start to understand how the dynamics of the office work and the culture of the company. When you're speaking to the same two or three people every day, you miss out on that. You also don't get as much feedback, seeing how someone's coping with a task, dipping in to help when needed.'

Clay agrees: 'It's those quick type of questions that have probably suffered the most by communicating via Teams - if you're next to someone [physically], rather than being remote, they'll pick up if you're unsure or need a quick clarification on something.'



Alex Clay

"It's not just about putting everything online. People get bored very quickly when they are on a Teams meeting for two or three hours... We've broken it down into 20-minute sessions"

help them learn about some of the key themes in our firm,' she explains.

Consultant David Fitzpatrick developed a remote training environment for manufacturer and contractor Exyte Hargreaves, and says integrating starters into a company culture requires a more focused approach.

'The way that we've found works is to block off a half-hour session with the trainees, on a one-to-one basis, to start talking about culture,' he says. 'People have commented that they enjoy getting time with a senior person in the business; you don't necessarily get that one-to-one interaction under normal circumstances.'

Exyte Hargreaves' head of HR, James Hoare, says the line manager will integrate a new team member into the business after the employee has undertaken inductions on topics such as health and safety, IT and HR.

'Regular discussions are taking place between employee and line manager, particularly during probation, to ensure successful onboarding,' he says.

Adapting technology

Kaczowska says Arup already had a well-established portfolio of learning - including classroom, online and virtual methods - but still had to adapt.

'We've rolled up our sleeves and put our efforts into converting any core, classroom-based training into online and virtual modules,' she says. 'Some of the previous technology used proved to be insufficient when virtual learning became the new normal. We moved quickly to invest in sourcing better systems and training internal subject experts to use them effectively.'

Shifting from largely office-based training to remote learning brings the challenge of translating an interactive physical experience into an environment that is based around video calls and webinars. For some, that has meant developing their own learning structure.

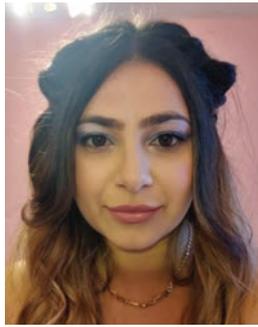
'Through trial and error, we have developed a structured delivery model for our interactive learning modules,' says Aecom's Hodgens. 'One of the best ways our graduates and apprentices respond to virtual content is through smaller, instructor-led training sessions that allow for learners to input and interact with one another,' she says.

At the start of the first lockdown, Aecom introduced fortnightly webinars on subjects that graduates and apprentices felt were important, such as 'developing skills in virtual working' and 'building resilience and adaptability'.

Fitzpatrick, meanwhile, says developing a remote graduate-training environment for Exyte Hargreaves' intake of five graduates was about trying a very different approach from more familiar workplace-based learning.

'It's not just about putting everything online. People get bored very quickly when they are sitting on a Teams meeting for two or three hours. We've made it interactive, and broken it down into 20-minute sessions of teaching - but with testing at the end of each session to make sure the trainees have taken in the knowledge.'

Getting onsite experience presented another challenge, >>



Clockwise from top: Consultant David Fitzpatrick, CIBSE's corporate training manager Lara Archer, and Sweco associate Peter Holmes

"Our trainers are used to presenting face to face, so it has been an adjustment – especially because many of them work off a crowd"

» says Fitzpatrick, but technology is at least enabling people to visit project sites (though not in the flesh). 'We have been uploading media, from people wearing cameras, for graduates to view. It's not the same as a real site visit, but it's better than just looking at documents; we'll definitely take it into training post-Covid.'

New normals

For many organisations, any return to 'normal' working practices post-Covid is likely to bring some change, as positive lessons from remote-working experiences are adopted. Sweco's Holmes says remote learning has accelerated the adoption of digital-collaboration practices within the wider team, and recorded CPD sessions, for ongoing internal learning, now mean employees can refer back to them later.

'That works very well,' says Sweco's Crofts. 'People are definitely asking more questions and there's more of an open discussion. We've got better at sharing information, and having that information in one place for reference.'

Sweco says other initiatives borne out of necessity under lockdown will be adopted when life returns to normal. For example, graduates will be invited to attend client meetings virtually, after Sweco found that trainees gained a deeper level of experience when engaging with clients remotely in meetings (which they would not have attended pre-Covid).

DELIVERING CIBSE'S COURSES

In response to the first lockdown, CIBSE's face-to-face courses were adapted for an online format, which combined text, pre-recorded videos of the trainer, and quiz questions. These courses were run on CIBSE's pre-existing learning management system, which already had a catalogue of online courses.

'Covid-19 has forced us to adapt our training, and make it safe and convenient for attendees. They can now save time on commuting, and money on expenses,' says Lara Archer, CIBSE's corporate training manager, who adds that trainers have had to ensure courses are engaging to make them effective online.

'We keep them interactive – by adding quizzes and Q&As – and break them up, so it's not just the trainer talking.'

'Our trainers are used to presenting face to face, so it has been an adjustment – especially because many of them work off a crowd. This is why we have tried to encourage viewers to keep their cameras on, and to put their mics on when they have a question.'

Details of CIBSE's training events are at: www.cibse.org/training-events/cibse-training

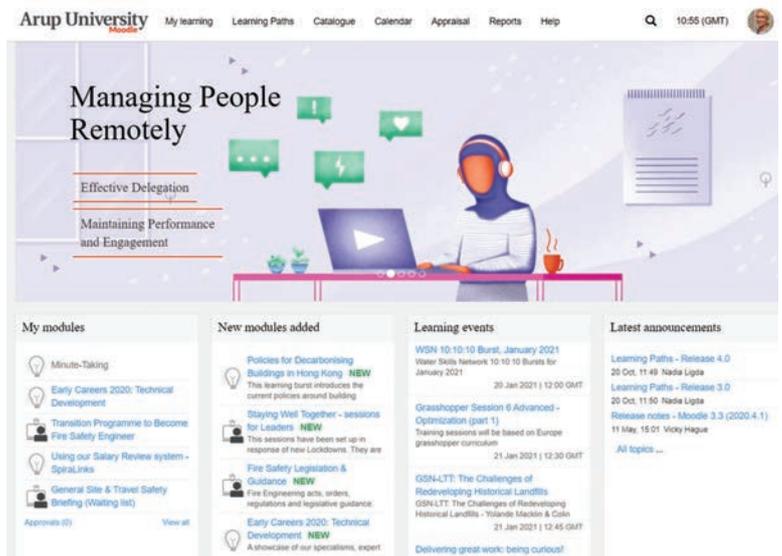
'It's not necessarily just the way we work internally, but the way we work with clients and architects,' says Holmes. 'There's been quite a recognition that the Teams meetings can be just as good as physical meetings, if not better, for some sessions. They are able to have more engagement with a project and interaction with their peers on projects, which is great.'

Exyte Hargreaves' Hoare also wants to keep the remote-learning system in place. 'When things return to "normal", we will continue to look at training solutions that are digital, which can be effectively delivered remotely rather than from a classroom.'

He adds that the firm will look at having its own platform, where employees can select e-learning modules and build on their CPD.

Despite some of the unforeseen benefits remote learning has brought, getting back to a more normal training environment is, naturally, a priority for everyone.

'Having always endeavoured to work towards a blended learning programme, there will always be a place for virtual elements,' says Hodgens, from Aecom. 'But we very much look forward to bringing together our graduates and apprentices in person again in the future.'



Arup engaged with new employees and graduates before their start date through its Moodle platform



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STAYING PUT, FOR NOW

Despite the pandemic, salaries across the building services sector rose last year, according to the Hays Salary Survey. While engineers' prime concern now is job security, two-thirds will look to move in the next 12 months. **David Blackman** reports

Everyone was on a rollercoaster and didn't know where it was going to end,' says Tomás Neeson, managing partner at Cundall, recalling last March, when the construction sector was hurtling into lockdown part one.

After what he describes as a 'three-month bump', however – and despite a slowdown in commercial work – Neeson says Cundall is in a 'strong position' as it enters the new year.

He adds that bad debt has proved to be a smaller headache than initially feared. 'Everyone says clients have behaved, and cash flow hasn't been the issue anticipated. Clients didn't go bust and didn't stop paying bills, which was really good.'

Wendy Belfield, commercial director of Hampshire-based InTandem Systems, agrees that building services has weathered the Covid-19 storm better than many other sectors. 'It's challenging,' she says, 'but in the current environment we feel that the sector is buoyant.'

This perhaps surprisingly upbeat picture is reflected by the results of the latest annual salary survey of the building services sector, carried out for *CIBSE Journal* by recruitment consultants Hays.

Across construction and property, 89% of employees expect their organisation's activity levels to increase or stay the same over the next 12 months, Hays says.

According to its survey – which was carried out last year, before the latest tightening of restrictions – pay has suffered during the pandemic. Exactly a quarter of building services professionals said their salary has decreased over the past 12 months and just more than half (53%) said it has stayed the same. Three-quarters of those who had suffered a salary drop blamed it on the Covid-19 crisis.

The proportion of building services professionals who reported a pay increase was down from 41% in last year's survey to 22% – and the

average salary rise in building services was 1.1%, half the figure of 2.2% recorded this time last year.

Around one-third (34%) of professionals expect their salary to increase over the next 12 months, however, while 60% say they are currently satisfied with their salary.

Gaelle Blake, director for construction and property at Hays, warns building service employers not to be lulled into neglecting salaries. 'I wouldn't push goodwill too hard. As things loosen, it won't be long before people will want a pay rise.'

The salary increases associated with Cundall's latest round of promotions have been 'more modest' than normal, admits Neeson, but he agrees: 'Just because we are in a recession, doesn't mean people don't want to progress their careers.'

Brian Goldsmith, managing principal at Elementa Consulting, says his firm's salary rise will be closer to two than one per

cent. 'We are still aiming to give those increases,' he adds, 'because it's important to reward staff, especially when you are making a profit.'

Confidence across the sector has certainly taken a knock though, as the Hays survey shows. Only around a third (35%) of professionals working in building services said they were positive about their career prospects in the coming year, compared with 59% last year. A quarter (25%) of building services engineers said they were 'very' concerned about the wider economic climate and the employment opportunities in the next two to five years, while 36% reported being 'quite' concerned.

In a reflection of this shaky mood, the survey also reveals that building services engineers are prioritising job security when considering their career moves. The main factor driving building services engineers to want to leave their current role is job security (20%), with 14% citing salary and benefits. This, notes Blake, marks a departure from previous years, when salary has been the biggest spur for people to move jobs.

In the current climate, it should be 'no surprise' that job security is motivating employees, she says: 'It would be understandable for someone to be more nervous than usual now.'

Blake suspects that even more engineers would have emphasised job security during the first lockdown. 'It was so uncertain, and we didn't know what was going to happen. We went into a shell to survive. Then, when we went into second lockdown, it was more like business as usual.' >>

Contractors: Director

Region	Typical salary 2021	Min salary 2021	Max salary 2021
East Midlands	£65,000	£60,000	£80,000
East of England	£67,000	£60,000	£80,000
London	£100,000	£85,000	£120,000
North East England	£56,500	£48,000	£62,000
North West England	£72,000	£65,000	£85,000
Northern Ireland	£75,000	£65,000	£85,000
Scotland	£58,000	£50,000	£65,000
South East England	£76,500	£73,000	£80,000
South West England	£65,000	£62,500	£67,500
Wales	£59,000	£55,000	£65,000
West Midlands	£70,000	£60,000	£80,000
Yorkshire and the Humber	£60,500	£57,000	£62,000
National average	£68,708	£61,708	£77,625
% increase year on year: 1.7%			

Contractors: CAD technician

Region	Typical salary 2021	Min salary 2021	Max salary 2021
East Midlands	£30,000	£25,000	£32,000
East of England	£27,500	£24,000	£32,000
London	£44,000	£40,000	£50,000
North East England	£27,250	£23,000	£28,500
North West England	£30,000	£25,000	£32,000
Northern Ireland	£35,000	£25,000	£40,000
Scotland	£24,000	£22,000	£26,000
South East England	£38,000	£33,000	£40,000
South West England	£31,750	£25,000	£32,000
Wales	£30,000	£25,000	£30,000
West Midlands	£29,000	£25,000	£30,000
Yorkshire and the Humber	£26,750	£23,000	£28,500
National average	£31,104	£26,250	£33,417
% increase year on year: 0.7%			

Contractors: Quantity surveyor

Region	Typical salary 2021	Min salary 2021	Max salary 2021
East Midlands	£50,000	£45,000	£60,000
East of England	£50,000	£47,000	£60,000
London	£65,000	£60,000	£80,000
North East England	£43,000	£35,000	£45,000
North West England	£45,000	£40,000	£55,000
Northern Ireland	£46,000	£40,000	£50,000
Scotland	£44,000	£36,000	£46,000
South East England	£65,000	£60,000	£68,000
South West England	£52,500	£45,000	£55,000
Wales	£46,000	£43,000	£50,000
West Midlands	£45,000	£44,000	£55,000
Yorkshire and the Humber	£39,500	£32,000	£42,000
National average	£49,250	£43,917	£55,500
% increase year on year: 2.3%			

Contractors: Estimator

Region	Typical salary 2021	Min salary 2021	Max salary 2021
East Midlands	£46,000	£30,000	£55,000
East of England	£47,500	£40,000	£60,000
London	£60,000	£50,000	£62,000
North East England	£38,000	£31,000	£40,000
North West England	£43,000	£38,000	£45,000
Northern Ireland	£40,000	£35,000	£45,000
Scotland	£41,000	£35,000	£44,000
South East England	£62,000	£47,000	£65,000
South West England	£46,000	£42,000	£47,000
Wales	£42,000	£40,000	£45,000
West Midlands	£44,500	£30,000	£50,000
Yorkshire and the Humber	£36,500	£27,000	£38,000
National average	£45,542	£37,083	£49,667
% increase year on year: 0.8%			

Contractors: Project engineer

Region	Typical salary 2021	Min salary 2021	Max salary 2021
East Midlands	£39,000	£30,000	£45,000
East of England	£42,000	£32,000	£50,000
London	£54,000	£50,000	£60,000
North East England	£35,500	£28,000	£38,000
North West England	£40,000	£30,000	£45,000
Northern Ireland	£35,000	£30,000	£40,000
Scotland	£40,000	£29,000	£41,000
South East England	£47,500	£42,000	£55,000
South West England	£42,000	£38,000	£45,000
Wales	£37,000	£35,000	£40,000
West Midlands	£40,000	£30,000	£45,000
Yorkshire and the Humber	£36,500	£30,000	£42,000
National average	£40,708	£33,667	£45,500
% increase year on year: 0.5%			

Contractors: Project manager

Region	Typical salary 2021	Min salary 2021	Max salary 2021
East Midlands	£49,000	£40,000	£55,000
East of England	£50,000	£40,000	£57,000
London	£70,000	£65,000	£80,000
North East England	£46,000	£40,000	£50,000
North West England	£48,000	£40,000	£50,000
Northern Ireland	£40,000	£38,000	£46,000
Scotland	£45,000	£32,000	£47,000
South East England	£65,000	£52,500	£67,000
South West England	£50,000	£42,000	£50,000
Wales	£45,000	£40,000	£50,000
West Midlands	£49,000	£40,000	£55,000
Yorkshire and the Humber	£49,500	£40,000	£57,000
National average	£50,542	£42,458	£55,333
% increase year on year: 0.2%			

» Overall unemployment figures paint a bleak picture, but the bulk of redundancies are in sectors such as hospitality and leisure, points out Blake, who also oversees Hays' economy-wide permanent recruitment business. By contrast, construction activity has been propped up by measures such as public spending on infrastructure and the stamp duty holiday for home purchases.

Companies must be on the look-out for employees developing itchy feet, she says: 'As things have got easier, and it's not as catastrophic as it felt in March, people are thinking about their career again. Organisations now need to act more like it's business as usual.'

Almost two-thirds (59%) of professionals surveyed by Hays said they expect to move roles in the next 12 months, only slightly lower than the 64% figure recorded for the previous year. However,

77% of professionals said their employer had not taken steps to reduce uncertainty about career prospects since the onset of the pandemic last March.

Companies should be communicating the strength of their order books to provide reassurance about future work prospects, says Blake: 'If it's not spelled out, they could jump ship permanently.'

The same applies to those firms seeking to attract talent, she adds: 'If someone is going to leave their job, they need to be reassured about the order book, in addition to money.'

One of the reasons that companies are still planning to recruit is the continuing headache over skills shortages. More than four out of five (82%) construction and property employers reported some form of skills shortages in their team over the past 12 months.

Skilled engineers continue to be in high demand, Elementa's Goldsmith says: 'If there are good people out there, and they are trained well, then there will always be a role for them.' Belfield, meanwhile, says her company is 'definitely' looking to recruit.

The remote-working revolution that building services, like many other parts of the economy, has undergone over the past year looks set to have a profound impact on recruitment patterns, though. Nearly three-quarters (72%) of employers believe the workplace will never return to its pre-pandemic state. Goldsmith, who is also vice-chair

»

Contractors: Senior contracts manager

Region	Typical salary 2021	Min salary 2021	Max salary 2021
East Midlands	£55,000	£45,000	£65,000
East of England	£60,000	£55,000	£70,000
London	£70,000	£65,000	£85,000
North East England	£44,000	£32,000	£46,000
North West England	£54,000	£50,000	£68,000
Northern Ireland	£55,000	£50,000	£60,000
Scotland	£47,000	£40,000	£50,000
South East England	£68,000	£57,000	£69,000
South West England	£55,000	£50,000	£60,000
Wales	£51,000	£45,000	£55,000
West Midlands	£55,000	£50,000	£70,000
Yorkshire and the Humber	£40,500	£35,000	£45,000
National average	£54,542	£47,833	£61,917
% increase year on year: 1.0%			

Consultants: Associate

Region	Typical salary 2021	Min salary 2021	Max salary 2021
East Midlands	£60,000	£55,000	£65,000
East of England	£59,000	£55,000	£67,000
London	£70,000	£65,000	£75,000
North East England	£44,750	£39,000	£46,000
North West England	£58,500	£50,000	£60,000
Northern Ireland	£55,000	£50,000	£55,000
Scotland	£55,000	£55,000	£60,000
South East England	£65,000	£60,000	£70,000
South West England	£58,000	£55,000	£60,000
Wales	£55,000	£50,000	£60,000
West Midlands	£55,000	£50,000	£60,000
Yorkshire and the Humber	£49,500	£43,000	£50,000
National average	£57,063	£52,250	£60,667
% increase year on year: 0.5%			

Consultants: CAD technician

Region	Typical salary 2021	Min salary 2021	Max salary 2021
East Midlands	£32,000	£25,000	£32,000
East of England	£32,000	£25,000	£38,000
London	£35,000	£30,000	£40,000
North East England	£25,500	£21,000	£26,500
North West England	£29,000	£25,000	£37,000
Northern Ireland	£24,000	£20,000	£28,000
Scotland	£28,000	£22,000	£30,000
South East England	£33,000	£30,000	£35,000
South West England	£30,000	£25,000	£33,000
Wales	£31,000	£25,000	£32,000
West Midlands	£30,000	£25,000	£35,000
Yorkshire and the Humber	£27,500	£23,000	£29,500
National average	£29,750	£24,667	£33,000
% increase year on year: 1.0%			

Consultants: Director

Region	Typical salary 2021	Min salary 2021	Max salary 2021
East Midlands	£68,000	£60,000	£70,000
East of England	£65,000	£60,000	£70,000
London	£95,000	£90,000	£120,000
North East England	£53,500	£43,000	£55,000
North West England	£70,000	£60,000	£75,000
Northern Ireland	£65,000	£60,000	£70,000
Scotland	£60,000	£55,000	£80,000
South East England	£75,000	£70,000	£85,000
South West England	£63,000	£60,000	£70,000
Wales	£58,000	£55,000	£65,000
West Midlands	£66,000	£60,000	£70,000
Yorkshire and the Humber	£54,000	£43,000	£56,000
National average	£66,042	£59,667	£73,833
% increase year on year: 1.6%			

Consultants: Intermediate design engineer M&E

Region	Typical salary 2021	Min salary 2021	Max salary 2021
East Midlands	£37,000	£33,000	£40,000
East of England	£42,000	£37,000	£50,000
London	£40,000	£35,000	£48,000
North East England	£32,000	£28,000	£40,000
North West England	£37,000	£28,000	£38,000
Northern Ireland	£32,000	£30,000	£35,000
Scotland	£36,500	£28,500	£38,000
South East England	£36,000	£33,000	£38,000
South West England	£39,000	£35,000	£40,000
Wales	£36,000	£30,000	£40,000
West Midlands	£35,000	£25,000	£40,000
Yorkshire and the Humber	£27,500	£23,000	£28,500
National average	£35,833	£30,458	£39,625
% increase year on year: 1.3%			

Consultants: Junior design engineer M&E

Region	Typical salary 2021	Min salary 2021	Max salary 2021
East Midlands	£28,000	£25,000	£30,000
East of England	£26,000	£22,500	£30,000
London	£31,000	£25,000	£32,000
North East England	£22,250	£18,000	£24,000
North West England	£26,750	£18,000	£27,000
Northern Ireland	£25,000	£23,000	£28,000
Scotland	£29,000	£24,000	£31,000
South East England	£30,000	£22,000	£30,000
South West England	£28,500	£25,000	£33,000
Wales	£27,000	£25,000	£32,000
West Midlands	£25,000	£22,000	£30,000
Yorkshire and the Humber	£22,250	£18,000	£25,000
National average	£26,729	£22,292	£29,333
% increase year on year: 0.2%			



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» of CIBSE's training and development panel, says: 'Anyone who says things will return to exactly as they were is kidding themselves: businesses are seeing advantages in terms of things such as cutting down on real estate.'

Neeson agrees: 'People have adapted, and have got used to not coming into work. Some people continue to come into work, but, as designers, individuals can do a lot from home.'

Many employees, too, are clearly hoping to retain the improved work/life balance they have gained during lockdown by cutting out the commute. Of the 29% of building services professionals who are considering career changes in the next 12 months because of the Covid-19 pandemic, 21% are planning to find a role that involves remote working entirely, and 44% want a hybrid working arrangement.

However, remote working won't be suitable for everybody, says Goldsmith: 'You have to do it the right way to ensure staff have the right working environment. We have kept offices open during the Covid-19 pandemic because we have had people – more so graduates and interns – starting out on their careers who may not have facilities at home.'

Jobs such as connecting sensors and fitting valves also cannot be carried out virtually, says Belfield: 'Although we are doing more remote-access work, there is still going to be an awful lot of site work.'

Engineers are likely to spend a couple of days working at home, which should provide opportunities to mentor junior engineers, says Goldsmith: 'That means people early in their career get the opportunity to sit with more experienced engineers. If they don't understand what

they are designing and building, you can have problems further down the line.'

Neeson believes the office will continue to play a role, albeit a diminished one: 'We are looking at a very flexible future – a blend of agile working at home, site and office – but we don't see a future where people don't work in the office at all.'

An upside of remote working is that building services engineers can draw on a more geographically dispersed pool of talent than they have traditionally, Neeson adds: 'We have to do everything to keep talent in this field of engineering.'

'We now employ people in locations where, previously, we wouldn't have contemplated, such as in the Highlands or the Lake District, which are nowhere near a large office or commercial centre. Now everybody can be everywhere, it can be a positive thing.' **CJ**

“Nearly three-quarters (72%) of employers think the workplace will never return to its pre-pandemic state”

Consultants: Professional quantity surveyor

Region	Typical salary 2021	Min salary 2021	Max salary 2021
East Midlands	£50,000	£45,000	£60,000
East of England	£54,000	£40,000	£60,000
London	£70,000	£55,000	£75,000
North East England	£41,000	£36,000	£42,000
North West England	£45,000	£38,000	£50,000
Northern Ireland	£40,000	£35,000	£45,000
Scotland	£40,000	£35,000	£50,000
South East England	£68,000	£55,000	£70,000
South West England	£53,500	£50,000	£60,000
Wales	£45,000	£42,000	£55,000
West Midlands	£45,000	£40,000	£50,000
Yorkshire and the Humber	£43,750	£35,000	£45,000
National average	£49,604	£42,167	£55,167
% increase year on year: 1.5%			

Consultants: Revit/BIM technician

Region	Typical salary 2021	Min salary 2021	Max salary 2021
East Midlands	£35,000	£30,000	£40,000
East of England	£38,000	£30,000	£45,000
London	£50,000	£40,000	£65,000
North East England	£35,500	£28,000	£36,000
North West England	£40,000	£32,000	£45,000
Northern Ireland	£30,000	£25,000	£35,000
Scotland	£32,000	£25,000	£40,000
South East England	£45,000	£43,000	£55,000
South West England	£41,500	£38,000	£45,000
Wales	£39,000	£34,000	£42,000
West Midlands	£35,000	£25,000	£40,000
Yorkshire and the Humber	£36,500	£28,000	£38,000
National average	£38,125	£31,500	£43,833
% increase year on year: 2.1%			

Consultants: Senior design engineer M&E

Region	Typical salary 2021	Min salary 2021	Max salary 2021
East Midlands	£50,000	£45,000	£55,000
East of England	£50,000	£43,500	£58,000
London	£58,000	£50,000	£65,000
North East England	£45,500	£40,000	£45,500
North West England	£50,000	£45,000	£55,000
Northern Ireland	£43,000	£40,000	£48,000
Scotland	£48,000	£38,000	£50,000
South East England	£57,000	£52,000	£57,000
South West England	£49,000	£45,000	£55,000
Wales	£47,500	£42,000	£50,000
West Midlands	£47,000	£42,000	£55,000
Yorkshire and the Humber	£44,500	£39,000	£46,000
National average	£49,125	£43,458	£53,292
% increase year on year: 0.7%			

Consultants: Sustainability consultant

Region	Typical salary 2021	Min salary 2021	Max salary 2021
East Midlands	£45,000	£40,000	£50,000
East of England	£52,000	£42,000	£60,000
London	£56,000	£45,000	£65,000
North East England	£42,500	£36,500	£44,000
North West England	£47,000	£40,000	£50,000
Northern Ireland	£38,000	£35,000	£45,000
Scotland	£45,000	£35,000	£50,000
South East England	£45,000	£42,000	£47,000
South West England	£48,000	£45,000	£50,000
Wales	£44,000	£42,000	£50,000
West Midlands	£45,000	£39,000	£48,000
Yorkshire and the Humber	£45,000	£40,000	£47,500
National average	£46,042	£40,125	£50,542
% increase year on year: 0.4%			



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10 MAJOR CHANGES TO CP1 (2020)

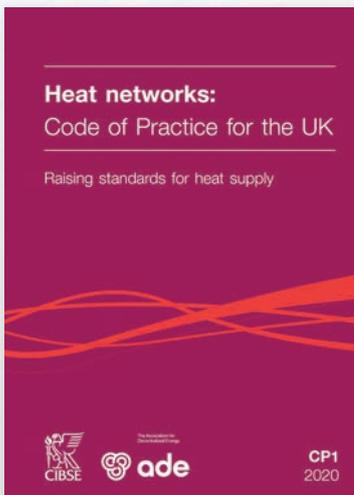
A big update to the CP1 (2020) Heat networks: Code of Practice aims to improve performance and provide the foundations for a quality assurance scheme. The authors, **Phil Jones, Paul Woods** and **Martin Crane**, highlight the key changes

CP1 (2020) Heat networks: Code of Practice is a major update to the 2015 version, and a huge step forward for the industry. Developing this edition of the Code, published by CIBSE and The Association for Decentralised Energy (ADE), has involved a vast amount of consultation. Gaining widespread consensus, it has helped to define the heat networks sector as a maturing growth area that can make a significant contribution to decarbonising heat across the UK. More than 50 experts came together to agree the Code. Three major rounds of consultations – including one

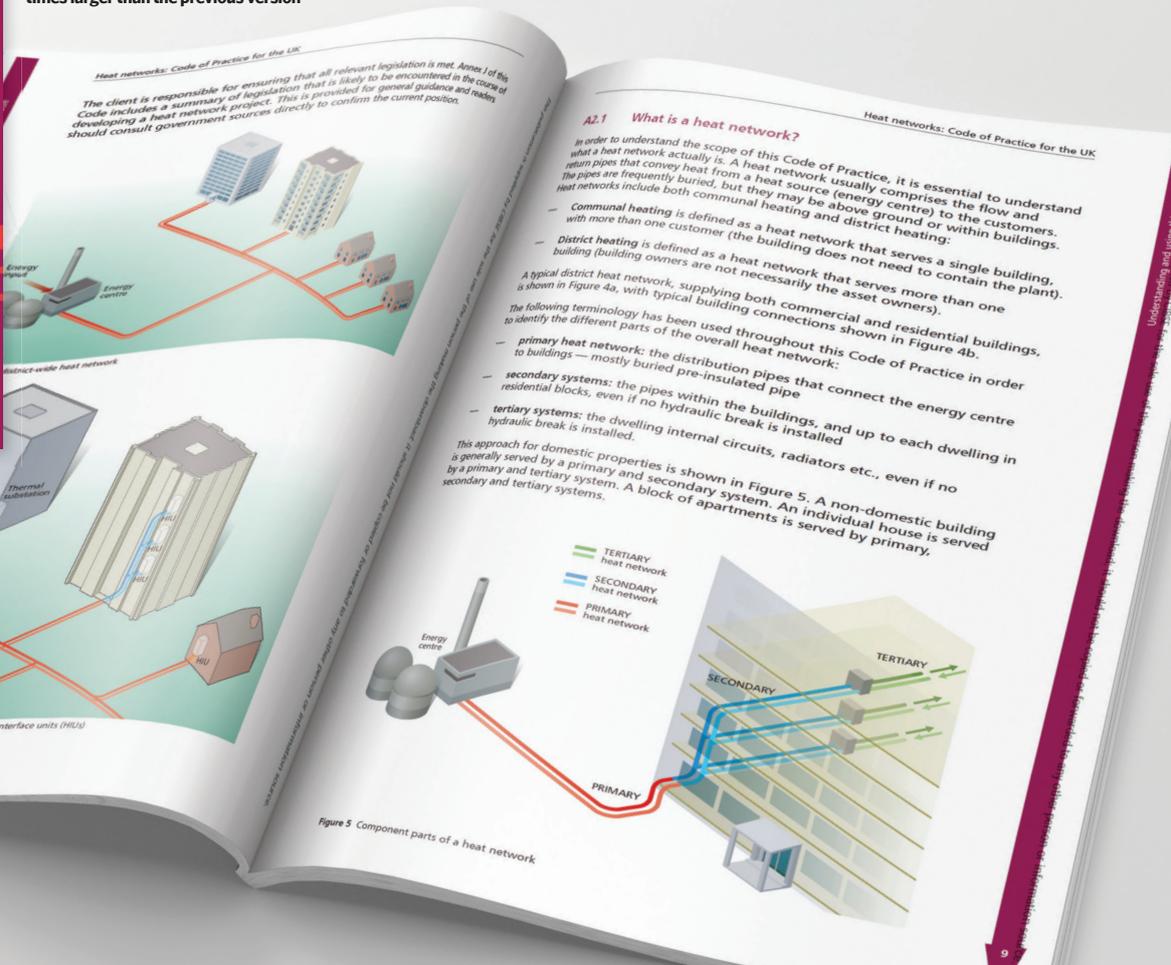
public round – gave rise to contributions and comments from around 100 others, generating 3,000 comments. It's been an epic journey, but the industry is much the better for it, with everyone on the same page. CP1 (2015) proved to be a catalyst for major change in the industry; it is doubtful that we would have been able to drive the sort of success we have had without it. Today, we have a much greater number of high-performance schemes, which are largely a product of the CP1 (2015) initiative. It was always recognised, however, that the Code of Practice would need to be updated at intervals, to reflect new experience and understanding, feedback from the industry, changes in regulation, and results from research projects. So, what are the key changes in CP1 (2020)? To give you a flavour, here are 10 of the most significant ones.

1. Customer satisfaction

A new theme in the Code is additional focus on providing customers with affordable heat and a reliable service. Customer satisfaction starts at the briefing stage and runs through all stages of CP1. We need to make sure the end-user is happy with the service. If they are not, we have failed. CP1 is now complementary to the Heat Trust (the non-profit organisation that sets standards on customer protection) and sets early commitments – and eventual requirements – to sign up to Heat Trust for all heat networks. >>

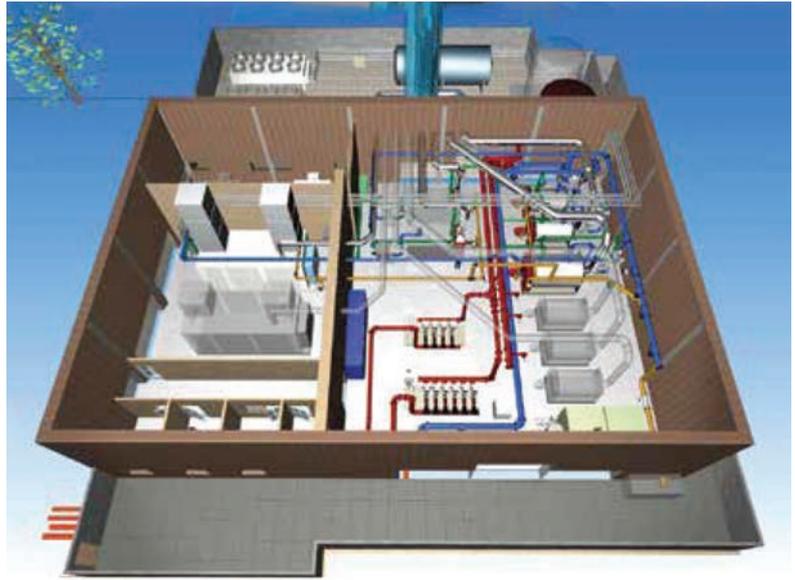


The 240-page Code is almost three-times larger than the previous version





Inside the King's Cross energy centre



Design of an energy centre created using BIM

» 2. Minimum requirements are bigger/deeper/wider

At 240 pages, compared with the original 92, CP1 (2020) is more than just an update. It sets a greater number of minimum requirements (540 in total) that are generally more onerous, and often wider in scope and deeper in requirement. There are also 110 best-practice examples. While the Code is voluntary guidance and not regulation, clients and funders increasingly expect it to be adopted on projects.

This edition also brings much more clarity, with improved definitions of things such as 'district heating' versus 'communal heating'. There are also better definitions around primary, secondary and tertiary parts of the system that tighten up the terminology throughout the Code – in particular, around heat losses.

3. Client briefing

The 2020 version puts much greater emphasis on the client setting a good brief for the team, across the whole supply chain. What the client writes in the brief should be proved in operation. Unfortunately, in the past, this hasn't always been the case.

CP1 has begun to have a strong influence on the procurement of heat networks, with clients specifying the Code in tenders, and making it a clear that they want the CP1 requirements and process followed. CP1 also underpins much of the Heat Networks Delivery Unit (HNDU) and Heat Networks Investment Project (HNIP) work by the Department for Business, Energy and Industrial Strategy (BEIS). It has a much better briefing process to help this, and sets out clearer definitions of roles and responsibilities throughout a heat network project.

4. Performance measuring

Although it was our first shot at a Code, one criticism that could be levelled at CP1 (2015) was the lack of performance targets/metrics. The 2020 version plugs this gap with enhanced performance targets, not least on heat losses

from primary, secondary and tertiary pipework, and heat interface units (HIUs). Secondary pipework has long been a problem in residential blocks, with year-round hot corridors because of high heat losses. There are now performance metrics in CP1 on absolute kWh/dwelling to address these issues. The minimum requirement is now 876kWh/dwelling/year and a best-practice target of 550kWh/dwelling/year.

Performance metrics are set at the beginning then tested at each stage of design, construction, commissioning and operation, to ensure each is being met.

5. Diversity and pipe sizing

There has been a fundamental change in the approach to diversity and pipe sizing in CP1 (2020). Rather than having a range of diversity curves from which to choose, there is now a single approach, based on a better interpretation of the Danish DS439. This standard was being misinterpreted by some, and a fully worked example in Annex D, developed by FairHeat, gives greater clarity. Indeed, as a separate exercise BEIS helpfully funded the translation of DS439 into English for the UK market. Promotion of more accurate diversity standards for domestic hot water (DHW), and now guidance for space-heating diversity, will make a real impact, tackling the issue of oversizing.

There is a general shift towards using velocity limits, rather than pressure constraints, for sizing pipework in risers, laterals and terminal runs. This offers a better whole life-cycle approach to energy use. Instead of outdated guidance based on constant flow systems, updated pipe selection criteria are now more suitable for variable flow systems (which a heat network should be). This will have a real impact on heat losses in networks that we develop.

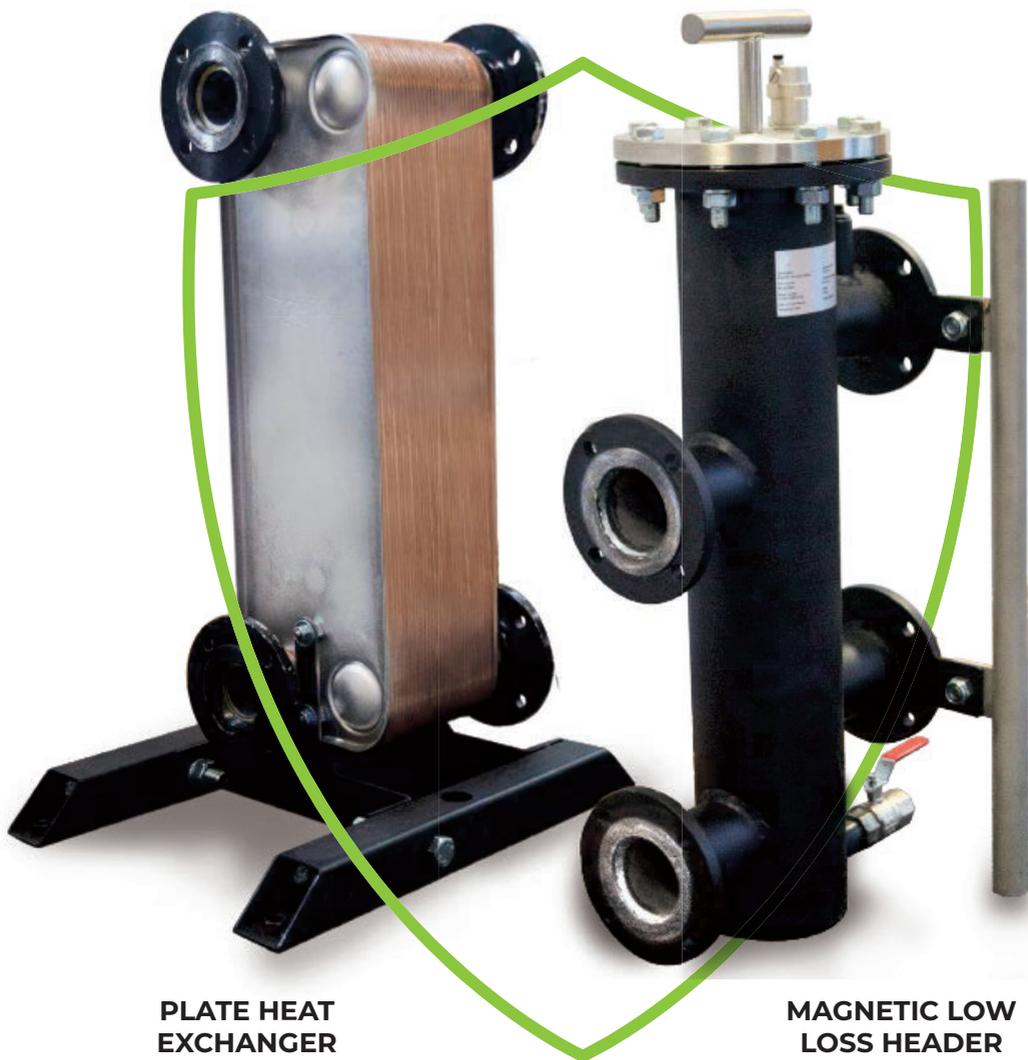
6. Acceptance testing

Even plant that has been formally commissioned can fail to deliver an efficient and reliable service to the heat customer. Unfortunately, it is common for formal commissioning to focus on testing that equipment 'actually works' when turned on – often a single item of equipment in isolation – rather than the overall network performance. The commissioning section of CP1 now includes enhanced requirements around onsite acceptance testing to prove it works in practice.

Acceptance Testing is a whole new objective, 5.7, setting minimum

»

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» requirements on a graduated, risk-based approach to avoid installation and commissioning problems being rolled out across 100% of dwellings.

Best practice is to carry out independent acceptance testing on all dwellings. This ensures that the system meets the required performance standards and that the end customer receives the promised service.

Without adequate acceptance testing, faults will only emerge during the early years of operation, when they are typically more expensive and disruptive to resolve. In particular, CPI (2020) introduces a requirement for hot-water delivery times – that DHW should be delivered to the tap at 45°C within 45 seconds.

7. Low return water temperatures

The updated Code puts even more emphasis on achieving low return water temperatures. A system designed with a low return temperature will have reduced peak-volume flowrates and will, therefore, need smaller pipes, leading to lower heat losses and reduced pumping energy.

Although heat networks are generally technology neutral, temperatures do have an impact on the transition to low carbon technologies. The 2015 Code had only 13 mentions of heat pumps; there are now 82. With a greater focus on lower operating temperatures through better design and operation, combined heat and power (CHP) is now mentioned 75 times, and heat pumps 82 times. Looking at the current carbon intensity of the UK grid (181g/kWh average in 2020) the trend to lower temperatures and heat pumps is likely to increase.

8. Heat interface units

There is now a minimum requirement to use tested HIUs. The BESA HIU standard is currently the main test regime www.thebesa.com/ukhiu CPI best practice states that, where indirect HIUs are specified, they should be used with a tested volume-weighted average return temperature (VWART) of less than 33°C, as defined in the BESA UK HIU Test Regime.

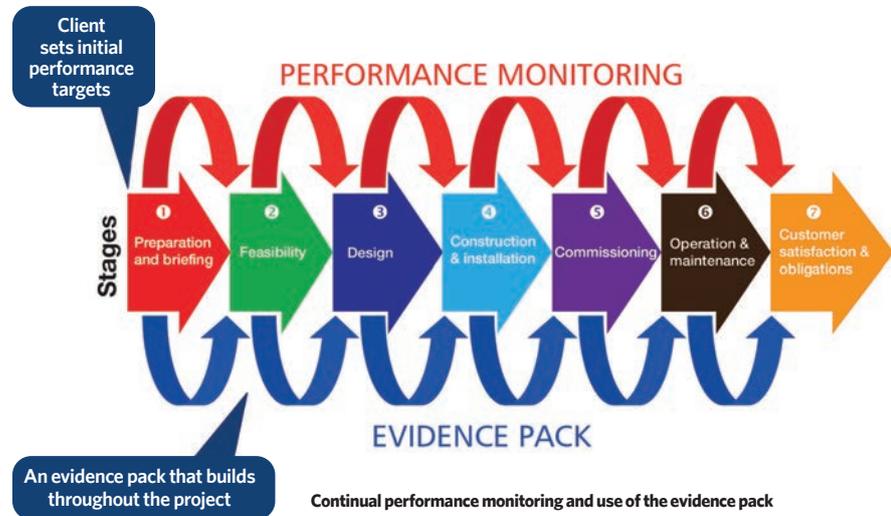
There is also a strong move to reducing DHW supply temperature to 50°C for systems with instantaneous DHW HIUs, instead of 55°C, measured at the HIU outlet instead of at the tap. (See ‘Taking the temperature’, February 2020, *CIBSE Journal*). Along with lower return temperatures – in hot-water demand and during keep warm – it helps lower the primary temperature and promote the use of heat pumps.

Oversized systems – based on work by Huw Blackwell, of Anthesis, the Code now states that, for typical dwellings (for example three-bed/two-bathroom homes), there should be no need to provide more than 35kW of instantaneous DHW. The ability to apply both space heating and greater DHW diversity will result in a reduction in oversized systems. Onsite measurement and analysis of extensive dwelling-level heat meter data shows this approach to sizing is the right way to go.

9. Compliance – checklists, evidence pack and a statement of applicability

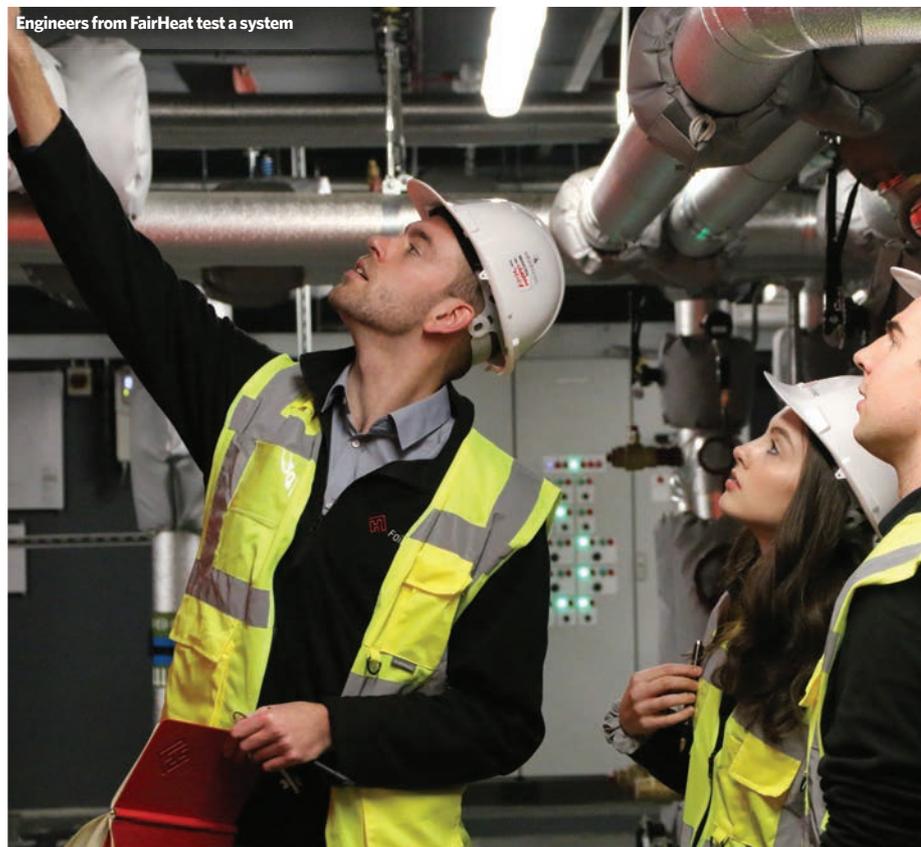
Compliance, compliance, compliance. CPI (2020) has an accompanying set of checklists. These are not add-ons; they are fundamental to proving CPI has been followed,

“Critically, a number of performance metrics are focused on customer outcomes. For example, domestic hot water delivery times and maximum heat network losses”



with documented proof and an audit trail across all project stages.

Less visible, but perhaps even more powerful, is the introduction of a Statement of Applicability (SoA), along with hard performance targets, which is a huge benefit when it comes to verifying compliance with CPI. The SoA sets out whether parts of CPI are not applicable to a particular heat network. With the SoA and new checklists, the updated version seeks to fill the biggest gap from the original document – what is a CPI-compliant heat network? In conjunction with performance metrics, this makes the Code much stronger, as it can be used to hold designers, installers, commissioners and operators to account.



Taken together, this provides a platform for assessing whether CPI (2020) requirements have been met, in an outcome-based way. Critically, a number of performance metrics are focused on customer outcomes. For example, DHW delivery times and maximum heat network losses. This provides a methodology for assessing whether the network performs well, is efficient, and gives affordable low carbon heat, while ensuring good outcomes for non-domestic and residential customers.

The switch to an outcome-based, verification approach is a fundamental change in CPI (2020). It is also timely, because it allows opportunities for heat network scheme quality assurance, which will be fundamental as we move toward regulation of the industry.

10. The evidence pack

The checklists include a process for building an evidence pack to monitor and audit progress throughout a project. This makes the entire process of developing a heat network more objective, well-documented, and auditable, with clear handover between parties.

The brief is documented and handed to feasibility consultants; their work goes to the designers, and so on. If anything goes wrong, it is possible to go back through this audit trail and establish what happened, when, and why. In many ways, this protects all parties – the client; their M&E consultants; the build contractors; those commissioning and operating; and, ultimately, the customer.

This isn't an extra cost; it's just proving good processes and compliance with CPI. Good design doesn't need to cost more, but – where it does – it will easily be paid back with savings in capital expenditure, as well as recurring operating expenditure savings.

The new CP world

There are other big changes in minimum requirements – insulation thicknesses are much greater and heat losses are capped. Controls, keep-warm, metering, water quality, economic optimisation, building the business case... the list goes on. The compliance process with CPI is also easier to verify, and the fully integrated checklists offer a more structured and robust toolkit for checking compliance.

As authors, we need to thank ADE, CIBSE and BEIS for helping make it happen, as well as all those on the CPI Steering Group, and the many commentators and contributors. It is hoped this new Code will support the development of a wider heat networks quality assurance scheme, ultimately contributing to the regulation and decarbonisation of the heat sector. This clearly indicates that the heat network market is maturing and is set to make a big impact on decarbonising heat in the UK.

This second edition remains a work in progress, however. There is a clear need for a more detailed evidence base, and more work is needed to develop further guidance and verification in the long term. But CPI (2020) is a very significant step forward and aims to take the heat network sector to the next level. **CJ**

■ CPI is available at www.cibse.org/knowledge

■ Professor **PHIL JONES**, Building Low Carbon Solutions & London South Bank University; **PAUL WOODS**, independent consultant.

MARTIN CRANE, Carbon Alternatives

■ With thanks to Gareth Jones, at FairHeat, and Ruben Vos, at Hysopt

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WATERSHED MOMENT

A method of pre-commission pipework cleaning that could save millions of litres of water has been accepted by BSRIA in its BG29/209 guidance. Alex Smith summarises the guidance and looks at the system's benefits



A Hydosphere pre-treatment rig used for CPC

Pre-commission cleaning of pipework is traditionally carried out by flushing out dirt and debris with water, but BSRIA's latest updated guidance, BG29/209, introduces another method, which cuts the amount of water used significantly.

Closed-loop pre-treatment cleaning (CPC) only requires the initial system-fill water and avoids the need to discharge large amounts of water to the drain. According to Hydosphere, which patented the system and created a prototype for the Channel Tunnel, the traditional method uses 20-30 times the system volume. For a medium-sized office block, this means more than 1.5m litres of potable water being flushed down the drain in its lifetime. Hydosphere says CPC is gaining in popularity, with one notable recent client being Buckingham Palace.

The traditional cleaning process has a series of stages. First, a system is filled with water and flushed to clear debris. It is filled again and a biocidal wash added, to minimise the risk of bacteria; this is flushed out before it is refilled with water and powerful chemicals, which remove surface oxides. The system is flushed again and then refilled with water, plus an inhibitor, to protect against corrosion.

CPC filling is undertaken by pre-treating the initial system-fill water in a special pre-treatment rig (above). Chemicals to assist in mobilising system contaminants, and to provide corrosion and microbiological protection, are introduced directly in proportion to the volume to fill water. This pre-treated water is used to clean the system by circulating it through filter media to remove solids, with minimal flushing to drain. Rigs can also contain UV water treatment to kill bacteria.

The pre-treatment equipment and filling process should aim for optimum corrosion and microbiological protection to installations at the point of filling. A purpose-built pre-treatment rig (CPC filling unit) should be used for this, which would ideally incorporate:

- Adjustable proportional dosing equipment for the introduction of corrosion and microbiological control chemicals
- Microbiological reduction and/or removal apparatus
- Failsafe mechanism to prevent the introduction of untreated or undertreated make-up water
- Incoming and outgoing water testing points
- Hygienic connection hoses.

BSRIA says CPC can reduce water consumption, providing an effluent-free or reduced-effluent process. It states that CPC can be beneficial where water supplied is limited; demineralised or softened fill water is used; and when system draining is impractical. CPC avoids repeated

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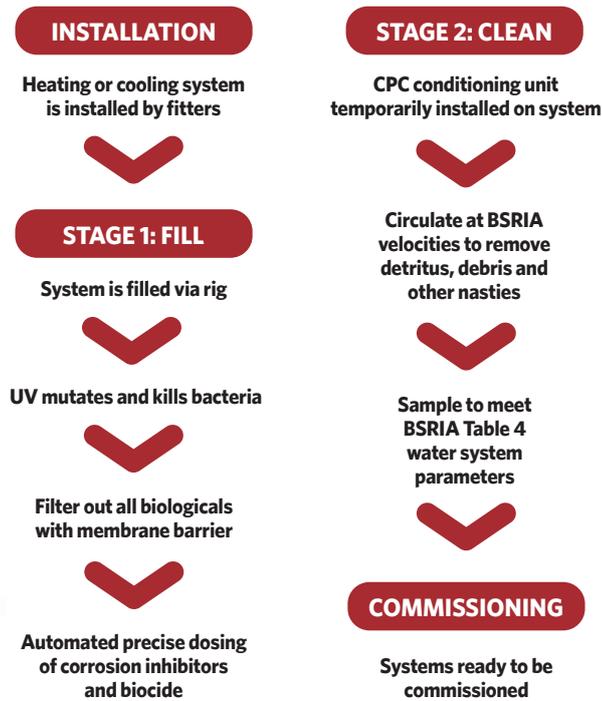
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How it works



Hydrosphere's system of closed-loop pre-treatment cleaning

system exposure to raw water, and the risk of introducing now aerated water into the system.

As water is not exchanged during the cleaning process, system trending, using a corrosion-monitoring service, may start as soon as the system has been filled. During and on completion of filling, tests should be done on the water to ensure the pre-treatment equipment is functioning correctly, and that acceptable chemical and microbiological parameters are being achieved. Standard test kits may be used to determine key chemical properties, and an adenosine triphosphate test kit to monitor microbiological levels. These methods may be backed by lab analysis.

If microbiological removal or reduction apparatus is incorporated, laboratory sampling of system water may start seven days after completion of the final bulk fill. Installations should, ideally, be filled from the lowest point. During filling, thorough venting procedures should be undertaken using installed facilities. To prevent untreated water reaching the system, failsafe mechanisms on the rig >>

CASE STUDY

The Arnos Grove heat network supplying the Ladderswood Estate was the first of Energetik's heat networks to go into operation in the London Borough of Enfield.

Dennis King, project manager at Energetik, says it set an important precedent for the level of quality and positive customer experience.

'One of our key drivers is to ensure that the life expectancy of heat networks is achieved - and water quality is paramount to this,' he adds.

'When CPC has been used, not only have we seen water consumption reduced during the construction phases of projects, but we have also been able to achieve consistently high water-quality standards from the outset.'

This provides an excellent platform for these standards to be maintained throughout the life of the heat networks, King says. 'This will give them a greater chance of achieving, or even exceeding, their life expectancy.'

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» stop pumps working if there is a power cut, mechanical fault, over pressurisation, or if chemicals run out.

CPC dynamic flush

When flushing a system, temporary CPC conditioning units (or filter units) should be fitted on a common system return circulation point to remove contaminants, as shown in Figure 1. The conditioning unit should be connected to the system using appropriate pressure- and temperature-rated hoses or pipework, taking account of system operation pressure at the point of connection. It should also be fitted with a flow-measurement device to measure cleaning rates, and as a way of indicating the condition of filter media.

Temporary deaeration equipment should be connected to the system or conditioning unit during flushing, to help stifle corrosion during the process itself. It must have a working pressure rating greater than the system head pressure at the point of connection. It may be necessary, because of system pressures, to locate the deaeration equipment remotely from the conditioning unit.

After filling, the system is subjected to dynamic flushing velocities, as described for primary and secondary circuits. However, instead of opening a valve to allow flushing water to enter, and drawing from the system, flushing water is directed through the condition units so that debris is removed by the filter media.

The cleaning can be done on a side-stream or full-flow basis but, ideally, it should be full flow, as this prevents the recirculation of contaminants. As all, or a proportion, of the recirculating water is passed through the filter, the duration of the clean will depend on the method chosen. **CJ**

■ Pre-Commissioning Cleaning of Pipework Systems 6th edition (BG 29/2020) is available at bit.ly/CJFeb21CPC

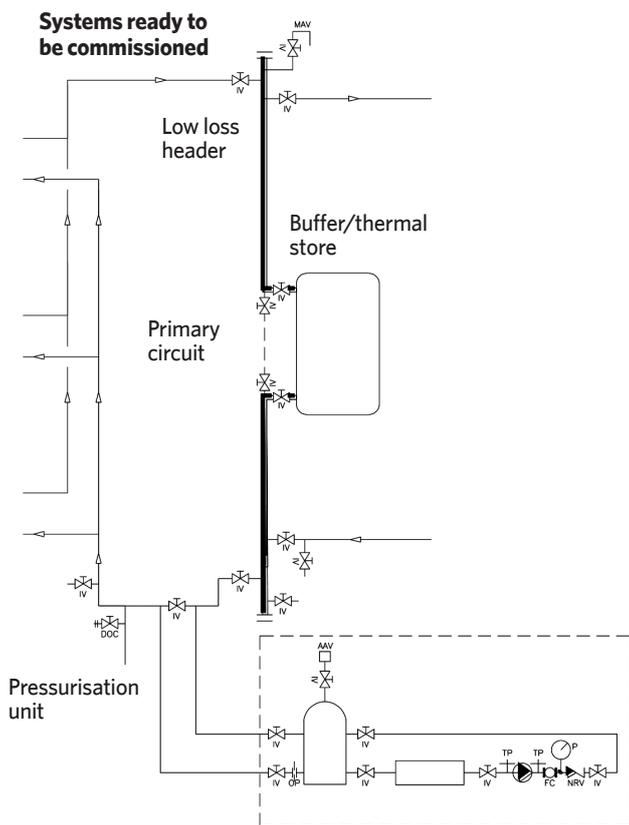


Figure1: CPC conditioning unit incorporating filtration and deaeration apparatus

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AHUs

CHILLERS

PROJECTS

SERVICE

REFRIGERANT RETHINK

Specifiers need to start assessing a refrigerant's embodied carbon as well as its global warming potential, says Klima-Therm's **Tim Mitchell**, who is working with bodies such as LETI and CIBSE to calculate the full carbon impact of HVAC systems



Enerblue's heat pumps use CO₂ as a natural refrigerant and can heat water up to 90°C

A host of different criteria needs to be assessed and balanced to decide which heat pump or chiller technology is right for a particular application. Complicating the picture further for heat pumps are the refrigerant choices; refrigerants are a particular minefield that must be negotiated before a consultant can go any further in specifying HVAC equipment for new projects.

All the most common hydrofluorocarbons (HFCs) are categorised as A1 and so non-toxic and non-flammable. They are readily available, well understood, and relatively cheap – so why consider using natural refrigerants at all?

There are fundamentally two reasons. The first is application suitability, which has been created by the recent drive to remove the burning of fossil fuels from the built environment. For example, using CO₂ as the refrigerant in a heat pump can deliver hot water at boiler-like temperatures and beyond – 90°C is no problem – at much better efficiencies than any HFC. This means that, for modern boiler-replacement projects, it is typically the most applicable option.

A typical air source CO₂ heat pump might deliver hot water at 75°C from air at -4°C with a coefficient of performance (CoP) of 2.53 or so, whereas an HFC using the same criteria would give a CoP of around 1.78 and would be at the top of its operating range. However, that is not the end of the story.

CO₂ systems are peculiar in the HVAC selection ranges because they operate trans-critically, so require a very wide differential between the leaving and return water temperatures. This characteristic means they are especially suited to sanitary or process applications, for which you

consume a lot of very hot water. This makes CO₂ stand out among the natural refrigerant options – it has its own application envelope, whereas there are HFCs that have a more complete 'operational overlap' with ammonia and propane.

The second reason to consider natural refrigerants is sustainability, particularly in relation to their ultra-low global warming potential (GWP). For example, ammonia's GWP is 0; CO₂ has a GWP of 1 (it is the base for the GWP metric); and propane's GWP is 3. This compares with the lowest GWP HFC that we currently see in common use for HVAC applications – R32 – which has a GWP of 675.

Some HFC/HFO blends can offer lower GWPs – R513A and R454B have GWPs of 631 and 467 respectively, for example – but none get down into the ultra-low category of natural refrigerants, with the exception of pure hydrofluoroolefins (HFOs) which have environmental issues of their own (the energy needed to produce HFO refrigerants can be problematic, and the by-products from the breakdown of some are acidic).

There is a third metric that specifiers >>

“One reason to consider natural refrigerants is sustainability, particularly in relation to their ultra-low GWP”



Tim Mitchell says a refrigerant's embodied carbon must be considered

» should take into account after application and GWP – ‘embodied’ carbon. A building, for example, can be very efficient in use, but if it is built from traditional concrete, the embodied carbon – the carbon expended in manufacturing the concrete – can be huge.

Refrigerants also have an embodied-carbon element. The metric that takes this and other environmental factors, such as GWP and energy efficiency, into account is called life-cycle climate performance (LCCP). LCCP does not, however, take account of the amount of embodied carbon there might be in, say, a commercially built HFC chiller compared with an industrially built CO₂ or ammonia machine.

There are no wide-ranging studies yet complete in this area, but we are working with the London Energy Transformation Initiative (LETI, www.leti.london) and Rhoss, one of our manufacturing partners, to calculate the embodied carbon in a chiller or heat pump as we make them.

It is hugely complicated to do these calculations, however, and there are lots of places where it is difficult to make direct comparisons – for example, with refrigerant leakage. Which brings us back to where we began – struggling with the knotty problem of what criteria you should apply to accurately assess the benefits and drawbacks of each piece of HVAC technology and the refrigerants it uses.

Arguably, the starting point should be to consider the sustainable, ultra-low GWP options first. Beyond that, the application determines

the solution. The specification decision really comes down to horses for courses. As a specifier and client’s trusted adviser, all you need to do is decide which horse to back. **CJ**

■ www.klima-therm.co.uk

■ **TIM MITCHELL** is the sales director at Klima-Therm

References:

- 1 AR4, the Intergovernmental Panel on Climate Change’s Fourth Assessment Report – bit.ly/3qdeRaQ

IMPACT OF F-GAS REGULATIONS

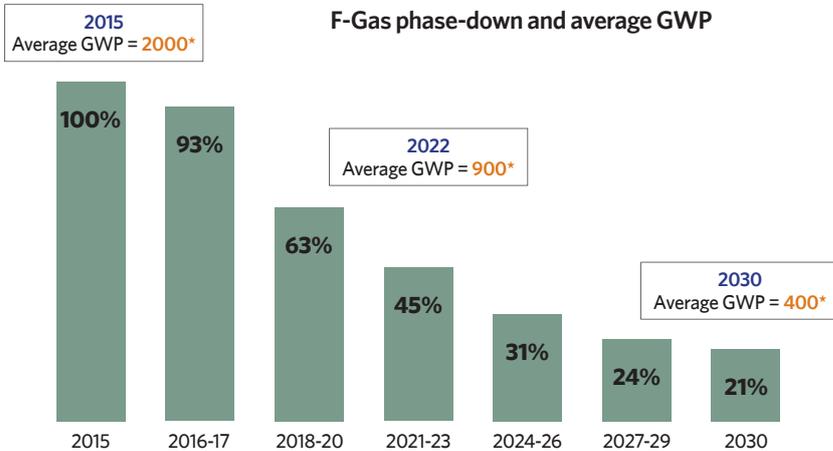
The latest phase-down in F-Gas regulations was introduced on 1 January (see graph). The new threshold timings have been well understood for years, so the industry has done a lot to ensure the transition does not result in the madness that ensued after the first severe reduction in 2018.

This is partly down to better control of refrigerant leakage, and not treating refrigerant as a consumable. More intelligent design of systems has reduced refrigerant charge.

The most common refrigerants used in heat pumps are HFCs, which have a high GWP compared with natural refrigerants. The GWP metric is based directly on the GWP of 1kg of CO₂, itself a useful natural refrigerant. For example, the GWP of R410A, the HFC refrigerant used exclusively in variable refrigerant flow systems for the past decade or so, is 2088¹ – that is, 2,088 times that of CO₂. By definition, the leakage of 1kg of R410A to atmosphere has the equivalent greenhouse effect, over the standard GWP base of 100 years, that 2,088kg of CO₂ would have in that same period.

Particular progress has been made in the moves away from higher GWP refrigerants to low and ultra-low ones by manufacturers (for example, from R410A (GWP 2088) to R32 (GWP 675) in splits and small chillers/heat pumps, and ultra-low GWP HFOs and low-GWP HFO blends in larger chillers), supported by more of the component supply chain and as demanded by end users.

There are natural alternatives to HFCs. For chiller and heat pump applications, the common ones are ammonia (R717), propane (R290) and CO₂ (R744). The standard classifications for refrigerants revolve around toxicity (A or B – non-toxic or toxic) and flammability (1, 2L, 2 or 3 – non-flammable to highly flammable), as defined in ISO 817. CO₂ is an A1 refrigerant, so neither toxic nor flammable. Ammonia (B2L) is toxic, but exhibits low flammability. Propane (A3) is non-toxic, but highly flammable.



The new threshold timings for the phase-down are well understood by the industry



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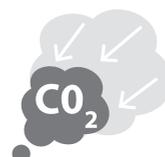
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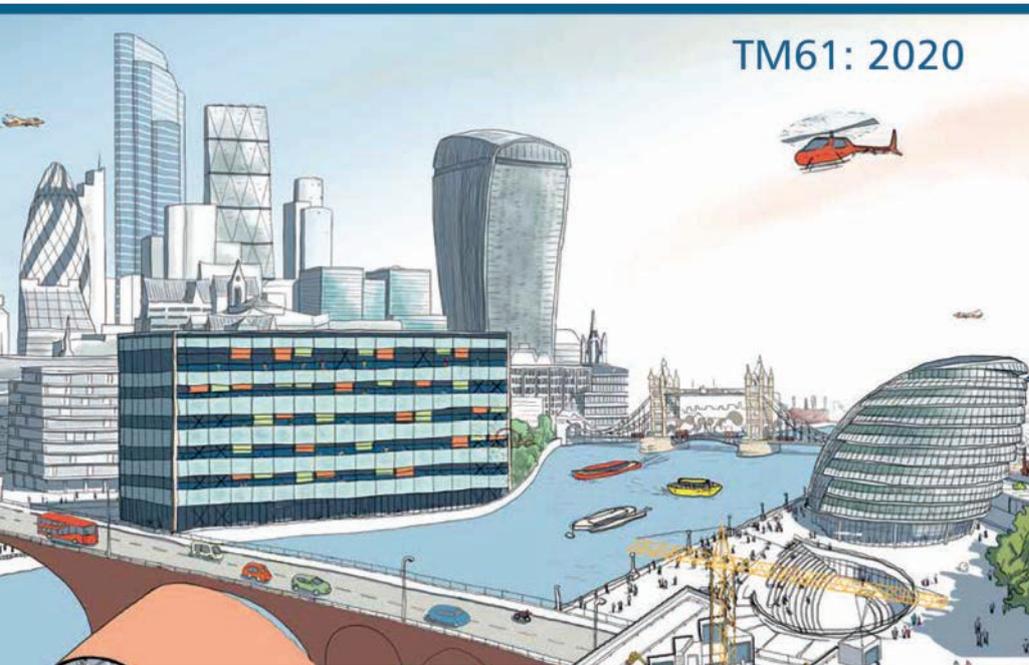
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Towards the closing of the building performance gap

This module considers some of the key areas covered by CIBSE TM61: *Operational performance of buildings*

The recently published CIBSE TM61: *Operational performance of buildings* aims to provide insights into the problem of the performance gap (as illustrated in Figure 1) by following an integrated approach to the assessment and delivery of robust designs that perform in terms of both energy and indoor environmental quality. This article will explore some of the key areas considered in TM61.

CIBSE TM61 and its companions – TM62, TM63 and TM64 – aim to provide detailed insights into operational building performance for those who influence design, construction, and facilities management outcomes.

The technical memorandum (TM) explores contributors to the energy performance gap and aspects that affect the coincident internal environmental quality in non-domestic buildings and large apartment blocks, by providing an overview of key parameters at design, construction, commissioning and handover, as well as the operational stage. TM61 also recognises the potential unintended consequences of undue focus on particular sets of performance objectives.

The uncertainties of energy modelling are discussed in terms of the vagaries introduced during the building specification; the development of the model; the robustness of the underlying algorithm; the setting and simplification of the modelled scenarios; and, finally, issues that result from human-introduced errors in the form of modellers' bias or mistakes. It notes how the variability in different tools, developed to meet the needs of different global regions, can deliver significant differences in predicted energy consumptions for similar buildings.

The lack of a certified audit trail to confirm that buildings have been built to meet the performance desired by the specifications is identified as a significant failing in the construction process. This allows deficiencies – potentially caused by inappropriate site practices and misguided interpretation of design documents, as well as those introduced by post-design, onsite variations – to corrupt the design intent. This might, of course, be identified by a robust, and possibly continuous, commissioning process that reaches across the whole building process

into post-occupation that – as suggested in the TM – could be facilitated through a Soft Landings Framework.¹

Once occupied, a building's performance will be highly dependent not only on the operating practices of the building systems and equipment, but also on the conduct of the building occupants. The TM notes that the degree of engagement and behaviour of a building's users and the systems has been shown to potentially impact on the overall energy consumption of a building by between -50% and +90%. Throughout the operational life of a building, the TM highlights that performance will typically deteriorate. The ready availability of data from the control systems are, in themselves, not a panacea for operational inefficiencies, as the TM points out that large amounts of data can potentially result in more confusion and operational problems.

The section on indoor environmental quality (IEQ) performance explores performance evaluation approaches for lighting, acoustics, thermal comfort and indoor air quality (IAQ) in buildings. This relatively brief section provides a summative overview, giving useful references to – and

developed abstracts from – contemporary research, standards and guidance documents.

The concluding sections of TM61 feature four contemporary detailed case studies that provide a practical base on which to apply and question the elements explored in the preceding chapters. The case studies (office, school, hospital and apartment block) focus on a holistic evaluation of operational building performance, and give some substantiation for the TM's best-practice recommendations to reduce the performance gap. Each case study includes detailed descriptions and assessments of the energy performance and the internal environments (thermal, IAQ, lighting and acoustic measurements and observations, and occupant evaluations).

The first case study considers a four-storey office building, owned and occupied by a local council, where operational rating was a key measure for sustainability instead of a Breeam rating. An Energy Performance Certificate (EPC) asset rating of 'A' was achieved and an operational rating of 'A' targeted, and the project followed the Soft Landings Framework with an aftercare period of at least two years. The building achieved an operational rating of 'B' by the second full year of operation – in terms of a Display Energy Certificate (DEC) – significantly better than most peer buildings, with some room for improvement as identified in TM61.

The operational energy and carbon emissions targets were defined for the case-study office at the early stages of design, and adhered to throughout the construction process and in operation, with attention maintained on the potential interrelationship between energy efficiency measures and IEQ performance.

The balance between exposed thermal mass and acoustic panels on the ceilings of the

building provided a good example of attention to details and the integrated view of performance. Fine-tuning of building performance in the first two years of operation proved effective, especially for heating and lighting energy use. The current energy performance of the building puts it in the top 10% of public office buildings in England and Wales, and designers and contractors are still engaged to explore improvement opportunities.

The TM identifies several key lessons from this case study that can be adopted in other projects, which include, among others: the importance of clearly setting out operational targets for IEQ parameters, energy performance and carbon emissions; and the need to protect key energy efficiency measures from value engineering, especially in design and build contracts, and in the operational phase. Soft Landings and performance contracting were shown to ensure proactive engagement of the design and construction teams in the early stages of post-occupancy to achieve the operational targets. The cost of aftercare and building fine-tuning post-occupancy were seen as being very low compared with the construction cost, and considered as adding significant value during the life-cycle of a building.

The TM considers that applying Soft Landings can create a positive reputational effect for the construction teams and their clients that outweighs any associated additional cost.

The second case study is of a campus secondary school, where six of the eight buildings were replaced, employing strict design targets set to comply with the Building Regulations. However, actual performance in operation has pointed to construction and operational issues that are not unique to this project. This is seen as highlighting the need to identify potential risks and mitigation measures, and ensure the targets are met in operation, even with the current regulatory framework that apparently incentivises 'design for compliance' rather than 'design for performance'.

Low or zero carbon technologies should be carefully selected and specified in consultation with end users, and it is important to identify the failure modes of these systems, and plan for preventative and proactive system maintenance. A good design measure that was noted is that classrooms have operable windows and are not entirely dependent on mechanical ventilation.

Enhanced and seasonal commissioning are essential to ensure that the energy and environmental benefits of design measures are fully achieved. For example, effective commissioning of automated lighting control was identified as resource-consuming but essential to achieve optimal performance. An example is given of a third-floor classroom, illustrated in Figure 2, where three luminaires nearest the window had been set up incorrectly and, five minutes after being switched on, dimmed to around 7%, regardless of the amount of daylight. That is probably a commissioning issue, with a potentially incorrect configuration of the photocell. The middle row luminaires are on constantly most of the day, indicating an additional failure.

The TM suggests that perception-driven acoustic analysis, conceptually illustrated in Figure 3, is able to improve the understanding of IEQ performance of a building under real operating conditions. For example, a high-performing window that prevents practically all external noise may actually shift occupants' attention towards indoor sound sources that would not normally be noticeable, potentially highlighting otherwise unidentified problems in a mechanically ventilated building.

The third case study in the TM is a new ward for an existing nine-storey hospital, in the centre of Bristol, that hosts a medical assessment unit, dementia care, paediatric facilities, intensive treatment unit (ITU) and two operating theatres.

Comparing the outcomes of the design calculation with measured data shows that the relevant Health Technical Memorandum, HTM 07-02,² could be useful in predicting energy performance of hospital facilities at design stage, although this may lead to overestimation of equipment loads. It notes the importance of equipment loads being covered in total energy performance analysis and not excluded, as they are in Building Regulation compliance calculations.

The TM notes there was a lost opportunity from not regularly monitoring and benchmarking the building's energy performance.

The required air change rates are achieved through mechanical ventilation, but it was noted that the included particle filters would not be effective in ameliorating the potentially high nitrogen dioxide (NO₂) levels in the incoming outdoor air.

There was evidence of low illuminance levels from daylight and artificial lighting in some zones. Misuse of lighting systems was possibly because of some

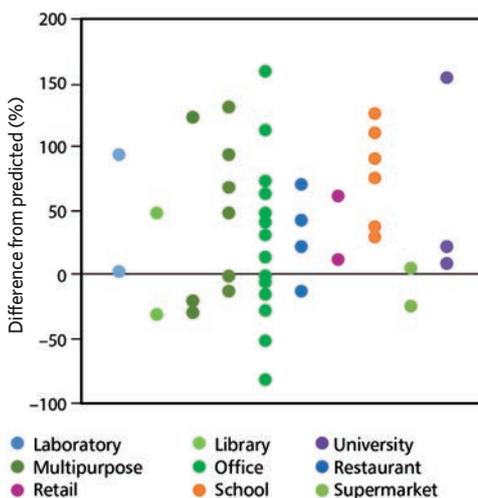


Figure 1: Examples of predicted and measured energy use intensity where +100% means that measured energy use is twice the amount predicted (from previous studies)

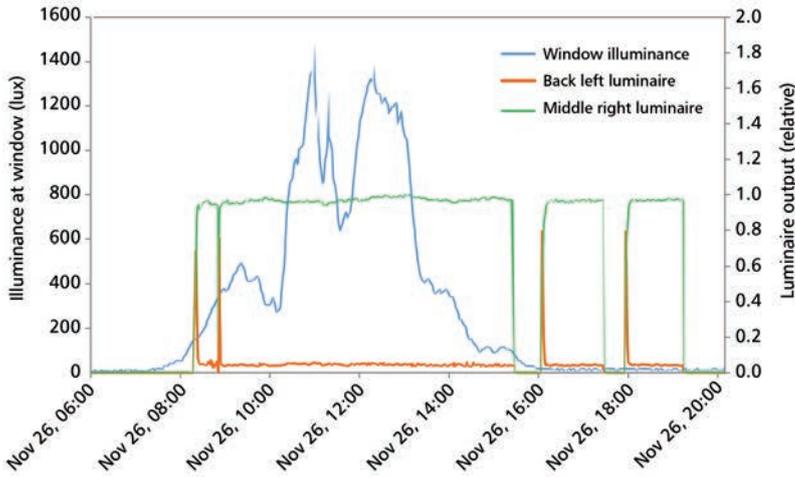


Figure 2: Example of poorly performing lighting control in a third-floor classroom

» unnecessarily complex switching arrangements, such as that shown in Figure 4, where three switches are used when two would have made the system more logical. This is reminiscent of confusing switching arrangements shown in presentations given by Bill Bordass following the revealing, and apparently resilient, Probe Studies³ of more than 20 years ago.

The final case study is of two adjacent apartment blocks, located close to main roads in east London, one 13 storeys and the other nine storeys, that provide 98 flats and maisonettes. These employ community heating schemes currently based on gas-fired boilers, with provisions for integration of a combined heat and power (CHP) plant in future. The TM advises that such heating schemes present opportunities for energy efficiency and decarbonisation, and gives some general advice on the preferred future for performance indicators and heat sources for such schemes.

It notes that, as mechanical ventilation with heat recovery (MVHR) systems are often used in low-energy dwellings, there can be benefit in improving the filtration strategy (above that of the normal particle filters) to improve the quality of indoor air and protect building users against outdoor pollution in urban areas. The TM highlights the importance of providing accessible information about maintenance requirements of MVHR systems to users, landlords and housing associations.

In an attempt to consolidate the best-practice principles discussed in the TM, nine specific technical recommendations are included, the headlines of which are summarised in Table 1.

TM61 additionally presents best-practice recommendations to enhance performance via collaboration, alignment and information sharing, with a methodology related to the design, construction and operation phases. These emphasise the involvement of experienced design team members who are unwilling to compromise on performance, while being able to balance conflicting goals and temper unreasonable expectations. It notes that working repeatedly with the same parties (clients, designers, consultants, contractors and subcontractors) reduces coordination time and enhances communication, information sharing and quality of work. Collaboration and information sharing should be encouraged, including

TABLE 1: KEY HIGH-LEVEL TECHNICAL RECOMMENDATIONS OF TM61

1. Set out clear operational targets for energy and IEQ performance at the outset of the project and consider the contractual arrangements required to meet these targets.
2. Use a holistic approach to performance to design, construct and operate low-energy buildings that deliver high IEQ and focus on the occupant needs.
3. Use CIBSE TM5⁴ methodology to develop performance models for evaluation of operational energy performance at design stage.
4. Minimise the introduction of any harmful pollutants within the building envelope and indoor environment. Use the checklist and guidelines available in CIBSE TM6.⁵
5. Use CIBSE TM52⁶ for non-domestic buildings and TM59⁷ for dwellings to assess overheating risk, and use results for defining ventilation rates.
6. Consider using advanced psychoacoustic parameters for human-centred acoustic design.
7. Adjust lighting for occupant needs.
8. Investigate predicted against measured performance using post-occupancy evaluations to understand the underlying causes of any performance gap.
9. Use CIBSE TM63⁸ for measurement and verification of energy performance in use.

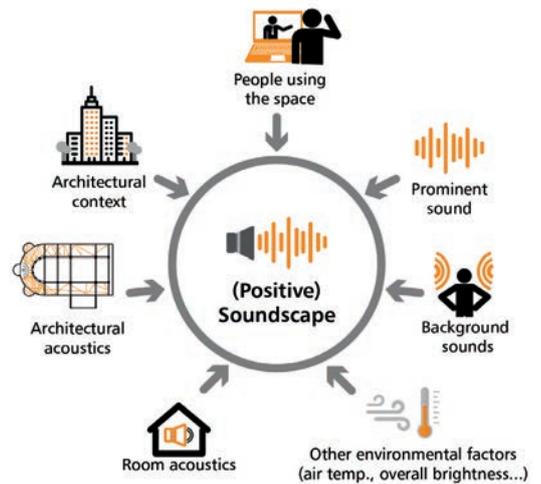


Figure 3: Ensuring a positive soundscape. TM61 is probably the first technical memorandum to bring in the concept of human-centred and perception-driven acoustics (psychoacoustics), in addition to regulatory requirements and its implications for building design

communicating changes and facilitating effective feedback. The team should be encouraged to associate their reputation with high total performance, but not be able to claim reputational benefits without delivering good performance, with benefits of long-term collaboration outweighing short-term individual gain.

In an effort to uphold performance targets, TM61 emphasises the importance of maintaining the connection with the client and building user – including making clients aware of defects – throughout design, construction, and operation. The culture should be one of solutions rather than blame, where motivations for performance, sustainability and public benefit drive alignment, commitment and collaboration. Contractual arrangements and incentives can align interests across the teams with performance contracts focused on operational performance that include high levels of testing and feedback during construction and operation.

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■ See opposite page for references.

■ With thanks to Esfand Burman, lecturer at UCL Institute for Environmental Design and Engineering, and a coordinating editor of TM61, for his guidance on this article

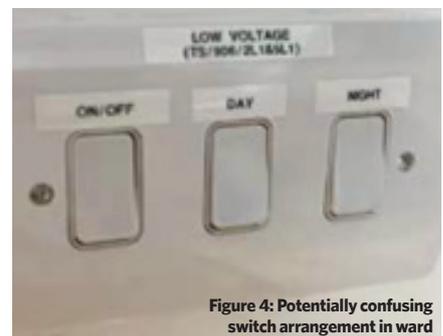


Figure 4: Potentially confusing switch arrangement in ward

Module 175

February 2021

1. In the examples of predicted and measured energy use intensity, which of the building types had the greatest spread of deviation from the predicted energy use?

- A Laboratories
- B Offices
- C Restaurants
- D Schools
- E Universities

2. What range of impact on overall energy consumption is cited in TM61 as being found to potentially result from the behaviour of a building's users and the systems?

- A Between -5% and +50%
- B Between -20% and +40%
- C Between -50% and +90%
- D Between -70% and +40%
- E Between -80% and +90%

3. The article notes that when considering IEQ performance in buildings, TM61 does not explicitly assess a performance evaluation approach for which one of these?

- A Acoustics
- B IAQ
- C Lighting
- D Productivity
- E Thermal comfort

4. What word is used for 'human-centred and perception-driven acoustics'?

- A Phenoacoustics
- B Physioacoustics
- C Phytoacoustics
- D Psycheacoustics
- E Psychoacoustics

5. Which of these was not included in the recommendations to enhance performance via collaboration, alignment and information sharing?

- A Develop a culture of solutions rather than blame
- B Employ performance contracts focused on operational performance
- C Encourage the team to associate their reputation with high total performance
- D Maintain the connection with the client and building user throughout the project life
- E Promote the liberal use of value engineering techniques

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- 1 2018 *Soft Landings Framework*, Building Services Research and Information Association, 2018.
- 2 HTM 07-02, *Making energy work in healthcare*, UK Department of Health, 2015.
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- 4 CIBSE TM54 *Evaluating operational energy performance of buildings at the design stage*, CIBSE 2013.
- 5 CIBSE TM64 *Operational performance: indoor air quality*, CIBSE 2020.
- 6 CIBSE TM52 *The limits of thermal comfort: avoiding overheating in European buildings*, CIBSE 2013.
- 7 CIBSE TM59 *Design methodology for the assessment of overheating risk in homes*, CIBSE 2017.
- 8 CIBSE TM63 *Operational performance*, CIBSE 2020.

› Story of the month

Topskan rebrands to Sircle

Built environment surveyor changes name to reflect its broader range of services

Topskan, a multidisciplinary surveyor of the built environment, has rebranded to become Sircle.

The new name is built on the company's 30 years of experience providing the building sector with a wide range of services, including: land, building, and mechanical, electrical and plumbing (MEP) surveys; compliance and fire safety audits; and, more recently, building information modelling (BIM). With significant growth since its document-scanning and CAD service beginnings, Sircle now delivers an extensive range of services to international clients in healthcare, education, hospitality, leisure, retail, and many other sectors.

Chad Coombes, Sircle's sales and marketing director, said: 'The decision to change our name was instigated by the evolving breadth of services that we supply to our clients.'

'Our Topskan name no longer represented what we do. Sircle allows us to reach out to new



markets and demonstrates our out-of-the-box approach to delivering projects.'

Sircle ensures its loyal customer base has a full understanding of their estates by providing accurate information on size, condition and usage, MEP services and assets, and compliance with current regulations.

Recently, it added project management and contract administration to its portfolio, and attracted new talent to its staff, cementing its

proposition as a one-stop shop for its clients.

Sircle is RICS-accredited, giving clients extra reassurance that works are done to a regulated standard and within RICS guidelines. It is on several procurement frameworks, so appointing Sircle for your project is easy.

■ Visit www.sircleuk.com or contact Paul Ritchie, marketing manager, on 0333 999 3747 or email paul.ritchie@topscan.co.uk

› Product of the month

Toshiba reveals new VRF system

SMMS-u has exclusive triple-rotary compressor for greater efficiency and capacity

Toshiba has unveiled the seventh generation of its industry-leading variable refrigerant flow (VRF) system for centralised cooling and heating in commercial buildings.

The company's innovative super-modular multi system (SMMS-u) has been redesigned to optimise climate control in all types of commercial buildings. It offers top-class efficiency, adaptability and connectivity, as well as ease of installation and year-round comfort control.

Among several new technologies is Toshiba's exclusive triple-rotary compressor, for greater efficiency and capacity, a space-efficient chassis, and a high-capability communications protocol.

Housed in an ultra-compact chassis, the Eurovent-certified SMMS-u's energy consumption is minimised through the combination of the proprietary triple-rotary



compressor and super-efficient heat exchanger. These technologies position it as a sector-leading VRF in seasonal efficiency that helps reduce energy bills. Efficiency is also assured in part-load conditions.

The adaptability of the SMMS-u to address virtually any commercial building application (new-build or refurbishment) derives from an unparalleled array of line-up choices. Nine single modules, from 8HP to 24HP - and up to five

outdoor units - can be combined to achieve 120HP. Around 3,000 solutions can be created to meet requirements for efficiency, capacity, refrigerant amount or footprint. The SMMS-u is able to operate from -25°C to +52°C.

Innovative engineering ensures there is no need to be limited by piping restrictions. The system allows a total piping length of 1,200m, with 250m permissible from the outdoor unit to the farthest indoor unit. A height difference of up to 110m is possible between outdoor and indoor units for projects in elevated buildings, giving even more options to consultants and installers.

Another advance is the connection of up to 128 indoor units, thanks to Toshiba's new TU2C-LINK protocol, which is bringing new perspectives in data volume and communication speed. To adapt the capacity of the system to building use, the SMMS-u offers an impressive 200% diversity ratio. The refrigerant charge is almost 50% less in comparison with the previous model, for a truly optimised SMMS-u environmental footprint.

■ Visit www.toshiba-aircon.co.uk/product/smmsu-r410a-new

Grundfos' white papers

White papers are a good reference point and an important source for engineering specialists to learn more about specific, complex issues in a logical format. Over the years, Grundfos has created a portfolio of white papers aimed at helping engineers to better understand a range of pumping challenges.

Designed to be used as a handy reference document, each paper has been carefully developed to get right to the heart of the chosen topic, and to break it down so that it is easy to understand.

The themes range from water boosting and proportional pressure control to the digital impacts on building services. All these topics, and many more, are free to download from the Grundfos website, once you have completed a simple registration.

Whenever you need to access a reliable, authoritative, accessible pump reference, check out Grundfos first.

■ Visit www.grundfos.co.uk/isolutions



Essco's new look

Essco is delighted to unveil its revitalised company branding, including a new name, look and website to reflect the creation of the Essco Group.

The company is also enhancing its existing assets, with the addition of new products, services and solutions.

The new Essco Group features four divisions: Essco Energy, Essco Hydraulics, Essco OEM and Essco Process Valves.

Richard Stammers, Essco Group managing director, said: 'Our mission is to deliver the best energy-efficient products and systems to the heating, ventilation, air conditioning and process industries.'

■ Visit www.esscogroup.co.uk or call 01489 779068

Panasonic introduces Conex

Panasonic has developed Conex, a new internet of things (IoT) remote controller. Offering next-generation solutions for the Panasonic commercial air conditioning line-up, this system brings a host of benefits for compatible units through a smartphone or tablet.

Conex is accessible, flexible and scalable, with accompanying apps tailored to meet the requirements of installers, service engineers and end users.

With simple control via easy-to-use graphics, Conex offers a range of apps for daily remote operation and maintenance, and additional benefits for end users, such as energy monitoring.

■ Visit www.aircon.panasonic.eu or, to see Panasonic Conex in action, go to www.youtube.com/watch?v=INdMA_op9ZI&t=4s



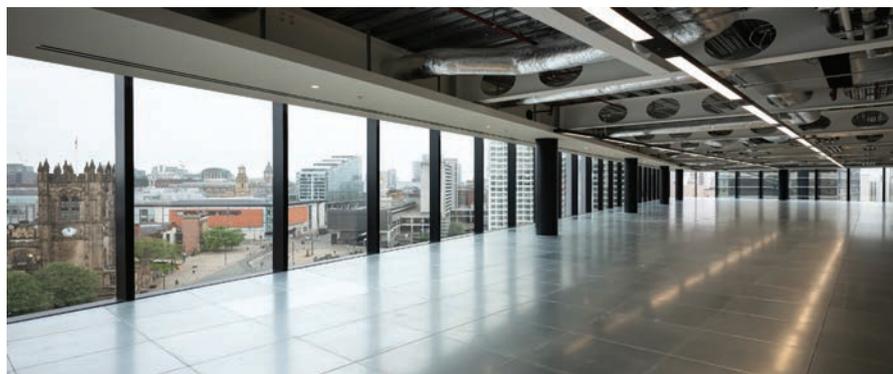
Gilberts helps achieve grade A

The choice of Gilberts ventilation diffusers has played a key part in the architectural aesthetics of 100 Embankment, a grade-A office development in Manchester.

Gilberts supplied more than 500 ventilators to air the internal spaces, while its PG perforated-face ventilation diffusers – complemented by its GSFA circular swirl diffusers – ensure excellent distribution of fresh air and mirror the smooth, angular interior design.

'Gilberts' diffusers were the ideal choice to balance the design aesthetics with the practicalities of installation,' said A & B Engineering contracts director Ian Buxton.

■ Visit www.gilbertsblackpool.com



Distech Controls set to impress

A recent office building project at The Corniche building in London – undertaken by Energy & Technical Services – demonstrates the impressive capabilities of Distech Controls products, including the innovative Eclipse Connected Terminal Unit Controllers (ECY-TU/PTU) that were used to connect to the building's new fan coil units.

Paul Martin, senior technical consultant at Energy & Technical Services, said: 'We suggested using Distech Controls' products to provide the flexibility and controllability the end user required. I knew they would work perfectly in this situation.'

■ Visit www.distech-controls.com

New chapter for ACV UK >

ACV UK has joined Groupe Atlantic, which consists of 13 brands that create thermal comfort solutions in heating, hot water, air conditioning and ventilation.

In the UK, ACV focuses on the commercial market, with its range of heating and hot-water products that use its patented tank-in-tank concept.

Darren Finley, executive officer commercial products - Groupe Atlantic UK & ROI, said: 'ACV UK joins some leading UK commercial heating brands in Groupe Atlantic to strengthen our product offer and provide complementary hot-water products to our customers.'

■ Visit www.acv.com/gb/specifier or call 01383 820100



Inform appoints new associate directors v

Inform Consulting Engineers has appointed Oliver Atkins (below right) and Thomas Finn (below left) as associate directors.

Inform CE is a fast-growing MEP consultancy based in Bristol, with a nationwide client base.

Tim Crocombe, director of Inform CE, said: 'Our growth through 2020 and projections into 2021 mean it is an exciting time to join Inform CE. Oliver and Thomas complement our highly skilled and client-focused team.'

■ Visit www.informce.co.uk



< Condair's biltong-drying success

Specialist South African food supplier The Savanna is using Condair dehumidifiers to dry its award-winning biltong at its production facility in London.

Two Condair dehumidifiers were installed to help in the production of this traditional product of South Africa.

Lisa Gardshol, founder and CEO of The Savanna, said: 'We have been very happy with the performance of the Condair dehumidifiers. Not only have we increased production, but we also now have full control over the entire process, and can make decisions based on the data that we receive.'

■ Visit www.condair.co.uk



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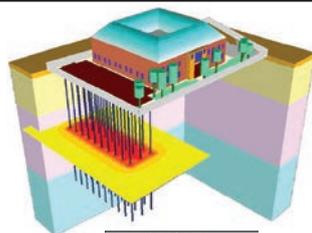
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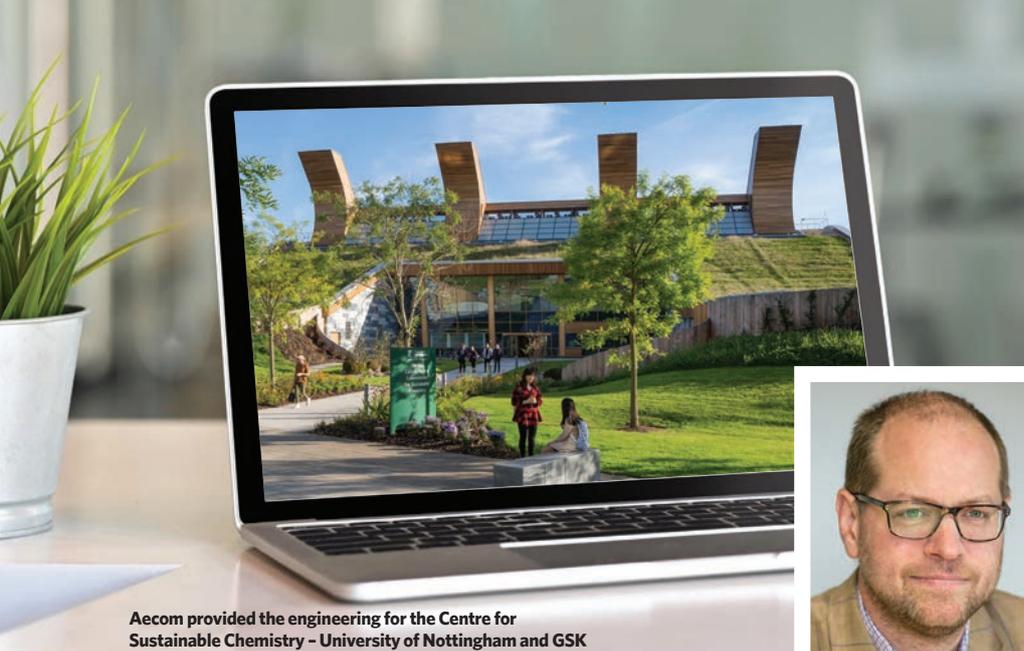
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Aecom provided the engineering for the Centre for Sustainable Chemistry – University of Nottingham and GSK

Robert Spencer

Training for net zero

Aecom is equipping its designers to help clients meet ambitious carbon targets, as Robert Spencer explains

Aecom is aiming for net-zero carbon design solutions from 2025, and to help achieve this ambition it has launched a sustainability training plan for the 2,300 employees in its UK buildings and places team.

Robert Spencer, Aecom's director of sustainable development, is helping lead the initiative. 'There's a real hunger from our clients for support and solutions to help them meet the net-zero commitments they have made,' he says. 'Now, everyone's got to be carbon competent. Gone are the days when the sustainability department was a few people in the backroom who were called upon occasionally.'

The online training comprises modules based around six design principles: focus on refurbishment over new-build; reuse existing materials and equipment; quantify options in terms of carbon and cost; specify low carbon materials; consider materials' end of life; and optimisation of design. Aecom developed training material during the Covid-19 lockdowns, including carbon calculators and client dashboards, and had its first training session last month.

Why a net-zero training initiative?

A lot of our clients have a net-zero carbon target of 2030, but you need to hit some big milestones well before then. We need to be looking at net-zero design now rather than wait until 2027-28. We decided that everyone in the team had to be a net-zero practitioner to a certain point. Sustainability is now front of house; it's the first thing you talk about in a conversation, not the last, so we need to be on the front foot.

There's a groundswell of interest from Aecom's grassroots practitioners. It's about enabling that energy and enthusiasm to be unleashed. If the MD says he wants net-zero solutions for clients, that excites a lot of people who came to Aecom wanting to work on these kinds of projects. They are now thinking 'we can really do this'.

How has Aecom responded to the climate emergency?

At an Aecom leadership conference in the autumn of 2019, I was asked to describe what we were doing on sustainability, and the discussions morphed into our response to the climate challenge in 2020. We signed up to the Declarations [such as Building Services Engineers Declare] and co-founded Pledge to Net Zero, which commits to science-based targets to meet the UK's 2050 net-zero target. We established a UK and Ireland climate council, developed our climate policy and, in October, became carbon neutral for UK and Ireland operations.

In April 2020, we set up a net-zero emissions task force in the buildings and places

team, as client demand for net zero was strongest in the built environment. Clients have set big strategic targets and we have to come up with solutions to get them there.

What does the training look like?

We are using the Aecom University online learning platform to roll out the net-zero modules. The curriculum development was led by Miles Attenborough, director at Aecom's sustainable development group.

Modules will start with basic climate awareness training, then look at achieving zero carbon through use of renewables, carbon budgeting, and offsetting when you can't do anything else.

For embodied carbon, we will examine different solutions in terms of structure, foundations, materials and so on, and see what trade-offs mean for carbon and costs. We'll also look at what the transport and logistical implications are of selecting certain materials.

How buildings can be designed to operate at really low levels of energy consumption is another area of study, and there will be climate-focused masterplanning, where we look at the city level.

What's your approach to lowering energy use?

When looking at low carbon energy performance, we're now including Passivhaus principles – and it is informing a lot of our tool development. Before Christmas, 30 people were trained up to a reasonable Passivhaus level. We're going to do more training, and many of our healthcare and commercial clients are looking at Passivhaus; Oxford University says projects over a million pounds will now use the method.

It's very expensive and time-intensive to have everyone as a certified Passivhaus practitioner, so we've adopted a 'train the trainer' approach where a handful of people become certified Passivhaus consultants and act as ambassadors, generating a good level of understanding and competency across the business.

What tools are available to clients?

We want to give clients a good sense, early on, of what going down a specific route means in terms of net-zero outcomes. They want accessible, workable dashboards, where they see what changing variables such as materials and building functionality means for carbon. We're managing a lot of data to create tools that make choices seem straightforward.

EVENTS

Event details are correct at the time of going to print, but as a result of the ongoing coronavirus (Covid-19) situation, they may be subject to change. For updates, please check cibse.org/training for training and cibse.org/events for CIBSE groups and regional events. CIBSE has a range of online learning courses available to support your learning, visit cibse.org/training-events/online-learning



BUILDING PERFORMANCE AWARDS

25 February 2021
The CIBSE Building Performance Awards 2021 will take place online, for the first time. The shortlist has been announced, so join us for free to find out who takes the trophies, and celebrate the industry talent and achievements.
www.cibse.org/bpa



CIBSE REGIONS AND GROUP EVENTS

Check the website for up-to-date information on regions and groups meetings, webinars and podcasts, visit www.cibse.org/events

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Energy Savings Opportunity Scheme

4 February

Electrical services explained

9-11 February

Overview of IET wiring regulations (18th Edition)

17 February

Above-ground building drainage

18 February

Fire-risk assessment to PAS 79

18 February

Mechanical services explained

22-24 February

Low carbon consultant design training

23-25 February



CIBSE JOURNAL WEBINARS

CIBSE Journal hosts regular, sponsored webinars covering a wide range of building services-related topics. All webinars are available on demand on the Journal website at www.cibsejournal.com/cpd/webinars

The next CIBSE Journal webinar, sponsored by Kohler Uninterruptible Power, will take place on 24 February.

Other recent webinars include:

- Staying in control of design to value pumping solutions, sponsored by Grundfos
- R32 VRF and F-Gas phase down, sponsored by Dakin
- A case for change: setting new UK standards for high-rise drainage, sponsored by Geberit.

Practical project management

25 February

Low carbon consultant building operations

2-5 March

High voltage (11kV) distribution and protection

2 March

Building services explained

3-5 March

Electrical distribution design

5 March

Air conditioning and cooling systems

9 March

Energy Efficiency Building Regulations Part L2 2020

9 March

Low carbon consultant

10-11 March

Introduction to combined heat and power

12 March

Mechanical services explained

22-24 March



ONLINE LEARNING

CIBSE has a portfolio of online courses that contain interactive content, with quizzes and additional resources to support your learning. www.cibse.org/training

WEBINARS

#Growyourknowledge

CIBSE's free webinar series continues in February. Taking place every Thursday at 11am, the webinars are designed to support the CIBSE community in maintaining their CPD remotely. To register for the webinars, visit cibse.org/growyourknowledge

All previous webinars are available on the #GrowYourKnowledge GoToWebinar channel.

CIBSE Membership

CIBSE Membership is hosting free webinars to support members with applications for the Associate and Member grades, and registration with the Engineering Council at Incorporated Engineer and Chartered Engineer levels.

The series includes two separate webinars, with session one covering routes to membership, and session two focusing on how to write the Engineering Practice Report.

Upcoming webinars:

- 16 and 23 February
- 9 and 23 March



To register for the webinars, visit www.cibse.org/webinars



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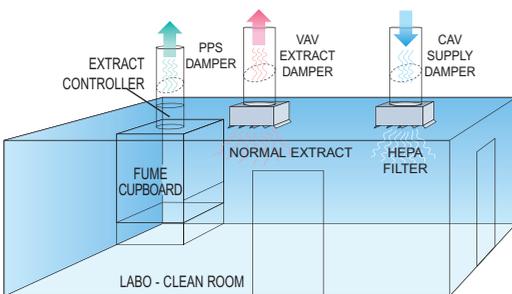


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