CIBSE JOURNAL

B uild P erform

November 2021 www.cibsejournal.com

PR DICTING NET ZERO B ILDINGS IN D B

EMBODIED ENERGY IN B ATN G SYSTEMS REVEA ED

COOL R A NIA ROYA A BERT A LL RETROFIT

MISSION POSSIBLE

CIBSE Young Engineers Award winners ready for the net zero challenge

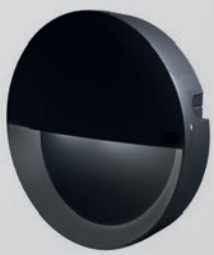
CPD Special

NEW CITY PTS

TAMLITE®

Lighting for **Urban** beautification projects require high performance luminaires with high optical control. Maximise light distribution and energy savings with Tamlite's **CITY** range.

CITY BL



CITY WP

NEW CITY BEAM

Environmental

Wellbeing

Safer Buildings

#BritishManufacturer
Est. 1967

Explore the CITY: **tamlite.co.uk/cibse-city**

Editorial
Editor: Alex Smith
Tel: 01223 378034
Email: asmith@cibsejournal.com
Deputy editor: Liza Young
Tel: 01223 378048
Email: lyoung@cibsejournal.com
Technical editor: Tim Dwyer
Designer: James Baldwin

CIBSE Journal is written and produced by CPL (Cambridge Publishers Ltd) Tel: +44 (0)1223 378000.
www.cpl.co.uk
1 Cambridge Technopark, Newmarket Road, Cambridge CB5 8PB.

Editorial copy deadline: First day of the month preceding the publication month

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

Mapping out a route

In the run up to the UN Climate Change Conference, COP26, in Glasgow, the UK government finally published its *Heat and Buildings Strategy* last month.

Central to the strategy is the transition away from fossil fuelled heating to low carbon alternatives. It states that new and replacement gas boilers in homes will be banned by 2035, and promises grants of £5,000 if homeowners replace them with a heat pump.

The government strategy firmly backs heat pumps and states an aim of 600,000 installations a year by 2028. This is a 20 fold increase in the number currently being installed annually in the UK, and is a huge challenge for an industry that will have to find a way of scaling up in the midst of a skills crisis. The £450m Boiler Upgrade Grant is also only for three years, enough to pay for 90,000 heat pumps. The grant will need to be a lot higher to hit the 600,000 target.

For heat pumps to function efficiently and cost effectively, homes need to be well insulated and airtight, which millions of homes in the UK are not. For many, the switch to a heat pump will entail a hefty investment in energy efficiency measures. There is little support for energy efficiency measures in the strategy, which is a pity when you consider that a building s carbon emissions could be cut by 38% if steps were taken to improve energy performance, according to BEIS.

Whether hydrogen will one day be piped through existing gas network is still an unknown. The government will be carrying out more large scale trials before making a decision in 2026. There is continued support for heat networks, and a consultation on heat network zoning released last month aims to expedite the development of networks by identifying the areas that would most benefit from one (page 39).

With so much uncertainty about which low carbon technologies will prevail, it s difficult to predict what buildings will look like in 2050. We ve asked six industry experts to gaze into the crystal ball to share their visions of the future (page 22).

There will be more certainty around embodied energy in heating and hot water systems with the upcoming publication of CIBSE TM65.1. It breaks down the embodied energy in common domestic systems, based on research by Elementa Consulting. One of its graduate engineers, Yara Machnouk, shares the findings on page 28. There are also details of a similar upcoming study for commercial systems that manufacturers are welcome to join.

Machnouk also happens to have come third in last month s CIBSE ASHRAE Graduate of the Year awards. Details of her presentation can be found on page 20, alongside those of winner Lucy Sherburn and runner up Matthew Dickenson.

ALEX SMITH, EDITOR asmith@cibsejournal.com

CONTRIBUTORS

Hywel Davies
The competency requirements in the Building Safety Bill and how clients will prove they have complied

Sorcha Breslin
What it means to be a volunteer at the COP26 conference in Glasgow, and how it relates to working as an engineer

Julie Godefroy
What to look out for at COP26, including the cross-industry climate action plan, of which CIBSE is a signatory

Tim Dwyer
November's CPD looks at the application of CFD to examine supply of fan-assisted outdoor air

District Heating Solutions

Supporting your Heat Network project from design to completion and beyond.

At Bosch Commercial & Industrial, we offer a wide portfolio of heat generation technologies and BESA registered HIU's to help thousands benefit from affordable low-carbon heating and hot water.

Our dedicated support services:

- Help you determine the right technologies during your project's feasibility stage
- Provide initial and detailed design services in line with CIBSE CP1 heat network code of practice
- Offer on-site installation and commissioning support for contractors.

To discuss any upcoming projects, or to book a feasibility consultation, please visit **bosch-industrial.co.uk/heat-networks**

32

CONTENTS

CIBSE JOURNAL
www.cibsejournal.com
The official magazine of the Chartered Institution of Building Services Engineers

SOCIAL MEDIA
@CIBSEJournal
CIBSE LinkedIn
CIBSE Journal newsletter
www.cibse.org

FOR CIBSE
Journal production manager: Nicola Hurley
Tel: 020 8772 3697, **nhurley@cibse.org**
CIBSE, 222 Balham High Road, London SW12 9BS
Tel: +44(0)20 8675 5211

 ISSN 1759-846X

SUBSCRIPTION ENQUIRIES
If you are not a CIBSE member but would like to receive *CIBSE Journal*, subscribe now! Costs are £80 (UK) and £100 (international). For subscription enquiries, and any change of address information, please contact Nicola Hurley at **nhurley@cibse.org** or telephone **+44 (0) 20 8772 3697**. Individual copies are also available at a cost of £7 per copy, plus postage.

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

The US annual subscription price is £100. Airfreight and mailing in the USA by agent named WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Periodicals postage paid at Jamaica NY 11431.

US Postmaster: Send address changes to *CIBSE Journal*, WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Subscription records are maintained at CIBSE, 222 Balham High Road, London, SW12 9BS, UK.

CREDITS
Cover image Credit / Ben Hasler P06 iStock.com / VictorHuang P08 iStock.com / Maksim Safaniuk P09 Credit / Dennis Gilbert P10 iStock.com / Suebsiri P22 iStock.com / VladSt P28 iStock.com / Matteogirelli P32 Getty images / Justin Tallis P33 iStock.com / Mikeinlondon P61 iStock.com / Nostal6ie P64 iStock.com / Rusak / SlobodanMiljevic / TommL / Vchal / Serts / VioNettaStock / PeopleImages P76 iStock.com / Metamorworks P89 iStock.com / Alexey Rezvykh P90 iStock.com / Intpro

FSC MIX Paper from responsible sources FSC® C017177
abc
ABC audited circulation: 17,944 January to December 2020
Printed by: Warners Midlands PLC

IN BRIEF

Climate action plan to be revealed at COP26

A cross industry climate action plan is to be presented at COP26 by construction institutions.

Carbon Zero will be presented during Built Environment Day at COP26, on 11 November.

CIBSE is one of the signatories and has had an influential role in determining the actions. The actions we have committed to in this plan are substantial, and range from a review of accredited degrees and CPD requirements through to joint industry targets, guidance and associated professional obligations, said Julie Godefroy, head of sustainability at CIBSE.

Signatories have committed to publish an implementation plan by COP26. See page 16 for more.

Embodied energy in heating revealed

Embodied energy in heating and hot water systems is responsible for between 3% and 25% of whole life embodied carbon in a building, according to new research for CIBSE.

The study, undertaken by Elementa Consulting revealed an average measure of 9kgCO_2e per kg of product weight in the systems examined.

Products were selected to represent the most used heating and hot water systems in new build residential schemes in the UK. The results will be published in new CIBSE guidance TM65.1.

Manufactures are invited to take part in a new study on offices. See page 28 for more information.

Greener London projects to get faster approval

London Mayor Sadiq Khan has published guidance designed to ensure new developments are greener by giving faster approval if they prioritise energy performance and give more space for walkers, cyclists, and public transport users.

The guidance will require developers to monitor and report the operational energy performance of major developments for at least five years post construction, which the mayor sees as a critical step towards his strategy for delivering net zero carbon buildings.

Architects and engineers publish home retrofit plan

LETI-published guide defines retrofit specifications for four house types

More than 100 architects, engineers and other building professionals have produced a *Climate Emergency Retrofit Guide* under the banner of the London Energy Transformation Initiative (LETI).

The guide defines targets for existing homes and gives practical advice on how to transform them through energy-efficiency measures and heat pumps, in line with carbon-reduction targets. It also defines retrofit specifications for four primary housing types: mid-terrace, semi-detached, detached, and apartment.

The authors say that more than one million homes would have to be retrofitted every year for the next 30 years to meet net zero aims. 'Whether retrofitted in one go or phased over time, we cannot afford to retrofit them twice,' they add.

The guide defines space heating and energy use requirements, and aims for a 60-80% reduction in total energy consumption for the average UK home. 'These targets have been determined through a combination of practical experience and understanding of what measures are realistically achievable, informed by a national housing stock model to examine issues such as renewable energy provision and grid capacity,' a LETI statement said.

'There is a retrofit skills gap in the UK construction industry,' it added. 'This knowledge and understanding of how to make our homes more energy efficient must be disseminated across the construction industry so that these requirements become standard retrofit practice.'

The guide defines targets for existing homes

CO_2 emissions rebound after lockdown

CO_2 emissions have risen sharply since global economies got back up and running, according to the latest analysis from the International Energy Agency (IEA).

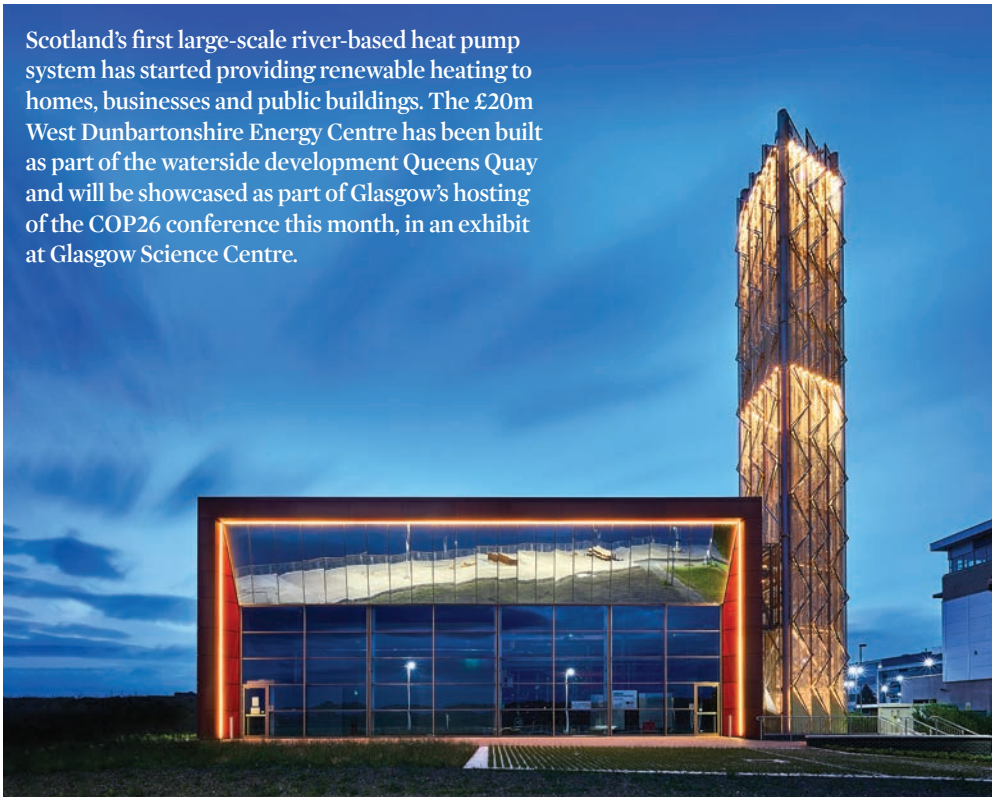
The second-biggest year-on-year rise was recorded in this year's *World Energy Outlook*, which increases the need for governments to invest $4tn in climate-mitigation measures before the end of this decade if net zero is to be possible by 2050.

The report says growth in renewables had remained steady, but there had been a 'large rebound' in fossil-fuel use, with demand beginning to reach pre-pandemic levels as lockdown restrictions lift across the globe. The IEA now believes emissions could hit record highs in 2023 and that much more concerted action is needed from governments.

'Today's climate pledges would result in only 20% of the emissions reductions by 2030 that are necessary to put the world on a path towards net zero by 2050,' said the IEA's executive director, Fatih Birol. 'The world's hugely encouraging clean-energy momentum is running up against the stubborn incumbency of fossil fuels in our energy systems. Governments need to resolve this at COP26 by giving a clear and unmistakeable signal that they are committed to rapidly scaling up the clean and resilient technologies of the future.'

'The social and economic benefits of accelerating clean-energy transitions are huge, and the costs of inaction are immense,' added Birol.

CLYDE RIVER HEAT PUMP UP AND RUNNING



Scotland's first large-scale river-based heat pump system has started providing renewable heating to homes, businesses and public buildings. The £20m West Dunbartonshire Energy Centre has been built as part of the waterside development Queens Quay and will be showcased as part of Glasgow's hosting of the COP26 conference this month, in an exhibit at Glasgow Science Centre.

Heat strategy backs heat pumps and delays hydrogen decision

New gas boilers banned from 2035 in *Heat and Buildings Strategy*

The government has published plans to achieve price parity between gas boilers and electric heat pumps in its long-delayed *Heat and Buildings Strategy*, which was published last month.

A key tactic will be moving green surcharges from electricity to gas bills to make heat pumps more attractive to consumers. The government has also confirmed a ban on the installation of new and replacement gas boilers by 2035.

The strategy says 600,000 heat pump installations per year is the minimum market size that will be required by 2028 to be on track to deliver net zero.

The government also published its *Net Zero Strategy,* which provides a roadmap for emissions reduction in other industries including: power; fuel supply and hydrogen; industry; transport; natural resources, waste and F-Gases; and greenhouse gas removals.

Currently, 85% of UK homes use natural gas for heating and cooking. The UK housing stock is also among the most energy inefficient in Europe, so addressing this was rated a top priority by the government ahead of the COP26 climate conference in Glasgow.

The government believes electricity prices have been kept unnecessarily high by the burden of subsidies and is looking to move to a situation where consumers use more electricity, but pay lower rates for it, while gradually reducing their gas consumption as its cost rises.

Householders switching from gas to heat pumps will receive a £5,000 grant from a new £450m boiler upgrade scheme. However, CIBSE technical director Hywel Davies said the grant would not cover all the costs of transition.

'If you put a heat pump in a 1950s house, other improvements will have to be made, such as installing more insulation.'

He added: 'The other real concern is around installation, and whether we have enough people who can design and install heat pumps.'

The strategy also commits the government to investing £60m in heat pump innovation to make them smaller and easier to install.

A final decision on the role of hydrogen in heating will be made in 2026 following large-scale pilot projects.

IN BRIEF

Heat networks to play key role in achieving net zero

Heat networks will play a key role in transitioning existing buildings to low carbon sources, according to the government in its *Heat and Buildings Strategy*, published last month.

The government said that its Heat Networks Market Framework will introduce maximum CO_2 emission limits for district heating by the early 2030s at the latest.

It said its £338m Heat Network Transformation Programme would continue to grow the market for low carbon heat networks.

Heat Networks Regulations would be introduced as soon as possible, it added.

British Gas sees big future in heat pumps

British Gas is hoping to grow its workforce to take on more heat pump installation work.

The energy giant s social housing subsidiary, PH Jones, maintains more than 195,000 homes across the UK, and said a growing number of its installations now involve renewable systems, with noticeable growth in heat pumps.

With the social housing sector moving more quickly towards low and zero carbon targets, British Gas said upskilling the PH Jones workforce was a priority.

The industry is clearly suffering from an acute skills shortage, and it is crucial that large employers like us step up to address it, said director Matt Isherwood.

Hydrogen heat solution wins Earthshot prize

A green hydrogen technology has secured one of the first Earthshot Prizes awarded last month by Prince William.

Pacific based Enapter s AEM Electrolyser technology turns renewable electricity into emissions free hydrogen gas for powering transport and industry, and for home heating.

It won the Fix Our Climate category and said the £1m funding from winning The Earthshot Prize would help it to start mass production next year. By 2050 Enapter s vision is to account for 10% of the world s hydrogen generation.

£1m penalty for F Gas offender

UK F Gas register Refcom has welcomed the Environment Agency s decision to issue a fine of more than £1m to a company that breached the F Gas Regulations.

The London based firm IMO Gas Supplies was found guilty of seven offences all linked to breaches of regulation 31A of the Fluorinated Greenhouse Gases Regulations over a two year period. It was given five £200,000 fines for failing to ensure that the quantity of HFCs it was using did not exceed its F Gas quota. It also received a £10,000 fine for failing to sufficiently report imports of HFCs to the European Commission and a £1,500 penalty for not keeping proper records. The firm is reported to have been using refrigerants R134A, R404A, R410A and R407C, which are subject to restrictions under the regulations.

This is precisely the kind of tough action we have been urging from the Environment Agency, said Refcom s head of technical Graeme Fox.

BEIS launches heat network zoning consultation

Methodology to be studied for identifying and designating heat network zones

BEIS is seeking views on its proposed approach to deliver heat network zones in England and identify areas where they are the most appropriate solution for low carbon heat.

The consultation, which closes on 19 November, will consider how central and local government can work more effectively with the industry and local stakeholders to identify and designate areas where heat networks are the lowest-cost solution for decarbonising heat.

It will inform the government's project to develop legislation and processes for zoning, and is inviting views on the broad principles for how heat network zones could be designed, ahead of later consultations that will go into further detail.

This consultation will cover: the methodology to be used for identifying and designating zones; the roles and responsibilities of different parties involved in the zoning process; the requirements for certain buildings within zones to connect to a heat network; the requirements on certain parties to provide information to support the identification and designation of zones; and the enforcement, monitoring and reporting regimes.

For more on the *Heat Network Zoning* consulation see page 39.

Environment Agency issues UK flood warning

The UK is 'dangerously underprepared' for the impacts of climate change, according to a report from the Environment Agency (EA), prepared to coincide with the COP26 climate conference in Glasgow this month.

Entitled *Living better with a changing climate*, the report predicts that winter rainfall will rise by 6%, and decrease in summer by 15%, by the 2050s. It adds that this would have a devastating effect on farming and exacerbate water scarcity in cities.

Flooding will increase dramatically, it continues, with London's sea level expected to rise by 23cm by the 2050s, and 45cm by the 2080s. River flows will also be 27% higher in the 2050s than they are today. This will lead to severe flooding across the country, similar to that experienced in Europe this summer.

The report adds that this kind of episode 'will happen in this country sooner or later, however high we build our flood defences, unless we also make the places where we live, work and travel resilient to the more violent weather the climate emergency is bringing'.

'While mitigation might save the planet, it is adaptation, preparing for climate shocks, that will save millions of lives,' said EA chair Emma Howard Boyd.

'Choosing one over the other on the basis of a simple either/or calculation is like telling a bird it only needs one wing to fly.

'With that in mind, it is deeply worrying that adaptation is in danger of being grievously undercooked at COP26. Not by the UK government, but by the world at large.'

Read the report at **bit.ly/CJNov21NewsEA**

UNIVERSITY BUILDING WINS STIRLING PRIZE

A 'warm and dynamic' university Town House in London has won this year's RIBA Stirling Prize 2021.

The £50m Kingston University building, which has a dance studio, library and theatre, as well as open terraces and roof gardens, was designed by Grafton Architects.

ChapmanBDSP provided MEP, environmental, fire and lighting consultancy services, and worked with structural engineers AKT II and the design team to ensure the building had environmental and engineering strategies to make it easier to operate and maintain.

Rising costs and skills crisis causing contractors to lose sleep

Shortage of M&E engineers, pipe fitters, plumbers and service technicians, says BESA

Rising costs and a shortage of skilled people are giving building services contractors sleepless nights, according to a new business survey.

Members of the Building Engineering Services Association (BESA) said they were facing 'major challenges' because of a combination of rising labour and material costs, growing lead times, shortage of equipment and delivery delays. Many respondents to the quarterly survey said they expected the situation to get worse before it gets better, although 80% said they expected to see growing or stable turnover levels through to the end of the year.

There is a particular shortage of M&E engineers, pipe fitters, plumbers and service technicians. One consequence is that many businesses will employ fewer direct staff, agency workers and apprentices over the next six months, despite the urgent need to increase the flow of skilled people into the industry. 'With the ambitious targets for decarbonisation of heat and buildings, this shortfall is a major concern and a serious risk to successful delivery of low carbon heat,' said Hywel Davies, CIBSE technical director. 'If we are to meet our targets for low carbon heating and retrofitting our homes and buildings, we need many more people with the right skills and training to design and deliver projects.

'The shortage of skilled people will be compounded by the new regulations on competence [see page 14] as designers and contractors will have to demonstrate that those who design and build are competent to do so.' This will only serve to build up longer-term shortages, said BESA's director of legal and commercial, Debbie Petford. 'It is a global issue and I hope it will be high on the agenda at COP26.'

Industry body backs rates reform call

An alliance of engineering services bodies, Actuate UK, has urged the government to take the advice of the CBI and reform business taxation in the forthcoming Budget and Comprehensive Spending Review.

The group of eight bodies, including CIBSE, said business rates should be reduced to help firms invest in net zero measures and 'support levelling up'. It added that the government should allow rates liabilities to fall in line with property values and without further increases in the headline rate, which would be equivalent to a reduction in the uniform business rate. It should also increase the frequency of business rates revaluations and ensure rates are adjusted quickly to economic changes to reflect firms' ability to pay.

Creating a 'greener' business rates system could unlock investment in making buildings more energy efficient and decarbonising property stock, added Actuate UK. It wants rates exemptions for low carbon plant and machinery and new technologies that link to the 'green' agenda, such as solar PV and heat pumps.

IN BRIEF

Job vacancies hit 20 year high

Construction job vacancies have reached their highest level in 20 years, according to the Office for National Statistics (ONS).

There were more than 43,000 positions unfilled between July and September, traditionally one of the industry s busiest periods. This is 45% higher than the previous quarter and nearly double the same period a year ago. It equates to around 2.9 vacancies for every 100 jobs and is the highest figure since records began in 2001.

This is pushing up wages, with average total pay up by 9.7% in June to August the second highest wage inflation rate in the whole economy, only trailing financial services, which had reached 11%.

Construction output dips again

The recovery in construction has been knocked off course after five months of falling output, according to the ONS.

New work remained 3.7% below pre pandemic levels at the end of August, with the blame being put on supply chain problems and shortage of materials. Many firms said their order books were healthy, but projects were being held up by shortages and rising labour costs.

Growth was reported in the infrastructure, industrial and public housing repair and maintenance sectors, but other parts of the market were down or flat. Prices rose by 2.8% in August, compared with July, and were up by 23.5% compared with a year ago. The most dramatic annual price increases in August were imported plywood (78.4%), fabricated structural steel (74.8%), and imported sawn or planed wood (74%).

Scrap VAT on energy bills, says alliance

The Energy and Utilities Alliance has urged the government to scrap VAT on energy bills this winter in the face of soaring wholesale prices.

Chief executive Mike Foster said energy bills had already risen by £150 this year for those on the price cap and were almost certain to jump again next spring.

When the regulator does not dismiss speculation of an average household energy bill of £2,000, it is time for the government to act, said Foster.

Poor IAQ affects 'mental agility'

Researchers find that people's response times and accuracy in tests deteriorate as PM2.5 and CO_2 levels rise

Poor indoor air quality (IAQ) has a significant impact on the mental agility and focus of office workers, according to a new report.

Researchers from the Harvard TH Chan School of Public Health found that higher concentrations of fine particulate matter and lower ventilation rates could be linked to slower response times and reduced accuracy in cognitive tests. They studied 300 people working in offices in six countries, including the UK, running a series of tests for levels of PM2.5 and looking at levels of CO_2 to measure the effectiveness of the ventilation.

Research associate José Guillermo Cedeño Laurent said: 'The findings show increases in PM2.5 levels were associated with acute reductions in cognitive function. The study also confirmed how low ventilation rates negatively impact cognitive function.'

Response times and accuracy in a colour-based test deteriorated as PM2.5 and CO_2 levels rose. A rise in PM2.5 levels of 10 micrograms per cubic metre led to a 2% drop in the subject's accuracy. In an arithmetic-based test, increases in CO_2, but not PM2.5, were associated with slower response times, which increased by around 2% for every 500 parts per million rise in CO_2.

The study looked at the cognitive function of 300 office workers in six countries

New guidance on air quality published

New indoor air quality guidance, to which CIBSE has contributed and endorsed, has been published by the Institute of Air Quality Management (**bit.ly/CJNov21News1**).

The guidance aims to help those in the construction industry, building owners, occupiers and regulatory authorities to identify potential air quality issues in existing buildings, or to influence the design of new buildings and those undergoing refurbishment.

It provides guidance on assessment, monitoring, modelling and mitigation of indoor air quality, and is set out in sections relating to typical project stages. Assessment criteria are summarised and a new assessment approach is proposed.

The summarised assessment criteria are based on a review of existing air quality standards in legislation and guidance, and a consideration of the likely length of exposure for the people being considered.

● A free online ventilation tool to reduce the risk of Covid-19 transmission in buildings has been developed by the British Occupational Hygiene Society, **bit.ly/CJNOV21NEWSp10**

DAIKIN

Long-term value and sustainability

From one lifetime to the next

Specify Daikin's Service with Confidence package with our VRV systems, and you're specifying sustainability – for the entire lifetime of the system and beyond.

7 YEARS ESSENTIAL SERVICE

10 YEARS ENHANCED SERVICE

15 YEARS ULTIMATE SERVICE

All VRV units are now allocated with reclaimed R410A refrigerant to reduce the carbon footprint of the system. And by adding Service with Confidence to the specification, your clients will benefit from proactive management, monitoring and maintenance to optimise efficiency, plus a guaranteed supply of reclaimed R410A refrigerant for all servicing requirements throughout its lifetime* and responsible recovery of components when it's time to renew.

With cover available in three tiers, you can be certain you're offering your clients an expertly maintained, high-performing system that delivers cradle-to-cradle management of resources, from one lifetime to the next.

And that's Service with Confidence.
Visit daikin.co.uk/swc

F GAS SERVICE WITH CONFIDENCE

*'Lifetime' represents anticipated lifetime of equipment and is 15 years maximum.
Please see terms and conditions of offer for limitations and exclusions.

In conversation with leading lighting figures

The Society of Light and Lighting (SLL), in association with Signify, has launched an online series of conversations with leading lighting figures.

It includes prominent people in the sector, engaged in conversations about their journey in lighting, their specialisms, and the key issues that are driving change and innovation.

This series features Dr Ruth Kelly Waskett FSLL, president of the SLL and senior associate at Hoare Lea, and Florence Lam FSLL, global lighting design director for Arup, discussing light, health and humanity centric lighting.

Andrew Bissell FSLL, president elect of the society and director of lighting design for Cundall, and leading research scientist Dr Christopher Kyba discuss their ongoing work to produce more robust guidance for the protection of dark skies and research into the causes and effects of skyglow.

The aim of the series is to engage the lighting community and beyond in discussion about the work and challenges that face the industry. It will showcase some of the excellent people, initiatives, research and innovative approaches that are informing the direction of change, in the face of political, economic and environmental uncertainty. You can watch live and participate in a Q&A, or catch up on demand.

● For full details of the series, visit **bit.ly/CJNov21CN3**

Meet the trainer

The new CIBSE blog features the CIBSE residential fire sprinkler design course trainer, Tony Marlow, who introduces himself and talks about what he enjoys about being a trainer.

He has been involved in the fire sprinkler industry for decades and has been a CIBSE trainer since 2011.

Asked what he enjoys most about being a CIBSE trainer, he said: Sharing my knowledge with engineers, consultants and building control officers from various backgrounds and encouraging them to use their new knowledge in their dealings with contractors and specifiers.

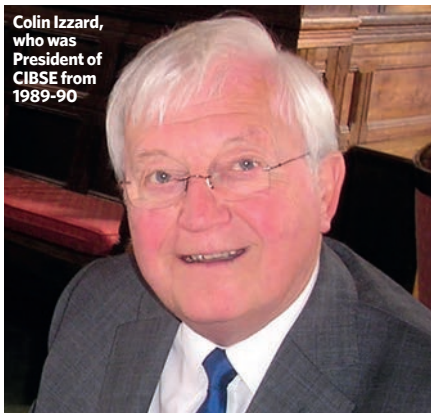
Read the blog in full at **www.cibseblog.co.uk**

Past CIBSE President Colin Izzard obituary

Former Royal Dragoon Guard was a leading public health engineer, talented musician and chef

It is with great sadness that we inform you of the death of engineer Colin Izzard, CIBSE President from 1989-90. He will be greatly missed by the Institution and the wider construction and engineering community.

On leaving school, Colin initially trained as a plumber on the 'tools'. At the age of 18, instead of doing the mandatory two years of national service, he signed up for three so he could follow his great love of music. He became an army bandsman in the Royal Dragoon Guards, and was a very able musician, playing clarinet and double bass.



Colin Izzard, who was President of CIBSE from 1989-90

On leaving the army, he joined R W Gregory & Partners as a plumbing design engineer, attending day and night school, as well as holding down a full-time job. In the early 1960s, he did the PHE design for the new Hull Royal Infirmary, which, at that time, was the largest single-phase hospital construction project undertaken in the UK. Colin was later promoted to senior design engineer, leading teams on many healthcare, civic and commercial construction projects.

In 1969, he was made an associate of RWG&P and, in 1971, a full partner, rising to senior partner in 1988. Colin became a CIBSE Fellow in 1981, serving on several committees, and was a flag bearer for the National Engineering Specification, ensuring it became a reality. He was also an honorary member of the Society of Public Health Engineers.

Colin had a great love of fine food and wine, and was a very accomplished chef, as well as an artist. He would design and produce his own Christmas cards – which were all themed around vineyards – and would hide his initials in the drawings for his family to try to find.

A man of great insight and knowledge, Colin was also a very good leader who will be greatly missed.

Virtual tour of children s hospital aims to inspire young engineers

CIBSE, together with Jones Engineering and Arup, have produced an inspiring virtual technical tour of the new National Children's Hospital, Ireland.

The tour of the hospital – which is the largest and most complex capital investment project ever undertaken in healthcare in Ireland – has been produced for the CIBSE Young Engineers Network, and demonstrates what would be a standout project in the career of any engineer. It focuses on the now complete utilities tunnel, and gives an unprecedented insight into the entire process, from initial concept design, through tender stage and construction, to final testing and commissioning.

The aim of the video is to share new and innovative approaches to design and knowledge exchange, and to encourage more people within and outside the industry to investigate the many appealing aspects of engineering. Whether you are a seasoned engineer, a young student considering your options or just someone with an interest in engineering, you will find something to fascinate you.

● To watch the tour, visit **bit.ly/CJNOV21CN1** – or if you only have a few minutes to spare, visit **bit.ly/CJNOV21CN2** For more information about the CIBSE Young Engineers Network, visit **www.cibse.org/yen**

ChapmanBDSP was commended on its diversity and inclusion approach

ChapmanBDSP wins CIBSE Employer of the Year Award

Building services engineer wins overall prize, while Fairheat and ATAL Engineering Group also triumph

ChapmanBDSP has been crowned overall winner at the CIBSE Employer of the Year awards; the engineering consultant also triumphing in the medium company category.

FairHeat won the small company award with ATAL Engineering Group claiming the prize in the large company category.

The judges said ChapmanBDSP's commitment to being an active and engaging sponsor for young and early career employees was clear.

Its impressive support for its engineers includes mentoring, training, a CIBSE-approved training and development programme, regular CPD, and technical sessions, and the company encourages employees to be STEM ambassadors. Judges commended ChapmanBDSP on its diversity and inclusion approach, saying it was 'exceptional'.

Kathryn Cox, HR director, ChapmanBDSP, said 'We continue to put all our employees at the centre of everything we do, encouraging them to achieve their full potential and be proud of this fantastic industry at a time when there is so much potential to achieve sustained and lasting change.'

Fairheat won in the category for firms with fewer than 50 employees, with judges saying it showed a clear commitment to developing young engineering talent and creating opportunities for young people to grow and thrive. In the past five years, 70% of Fairheat's 23 employees had been through, or were in, the company's graduate programme.

'The role of heat networks in decarbonising heat in the UK will require fresh ideas and approaches, and we have every faith that our young engineers will be at the frontline of this change,' says Fairheat. 'We are particularly proud of the opportunities we are giving engineering graduates to work, and see the impacts of their work, from an early stage.'

ATAL Engineering Group won in the large company category, the first time a firm from Hong Kong has won. Judges commended the firm for its clear paths for development across the organisation

ATAL Engineering Group won in the large company category

Fairheat won the category for firms with fewer than 50 employees

in preparing young engineers for their professional careers. Their outreach includes a scholarship programme for students in vocational training and universities.

'Nurturing of young engineers is one of our key corporate social responsibilities, to prepare them for the professional career of their choice,' says Dr Ir Otto Poon, group chairman and founder at ATAL. 'Our programmes are comprehensive and robust, producing engineers of the right calibre for the industry at large.'

In presenting the awards, CIBSE president-elect Kevin Mitchell thanked the judges for their hard work and time, and emphasised how impressed they had been with the high quality of entries this year.

'If these employers are representative of building services employers overall, the picture is very positive indeed for young engineers entering our industry,' he said.

The awards, together with Graduate of the Year and Apprentice of the Year (page 20) , form the Young Engineers Awards, recognising the best new talent entering our industry,as well as those companies that go the extra mile to support and nurture them.

The Employer of the Year award highlights the commitment and achievements of employers in supporting young people entering the industry, encouraging their growth through training, mentoring and initiatives that place them at the centre of their business.

The CIBSE Young Engineers Awards 2021 took place online on 14 October. They were delivered in partnership with CIBSE Patrons and sponsored by Ideal Heating, ACV and Swegon.

For full details of the winners, visit **www.cibse.org/yea**

Proving competency

The Building Safety Bill proposes new competence requirements for all those working on design and construction. Hywel Davies explains the draft regulations, and asks how clients and the new Building Safety Regulator will know who is competent

Contrary to common misunderstanding, the Building Safety Bill applies to all building work needing either a building notice or the deposit of full plans. It applies to all buildings, not just high rise residential ones.

Section 32 of the bill provides for regulations on the competence of those undertaking design and construction work. Draft regulations have been published: they apply to any work on any building, including homes, coming within the scope of the Building Regulations. They are quite clear; only non regulated work on a home where you live is excluded. These draft regulations, therefore, affect almost every working reader of this journal.

These draft regulations affect almost every working reader of this journal

The draft regulations require clients to appoint principal designers and contractors for all non domestic projects, and that anyone appointed to carry out design or building work is competent. Competence regulation 7 applies wherever one person proposes to appoint another to carry out building or design work.

Before permitting person A to carry out any work, Regulation 7 will require the appointer to take all reasonable steps to satisfy themselves that A either fulfils the general competence requirements in Regulation 8 or is in training to fulfil those requirements and properly supervised. This covers any design or construction activity that A may be appointed to undertake. Before A is allowed to start work, the appointing party must also take all reasonable steps to satisfy themselves that A meets the requirements of the general duty to plan, manage and monitor (created by Regulation 3).

All that applies to anyone individual or organisation appointed to the project. Where A is to be the principal designer or contractor, the client must take all reasonable steps to satisfy themselves that A fulfils the requirements for general competence in Regulation 8 and those set out in Regulation 9 for the principal designer, or in Regulation 10 for the principal contractor.

It bears stressing that these requirements will apply to each job notifiable under Building Regulations and to every client commissioning such works. The ultimate duty falls to the client to appoint competent people, to take all reasonable steps to satisfy themselves of the suitability of those they appoint. Many people in the industry are quite unaware of this and still think the bill only relates to high rise residential buildings. They could not be more wrong.

Regulation 8 is clear that any person carrying out any building work or any design work must have the skills, knowledge, experience and behaviours necessary to carry out the building work in accordance with all relevant requirements [or] the design work so that, if built, the building work to which the design relates would be in accordance with all relevant requirements . The regulations allow for that person to be an individual or an organisation with that capability.

The regulations also state that any person carrying out any building work as a contractor or any design work as a designer must have the skills, knowledge, experience and behaviours necessary to fulfil the duties of a contractor or designer under these Regulations in relation to the work .

So, how do law abiding clients show that they are appointing competent people and prove to the new regulator that they have taken all reasonable steps ? They will need to demonstrate that those appointed have the skills, knowledge and experience for the job and evidence that they will behave appropriately. This will mean seeking evidence that those people know what they are doing and have suitable experience, including qualifications and appropriate professional registrations. Which will be appropriate? This will depend on the job and be for the client to judge. There will be no list of approved schemes to which people must belong. The regulator will not mind how it s done, but they will want to know it has been done, and they will want to see evidence that gives assurance of this. They will have one simple request: Show me . Can you?

The draft *The Building (Appointment of Persons, Industry Competence and Dutyholders) (England) Regulations* [2021] is available at **bit.ly/CJNov21HD**

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

Competence is crucial

The New Providence Wharf fire reaffirmed the need for regular smoke control system maintenance to be carried out by competent contractors, says **Allan Meek**

The New Providence Wharf fire in May 2021 again highlighted the importance of operational smoke control systems; a serious failure of the smoke ventilation system resulted in the building acting like a 'broken chimney', leaving the only escape route smoke-logged, according to the London Fire Brigade's preliminary report.

Following the incident, which injured around 40 people, initial findings showed that the smoke detectors on the 8th floor communal corridor failed to operate the automatic opening vent (AOV) and cross-corridor fire doors. The AOV is designed to ventilate and extract smoke during a fire, helping residents to escape safely. Responsibility for these systems lies with the building owner or manager and it could be expected that a robust regime of regular testing and maintenance by a competent person should have identified and rectified the defects that caused such a failure.

The London Fire Brigade urged all those responsible for high-rise buildings to check fire-safety measures, including smoke ventilation systems, as a priority, advising that they should be regularly inspected and any issues acted upon.

It is common for smoke control system maintenance to be bundled in with fire alarm maintenance, but the skill set of a smoke control engineer is different from that of a fire alarm engineer, encompassing, for instance, air flow and pressure differential measurement. A fire alarm engineer may not be equipped to carry out the measurements required to confirm the correct operation of most smoke control systems.

As the Building Safety Bill enters Parliament, changes to building safety law will place new duties on those responsible for the safety of high-rise residential buildings. Preparations are under way to accommodate the proposed new regime and take all reasonable steps to make sure buildings are safe. A tried and tested method for assessing the competence of a contractor is through third-party certification, and it is mandatory for all SCA members who install smoke control systems to achieve SDI 19 accreditation as a condition of membership.

A smoke control system that is regularly tested and maintained by a competent person can save lives. Don't wait until it is too late to find out the system for which you are responsible isn't working as it should.

● **Allan Meek** is a director of Group SCS, members of the Smoke Control Association

CIBSE and COP26

With the COP26 Glasgow conference fast approaching, CIBSE's Julie Godefroy outlines the associated events and activities in which the Institution is taking part and supporting, as well as its upcoming guidance

It seems everyone will be at COP these days. In practice, professional institutions such as CIBSE typically do not attend COP, except on rare occasions as observers. COP itself is for the negotiating parties governments and approved representations from communities, NGOs and scientists.

However, many associated events are organised alongside the conference, either within the UN's Green Zone or independently, outside the UN umbrella, in Glasgow or online.

With so many organisations wanting to contribute in one way or another in the past few months, COP has certainly proved useful for raising awareness and catalysing action among industry and policy makers. CIBSE took the view that the most effective and appropriate way to play a part was to:

- Support the efforts of others for a high profile and coordinated representation of the built environment sector and what it can contribute to net zero
- Support our members with the ongoing development of guidance and events related to net zero.

This column gives a summary of CIBSE activities and events during COP26; you can find a more detailed list and information on our wider action on climate change in our dedicated COP26 page: **www.cibse.org/cop26**

There's nothing like a big deadline to make things happen, and CIBSE will be having a series of events during COP

Collective action

CIBSE's work on climate action will be represented in the COP Green Zone as part of the Construction Leadership Council's (CLC's) event on 11 November, Built Environment Day. The Construction Industry Council will present Carbon Zero, the cross industry climate action plan to which CIBSE signed up, and in which we have had an influential role from the start.

The actions we have committed to in this plan are substantial, and range from a review of accredited degrees and CPD requirements through to joint industry targets, guidance and associated professional obligations. Some actions can be implemented in the short term and are within the remit of individual institutions, while others are more deeply transformative, requiring longer term work and collaboration across institutions. All signatories have committed to publish an implementation plan by COP, and CIBSE will publish its plan on 11 November, to coincide with the CLC event.

CIBSE is also supporting several organisations arranging events around the timing of COP for example, the UK Green Building Council's Build Better Pavilion, and a series of videos produced by the Royal Academy of Engineering on net zero.

CIBSE net zero guidance and events

There's nothing like a big deadline to make things happen, and CIBSE will be having a series of announcements and events during COP to capture activities from the past few months.

These will include the launch of a new publication on electrical engineering for net zero. The guidance will add to the CIBSE body of guidance on net zero, all of which is mapped on our net zero page against each step of the recommended hierarchy, from passive design through to monitoring and evaluation: **bit.ly/CJNov21netzero** The page is regularly updated.

In the following weeks and months, you can also expect new publications, including:

- Embodied carbon in residential heating systems, following the huge interest in the TM65 methodology
- A revision to TM54 on energy performance modelling: this recognises the development of advanced modelling expertise and increasing onus on energy modelling predictions in the context of net zero targets, contractual performance requirements, and the new requirements for energy performance modelling in the draft Approved Document L for new non domestic buildings.

Our regular Grow Your Knowledge webinars (**cibse.org/growyourknowledge**), which are free to access for all, regularly include themes relevant to the net zero agenda, and we will highlight those during COP.

DR JULIE GODEFROY is head of sustainability at CIBSE

Finally, we have been working on net zero definitions and are planning to produce an FAQ jointly with the London Energy Transformation Initiative (LETI), to accompany the LETI Whole Life Carbon Network set of definitions (**leti.london/carbonalignment**).

We will run a survey over the first two weeks of November to gather feedback and test opinions from our members, and will have an event on 8 November co organised with the CIBSE Energy Performance Group (EPG) and Young EPG, for some live debate around key aspects of the survey. For example, the incorporation of energy targets and how to treat a decarbonising grid within the net zero carbon energy use definition.

You can find some of the questions to be covered in the FAQs in my column in the October 2021 *CIBSE Journal*. Look out for the survey and event, and do get in touch to add your questions to the list, or to comment on the current definitions.

Consultations

Normal work also continues, with regular consultations on building performance and the net zero agenda. For example, CIBSE recently submitted a response to the consultation on a low carbon hydrogen standard. Given the significant uncertainty around cost implications and technical feasibility of low carbon hydrogen production, CIBSE has reservations about the suitability of hydrogen for building uses, compared with other applications that have few or no other options for decarbonisation.

However, as the Climate Change Committee scenarios expect a significant contribution from hydrogen to the wider economy (comparable in scale to today s electricity use), whether and how low carbon hydrogen can be produced clearly needs attention.

The creation of a standard would therefore be useful to determine the carbon impact of hydrogen production options (whether UK based or imported for example, from solar rich countries), drive innovation by setting ambitious requirements, identify the best routes to produce it, and allow a robust and fair comparison with other energy vectors.

Upcoming consultations include *Proposals for heat network zoning*, run by the Department for Business, Energy and Industrial Strategy and closing on 19 November get in touch with CIBSE by 12 November if you would like to contribute to our response.

You can find our response to all past consultations, and a list of the current ones, at **www.cibse.org/news-and-policy/policy/consultations**

Reversing history

If carbon-reduction targets are to be met by nations attending COP26, greenhouse gas removal technologies must be on the agenda, says Dr Shaun Fitzgerald FCIBSE, of the Centre for Climate Repair at Cambridge University. Alex Smith finds out more

In August, the Intergovernmental Panel on Climate Change (IPCC) offered a stark warning: to limit global warming to 1.5 C above pre industrial levels, greenhouse gas emissions would need to be cut in half over the next decade, and net zero carbon would have to be achieved by 2050.

Shaun Fitzgerald believes more has to be done than merely reducing emissions at source for global warming to be limited to 1.5 C.

He is the director of the Centre for Climate Repair at Cambridge University (CCRC), which states that greenhouse gases must be removed from the atmosphere if catastrophic climate change is to be avoided.

The IPCC s sixth assessment report made it really clear that, even under the most ambitious emissions reduction scenario, we will have 1.5 C of warming. Climate change is just going to continue as populations grow, the middle classes swell, and people want increased standards of living. We ve got to do something about it, says Fitzgerald.

Founded by former government chief scientific adviser Sir David King, CCRC has three objectives: deep and rapid greenhouse gas emissions reduction; the removal of greenhouse gases from the atmosphere; and restoration of parts of the climate system that already pose risks to humanity.

King, who is the CCRC chair, is also focused on working with policy makers in the UK and abroad to build alliances dedicated to carbon sequestration solutions and technologies.

Technologies being considered including direct air carbon capture and storage (DACCS), and solar radiation management solutions such as marine cloud brightening, which involves spraying tiny droplets of seawater into clouds to make them whiter and lighter, leading to more sunlight being reflected back out to space.

Some have argued that, by using science to repair the climate, there will be little incentive for governments to cut emissions, with individuals feeling they have a licence to pollute.

Fitzgerald says the IPCC report makes it clear that more has to be done than just reducing emissions to hit climate change targets. We should definitely be tackling emissions at source, or not emitting them in the first place, but the IPCC report has laid it on our doorsteps that emissions reduction is not enough. It s necessary, but we must also do negative emissions, he adds. Without reducing emissions, the task of removing greenhouse gases from the atmosphere would be enormous.

Fitzgerald would rather not be doing this research, but says he has had to because this is the position society is in. Why would you tackle CO_2 or methane in the ambient atmosphere if you didn t have to? he says.

Climate change is just going to continue as populations grow, the middle classes swell, and people want increased standards of living

One area of research that CCRC has been looking at is a method of removing methane which represents 25% of global warming gasses from the atmosphere.

When there is a concentrated stream of methane, it can be oxidised and converted to water vapour and CO_2. For example, if you have a landfill site with leaky methane, it would be sensible to gather up the methane and produce electricity in a gas turbine, says Fitzgerald.

However, methane in the atmosphere is too dilute to generate electricity through a gas turbine. Fitzgerald says it can be captured using photocatalytic oxidation, whereby methane is passed over a metal oxide such as titanium dioxide or zinc oxide in the presence of UV light.

CCRC is looking at research on using zinc oxide decorated with silver , which is particularly good at

converting methane to CO_2, as a catalyst. If the process can be made widely available at a low cost, Fitzgerald says buildings or vehicles could, potentially, be coated with paint containing the material, particularly in locations with plenty of sunshine.

If a solution is proven viable, CCRC will look for funding to develop the technology and expedite its adoption around the globe. We re looking at potential solutions with a low technology readiness level, where research has already been done, says Fitzgerald.

In terms of reducing emissions in the built environment, Fitzgerald says engineers should be considering the whole building, not just whether it s powered by heat pumps or hydrogen. It s not just about minimising energy consumption in a building, but considering its relationship with the wider built environment, he adds.

One way of avoiding using air conditioning on a hot afternoon, for instance, might be to pre cool a building at night, when electricity demand is low, and use the building as a thermal store.

What you are doing is managing the provision of the electricity to the UK and reducing the peaks, says Fitzgerald, who believes engineers should also consider whole life carbon in their designs, to ensure emissions are minimised. For example, do you design a school to be thermally light or heavyweight, he asks.

Different design communities in the UK will come up with massively varying designs. With a heavyweight structure, you might reduce the operational energy, but the embodied energy of concrete will be high, says Fitzgerald. And the right answer now might change in 10 years time if the technology has been developed to capture carbon and inject it underground.

Designers must also consider the future carbon intensity of electricity, he adds: There are different forecasts, so it s not surprising school designers are coming up with different answers.

Fitzgerald will be attending next month s COP26 global climate summit and is keen to increase awareness of greenhouse gas removal (GGR) among delegates. He would ideally like to see separate targets one for emissions reduction and one for greenhouse gas removal.

The term net zero is meaningless unless you define the greenhouse gases that are being removed to offset the remaining emissions, says Fitzgerald.

If we can measure greenhouse gas removals, we are more likely to see progress in this area. It will be a very necessary part of us getting to net zero .

■ The government published two research reports on greenhouse gas removal options as part of its Net Zero Strategy announced last month. *Greenhouse gas removal methods and their potential UK deployment* ***bit.ly/CBNov21GGR1*** and *Monitoring, reporting and verification of greenhouse gas removals (GGRs)* ***bit.ly/CJNov21GGR2***.

The government says it has an ambition of deploying at least 5MtCO_2 per year of engineered removals by 2030, and will provide £100m innovation funding for DACCS and other GGRs.

■ **DR SHAUN FITZGERALD** FCIBSE is director at the Centre for Climate Repair at Cambridge and co-author of the CIBSE *Covid-19: Ventilation* guide.

TRIPLE CROWN

The winners of the CIBSE Young Engineers Awards demonstrated that the building services industry has the talent and drive to deliver the safe and sustainable buildings necessary to meet the challenge of climate change. **Alex Smith** reports

For the first time, three engineers have been crowned winners at the CIBSE Young Engineers Awards, which were held last month.

Judges named FairHeat s Lucy Sherburn as CIBSE ASHRAE Graduate Engineer of the Year for her excellent live online presentation on the challenges engineers will have to overcome to deliver sustainable and safe environments for future generations.

The title of Apprentice of the Year (Degree Level 5 7) was awarded to Josie Cheeseman, while Harry Playfair won the corresponding award for Technician Level 3 4. This was the first time the CIBSE Apprentice award had been split into two categories, reflecting the increased interest in apprenticeships as a route to a career in building services engineering.

In his speech before the presentations, CIBSE President Kevin Kelly praised the extra apprentice award. As a former apprentice, I m particularly interested in this competition, he said. Apprenticeships enable you to earn and learn, they increase diversity, and young people create a responsive dynamic in the workplace and fresh ideas.

The entrants recorded a film that was judged by an expert panel before the ceremony. Entries were of a very high standard, according to CIBSE Board Member and judge Vince Arnold. It was warming for us, as judges, to find the passion and excitement and the fact that all the apprentices said how grateful they were to their employers and colleagues for giving them the practical experience that comes with an apprenticeship, he said.

The first prize in each of the apprentice categories was £500, with the runners up each receiving £300 and the third placed finalists receiving £200.

From left: CIBSE ASHRAE Graduate of the Year Lucy Sherburn; Apprentice of the Year (Technician Level 3-4) Harry Playfair, and Apprentice of the Year (Degree Level 5-7) Josie Cheeseman

Sherburn was one of eight graduate engineers who presented live at the virtual event, which mirrored the format of the live event that took place before the pandemic, at iMechE s headquarters in London.

Speaking without slides, Sherburn said that inertia was the greatest challenge engineers would have to overcome to deliver sustainable and safe environments. Climate change is challenging existing natural environments, but society is resisting transformation, she added.

Social inertia was preventing engagement in sustainability, Sherburn continued, in part because low carbon technologies were too complex. That inertia in regulations meant standards and guides were out of date, while in the

built environment it meant industry not having the skills to retrofit buildings vulnerable to climate change. If there s a skills gap, it means theoretical performance will not be transferred into reality, she said.

Education was key to overcoming inertia, Sherburn told the audience, and she urged engineers to focus on non disruptive, customer centric solutions. Regulations had to be more pragmatic, she added, and there needed to be an extensive programme to retrain gas engineers to install heat pumps.

The FairHeat graduate engineer concluded her presentation by saying the response to the Covid 19 pandemic had proved that change is possible. It could be the catalyst that overcomes the inertia in moving towards a sustainable and safe built environment, she said.

Sherburn declared that she was shocked to win the award and credited previous winners with inspiring her to enter. As a young female engineer who entered the industry two years ago, it was important to have female role models who had won this award and were achieving great things, she said.

She revealed that she had already had offers to speak at conferences through being shortlisted for the award. It will help me network and be recognised. Hopefully, I can use this position to influence change in my industry in the area in which I work, decarbonising heat, and in making the industry inclusive for all types of people, she said.

As the CIBSE ASHRAE Graduate Engineer of the Year, Sherburn wins an all expenses paid trip to attend the ASHRAE conference in Las Vegas next year. As a heat network engineer, she is keen to see how America is decarbonising, and will have another reason to celebrate in Las Vegas the conference falls on her birthday!

The Graduate of the Year runner up, Matthew Dickenson, from Aecom, argued that sustainability had to be achieved by focusing on other factors, such as occupant wellbeing and comfort.

Industry had to act swiftly to address issues in existing building stock, he said, particularly in low income neighbourhoods, which are suffering from poor indoor air quality, and punitive energy costs, even before considering the expense of decarbonisation.

> Hopefully, I can use this position to influence change in my industry in the area in which I work and in making the industry inclusive for all types of people

Dickenson also highlighted the importance of wellbeing among engineers. We re intrinsically passionate people, and we pour ourselves into our work. Combined with the current work climate, it s no wonder so many of us struggle with our mental health, he said. We must find a new normal that works for everyone. Not only to retain talent, but to foster creativity and drive new recruitment.

Dickenson won £600 prize money, donated by CIBSE Patrons.

Third in the CIBSE ASHRAE award was Elementa s Yara Machnouk, who won £300, provided by the Manly Trust. In her presentation, she described a sustainable and safe environment as being one where people feel mentally and physically at their best which meant shielding them from external sources that can create stress and discomfort.

There were five challenges for engineers to address, she said: adapting buildings to cope with extreme climates; reducing energy consumption; using renewable sources more efficiently and economically; integrating nature based solutions in design processes; and ensuring energy equity across the globe as demand rises.

I think we need to delve deeper into nature based solutions and quantify the social value they bring to a scheme, she says. The simplest way is planting trees. The rate at which we are creating carbon is not in line with the rate we re sequesting it, she says.

There is much to learn from countries that use passive solutions, added Machnouk. Engineers worldwide need to support each other to avoid repeating mistakes of embedding inefficient solutions into our buildings that will cause harm to our environment. CJ

Read about the Employer of the Year winners on page 13.

2021 WINNERS

CIBSE ASHRAE Graduate of the Year
1st Lucy Sherburn, FairHeat
2nd Matthew Dickenson, Aecom
3rd Yara Machnouk, Elementa Consulting

Apprentice of the Year, Technician Level 3-4
1st Harry Playfair, NG Bailey
2nd Megan Ganderson, Couch Perry Wilkes
3rd Amanullah Amirmohammadi, Cooper Homewood

Apprentice of the Year, Degree Level 5-7
1st Josie Cheeseman, WSP
2nd Katie Baker, Tetra Tech
3rd Lewis Ward, Couch Perry Wilkes

The Young Engineers Awards were sponsored by ACV, Ideal Heating and Swegon, and supported by ASHRAE. CIBSE Patrons was the event partner.

Graduate of the Year runners-up Matthew Dickenson and Yara Machnouk

Ahead of Glasgow s COP26, we asked six leading engineers what a typical building will look like in 2050, and the challenges designers and industry will face in getting to net zero in key sectors

WHAT LIES AHEAD

Education buildings

Tom Bentham,
senior partner and education leader, Max Fordham

We must hope that, by 2050, the electricity grid and our manufacturing processes will have been decarbonised. So, the environmental impact of a building will be determined by how much decarbonised energy it uses, and the materials used to construct and maintain it.

We cannot know the ways in which technology will change education by 2050, but the quantity of digital information available to students will be greater, and how it is accessed will be more sophisticated. Making this information available means electricity consumption although, with devices increasing efficiency and the move of data storage and processing into data centres, the consumption of electricity by technology may go down in education buildings. Nevertheless, this will be the biggest electrical demand in a 2050 education building. Virtual reality has the potential to supplant face to face learning, making many buildings redundant but we will see the social and educational benefits of learning together, face to face, far outweigh the cost of providing the buildings.

The buildings themselves will be smart, too networked devices in all elements of building services will ensure no systems are on unless they are needed and system performance is optimised for minimum energy use through iteration. Car parks will double as energy stores to even out electrical loads, using vehicles battery capacity. All this networking takes energy, too, and the parasitic loads associated with thousands of networked devices are likely to become a significant part of the building load, so there is a challenge to reduce the standby load per network device.

New education buildings will need no heating because of high building fabric performance and the internal heat gains generated by students and technology. Those internal gains, together with summer heatwaves of increasing frequency and severity, will mean adaptable external shading and, in hot weather, background cooling will be required. Heat rejection plant will use refrigerants with a global warming potential of 10 or less. Thermal buffering will allow heat to be rejected from buildings at night. It s impossible to predict what materials will be considered low environmental impact in 2050 with a completely decarbonised grid and evolved manufacturing processes, thermally heavyweight structures may be back on the menu. If not, more technical coolth storage systems based on phase change materials will become normal.

Most education buildings that will be in use in 2050 exist today, so the challenge is transforming this huge portfolio into lean, low carbon buildings well before 2050. The basic technologies for this already exist insulation, triple glazing and ambient temperature heat exchange networks and heat pumps. There are plenty of interesting elements of engineering for us to resolve in this transition the building physics of retrofitting insulation, innovations in heat pump technology, and heating system design to match heat pumps to existing building systems.

What is needed to drive the transition to decarbonised education estates, as well as our expertise, is a stable policy and financial framework that provides equitable access to decarbonisation across all areas of the education sector.

Housing

Susan Hone Brooks,
director of sustainability, ChapmanBDSP

One thing is for certain, a residential building, or somewhere you would call home , will look very different in 2050. This will be important, because it s predicted that three quarters of people will be city dwellers that s 6.75 billion of the projected nine billon people on the planet.

People by then will be quite different too, the majority having grown up with the internet, and the others living way past their current predicted lifespans. So, first and foremost, any building would need to cater for the complex needs of the individuals.

Bearing this in mind, the main attributes would need to sit around flexibility of space for the individuals to feel safe and comfortable, together with a good level of community integration.

Taking this theme of design around the individual, the space would need to offer the right level of reactivity and, so, be filled with dynamic feedback loops that enable the correct level of service at every level.

To achieve this, buildings could be filled with smart sensors linked to machine learning algorithms, leading to a high level of artificial intelligence, which will allow effortless enjoyment for the individual while keeping sustainability at the heart of any decision.

We will be working with new building material elements, which will be self healing/cleaning, fully recyclable and adaptable to many different elements or uses. We will also be using kinetic materials and advanced energy systems, be they solar, wind or waste, to enable the building to self generate its own energy needs. This will probably be linked more closely to onsite food production, water purification and CO_2 capture for conversion. In effect, the building will become a living organism, working in a symbiotic way with the individuals of the space.

It s interesting that, as I write this, it feels to me like a bit of sci fi, but we are only talking of a mere 30 years to get this right, so we must start down this journey and not delay.

This is going to mean our industry taking bold decisions and stepping up to taking risks, with adoption of new technologies and delivery of buildings with which occupants may feel uneasy in the short term. We are starting to experience this today, with the announcement from the government to upgrade existing gas boilers with new heat pump technology and banning the sale of new gas boilers from 2035.

Clearly, this is a worry, as the construction industry is noted for being one of the most fragmented sectors, and lags far behind others, such as aerospace and, even, automotive. So, we ChapmanBDSP see the challenge as one of communication and collaboration . Communication with our clients that we can deliver beautiful, sustainable buildings that protect people, nature and the planet, and collaboration across the entire supply chain so we are able to source, manufacture and maintain the right building material elements.

»

Healthcare buildings

Steve Merridew, building services engineering director, BDP

In the context of decarbonisation, a better question would be: what do you think a typical healthcare estate will look like in 2050? NHS trusts are managing ageing estates with extensive maintenance backlogs and significant carbon footprints. This legacy estate will represent a significant proportion of the NHS footprint in 2050, even after delivery of the New Hospitals Programme (NHP), with its net zero carbon and digital legacy commitments. This is probably the greatest challenge to trusts and their designers. How do we retrofit, and digitally enable, the legacy estate, while completing the transition from fossil fuel fired and, in many cases, steam heating networks to a modern district infrastructure, allowing for the sharing of heating and cooling energy, while phasing out natural gas in heat and power?

An example of addressing the challenges to meet the net zero target is BDP s work with Milton Keynes University Hospital (MKUH), which is looking to increase the capacity of its clinical offer through new, net zero carbon, digitally enabled facilities under the NHP. Its existing buildings and infrastructure are typical of many NHS estates, with accommodation dating from the 1970s, 80s and 90s. While it does not have significant legacy steam infrastructure, the low temperature hot water heating is gas fired through combined heat and power and conventional boilers.

MKUH recognised that meeting its ambitious decarbonisation targets depends on its ability to improve the energy efficiency of its retained estate while decarbonising its heating infrastructure; most importantly, the trust recognised that both requirements are interdependent and interdisciplinary in nature. To help realise its ambition, BDP developed a comprehensive energy and infrastructure strategy, providing a blueprint for the phased retrofit and upgrade of the retained estates, alongside the phased delivery of a resilient, compliant and decarbonised infrastructure.

BDP developed an Estates Digital Energy Twin (EDET), calibrated using historic site metering data and coordinated with the capital masterplan and estate strategy. The EDET supported a life cycle analysis of various energy and infrastructure scenarios, demonstrating that in addition to drastically over sailing the trust s carbon reduction targets a business as usual approach was the most expensive over the strategy s life cycle. The strategy is a live document that is informing decision making for retrofits and infrastructure upgrade projects, while supporting the objective of connecting buildings delivered under the NHP to a modernised and decarbonised central infrastructure. MKUH is currently overcladding its cardiology building as part of a pilot to sustainably extend the life of its existing facilities, improve energy efficiency, enhance occupant comfort and reduce heat network temperatures to support a phased transition to decarbonised heat sources.

Looking to 2050, the typical healthcare estate will have a decarbonised energy infrastructure, after a coordinated phase out of fossil fuel energy generation. This will be part of the replacement of buildings to modern healthcare standards or, more likely, an improvement in efficiency of systems and the upgrading of building fabric.

Commercial buildings

Duncan Price, partner, Buro Happold

A typical commercial building in 2050 will be flexible, adaptable, and deliver exceptional health and wellbeing for its occupants, in support of commercial activities that promote social and environmental good. It will have multiple uses to ensure it is well used across the day, week and year, and adds social value, while reducing transport emissions and improving air quality.

The commercial structure will have been reused, repurposed or remade from existing materials or zero carbon new materials. These should be environmentally regenerative and net positive in their production, transportation and construction. The building will be supplied with clean, renewable energy from onsite and offsite sources, connected into a smart energy system that optimises production and consumption of clean energy across the city. The building services are likely to be all electric and powered by a zero carbon grid. It will have embodied the principles of the UK Green Building Council Net Zero Carbon Buildings Framework Definition.

Through intelligent design, and thermally appropriate materials, it will be resilient in the face of climate change, and support biodiversity, forming part of an urban green network. We have been working with C40 Cities on how to transition the industry to net zero through application of a Clean Construction Hierarchy.

Tier 1: Optimise the use of existing buildings:

The use of existing spaces to their maximum potential, to reduce numbers of unoccupied and vacant spaces in the city, will be of prime importance. This might require new approaches to funding and finance, such as increased taxes on unoccupied properties and projects highlighting the potential of a city s underused assets.

Tier 2: Retrofit and/or refurbish existing stock:

Building owners should do end of life demolition assessments to encourage renovation, reuse and adaptive use of buildings, and whole life embodied carbon assessments to drive design and planning decisions. Refurbishment schemes will be required to improve efficiency of buildings in operation, using low carbon materials and solutions. Cities might need to use their powers on permits, planning and development control, and support education and guidance around reuse and retrofit principles, and new assessment tools and data to support training and upskilling.

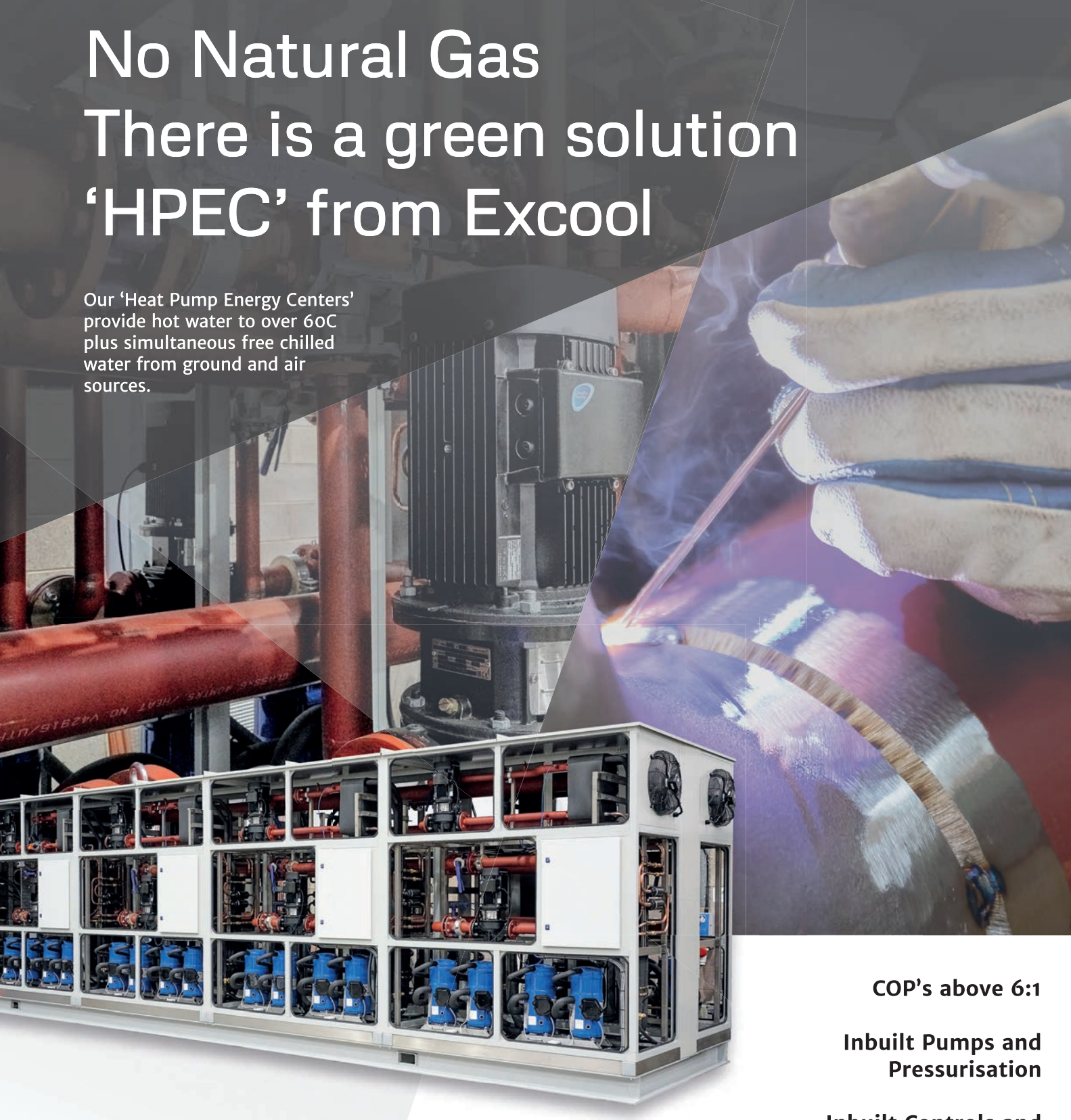
Tier 3: Build new only if necessary, reducing embodied carbon and following circular principles:

Production of new buildings might need a step change in the use of prefabricated, offsite and modular construction methods to reduce waste, improve the environment, and promote a circular economy with the use of bio based materials and certified timber products, backed by robust Environmental Product Declarations. Contractors will need to switch to zero carbon machinery and equipment. There may be a role for competitions and awards for the use of specific materials and processes, as well as the adoption of new building codes and standards incorporating regulations for Clean Construction design processes.

»

No Natural Gas
There is a green solution
'HPEC' from Excool

Our 'Heat Pump Energy Centers' provide hot water to over 60C plus simultaneous free chilled water from ground and air sources.



To date over 55,000 kW of Excool heat pumps designed, engineering and manufactured in the UK are in operation together with over 500,000 kW of cooling equipment around the world.

COP's above 6:1

Inbuilt Pumps and Pressurisation

Inbuilt Controls and Electrics - 5 Year Warranty

R290 refrigerant

GWP of just 3

eXcool
GROUP OF COMPANIES

European HQ | Bromsgrove. Worcestershire. UK | +44 (0)1527 492750 | info@excool.com

BRITISH DESIGNED ENGINEERED AND MANUFACTURED IN THE UK.

Data centres

Paul Scriven, energy and sustainability director, HDR

During the pandemic, different commercial building sectors experienced vastly different demand, and have had to adapt their offer accordingly. Hotels were one of the hardest hit in terms of restrictions on movement, but data centres have had pressure of a different kind as the whole world migrated to Zoom, Teams or similar. The commitment by governments to reach net zero carbon by 2050, and a halfway target of 2030, means a race against time for all industries to make sustainable changes.

Operators and trade associations have agreed to make data centres climate neutral by 2030, leveraging technology and digitalisation. This is a full 20 years ahead of the European Green Deal, which is aiming to make the continent climate neutral through significant inroads in greenhouse gas reductions by 2050.

There are several current and changing requirements impacting refurbishment and new builds, including energy performance certificate ratings, planning policy, and building regulations for conservation of fuel and power. Along with corporate sector concern from investors that environmental, social and governance criteria have been met, it s clear a typical data centre in 2050 will look and function differently from one built in 2015, for example.

At HDR, we are committed to well run, secure and sustainable data centre design and build in terms of efficient heating, cooling and energy management, as well as commissioning. This includes all typologies of centre, from smaller edge computing centres and medium sized enterprise facilities to hyperscale campuses. Green developments are coming on in leaps and bounds from a data centre powered by fuel cells to the Kolos Data Center in the Arctic region of Norway, which is powered by hydropower and wind. Use of renewable energy of this kind is subject to a data centre s location, of course. This is why places such as Scotland are showcasing their geography and weather to position themselves at the helm of this sustainable data centre revolution.

Key to addressing the challenges faced by designers and other stakeholders in the industry in getting to net zero is harnessing technology and data to make the best decisions. Developments in digital twin buildings are at the forefront of this. The ability to invest in such technology enables businesses to assess and plan all areas of their building assets, including resources, energy use, construction, refurbishment, in use facilities and scenario testing, and determining planned works.

Using leading technologies and innovative design, we are helping our clients achieve great strides towards net zero carbon in data centres. Some clients are only a stone s throw away from achieving it by 2025, greatly reducing pressure on the National Grid and resulting purchasing need for green energy.

A wider concern for centres that require refurbishment is embodied carbon. It is only a matter of time until we see the introduction of whole life carbon targets for buildings. The move to a circular economy is having a major impact on all sectors, from workplace and hospitality to data centres. It s our role to assist data centre providers to develop solutions that help them prepare for 2050, and the decades before, in terms of a sustainable future.

Hospitality buildings

James Warne, co founding director, WMEboom

By 2050, population is estimated to double, with 70% being urban habitation. There will be issues of resource scarcity, and from a changing climate. Solutions are found when we embrace circular design principles, reduce waste and pollution, keep materials in use, and regenerate natural systems.

When providing accommodation, food or leisure facilities, market forces are a balance of value for money and the experience of luxury. As markets dictate sustainable solutions, the sector will respond, as demonstrated by increasing offers of wellness and eco resorts, but the chance to be sustainable is rarely at the cost of the experience and that is an area with which the industry will wrestle most.

Typically, the hospitality sector has high water consumption and hot water demands. Addressing these is problematic, especially via an onsite strategy. Decarbonisation of the national power infrastructure is of paramount importance if we are to achieve targets, but the infrastructure will need a significant overhaul to facilitate the future heating and added e transport loads. Over the next 30 years, large investment in a more robust electrical infrastructure will be required. Water management systems need to be implemented to preserve and reuse where possible. Similarly, climatic predictions will result in more air conditioning.

As cities move to vertical urbanism, mixed use developments with communal energy systems will benefit from the inclusion of hospitality. Synergy between sharing resources through reuse of waste heat and waste water will create opportunities for shared benefits. Refurbishment will be encouraged over new construction. Repurposing of building materials will result in opportunities to build new, but from salvaged materials, with innovation in how obsolete systems get reused or upcycled. As planning authorities demand increased ecology, it is expected that the roof will be a battleground for habitat, plant space, solar and water collection, leisure space and views something that district cooling and water supply systems would help alleviate.

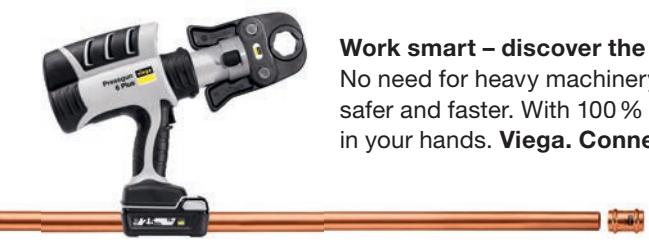
Areas typically known for hotel provision, such as surrounding airports, may find low carbon solutions such as a hyperloop or electric vertical take off and landing (eVTOL) aircraft providing rapid short haul journeys to attractive destinations for a hospitality offer, pushing to a more decentralised location for hospitality.

Movement in the traditional hospitality model may well be affected by disruptors. For example, decentralised accommodation offering consistency in quality and experience, but spread over a more diverse area, is made feasible through smart technology, with room service replaced by online food deliveries, and hotel gyms being shared with larger gym providers in the form of a day pass.

Smart cities will result in the hospitality sector knowing its target audience better, understanding preferences and spending habits from the moment a guest arrives, with the intention of improving satisfaction but, hopefully, encouraging a greener experience as well. We also need to learn lessons from the past 30 years: there is success in simplicity; with complex building services there is a growth in the performance gap; and people are social and will seek out connectivity both to one another and to nature.

Viega cold-press technology

Makes piping smarter.

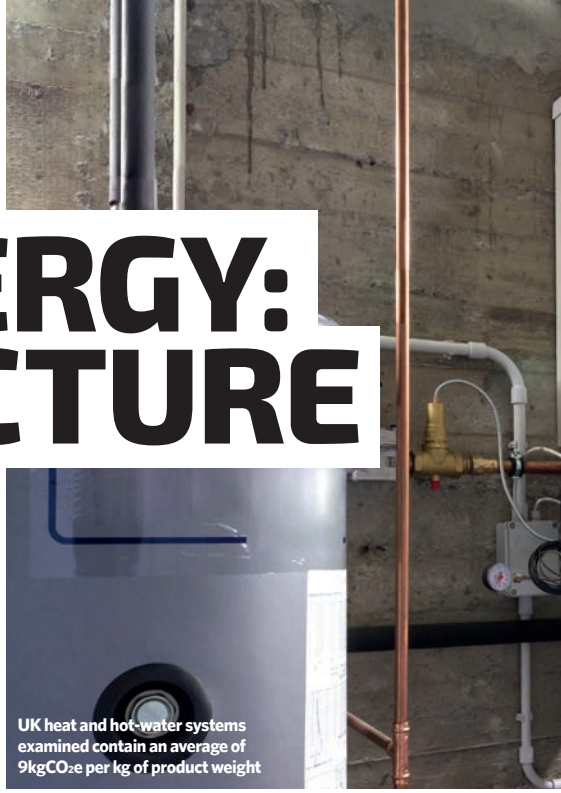


Work smart – discover the Viega advantage
No need for heavy machinery or hot-works measures: connect pipes much safer and faster. With 100 % efficiency, 0 % fire risk and just a Viega Pressgun in your hands. **Viega. Connected in quality.**

viega

EMBODIED ENERGY: THE WHOLE PICTURE

New CIBSE research shows that embodied energy in heating and hot water systems accounts for up to 25% of a dwelling s whole life embodied carbon. Elementa Consulting s **Yara Machnouk** reports on the study that will form the basis of CIBSE guidance TM65.1



UK heat and hot-water systems examined contain an average of 9kgCO_2e per kg of product weight

New research for CIBSE has uncovered the significant amount of embodied carbon in heat and hot water systems in UK homes. The study, undertaken by Elementa Consulting, revealed an average measure of 9kgCO_2e per kg of product weight in the systems examined. This represents between 3% and 25% (excluding refrigerant leakage) of the whole life embodied carbon of a building.

The research is due to be published as a Technical Memorandum (TM65.1) in winter 2021. It was conducted to provide recommendations on how engineers might consider and reduce embodied carbon in MEP equipment, which has a significant embodied carbon impact when a building is first constructed, and during its lifetime because of high equipment replacement rates.

CIBSE TM65, published in January 2020, has an embodied carbon calculation methodology for building services products, to be used where no Environmental Product Declarations are available. Engineers must understand the embodied carbon emissions of the systems they design and the products they specify, so informed choices can be made using whole life carbon thinking. Supply chain collaboration is particularly important when considering heating systems of residential schemes.

Study aims

The study focused on heating in residential new builds with ultra low energy building fabric (aligned with the Passivhaus fabric performance). The following residential typologies were explored:

- Three bed, five person terraced house
- Two bed, three person flat in multi residential building of 15 units, 100 units
- Large development of 10 buildings, each with 200 units.

Around 30 product types were explored. In total, 70 data points were collected, and 29 manufacturers provided information to enable basic or mid level calculations to be carried out for their products. See Section 2 of TM65.1 for additional details on the data points collected. Information provided in the TM65 manufacturer form was used to carry out a basic or mid level calculation. In most cases, meetings were held with technical representatives of manufacturer companies, to break down the information required and explain the benefit of sharing it. Individual results were shared with each person of contact so that manufacturers could understand the embodied carbon impact of their product(s). The remaining products were kept anonymous.

A range of products was selected to represent the most used heating and hot water systems in new build residential schemes in the UK. Equipment studied fell into the following categories: individual heat generation systems; central plant heat generation; heat emitters and heat exchangers; heat distribution; hot water storage; hot water distribution; ancillaries; and mechanical ventilation with heat recovery. In each instance, different capacities were requested, reasonably sized to suit the residential schemes included in this study.

In addition, a functional unit was assigned to each product based on the most common unit of measuring capacity.

The range of embodied carbon impact (at product level) by weight of products investigated is estimated between 3kgCO_2e/kg and 21kgCO_2e/kg, and the average is 9kgCO_2e/kg (excluding refrigerant). See Figure 1 for a summary of all the kgCO_2e/kg covered in the study. Capacity buckets were created to calculate generic data points that should be used for system level calculations.

The study concluded that heat generation equipment can account for 5–60% of the embodied carbon (stage A, B, C) of a heating and hot water system (excluding refrigerant leakage), and heat emitters 10–50%.

In the appendix of the TM65.1 document, the results for each product are given in four graphs. Figure 2 is one of these graphs for air to water air source heat pumps (ASHPs). It shows the results for an ASHP between 3kW and 500kW, with 18 data points collected from nine manufacturers. The graph shows »

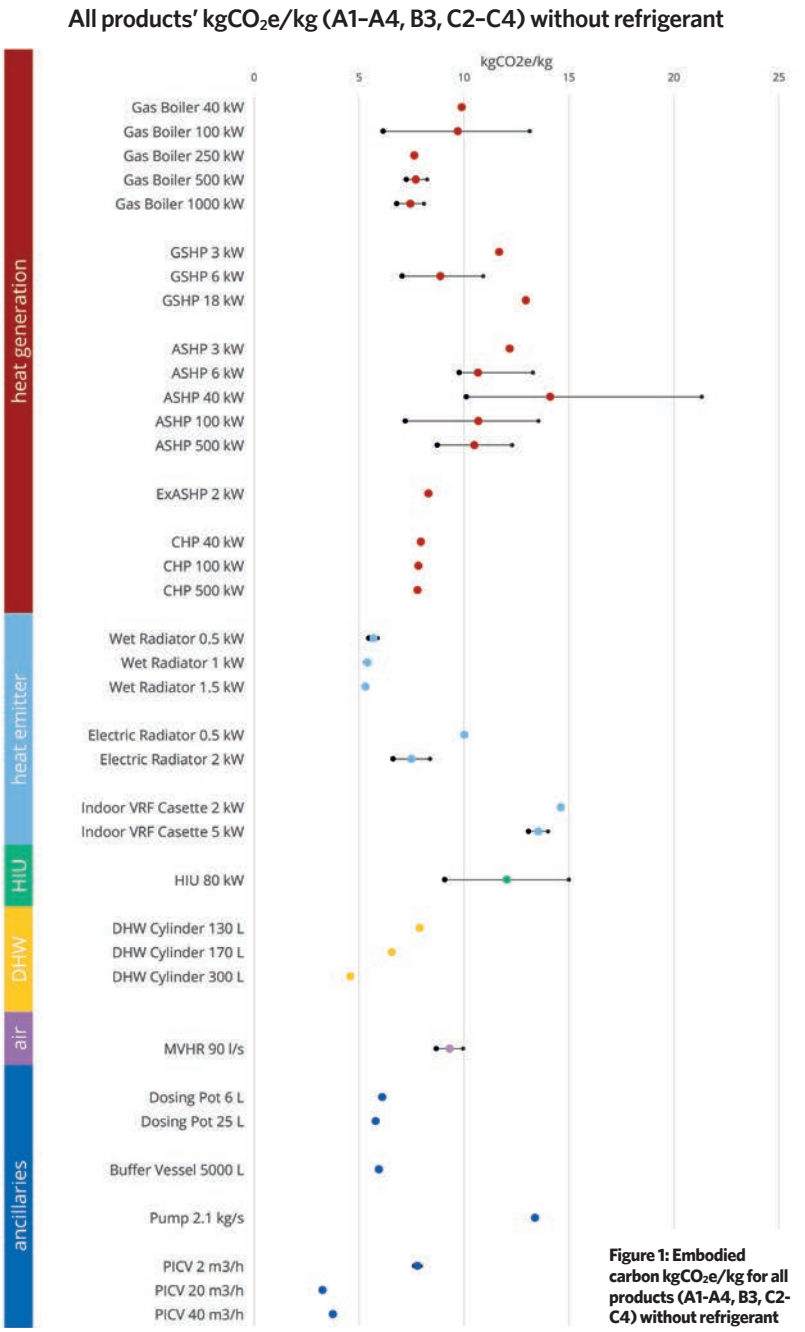


Figure 1: Embodied carbon kgCO_2e/kg for all products (A1-A4, B3, C2-C4) without refrigerant

» that the larger ASHPs have a lower $kgCO_2e/kW$ than smaller capacity ASHPs.

System level calculations were carried out by multiplying the product level embodied carbon results by the quantities for each residential typology. Individual and communal heating strategies were explored across the four residential typologies. The individual systems included a gas boiler baseline, heat pumps, VRF, direct electric, and exhaust air heat pump; the communal systems included an active ambient loop, passive ground loop, and connection to a district heating scheme. See Figure 3 for the embodied carbon emissions for a range of systems in a 100 unit residential development.

The range of embodied carbon impact in $kgCO_2e/m^2$ is large in the scenarios explored in this study. In a multi residential development, the strategy with the lowest embodied carbon, excluding refrigerant leakage, is direct electric, with $36kgCO_2e/m^2$, and the highest is an active ambient loop in a 15 unit scheme, at $201kgCO_2e/m^2$.

For upfront embodied carbon (A1 A5), heating and hot water systems could represent between 1% and 9%.[1] For total embodied carbon (A, B, C) over 60 years, they could represent between 3% and 25% (excluding refrigerant leakage). In the case of a VRF system with R134a, the embodied carbon impact of the heating and hot water system is above the current best practice whole building target when refrigerant leakage is included ($832kgCO_2e/m^2$).

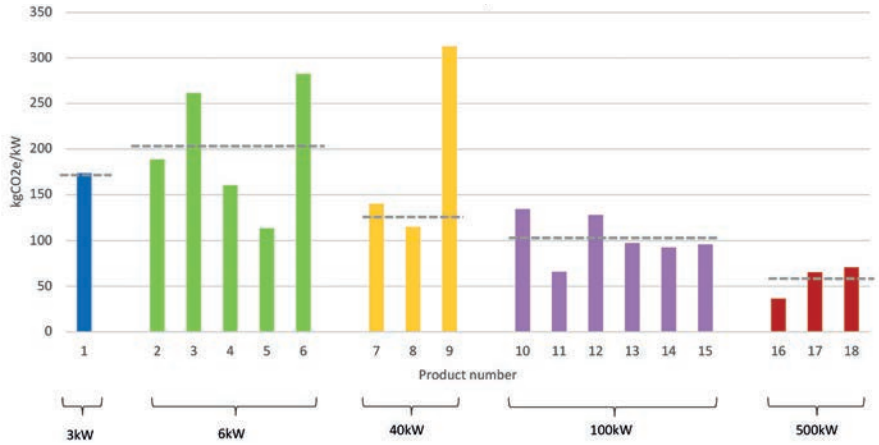
When excluding refrigerant leakage, an active ambient loop has the highest embodied carbon impact. As residential schemes get larger, the uplift compared with other systems is reduced. It is important to note that active ambient loops can have very low operational carbon emissions.

Refrigerant leakage can be significant. This is especially true for VRF systems where the evaporator and condenser are split, with refrigerant piped through the building. Factory sealed heat pumps should be prioritised, and low global warming potential refrigerants used.[2] Refrigerant choice can increase the embodied carbon impact of a VRF system by a factor of nine and of a heat pump system by 30%.

The study also explored the impact of a business as usual (BAU) fabric (based on a space heating peak load of $30W/m^2$) on the embodied carbon impact of two heating strategies: a gas boiler and an ASHP for a terraced house.

For the ASHP scenario, the upfront embodied carbon increases by 75% when the terraced house has a BAU fabric compared with an ultra low energy fabric.

2. ASHP – results by kW



The dotted line indicates the average generic embodied carbon value

Figure 2: Embodied carbon emissions for different sizes of ASHPs

HVAC study for office refurbishments

Over the next six months, CIBSE and Elementa will concentrate on heating, ventilation, and cooling systems in commercial schemes, to develop TM65.2 *Embodied carbon of HVAC systems in offices.*

As part of this study, information on the material breakdown of various HVAC products is needed from manufacturers. Those that provide information will be acknowledged in TM65.2 (see panel, Embodied carbon webinar for manufacturers). CJ

References:

1 This assumes the embodied carbon impact of a new home is $800kgCO_2e/m^2$ based on a LETI C rating (LETI, 2021). This was chosen because it represents current best practice for buildings being designed today.

2 *Refrigerants and environmental impacts: A best practice guide*, Hamot *et al*, 2020, **bit.ly/CJNov21ref**

■ Many thanks to the following manufacturers that contributed information to the TM65.1 study: Vaillant, Lochinvar, Ideal, Hamworthy, Upton, Stratton, Aldrich, Fulton, Glen Dimplex, Mitsubishi, Daikin, Rhoss, Kensa, Nilan, Merriott, Stelrad, Cetetherm, Rhico, ACV, Flamco, Swegon, Danfoss, Recoup, Kingspan and Uponor.

■ **YARA MACHNOUK** is a graduate environmental designer and was a runner-up in last month's CIBSE ASHRAE Graduate of the Year award

EMBODIED CARBON WEBINAR FOR MANUFACTURERS

Join a CIBSE webinar on 2 November to find out more about the study and to get involved in the next phase of research on office embodied energy. This is an opportunity for manufacturers to position their respective business as a leader in the field of embodied carbon and to be promoted through CIBSE-sponsored research activities. Register at bit.ly/CJNov21TM65
The webinar will offer:
- **An overview of CIBSE TM65**
- **A preview of TM65.1 – residential heating, which will be published soon**
- **Details of the scope of TM65.2 – commercial offices**
- **More on how manufacturers can support this study and the benefits of participation.**

Please send any complete TM65 manufacturer forms and reporting forms to CIBSE at embodiedcarbon@cibse.org to help contribute to this database.

DEFINITION OF EMBODIED CARBON

Embodied carbon is the carbon emissions associated with materials and construction processes throughout the whole life-cycle of a building or infrastructure. Embodied carbon includes:
Product stage: A1 Material extraction; A2 Transport; A3 Manufacturing
Construction process stage: A4 Transport to site; A5 Construction
Use stage: B1 Use; B2 Maintenance; B3 Repair; B4 Replacement; B5 Refurbishment; B6 Operational energy use; B7 Operational water use
End-of-life stage: C1 Deconstruction; C2 Transport to end-of-life facilities; C3 Waste processing; C4 Disposal
Benefits beyond the system boundary (D): Reuse, recovery, recycling potential.

Upfront carbon is the term given to emissions caused in the materials production and construction phases (A1-5) of the life-cycle, before the building or infrastructure begins to be used. These emissions have already been released into the atmosphere before the building is occupied or the infrastructure begins operation.

CIBSE BUILDING PERFORMANCE AWARDS 2022

Raise a glass with colleagues, friends and peers
as we celebrate excellence in the built environment at the
2022 Building Performance Awards

WINNERS ANNOUNCED:

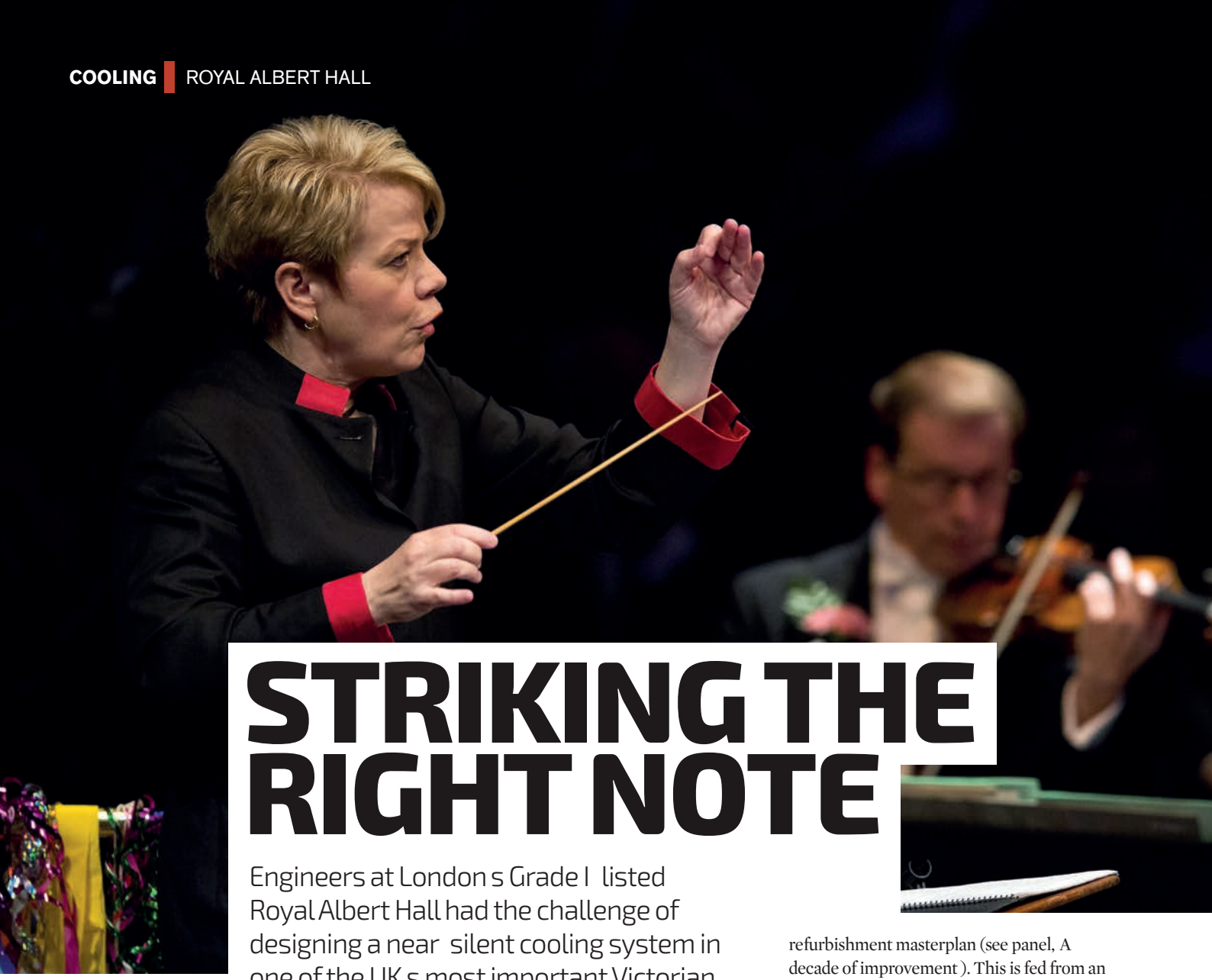
Thursday 24 February 2022
The Park Plaza Westminster Bridge, London

Sponsored by:

ABB AIRFLOW CRANE FLUID SYSTEMS
GRATTE BROTHERS ideal HEATING sfs Smoke and Fire Safety TAMLITE

cibse.org/bpa

@CIBSEAwards #BPA2022



STRIKING THE RIGHT NOTE

Engineers at London s Grade I listed Royal Albert Hall had the challenge of designing a near silent cooling system in one of the UK s most important Victorian buildings. **Andy Pearson** listens in

Around the outside of the elliptical, Grade I listed Royal Albert Hall is a 250m long terracotta mosaic frieze depicting The Triumph of Arts and Sciences . The frieze is a reference to the 150 year old London concert hall s original dedication. It might equally be applied to the work of Loop Engineering s displacement cooling scheme for the upper tiers of the giant auditorium.

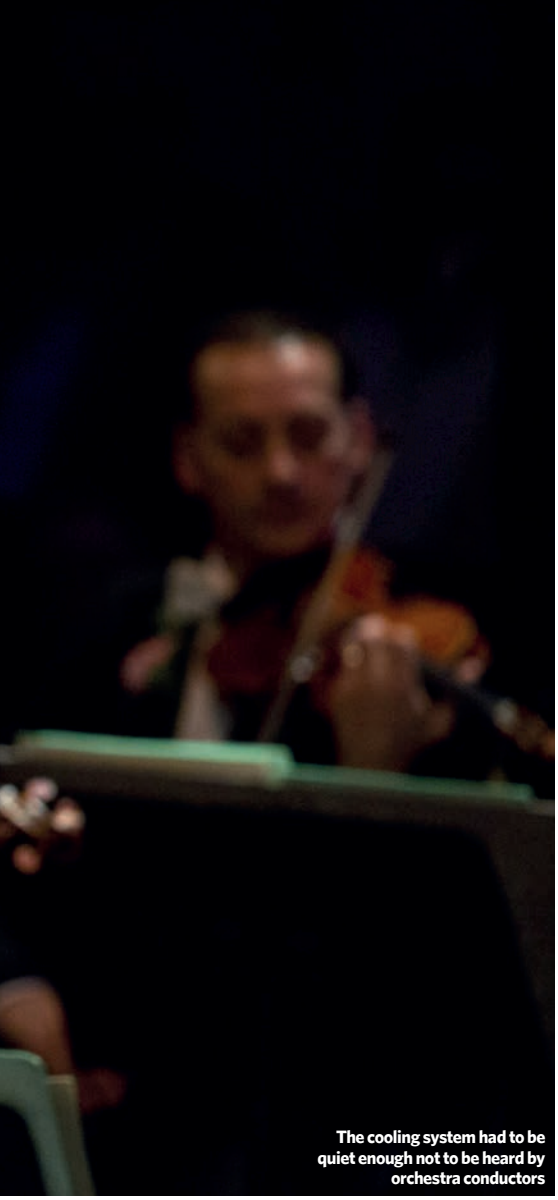
The need for comfort cooling of the Rausing Circle and Gallery Levels (the top two balcony tiers) was apparent from the high number of complaints received about the uncomfortable temperatures. Various teams at the Royal Albert Hall had experienced temperatures in the region of 37 C. As a result of this Royal Albert Hall projects engineer Neal Hockley, with support from the Trustees of the Hall, pushed to ensure the best environmental conditions in the hall.

Uncomfortable temperatures were also recorded during a performance of Phantom of the Opera in 2011. We have reviewed graphs from the 2011 cooling trials, detailing the temperature on the upper tiers nearing 33 C during this performance, says Marcin Silinski, director at Loop Engineering. Clearly, there was a need for a comfort cooling solution for the 1,500 seats up in the gods.

Fortunately, the overheating problem was confined to the upper tiers after the successful refurbishment of the auditorium s displacement ventilation system under an earlier phase of the Hall s refurbishment masterplan (see panel, A decade of improvement). This is fed from an air handling unit (AHU) that was originally intended to supply up to 28,000L·s^{1} of outside air. However, the airflow rate has been increased to 35,000L·s^{1}, following Covid 19 mitigation fan improvements as assessed Loop Engineering during the Hall s closure during national lockdowns. Before, only the lower [ground and second] tiers were cooled by the displacement ventilation but the chilled air did not reach a significant portion of spectators at the upper tiers, says Silinski.

A proposal to install a dedicated cooling system serving the upper two tiers was first put forward in 2013. For the circle, this involved installing 20 mini AHUs in the wedge shaped undercroft beneath the circle s banked seating. The undercroft was to be used as an air plenum, which would supply conditioned air to the auditorium via grilles set into the risers beneath the lower rows of seats. Return air was ducted back to the AHU via grilles set into risers beneath the upper row of seats. For the gallery level, this involved the use of fan coil units.

The 2013 circle cooling proposal was trialled using a single mini AHU connected to temporary supply and extract ducts. During



The cooling system had to be quiet enough not to be heard by orchestra conductors

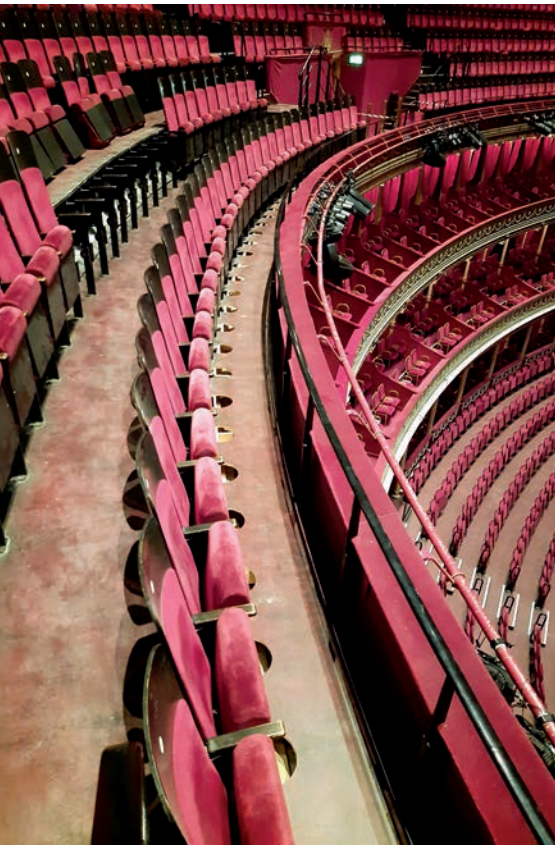
the trial period, the air temperature in that area of the circle is reported to have dropped from 33 C to 26 C, to the delight of the Hall; this demonstrated it was feasible to deliver comfort cooling to the upper areas of the auditorium, says Neill Jones, senior project engineer at Loop Engineering.

Loop's involvement with the Royal Albert Hall began in 2014, a year after the trial, when the engineer was appointed to technical support and resident engineer roles. It was not until 2017, however after upgrades to the chillers, boilers, low temperature hot water, and building management system (BMS) that Loop was tasked with engineering a cooling solution for the upper tiers.

Silinski says the cooling needs to be able to cope with heat loads from the audience, solar gains, small power and lighting (both stage and auditorium). As the detailed design for the system started to be developed, it was soon apparent that the original proposal needed to be adapted for it to work effectively.

The pressure drop was compounded by the heritage grilles that had to be used in the Grade I listed interior, and by a ring beam uncovered once strip out of the undercroft started. Air is supplied underneath the seats in rows one to four; it is returned to the AHU via 300x300mm return air grilles beneath the seats in row six. We had to drop [the return air channel] around the ring beam, which added further resistance in the system, says Silinski. »

> The pressure drop was compounded by the heritage grilles that had to be used in the Grade I listed interior



Temperatures in the top two seating tiers were reaching 37°C

A DECADE OF IMPROVEMENT

Since 2014 the Royal Albert Hall has undergone a number of major services replacements and improvements. Loop was involved in 2014 and from 2018-2021
2014 – Steam distribution replaced with LTHW stainless steel pipework throughout. Replacement of fan coil units to wall mounted units. Installation of plate heat exchangers between the new distribution and old steam boilers.
2015 – Installation of 800kW of adiabatic chillers under the south steps with a new chilled water distribution including circle level ring.
2016 – Installation of new BMS system for control and monitoring.
2018 – Construction of south-west basement with a space for new LTHW boiler room
2018 – Power infrastructure review
2020 – Installation of new incoming water main, removal of tanks on the roof, conversion of existing distribution to potable water only.
2021 – Installation of new condensing modular boilers (removal of heat exchangers)
2021 – Installation of air cool chillers on the roof and auditorium cooling.

The Royal Albert Hall is celebrating its 150th anniversary this year

The units are designed to operate in either classical or rock mode to reflect the difference in heat gains from the audiences for each musical genre

Acoustics

Acoustics were another issue that had to be carefully considered. The new system had to be extremely quiet so as not to distract the audience and performers during quieter movements in a classical music concert.

Even more importantly, the engineers had to design the system so it could not be heard by orchestra conductors, many of whom have very acute hearing. Accordingly, the fan speeds have been kept deliberately low, and the supply and extract ducts have been fitted with carefully considered acoustic attenuation devices.

We had to provide a world class experience to the audience. It was for this reason that we worked with the AHU manufacturer to design the 20 bespoke down flow AHUs, to ensure there was no perceptible impact on the auditorium s noise rating, says Silinski.

The further the design progressed, however, the larger the AHUs became so, in an attempt to keep the bespoke units as compact as possible, the cooling coil was inclined. Even with this modification, however, the AHUs were now too big to fit in the undercroft and had to be located in a series of specially built cupboards in the circulation corridor adjacent to the undercroft.

To minimise visual impact on the roof Loop Engineering specified flat-bed remote air-cooled condensers for heat rejection

Pandemic response

In response to the Covid pandemic, the team investigated fitting ultra violet sterilisation units to the AHUs, but space restrictions meant this was impossible , says Silinski, who adds that air quality has been tackled in a separate project. In addition to increasing the supply of outside air on the main air handling plant, mobile, Camfil air scrubbers have been positioned around the building to help clean the air.

National lockdowns helped the contractor when it came to installing the circle level AHUs. The plan had been to cordon off only the areas of the corridor where the AHUs were being installed. However, with the Hall closed to the public during lockdown, the contractor could do away with the piecemeal approach and take over the entire corridor. This made it much easier for the contractor and safer for the operatives, because they could maintain a safe distance, says Jones.

The floor standing AHUs are fitted with variable speed, plug fans, which can deliver up to 1.8$m^3 \cdot s^{-1}$ of chilled air. A point of discussion between Loop Engineering and the Royal Albert Hall was the temperature at which the chilled air should be supplied. According to Jones, the displacement air system serving the lower tiers of the hall supplies air at a temperature difference (ΔT) of 8K, without complaints.

From textbook design, we were not entirely comfortable supplying air with such a large delta T so close to the feet of the audience, he explains, so we ve opted for a delta T of between 4K and 6K at peak load, but with the in built capacity for the client to increase the delta T if additional cooling is required.

The final design uses 20 AHUs, strategically positioned to supply six circle cooling zones. A purpose built return air path has been incorporated into the circle soffit. The units are designed to operate in either classical or rock mode to reflect the difference in heat gains from the audiences for all the different musical genres.

For a classical concert, people will be seated, so the latent heat gain will be low, whereas, at rock concerts, people tend to dance, which increases the total heat gain, says Jones. During rock concerts or louder performances, the noise rating of the auditorium is not so critical;

MITSUBISHI ELECTRIC

CONSULTANT FOCUS

ON THE ECODAN QAHV MONOBLOC AIR SOURCE HEAT PUMP

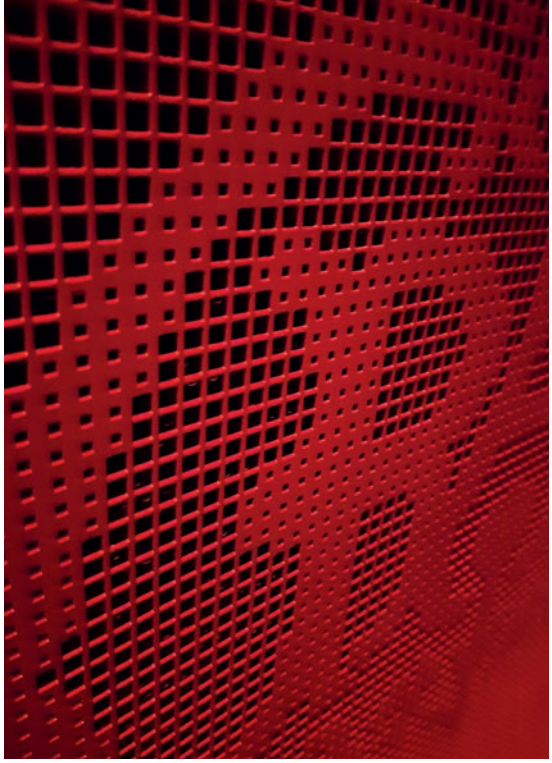
Specifically designed for commercial sanitary hot water applications

Efficient, versatile, and renewable, the Ecodan QAHV is ideal for applications with a high demand for high temperature hot water, such as hospitals, hotels, leisure centres and student accommodation.

- Low carbon hot water delivery up to 90°C
- High efficiency levels provide significant reductions in running costs and carbon emissions
- Utilises CO_2 refrigerant with a GWP of 1
- Super low noise levels
- Full heating down to -3°C outdoor temperature and operates down to -25°C

For further information please visit:
bit.ly/ECODANQAHV

ecodan®
Renewable Heating Technology



Above: AHUs were installed in specially built cupboards in a circulation corridor

» this allows the fans to be ramped up to deliver the cooling required.

The team was fortunate that much of the secondary circuit chilled water pipework had been installed during an earlier phase of the project, so the cooling capacity of the overall system was increased and the chilled water was distributed from the existing service to the new cupboards.

The task of providing cooling to the colonnaded gallery level (the tier above the circle) was far more straightforward. Fan coil units installed on the gallery during an earlier phase of the refurbishment project had cooling coils fitted in anticipation of a future increase in the Hall s cooling capacity. So, new pipes were run from the existing secondary circuit on the circuit level to the coils, and enhance the cooling.

A total of 800kW of cooling was installed. This incorporated: 120kW from two existing chillers that were to be removed under the scheme (providing cooling to various serveries and restaurants); 265kW of cooling for the circle and gallery; and 415kW additional capacity for the future expansion of the restaurants.

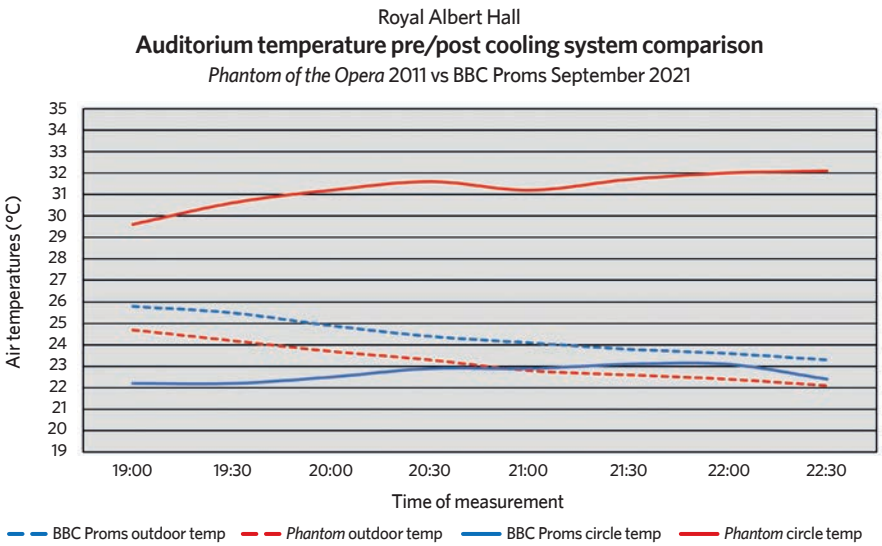
The project team had to convince the planners to allow the installation of four 200kW chillers on the ring of flat roof directly above the terracotta frieze. To help minimise the units visual impact, they specified flat bed remote air cooled condensers for heat rejection to keep their height to a minimum. The 2m high chillers tight against the back wall of the roof terrace (furthest from the parapet), to ensure they were out of sight of pedestrians below. The 1m high air cooled condenser units were positioned in front of the chiller, and were low enough to be concealed by the parapet. Fortunately, it was a solution welcomed by the planners.

Strict noise restrictions imposed by the London Borough of Westminster under its night time noise bylaws mean the chillers cannot exceed 75% of the cooling demand after 11pm, regardless of whether a concert has finished. Silinski says not many shows that require cooling go beyond 11pm, but under such circumstances the volume of the cooled inside space and the building s thermal mass will help maintain comfortable conditions within the auditorium. He adds that, on days when it is exceptionally warm, the chillers will be set to run for two or three hours before the audience arrives to pre cool the auditorium.

Many surfaces in the space have a high thermal admittance, so when the audience arrives, the space is quite cool, says Jones.

The engineer has the BBC Proms to thank for proving that the system works. For a near sell out concert in September 2021, which coincided with one of the hottest days of the year, the Hall s BMS temperature sensors recorded a maximum temperature in the region of 23.5 C in the circle, adds Jones.

This is a vast improvement on the temperature experienced in the 2011 cooling trials, and would suggest there is scope to reduce the pre cooling duration or reduce the delta T, to bring the auditorium temperatures to 24 25 C, in line with CIBSE Guide A recommendations for summer auditoria temperatures. CJ



On one of the hottest days of 2021, during the *BBC Proms*, the circle temperature was a maximum of 23.5°C

Trane Heating.
Maximum Comfort.
Minimum Impact.

The world is our building.
Were all in it together.

t 08457 165 162
e customer.care@trane.com
www.trane.co.uk

TRANE®

DAB
WATER•TECHNOLOGY

SAVE TIME, MONEY & ENERGY WITH THE REVOLUTIONARY

esybox max

COLD WATER BOOSTER SET

DAB Pumps has always been committed to innovation and forward thinking.
With a determination not to accept the status quo and to press for continual improvement.

With the Esyline concept, DAB Pumps took a bold step towards revolutionising the thinking around cold water boosting solutions. Esyline introduced simplicity, modularity, easy installation, easy service, quiet running, compactness, connectivity, and a whole host of other benefits. Above all, Esyline supports the drive towards improved efficiency and a **zero-carbon future.**

Esybox Max is the next step in the Esyline journey. With a pressure capability of up to 11.3 bar and flow rate potential of 4.8 litres per second per pump, Esybox Max is **truly a commercial solution**

From design to installation, **Esybox Max meets the needs of every user,** solving them in the best possible way: everybody is a winner with the easy-to-use technology of the revolutionary Esybox Max.

With a clean design comes clear advantages. The functional, modular and compact design allows it to be positioned even in the smallest of spaces. Different configurations cover a wide range of performance features and guarantee

20% energy savings when compared with traditional pumping systems with similar performance levels. With low noise levels, it makes choosing Esybox Max easy.

Taking up 3 times less space in your warehouse than similar pumping systems, Esybox Max is easier to stock and organise, allowing for considerable savings in time and running costs.

Esybox Max is **easier to move and handle** due to the compact size and practical ergonomic handles. No need for cranes, demolished walls or impossible manoeuvres, Esybox Max will save time and resources for a space-saving solution that guarantees a faster and more efficient workflow.

The **setup is extremely fast**, thanks to the interlocking mounting system and native connectivity.

Easy monitoring and maintenance; thanks to DConnect, DAB's cloud service, you can predict problems remotely and act quickly without having to even visit the installation site.

Energy saving and comfort are the added values that enhance the high performance and reliability of the incredible Esybox Max. Using the DConnect app it's possible to check the actual energy savings and see their real value in the bill.

Modular and functional construction. The modular components of the pump make it easier to perform maintenance. The parts can be removed, repaired and replaced separately, simplifying the resolution of any issues and reducing maintenance costs.

WRAS APPROVED PRODUCT

FOR MORE INFORMATION VISIT
D-WEB.CO.UK
T: 0333 777 5010
E: ENQUIRIESUK@DWTGROUP.COM

AVAILABLE TODAY FOR DELIVERY

UNLOCKING THE POTENTIAL OF HEAT NETWORKS

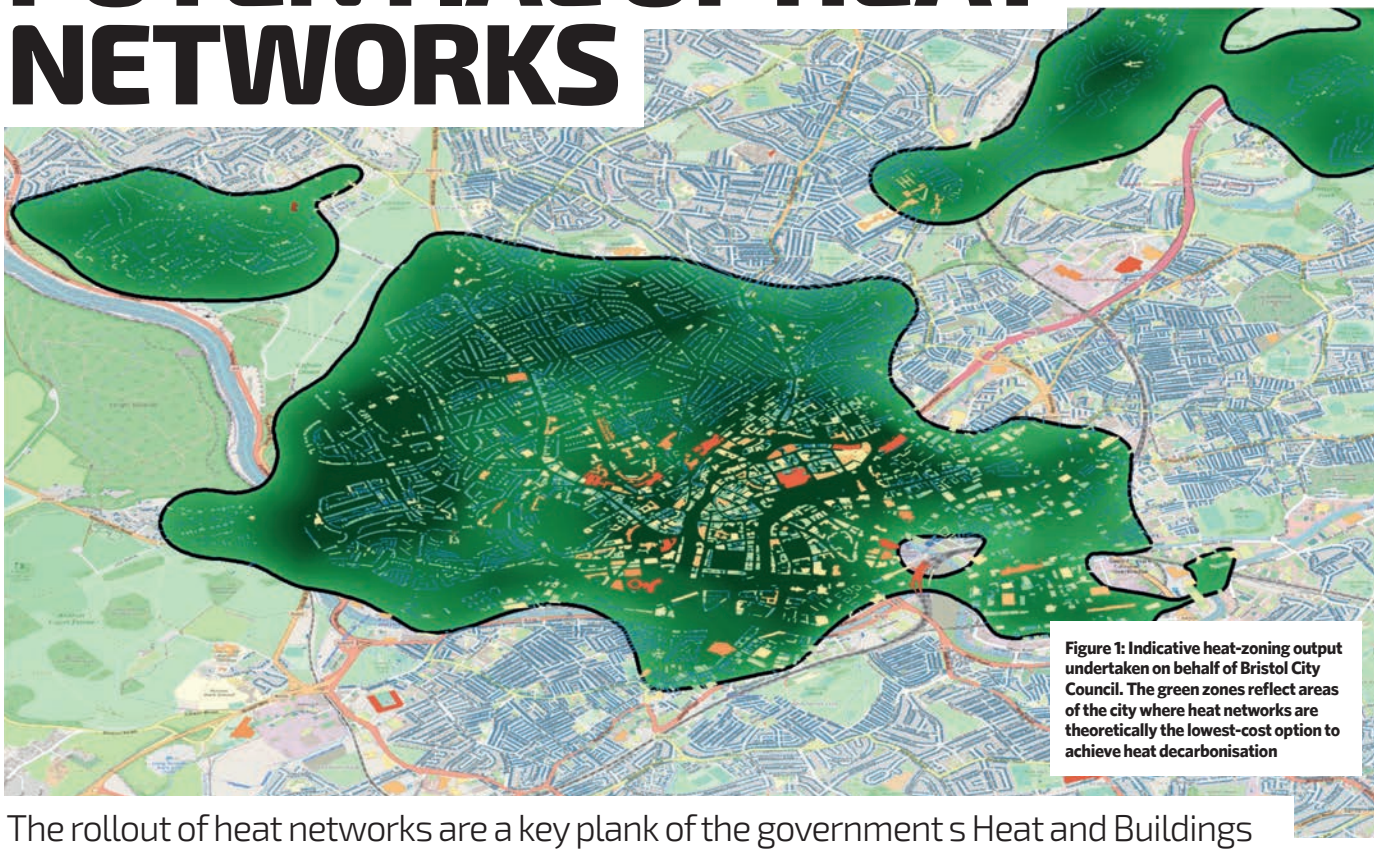


Figure 1: Indicative heat-zoning output undertaken on behalf of Bristol City Council. The green zones reflect areas of the city where heat networks are theoretically the lowest-cost option to achieve heat decarbonisation

The rollout of heat networks are a key plank of the government s Heat and Buildings Strategy. To identify the urban areas most suitable for networks, the government has published a new document on zoning, as **Andy Pearson** reports

On 8 October 2021, the government published a consultation on proposals for heat network zoning in England (**bit.ly/CJNov21HNZ**). Heat networks transfer heat (hot water/and or cooling) from a central source or sources to buildings, including dwellings, public buildings, and business and commercial premises. As such, they are able to unlock the use of large scale recovered waste heat from industry, rivers and mines.

The heat zoning proposals envisage central and local government working with industry and local stakeholders to identify and designate areas within which heat networks are the lowest cost low carbon solution for decarbonising heating. If adopted, certain buildings within declared zones could be mandated to connect to a heat network.

The proposals are underpinned by three CIBSE documents *CP1: Heat networks: Code of practice for the UK (2020); Design guide: Heat networks;* and *Guidance note: Domestic hot-water temperatures from instantaneous HIUs.*

A lot of things are coming together on the heat networks front, says Phil Jones, an independent energy consultant.

The consultation is the government s first step in addressing barriers to the implementation of heat networks in England. It says there is significant potential for the number and scale of networks to increase dramatically by central and local government working together with industry to designate areas in which networks can be deployed as a low cost solution for decarbonising heating.

Heat networks are sometimes characterised by high upfront capital costs with long payback periods. In addition, the risk of heat loads not connecting to networks can create uncertainty, which government says hampers investment. Zoning is intended to tackle this by providing investors with connection assurance, because it will be mandatory for key buildings to connect to networks, as long as it is cost effective (and practical) to do so.

To ensure an established customer base for heat, all new buildings, large public sector and large non domestic buildings, and communally heated domestic premises would be required to connect to a heat network within a prescribed timeframe . Jones says its about providing a demand so that a heat network operator can be certain that at least the mandated buildings will connect, leading to a viable project .

Developing a heat network also requires coordination and agreement between the developer and a range of parties, which can be challenging and deter investors. Zoning tackles this by taking a central strategic approach to heat decarbonisation and giving the government the »

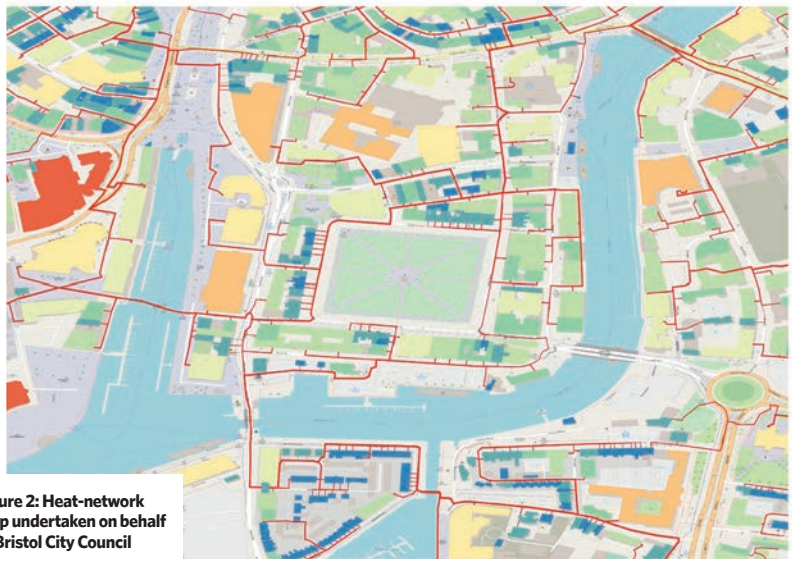


Figure 2: Heat-network map undertaken on behalf of Bristol City Council

» power to designate where zones are, and which buildings must connect.

The consultation is the government s first in a project that is intended to take place over several years. It is seeking views on a number of issues, including:

- The methodology used for identifying and designating heat network zones
- Roles and responsibilities of different parties involved in the zoning process
- The requirement of certain buildings within zones to connect to a heat network, with an exemption process to avoid sub optimal outcomes
- Requirements on certain parties to provide information to support identification and designation of zones
- Whether zones should meet a low carbon requirement
- Enforcement, monitoring and reporting regimes.

Customers for heat will be protected with the introduction of a separate regulatory framework for the sector . Ofgem has been appointed as the heat network regulator, with responsibility to enforce sector specific protections on pricing and quality of service once legislation is in place. Heat networks currently provide about 2% of UK heat demand. The impact assessment accompanying this consultation estimates that the zoning proposals will enable an additional 31TWh of heat to be deployed in the period to 2050, which is about 7% of UK heat demand.

Jones says the heat zoning document will drive use of CIBSE publication CP1, which sets out minimum standards for networks, as well as checklists for compliance.

To accompany CP1, CIBSE has published *Design guide: Heat networks*. Authored by Chris Parsloe, this document is written for those with previous experience of closed, recirculating commercial heating and chilled water systems. The guide focuses on hydronic issues: how to control flows and temperatures around the network to get the best carbon savings from central heat sources.

Both CP1 and the heat networks design guide reference a third document more recently published by CIBSE (August 2021), *Guidance*

note: Domestic hot-water temperatures from instantaneous HIUs. This summarises current hot water standards and legislation, clarifies where these are relevant to low volume instantaneous heat interface units (HIUs), and sets out a design approach that addresses all key temperature requirements. It also explains that, if you are not storing the heated water, there is very little chance of legionella being present.

The significance of the guidance note is that it enables a reduction in the temperature of a heat network, where instantaneous HIUs are used to connect to the system. What that does, is allow heat networks to be designed at 60 C, rather than 80 C or 90 C, so we ve effectively reduced hot water temperatures and, therefore, heat network temperatures, explains Jones.

Lower temperature heat networks have lower heat losses and are more compatible with renewable technologies, such as heat pumps, all of which serve to improve the economic viability of a heat network.

The three CIBSE documents work together as a suite for heat network designers. The guidance note effectively reduces heat network temperatures; the design guide has details on system design, pipe sizing and storage requirements; and the code of practice draws all of this together by specifying minimum standards, says Jones.

In addition, BESA has been running a UK standard for HIUs. This will enable the performance of HIUs to be evaluated within the context of typical UK operating conditions, so developers can evaluate the performance of a specific HIU against design requirements. It is now a requirement of CP1 to use tested HIUs.

Zoning is the first step in the government moving towards regulating the heat network sector, which could eventually see the supply of low carbon heat delivered as a utility.

CIBSE head of sustainability Julie Godefroy acknowledges the potential role of heat networks in heat decarbonisation, particularly for hard to treat properties that have few other options.

However, support to networks cannot be on principles alone and has to be related to outcomes, she says. In its response to the consultation proposals Godefroy says CIBSE will be looking at what requirements will be in place for networks to benefit from heat zoning obligations. These should be on condition of network energy efficiency and low running costs, says Godefroy. There should also be processes should actual performance in use not meet the intent at investment and design stages.

Godefroy adds that many properties could have lower carbon options than heat networks and that these should not be prevented.

CIBSE would also like more proposals on existing networks, many of which operate on gas with no decarbonisation plan in place, she says.

The consultation closes on 19 November 2021. Contact **JGodefroy@cibse.org** if you would like to contribute to CIBSE s response. To attend a CIBSE webinar on the design guide and DHW Guide on 11 November, visit **cibse.org/GrowYourKnowledge** CJ

Hoval

Hoval UltraGas® 2

The new benchmark for boilers.

Profitable | High Efficiency | Compact

The new UltraGas® 2 stands for maximum efficiency and maximum output in the smallest of spaces.
Ready for renewable fuels, our new boiler is the ideal partner for green systems, the UltraGas® 2 is an investment in a secure future.

Featuring all new TurboFer® heat exchanger technology with vertical design. This makes for a compact unit which uses very little floor space. The TurboFer® also allows for stratification of water, further increasing efficiency.

Find out more at www.hoval.co.uk/ultragas-2
Or scan the QR code

www.hoval.co.uk | info.uk@hoval.com | 01636 672711 | @hovalUK

DESIGNING EFFICIENT HYBRID HEAT PUMP SYSTEMS

Considering the optimal operational design conditions of both technologies is essential to maximise the efficiency of a hybrid heat pump system. Baxi Heating s **Ryan Kirkwood** offers advice on how to avoid conflict

Integrating ASHPs and high-efficiency condensing boilers can overcome project limitations while meeting heat demand more sustainably

Blending traditional heating with low and zero carbon technologies (LZCT) from combined heat and power and biomass to ground source heat pumps and air source heat pumps (ASHPs) is a time tested method to reduce the carbon intensity of the heating source.

A fully served ASHP building will achieve one of the lowest carbon footprints in new commercial building stock, but it is na ve to think that, at present, we can engineer all projects and budgets fully with just ASHPs. Physical space, available electrical power and/or capital expenditure budget are restrictions typically encountered.

Integrating ASHPs and high efficiency condensing boilers in a hybrid system is often a more practicable solution, as it can overcome project limitations while meeting heat demand more sustainably. The challenge, however, is to incorporate the heat pump and boiler into a harmonious design that maximises the efficiency of both technologies.

Overcoming ASHP hybrid challenges

If a hybrid boiler and heat pump system is deemed optimal for the building type, we must first be clear on a sizing proposal that maximises heat pump contribution performance while taking account of all limitations. Second, we must ensure hydronic integration with peak or backup heat generation that does not penalise efficiency or performance of the system which, in simplistic terms, means a balance of technology parameters.

Heat pumps provide a unique challenge in a hybrid system when paired with condensing boilers because of the temperature differential (ΔT). At the core, heat pumps work best at low flow temperatures and a ΔT of 5 10K. While condensing boilers also operate more efficiently at lower temperatures, the ΔT range for a typical commercial boiler is 10 40K.

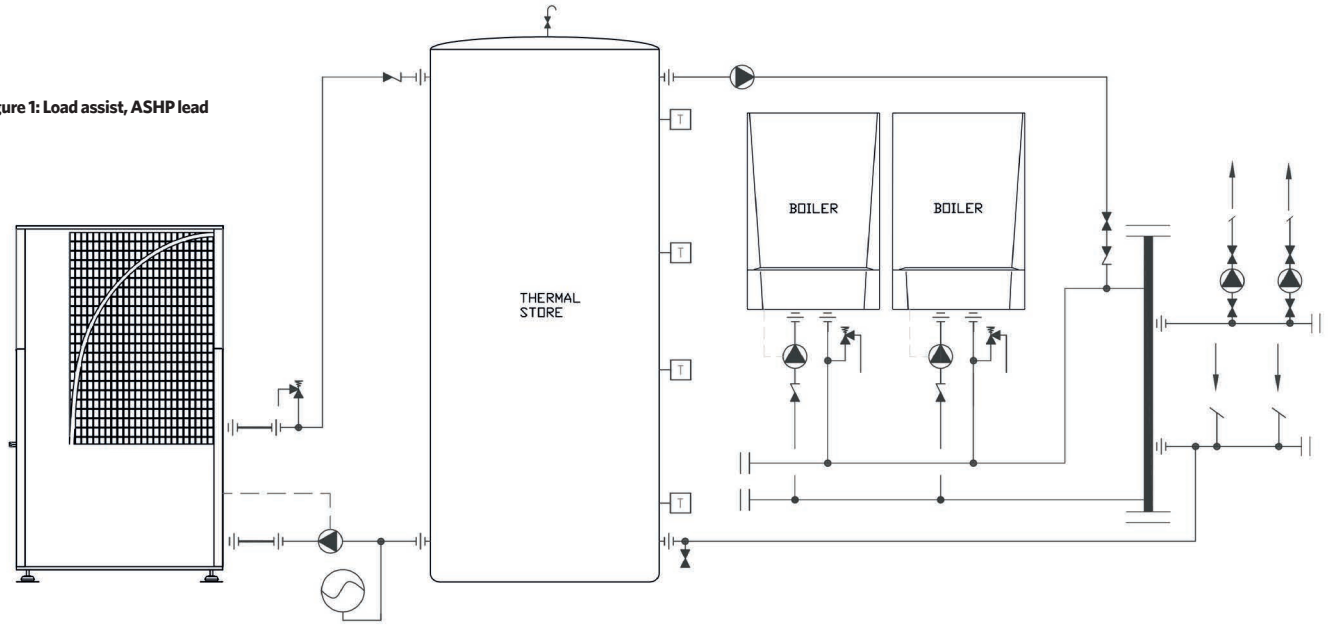
If applying Occam s razor principle, the approach may simply be to design to a 10K differential (an almost full circle back to our all too familiar 11K ΔT of older commercial heating systems). With that, however, all the advantages that larger differentials present such as pipe sizes, circulated volume and pump duties are now gone. So, what options are available to designers to balance out performance, efficiency and technology?

Load assist

Traditionally, a LZCT generator would run lead in a baseload configuration, with gas boiler(s) to assist as heat demands increased. ASHP hybrid systems can also be configured in this way, but the primary flow temperature and subsequent temperature differentials must be suitable for both the ASHP and boiler technology.

Running a full system on a 10K ΔT (pipe and pump sizes aside) would not be problematic for most pre mix condensing boilers, but it can reduce the performance of some ASHPs that optimise at 5 7K ΔT. To benefit from maximum boiler efficiency, the return temperature must be kept below 54 C »

Figure 1: Load assist, ASHP lead



» to promote condensing. One example of how this can be achieved is shown in Figure 1. To control this system, in basic terms, the ASHP charges the thermal store. The thermal store then discharges, acting as lead boiler.

As previously outlined in my article Optimising thermal store design for CHP , (March 2020 *CIBSE Journal*, **bit.ly/CJNov21CHP**), the thermal store discharge pump can ramp up and down to match building load. It should never be allowed to fully deplete, however, as this would break the stratification layer and, potentially, give a lower flow temperature than set point. Before this point, the gas boilers should be cascaded on, to duty assist with the demand. Installing heat meters provides valuable performance metrics to optimise the system and deliver live feedback to the BMS to help control the demand response.

The ratio of boiler to ASHP in this method will be project specific. Careful consideration must be made if both the ASHP and boiler(s) are required to satisfy peak demands in terms of operational robustness. The advantages of this method are flexibility and scalability, given that both generators can run together or independently as demands fluctuate.

High delta T load assist

In this method, the ASHP and boiler are operating together in a system in which the temperature differential or set point is above that which the ASHP alone can provide. A number of different methods can achieve this.

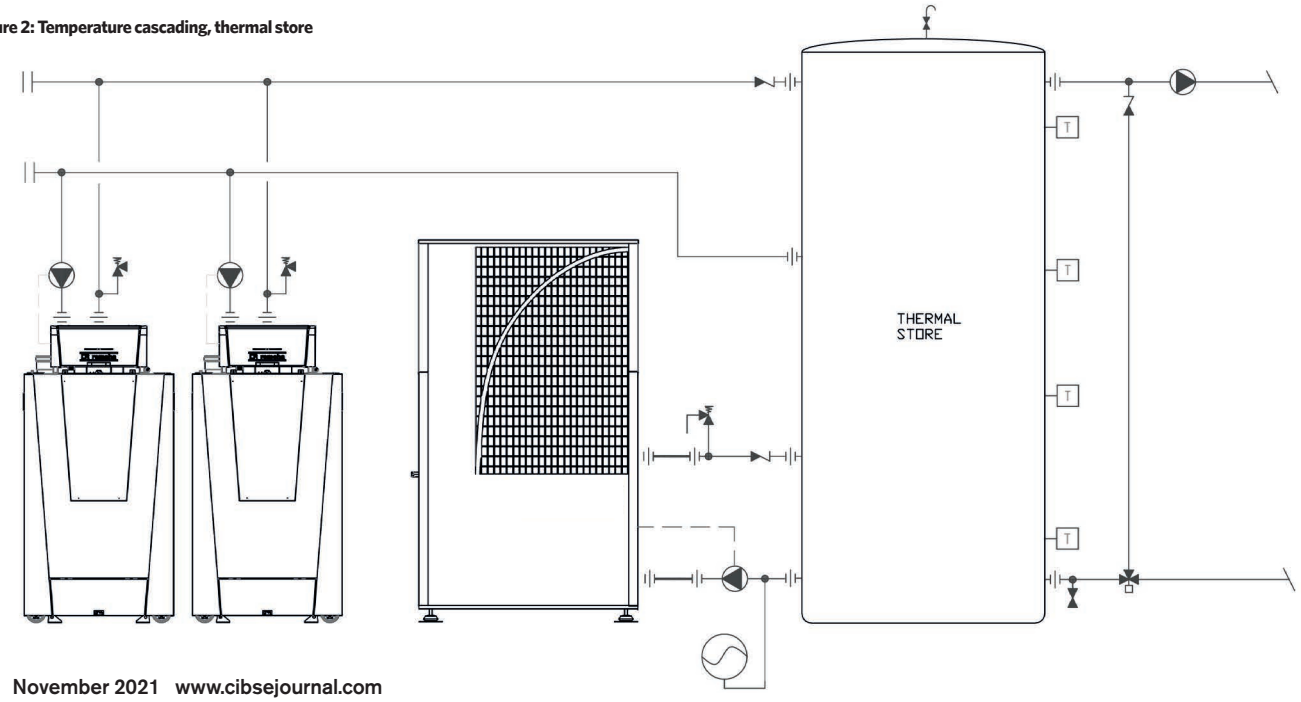
Thermal store method

With boiler and ASHP plant feeding into the same thermal store, the energy required to satisfy system loads is split. The ASHP maintains a stratified warm layer at the bottom of the tank to heat the cold return, with the boiler s hot layer giving the final lift to reach target flow temperature.

Under dynamic load conditions, care should be taken to avoid the boiler being required to top up the temperature by less than 10K, otherwise a temperature overshoot could occur in the tank. This overshoot is generally a result of most condensing boilers being unable to operate at less than a 10K ΔT condition. The introduction of a mixing valve to blend flow temperatures down on the demand side of the thermal store can help resolve this.

The controls should ensure that the boiler contribution is held back until absolutely required. This is achieved through close monitoring of tank temperatures, at multiple points, and of boiler and ASHP temperatures. »

Figure 2: Temperature cascading, thermal store



VIESMANN

Advanced gas condensing boiler

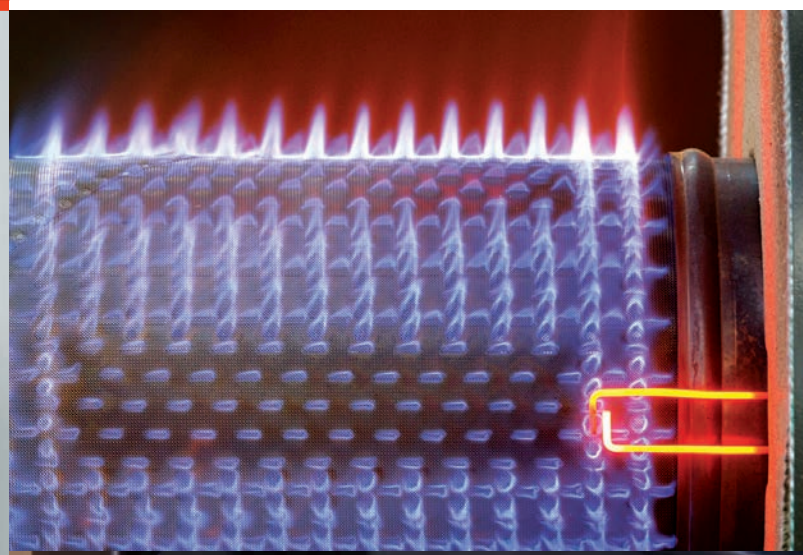
An award winning boiler with an output range of 80 - 318 kW, or 636 kW as a twin unit. Consistently high efficiency even with changing gas quality thanks to the Lambda Pro combustion controller.

VITOCROSSAL 100

- Compact design is ideal for smaller plant rooms
- NOx <24mg/kWh (2 Credit Points)
- Qualified for the Energy Technology List (ETL)
- Pre installed unit: quick and simple installation thanks to fully wired and pre assembled components
- Easily moved using three integrated wheels
- Modulation range: down to 1:10
- Operating pressure: 6 bar
- Maximum flow temperature: 95°C
- Certified for 20% hydrogen blend

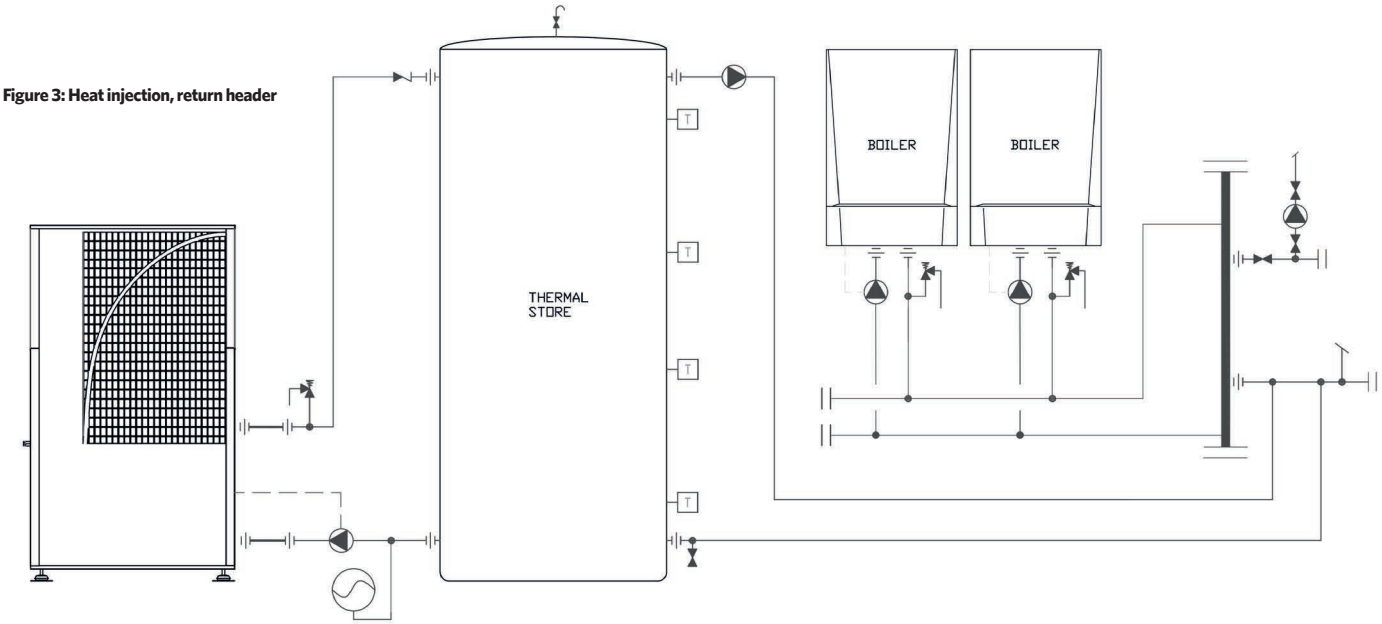
VIESMANN
H_2 READY
20% Hydrogen Ready

HVR AWARDS 2021
WINNER
Commercial/Industrial Heating Product of the Year



viessmann.co.uk/vitocrossal

Figure 3: Heat injection, return header



» The control strategy warrants greater discussion than can be covered in this article. Our advice, however, is to ensure a clear controls methodology is aligned during the design stage. Care should also be taken in the selection of the thermal store, to avoid mixing by making use of baffles, sparge pipes, and so on.

Injection method

This approach uses the gas boiler to boost the flow temperature to set point at times when the ASHP is unable to satisfy the demand differential.

There are many permutations of this method, a variant of which is used on the flow header to correct underperforming biomass boiler set ups.

This particular method, however, works on the return header prior to a low loss header (LLH). The thermal store discharge pump controls the charge and discharge cycle of the thermal store. Under low load conditions the store may be charged to system temperatures, to give usable heat without the requirement of the boilers cascading on (albeit for a finite period). During periods of high demand the thermal store injection will pre heat the return for top up by the boilers. Ensuring proper discharge/charge cycling of the store is critical to the performance of this method.

Pre heat efficiency loss, net efficiency gain.

We lose approximately 1 2.5% overall efficiency in a gas boiler when preheating a 30 C return by 5 10K, because of slightly reduced condensing efficiency. This modest loss in efficiency is massively countered by the renewable element of the ASHP efficiency. Provided the ASHP is not pre heating the boiler return above condensing temperatures, the slight loss is acceptable to achieve a net gain.

Avoiding conflict

We have often seen primary and secondary heat generation methods fight against each other, at the cost of system efficiency. So, it s crucial that flow and return temperatures, ΔTs, controls and, ultimately, the detailed hydronic design are taken into careful consideration when blending the technologies. Addressing and avoiding this conflict at the outset will help ensure optimal system performance and outcomes.

Along with standalone, purpose designed ASHP systems, hybrid systems offer the opportunity for important efficiency gains and emission reduction from heating in existing and new commercial premises.

In future articles, I will explore DHW generation and where this sits within standalone and hybrid heat pump systems, and take a detailed look at more innovative methods of hybrid heat generation. CJ

RYAN KIRKWOOD is the heat pump business development manager at Baxi Heating

TURN BIG DATA INTO BIG INSIGHTS

THE HEART OF YOUR BUILDING KNOWS HOW

Our connected pumps provide transparency through real-time HVAC performance data and unrivaled intelligence.

Armstrong's Active Performance Management™ delivers insights that lead to informed decisions and immediate actions. A connected network of systems provides benchmarks and deeper learning for sustained performance.

Mechanical equipment, pure data modeling, cloud-based analytics and digital controls, perfectly integrated for reliability and efficiency that no other partner can match.

ARMSTRONG FLUID TECHNOLOGY®

Energy Performance Upgrades always start with the heart.
To learn more, visit armstrongfluidtechnology.com.

THE QUEEN'S AWARDS FOR ENTERPRISE: SUSTAINABLE DEVELOPMENT 2021

COOLING A VERTICAL VILLAGE

To minimise energy use at a 62 storey glass tower in the City of London, it was critical that the chillers performed as efficiently as possible. **Andy Pearson** looks at the cooling specification for 22 Bishopsgate

22 Bishopsgate can accommodate 13,000 occupants

The tallest building in the City of London opened earlier this year. Billed as a new type of skyscraper, 22 Bishopsgate is described by its developers, Lipton Rogers, as a vertical village because it combines commercial office and social spaces. At 62 storeys and 278m high, this village has been designed to accommodate up to 13,000 occupants in 200,000m^2 of office space.

WSP was the building services consultant. Its team started to develop the services design for this landmark tower as far back as March 2015, before the project went for planning approval. Now, six years and one global pandemic later, tenants are finally moving on to the building s fully glazed floor plates. When all the floors are occupied, the engineer estimates that it will require 16MW of cooling to keep the occupants cool and comfortable.

The chilled water system, designed by WSP and installed by contractor Michael J Lonsdale, is based on four Carrier high efficiency, centrifugal liquid chillers, each capable of delivering up to 4MW of cooling. It is designed to be highly efficient in operation.

The chillers are located in Basement Level 3, while the cooling towers installed under a separate package are 270m above, on level 58. To reduce the condenser and chilled water static pressures, the systems have been split into two smaller circuits on floor 25, using heat exchangers; one circuit serves the upper floors, and one the lower.

Although there are pressure breaks in the building, it was pretty evident that the system would have high water pressure so we ve got high pressure water boxes that can withstand pressures up to 21bar, explains Stephen Avery, Carrier s equipment quality manager and product manager (centrifugal and absorption) HVAC for UK and Ireland.

Despite the building s size, space is tight in the basement because it incorporates the subterranean remnants of The Pinnacle the building that was to occupy the site, the construction of which came to a halt in the financial crisis of 2007, just as it was coming out of the ground.

As such, the basement incorporates additional

KEEPING OFFICES COMFORTABLE

The giant 22 Bishopsgate building is clad in a triple-glazed, bespoke 'Closed Cavity' glazing system. The cavity between the single- and double-glazed units is kept pressurised by a constant supply of clean, dry air to prevent the entry of dust and to minimise condensation on the glazing.

More than 9,000 of these closed-cavity units encase the building, and every one has a connection to the air supply. The cavity also contains a blind, to limit solar gain.

All 50 of the building's office floors are finished to Cat A standard, with the mechanical and electrical services fitted, including more than 3,000 four-pipe fan coil units (FCUs). Fresh air for the offices is ducted via constant volume boxes to the back of the FCUs.

In a recent interview, however, developer Peter Rogers admitted that the building would need to adapt in the wake of Covid-19, to bring in more fresh air to the offices.

structural transfer beams to shift the loads from the new tower structure above, to the existing supporting piles buried in the ground. As a result, the smallest possible machines were selected to achieve the specified duty. These are still very large units, however, so getting them to the plantroom was challenging.

At one point, it did look as if we d have to break the machines down to get them into the basement, but, as it turned out, there was still a series of big enough holes in the floor slabs to enable the chillers to be lowered into the basement in one piece and then skated into position, says Avery.

The machines run on R134a refrigerant. It was recognised that things may change in the future, with regards to the type of refrigerant, but when we were developing the system we had to go with the most efficient option available at the time, Avery adds. We know that 134a isn t being phased out over the lifetime of this equipment, and if things do change, these machines can be retrofitted with a different refrigerant.

An additional benefit of using R134a refrigerant is that it is A1 rated, with low toxicity and zero flammability, which were important properties given the location of the plantroom, says Avery.

The chillers are fitted with a variable speed drive to ensure the chillers constantly match the cooling demand, to minimise energy in use. To further minimise energy consumption, the chillers incorporate a new (at the time) dual stage aerodynamic centrifugal impeller design. The chillers were specified when the manufacturer had just completed the design and testing of a new dual stage compressor incorporating two impellers in place of the more conventional single impeller configuration.

The chillers used in 22 Bishopsgate underwent witness tests in Carrier's facility in Charlotte, North Carolina

The size of the plant and the amount of work they do means the chillers can generate a significant amount of heat

Using two impellers enables the compressor to accommodate a wider range of temperature applications and improves its efficiency, with one impeller helping drive the other. With the efficient compressor configuration and the variable speed drive, we are able to achieve really good part load efficiencies and COPs [coefficients of performance] for the equipment, explains Avery.

Another innovation introduced to drive up chiller efficiency is the use of tunnel diffusers. These help turn the kinetic energy imparted to the R134a refrigerant gas by the dual stage impellers into gas pressure. To do that, the gas passes through a diffuser. Avery describes this as being like a slotted plate in the refrigerant gas stream, which is designed to reduce the velocity of gas. A tunnel diffuser is essentially an enhanced version of the slotted plate, which can adjust its resistance based on the volume of gas across the impeller to optimise compressor performance. If you don t need the compressor to run so hard, you adjust the diffuser to release more gas to the evaporator, explains Avery.

Conversely, while the chillers have been installed to provide cooling, the size of the plant and the amount of work they do means the chillers can generate a significant amount of heat. Rather than allow this to accumulate in the plantroom and to improve motor efficiency the compressor motors are cooled by injecting refrigerant gas from the chillers into an enclosure surrounding the motor. If you have a traditional open drive type compressor, the heat from its motor will dissipate into the plantroom, which will then require ventilation or even air conditioning, says Avery.

With a refrigerant cooled motor, you take an element of the refrigerant from the condenser and spray it into the motor, to remove the heat from the windings, and then reintroduce the refrigerant back to the compressor so you are not losing the cooling efficiency of the machine and no heat escapes into the plantroom, he adds. The inverter on the machine is also refrigerant cooled.

Control of the chillers is via a proprietary plant management system a BACnet control solution that acts as the interface between the building BMS and the individual chillers. The controller has an onboard library of factory engineered control programmes designed to provide automatic control and monitoring to optimise operation of the four chillers and ensure they run in the most energy efficient mode. We get a signal from the BMS to say there is a cooling requirement and then the plant management system selects the best possible configuration of chillers to satisfy that requirement, says Avery.

The system provides the BMS with real time operating conditions, including chilled and condenser water temperatures, chiller capacities and their status. It also controls the chilled water system pumps and load shedding when the building resorts to generator power.

After delays caused by Covid 19, final handover of the chiller system was before Christmas 2020. CJ

DAIKIN

DAIKIN APPLIED (UK) LTD

Technically better...

Delivering Optimised Indoor Air Quality

Daikin Applied (UK) Ltd designs and manufactures a range of Air Handling Units that are fully HTM and SHTM 03-01 compliant. From standard modular units to more complex bespoke systems, our products are designed to provide inherent flexibility that can be configured and combined specifically to meet the exact requirements of any healthcare building.

Our AHU's are designed to be the most environmentally friendly and energy efficient on the market, thus reducing their ecological impact, whilst keeping costs down through the minimisation of energy consumption. Combined with the small physical footprint of the system, these features make our Air Handling Units ideal for your application.

MADE IN BRITAIN

Air flow (m³/s)

40
34
28
25
22
19
16
14
11
5.5
0

D-AHU
Professional

0.21 m³/s
up to 40 m³/s

D-AHU
Modular R

0.13 m3/s
up to 6.95 m3/s

D-AHU
Modular P

0.13 m³/s
up to 4.16 m³/s

D-AHU
Modular L

0.07 m³/s
up to 0.7 m³/s

AHUs

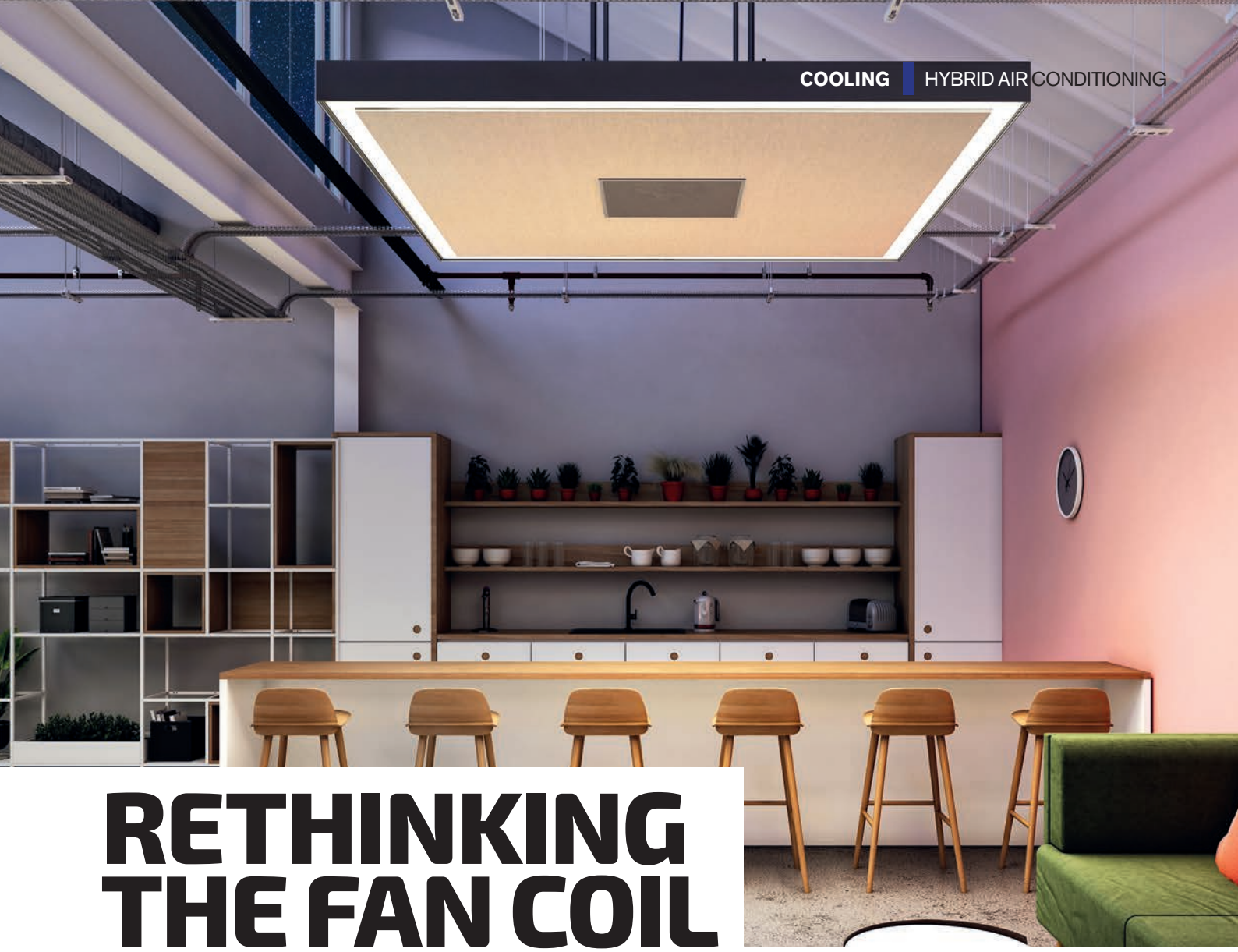
CHILLERS

PROJECTS

SERVICE

0345 565 2700

www.daikinapplied.uk



RETHINKING THE FAN COIL

The Artus hybrid air conditioning unit is only 200mm deep, yet it achieves energy savings of 83% over conventional fan coil units thanks to patented designs for the heat exchanger and fan assembly. **Andy Pearson** speaks to inventor Roger Olsen about his quest to cool buildings more efficiently

"It started with a blank sheet of paper and a consultant's daydream to do air conditioning better," says Roger Olsen. That was in 2012, when Olsen was at Arup. Now, a decade later, Olsen is chief technical officer of Artus Air, an Arup spin off business that is selling his innovative packaged, hybrid air conditioning device with the energy efficiency of a chilled beam and the flexibility and output of a fan coil unit (FCU).

The compact air conditioning unit measures a nominal 600mm x 600mm, so can slot into a standard suspended ceiling grid and because it is nominally only 200mm deep, it is ideal for installations with a constrained ceiling height. Its most impressive feature, however, is that it uses up to 89% less energy than ducted fan coil systems. Artus was recognised in the 2021 CIBSE Building Performance Awards, for which it was shortlisted in the Product or Innovation Thermal Comfort category.

The key to the design is the patented arrangement of the U shaped, vertical coil, which encloses the unit on three sides. You get a better rate of heat exchange from one continuous coil than from three separate units, says Olsen.

The coil's large surface area enables air to pass over it at a low face velocity of about 0.6m·s^{-1}. This is similar to the air velocity through an active chilled beam and a lot lower than the 2.5m·s^{-1} face velocity common in FCUs. It's a quarter of the face velocity [of a FCU] and, therefore, a 16th of the pressure drop for the fan to overcome. Hence, it has very low energy in use, explains Olsen.

An axial fan is used to pull air through the coil and move it down into the space. Olsen says a 'lightbulb moment' was to fit a low pressure drop fan to the unit to pass air though the coil, rather than the active chilled beam solution of connecting up ductwork from central plant to get the extra airflow. In this way Artus can be thought of as an active chilled beam.

The fan selected is an off the shelf unit, powered by a standard variable speed, electronically commutated, direct current motor. What makes it suitable for this unit, however, is that it is fitted with a bespoke, injection moulded shroud, which ensures a radial air distribution pattern.

Unusually, the fan is mounted behind a fascia panel on the underside of the unit. This allows it to supply the tempered air directly into the space in a swirl pattern. Its even distribution is similar to the effect created by the secondary ductwork legs on a conventional FCU. Because the axial fan is rotating so slowly [at about 700rpm] the »

The Artus unit has been popular for healthcare applications, because everything that needs to be accessed can be reached from below

The air conditioning unit's low noise levels make it suitable for residential applications

» interaction of the fan blades with the shroud means that the air does not flow straight down; instead, the fan generates a swirl pattern that induces and mixes the air in a similar fashion to that of a swirl diffuser, says Olsen.

The benefit of this arrangement is that it eliminates the additional pressure drop created by the secondary ductwork and diffusers, as Olsen explains: A conventional FCU will have a 25Pa pressure drop across the coil, plus an additional 30Pa on external ductwork totalling 55Pa whereas we have just 7.5Pa pressure drop across the entire unit. This is fundamental to how the very fan powers are achieved.

A consequence of the low pressure drop is that typical specific fan power (SFP) for the unit is 0.06 to 0.08. Ed Sayce, projects director at Artus Air, says a typical fan coil unit would have an SFP of 0.2 at best , while the backstop for Part L for non domestic services is an SFP of 0.25.

We re only using 25% of what is allowable, which is an 80% improvement in the SFP. We ve modelled for a model office scenario (see panel, Modelled energy use in an office), where it saves 21% of the regulated energy against Part L which is a phenomenal saving for what is a simple concept, adds Sayce, who points out that the SFP in the Part L calculation is 100% of load, but for most of the time, the fan will be running much lower than that figure .

Furthermore, the fan speed is variable, to save energy and reduce fan noise. Maximum fan speed is set based on the noise level required in the space. The unit can achieve noise levels as low as NR22, which makes it suitable for use in residential applications. In an open plan office, however, an acceptable noise level is NR35, with a 5dB relaxation allowed in the British Council for Offices Guide to Specification for a variable speed system.

We start with NR40; because we ve done loads of acoustic modelling, we know that if the units are spaced serving 25m^2 the fans can run up to 140L·s^{1} per unit and we work backwards from there to calculate the cooling capacity, says Olsen.

The unit comes packaged with the pressure independent control valves, the controller, and condensate pump pre fitted, to enable predetermined software in the controller to always run the components in the lowest energy use mode.

When you buy these components separately, as is common with a conventional fan coil system, you are reliant on onsite coordination of these components, whereas we ve got certainty of component compatibility and performance because we ve tested it all together, says Sayce.

In this version, the unit is fitted with a single, large heat exchanger coil to provide both heating and cooling via a changeover system, which is different from the UK convention of having FCUs with separate heating and cooling coils.

The coil is sized to provide 2.4kW of sensible cooling based on chilled water at 6 C flow/12 C return, which Olsen says is a bit smaller than the duty of some conventional fan coils . The consequence is that more units will be needed for a Cat A office fit out. We are developing a new unit of double the cooling capacity to match typical FCU coverage, says Olsen.

Despite the higher number of units needed, Sayce claims the installation is cheaper than one based on conventional FCUs. We ve done the exercise several times with external quantity surveyors: the capital cost is cheaper because you need to add in the cost of the secondary ductwork, grilles, controller, condensate pump and control valves to the cost of a conventional fan coil, he says.

That s before you add in the huge contractor savings on quicker install time, reduced procurement, less controls work and less commissioning because there is no secondary air balancing, and the operational savings from low energy use.

The unit can also run at an elevated chilled water temperature of 14 C/19 C enabling excellent central plant efficiencies, however, »

COMPREHENSIVE

EXTENSIVE PRODUCT RANGE AND BESPOKE SOLUTIONS

CRANE FLUID SYSTEMS

Trusted since 1919, our extensive portfolio of general and public health valves, pipe fittings and commissioning valves for constant and variable flow ensure you don't have to look anywhere else. Even if you need a bespoke solution come to us.

Find out more at Cranefs.com/solutions

» the trade off is that the cooling capacity drops off at these temperatures.

If you were to design a scheme to run all year round at elevated cooling temperatures, you would, in theory, need almost double the number of units or FCUs. However, a proprietary software and control system has been developed to provide a cost effective solution for applications designed to run at 14 C/19 C but with the capability of achieving peak demands by reducing the cooling temperature to 6/11 C. We realised that, for most of the year, 14 C/19 C is fine, because the peak cooling load only occurs for about 50 hours per year; for nearly all the rest of the time, it is running at almost 50% load, says Olsen.

The software overlay and intelligent control system looks at all of the units to see how hard they are working, to optimise flow temperature through the chillers using bespoke algorithms. This allows the system to drop the cooling water temperature to 6 C/11 C during the 50 hours of peak demand without compromising system energy efficiency for the remainder of the time. This ensures chillers are always running at the higher cooling temperature possible leading to high seasonal COP on the central plant.

Under current Breeam for refurbishment and fit out criteria, the 10% energy saving in changing from a compliant FCU to these units would give at least three Breeam points. With the bespoke controls optimisation and reporting software installed, to maximise energy savings in operation, it is possible to achieve up to seven.

There is big benefit in heating when using a single coil as the large coil area required for cooling is ample for the heating demand. If you run the heating circuit at 80 C flow/70 C return, the coil will be massively oversized , says Olsen. However, he adds, the advantage of the oversized coil is that it opens up the possibility of using heat pumps for example, to run the heating system at 35 C, and still get the heating you need from the one coil .

Artus also offers a twin coil option more akin to a traditional FCU for where a single coil system is not appropriate.

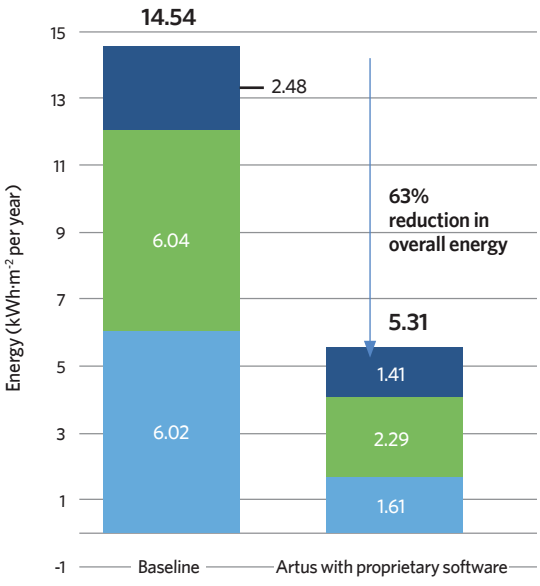
Sayce says the unit has been popular for healthcare applications, because everything that needs to be accessed, including the filters, can be reached from below by dropping the unit s hinged front face.

In fact, the unit s shallow depth, when compared with a FCU, means that on a tall building of 12 storeys or more, with a maximum development height the use of these units could allow developers to squeeze in an additional floor. If a developer can add 7 8% to the floor area of a development simply by using a different HVAC system, it could impact the viability of some developments.

The unit is also expected to be popular for use in cooling high end apartments, where its low noise level, combined with its shallow nominal 200mm depth and simplified returned air paths, means it can be accommodated relatively easily without the need to increase ceiling depths.

With several successful installations completed, Olsen s daydream has been realised. But, he s not put away his blank sheet of paper. In response to Covid 19, he s working on a version of the unit that recirculates and cleans the air. Watch this space.... CJ

Results of simulated energy use comparing traditional AHU with novel unit



MODELLED ENERGY USE IN AN OFFICE

The team carried out an energy simulation on a 10,000m² model building, designed to comply with Part L of the Building Regulations 2013. The modelling showed the novel units achieved a 14% reduction in total building energy, and a 63% energy reduction in the elements used for heating and cooling.

Auxiliary (terminal units)
Cooling
Heating
Total

Considered risk?

Fan coil units typically recirculate some – potentially contaminated – air from the ceiling void, says HDR's Adrian Gray, who believes infectious disease transmission must be embedded in ventilation regulations

Extract plenums have been an integral part of office ventilation solutions for a long time. Air is drawn through ventilation openings in ceiling and light fittings, into a void above the ceiling tiles that is kept under negative pressure using open ducts to draw air from the void and into a riser. Eventually, it is discharged via an extract fan. A similar principle can be used to draw air at the highest level, where there are exposed services. In both instances, the amount of air extracted is a close match to the amount of fresh air provided to the space.

The concept became common in the late 1980s, when it was used with high pressure variable volume systems. Compared with a ducted extract system, the savings were substantial; the costs of large amounts of sheet metal extract ductwork was saved, and the space saved by the reduced coordination allowed ceilings to be higher and the height of a building storey to be reduced. The concept was simple: an even distribution of supply air gradually eased the return air into the ceiling to balance the pressure.

Mechanical systems continued to develop in the 90s, with fan coil units (FCUs) and minimum fresh air supplies becoming the norm, bringing further savings in costs and space. Fan coils may be served by ventilation ducts to provide fresh air from an air handling unit and, usually, draw additional air from the room or surrounding plenum.

There are other options, such as chilled beams and ceilings, but the reliable familiarity of FCUs makes them the default solution for cooling and fresh air. These more modern systems are routinely used with an extract plenum.

Then came the pandemic. Our industry was quick to respond with guidance that recirculating air should be avoided and equipment such as thermal wheels which provide a potential contamination route between extract and supply systems switched off or isolated.

If there is a good outside air ventilation supply (mechanical or natural) to the room or zone, the FCU fan will help destratify the air and reduce the chance of stagnant air pockets, helping to dilute any airborne pathogens. Other advice stated that it is acceptable for a FCU to recirculate air within a single room.

If we consider a FCU located in a return plenum, it seems there are risks that are not considered by the advice to date. Typically, FCUs will recirculate a proportion of air from the ceiling void, and this air could be contaminated with virus particles extracted from elsewhere in the office. If this were the case, the air supplied to the office from the fan coil would further spread the virus particles, with the cycle starting again to spread the contaminants further. In the current pandemic, I believe this is a risk that should be considered more carefully.

In the short term, we should consider the benefits of using a ducted extract in conjunction with FCUs

Things can be done to reduce the risk of such spreading of contaminants. FCUs do not have sufficient fan power to operate with a filter fine enough to remove Covid 19 viruses from the air. Air cleaning technologies are available, and ionisers and ozone cleaners can be fitted into the air stream of FCUs. However, while common overseas particularly in the US these solutions are not currently recommended in the UK because of concerns about the risks of secondary chemicals generated by the devices, and of chemical oxidation, photocatalytic oxidation or electrostatic precipitation.

In the short term, we should consider the benefits of using a ducted extract in conjunction with FCUs. This would keep extracted air separated from the supply on its way back to the riser and reduce the risk of wider contamination. In the longer term, consideration of infectious disease transmission needs to be embedded into building ventilation regulations and associated statutory guidance, in the same way that energy, comfort and air quality have been. Part F: Ventilation is under review, so there is an opportunity to consider this immediately.

Many knowledge gaps including lack of data on the viral load in the exhaled breath of asymptomatic and symptomatic people, the size distribution of particles and how this varies with activity, and lack of data on the dose response mean uncertainty remains over how to evaluate aerosol transmission effectively and determine the most appropriate interventions.

Building regulations should identify performance standards, and enhanced measures should be taken to ensure compliance is achieved in use. Further regulation and guidance may be required to ensure existing buildings can meet necessary standards. There are no silver bullet solutions, however, and a combination of measures is required to reduce the risks of infections indoors.

ADRIAN GRAY
is global sector leader (corporate and commercial) at HDR

There's more to come from Remeha.

Complete sustainable heating and hot water solutions

remeha

Assessing commercial boiler systems for replacement and enhancement

This module explores issues around assessing an existing non-condensing commercial boiler installation for replacement or enhancement

CPD CIBSE APPROVED

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

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

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

This CPD will consider some of the factors that are likely to be encountered when assessing a typical legacy non condensing commercial boiler system for replacement, and explore some of the changes to primary hydronic systems that enable new systems to meet the demands of loads in an existing building.

It is a somewhat daunting task for many building services engineers to assess an existing, formerly unseen, boiler installation when considering a replacement or enhanced system. Ideally, there will be schematic as fitted drawings or digital models (and associated documentation), or operation and maintenance manuals that will be available for inspection prior to visiting the site but, particularly for older installations, the boiler plantroom will be the most reliable source of intelligence. However, boiler replacements are often undertaken as part of a more extensive building refurbishment, or the building may well have been altered in form or application since the boilers were installed, so any insight gained from the existing equipment must be considered in combination with a proper analysis of the building s load requirements.

Before commencing any site activity, an appropriate health and safety assessment will have been undertaken and relevant enquiries and notifications made to those responsible for the installation, to ensure safe access (and egress) and that relevant personal protective equipment (PPE) is employed that meets both personal needs and site policies. Having ensured a safe working environment, and always being mindful of the risks in a boiler plantroom, an initial visual orientation should be undertaken in an attempt to understand the boiler configuration.

The boiler data badge can yield a significant amount of information. So, for example, the data badge shown in Figure 1 provides Pn the nominal rated output in kW at the stated flow and return temperature, while Qn is the related nominal input (gas/oil) power. Dividing input by output power will provide an idea of the original boiler efficiency for estimation purposes (based on these specific nominal conditions). This particular boiler does not identify an output at 50/30 C this infers that the boiler is non condensing an important consideration when considering the flue design.

Other data on the badge relates to the maximum operating pressure of the boiler (6bar); the power supply (230V @ 50Hz) and the Ingress Protection (IP) rating (IP20 touchproof, resistant to dust or objects that are over 12mm in size, but with no protection against liquids and susceptible to damage if it comes into contact with sprays of water); and the B23, which indicates that the boiler does »

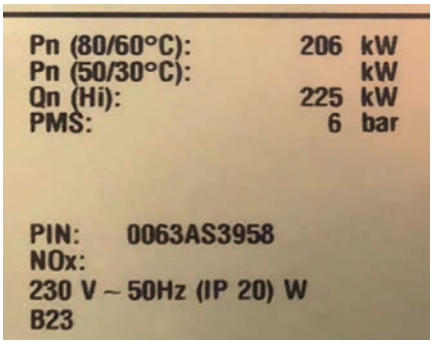


Figure 1: Photograph of boiler data badge

Figure 2: Two pressure jet boilers on a plinth with flue rising through a brick chimney

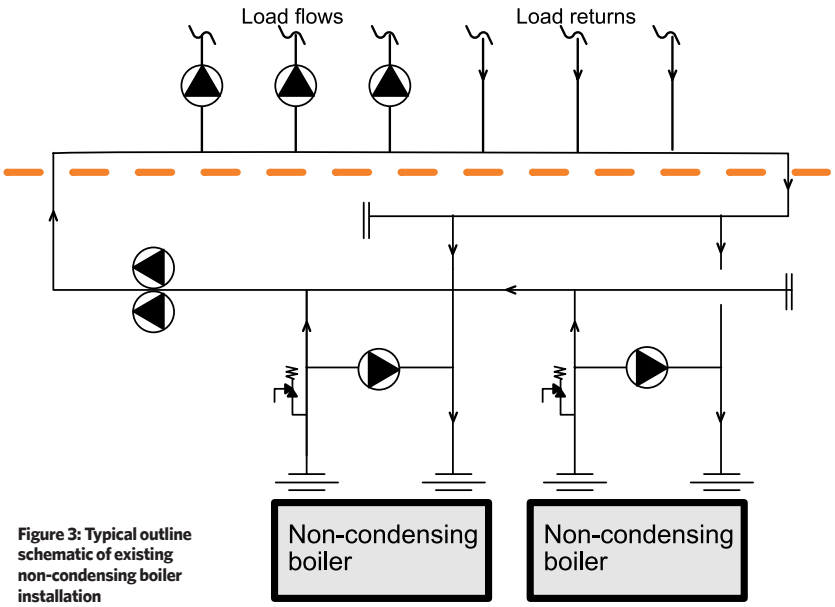


Figure 3: Typical outline schematic of existing non-condensing boiler installation

» not have a draught diverter, but uses a fan upstream of the combustion chamber/heat exchanger, and is designed to be connected to an open flue that will terminate vertically through the roof, with the combustion air being drawn directly from the plantroom.

Typically in small and medium load installations, two boilers were often selected, with each boiler sized to cope with 67% of peak load and then operated on a duty/assist basis, as in the example of Figure 2. This illustrates two gas pressure jet boilers on a plinth (with the flue going off to rise through a brick chimney). The gas train (the components that combine to safely supply natural gas to the boiler) for each boiler are to the left of the respective boiler connecting to the (red) burner assembly that contains the fan (blower), air/gas mixing section and control. The water side connections are all made to the rear of these boilers.

The tracing of pipework, which is often complicated by the lack of pipe marking and obfuscated by enveloping insulation, may be undertaken through a combination of visual and thermal means (potentially aided by an infrared or contact thermometer). A simplified representation of a commonly encountered legacy piping system for a fixed volume, non condensing arrangement, is shown in Figure 3. A main system pump (with standby) moves water from the reverse return header to serve the load. Each boiler has an individual shunt pump used when return water falls below approximately 60 C, to redirect high temperature flow back into the boiler return to prevent the boiler flue gas from condensing (as is increasingly the case when the boiler heat transfer surfaces drop below 55 C these boilers are not designed for condensing operation). Although such constant volume flow systems may have been commonly designed on 82 C flow and 71 C return, extremely low return temperatures are likely to occur during periods of high demand, such as at system start up. A common alternative to employing a shunt pump was to use a three port valve in combination with separate primary and secondary pumping. The contemporary guidance was that if the return water required to be pre heated prior to returning to the boiler for extended periods (for example, 20 minutes or more) a pump was preferred. So, three port valves were typically employed on smaller systems with shorter warm up periods. These valves are typically known as back end protection valves and are often thermostatically controlled to maintain a safe, condensation free, return water temperature.

The purpose of the reverse return header was an attempt to balance the hydronic resistance of the two boiler pathways to allow easier commissioning.

Figure 4 shows where condensing boilers have been dropped in to replace the old non condensing boilers. The three port valve has been removed, as the boiler is designed for condensing operation with a commissioning set often added to assist in the commissioning of the resistance of the replacement boiler. Frequently, it has been observed[1] that the only additional work undertaken is the replacement of the primary pump set. (That would hopefully have been preceded with a full power flush of the horizontal header to remove accumulated sludge.)

A consequence of such an approach is temperature dilution . As an illustration of this, using the system of Figure 4, assuming that the replacement boilers are each 200kW, initially set to operate at 80 C flow and designed for a constant 60 C return ($\Delta\theta$ = 20K) with a minimum boiler turndown of 25%. (And obviously, at these temperatures, not operating in condensing mode.)

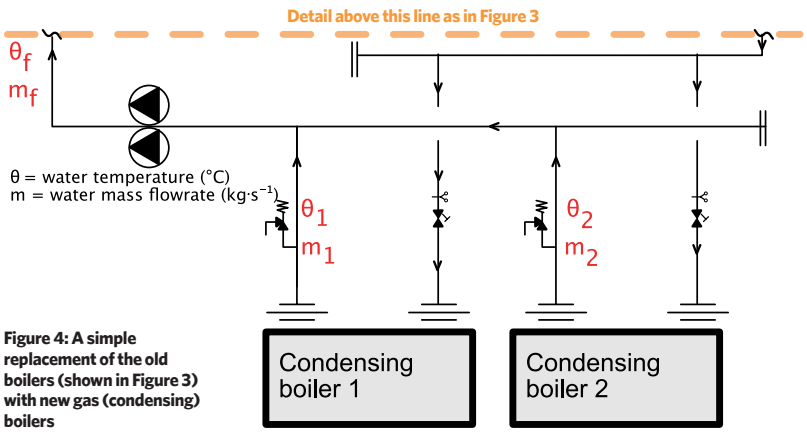


Figure 4: A simple replacement of the old boilers (shown in Figure 3) with new gas (condensing) boilers

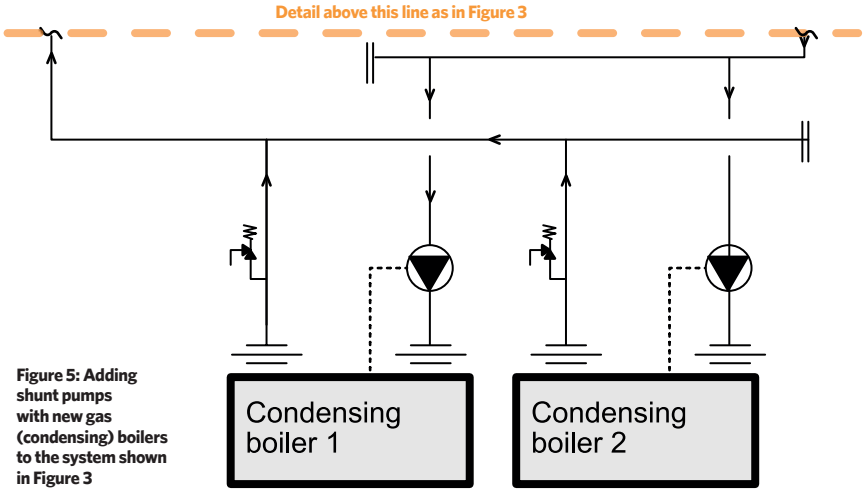


Figure 5: Adding shunt pumps with new gas (condensing) boilers to the system shown in Figure 3

The primary temperatures may be examined by undertaking a simple assessment of a heat balance in the primary circuit and, by assuming a constant specific heat capacity, are approximated by considering a temperature balance of the flows. Referring to Figure 4, where θ is the water temperature (C) and m is water mass flowrate (kg·s^{-1})

$\theta_f = (m_1\theta_1 + m_2\theta_2)/m_f$ that, in fractional terms, where $m_1/m_f = F_1$ and $m_2/m_f = F_2$ and, in this case, as the flowrates through each boiler are the same $F_1 = F_2 = 0.5$, hence $\theta_f = (0.5\theta_1 + 0.5\theta_2)$

Considering a 50kW part load (while maintaining a boiler flow temperature of 80 C) so boiler 1 would be on (at 25%) and boiler 2 off as boiler 1 is on, the 60 C entering water will leave at 80 C and boiler 2 is off, but still has water circulating through it, so the water will leave that boiler at 60 C. Provided that both boilers are in balance, the flowrate will split equally between each boiler and (on a first iteration) the combined flow temperature can be assessed as $\theta_f = (0.5 \times 80\ C + 0.5 \times 60\ C) = 70\ C$.

So, although the system is based on 80 C/60 C (that is, a 20K temperature differential) the system flow temperature is diluted to 70 C. Depending on the system side control, and accounting for it being a constant volume flowrate load, the return from the load could well be 50 C (or lower) that, although good for condensing operation, will act to further dilute (and reduce) the flow temperature, which then further reduces the return temperature, and so on. This will likely adversely impact the performance of the equipment supplying the load unless the load side has been adapted to work at a lower temperature. (A real application is likely to be rather more complex.) In an attempt to meet the required load flow temperature at part load, the boiler flow temperature could be increased to an extremely high 95 C (with a Δθ through boiler 1 of 35K). This would result in a combined flow temperature of $\theta_f = (0.5 \times 95\ C + 0.5 \times 60\ C) = 77.5\ C$.

This does not fix the issue, as this simplified example illustrates, since the boiler is only able to produce a blended temperature of 77.5 C. (This can become more of an issue when there are more boilers connecting into the primary system.)

An option to overcome this is to replace the main primary pump set with shunt pumps to each boiler, as shown in Figure 5. This will allow full load flow through either boiler so that there is no flow temperature dilution through a non firing boiler. The shunt pumps may be on/off controlled from the boiler; however, they can also be controlled by the building management system (BMS). Controlling the pump via the boiler has the advantage that it allows the boiler to control run on, enable, and disable all from a simple signal from the BMS to the boiler, so simplifying the installation and mitigating the requirement for any additional points to be added to the BMS panel.

Alternatively, two port valves can also be used with a common primary pump to isolate offline boilers. However, this would require the common shunt pump to be speed controlled via local pressure sensing or BMS intervention. The two port valve would also require control via the BMS, again adding some complexity to a potentially dated BMS panel.

An example of a more extensive solution, as illustrated in Figure 6, is to remove the reverse return arrangement and to hydronically decouple the primary and secondary circuits with a low loss header (which can also readily combine air and dirt separation). The individual boilers are free to control themselves (overseen by the building control system). As the return water temperature rises, the variable speed boiler pumps modulate down to reduce the burner firing load, so maintaining a constant temperature differential.

The major advantage of this modification is that it decouples the generation and distribution side of the plant in terms of pressure and flow influence. The boilers are free to circulate through the low loss header without a direct hydronic influence of the constant volume load side and so the boilers can run with varying volume flowrates

A vertical low loss header can be used to improve air and dirt removal. The addition of vacuum de gassers can also help remove excess air from the system, as this is a particular problem often seen in re filling existing systems, as fresh (aerated) water will increase corrosion of existing pipework.

Wherever possible, to provide the most effective operation of the replacement condensing boilers, the load side should be critically examined, and potentially modified, in an effort to reduce the required water temperatures to ensure the gas boiler operates in condensing mode.

With thanks to Ryan Kirkwood at Baxi Heating for the core information used in this CPD.

Turn to page 60 for Further reading and references. »

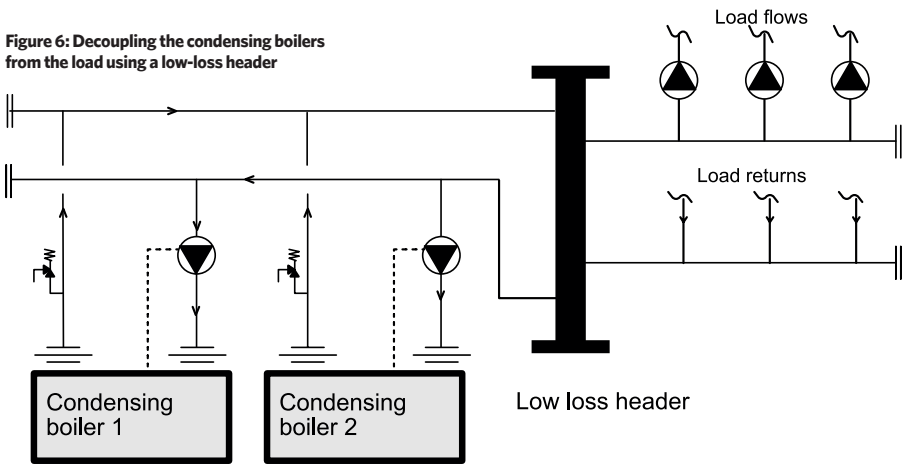


Figure 6: Decoupling the condensing boilers from the load using a low-loss header

Module 187

November 2021

1. In small and medium load installations with two boilers, what proportion of peak load were boilers often sized to cope with?

- ☐ A 50% each
- ☐ B 67% each
- ☐ C 75% each
- ☐ D 90% each
- ☐ E 100% each

2. What was the particular name given to the valves that were used to reduce the opportunity for condensation in non condensing boilers?

- ☐ A Three port control valve
- ☐ B Anti condensation valve
- ☐ C Back end protection valve
- ☐ D Bypass valve
- ☐ E Primary loop valve

3. What is the term used to describe the impact on flow water temperature of the mixing of cool water from a non firing boiler with that of a firing boiler?

- ☐ A Temperature attenuation
- ☐ B Temperature degradation
- ☐ C Temperature dilution
- ☐ D Temperature diminution
- ☐ E Temperature erosion

4. Which one of these was not cited as one of the benefits of controlling the pump via the boiler?

- ☐ A Allows the boiler to control disable
- ☐ B Allows the boiler to control enable
- ☐ C Allows the boiler to control run on
- ☐ D Mitigates the requirement for additional points to be added to the BMS panel
- ☐ E Provides enhanced monitoring capabilities for the boiler

5. What is noted as the major advantage of the application of the low loss header?

- ☐ A Can include air separation
- ☐ B Decouples the generation and distribution side of the plant
- ☐ C Enables the use of variable speed pumps
- ☐ D Integrates dirt separation
- ☐ E Provides a vacuum de gasser

Name (please print).....

Job title .....

Organisation.....

Address .....

.....

.....

Postcode .....

Email .....

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

The *CIBSE Journal* CPD Programme

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

I understand that I will receive marketing communications from Baxi Heating after completing this module (please tick here): ☐

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

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

Further reading:

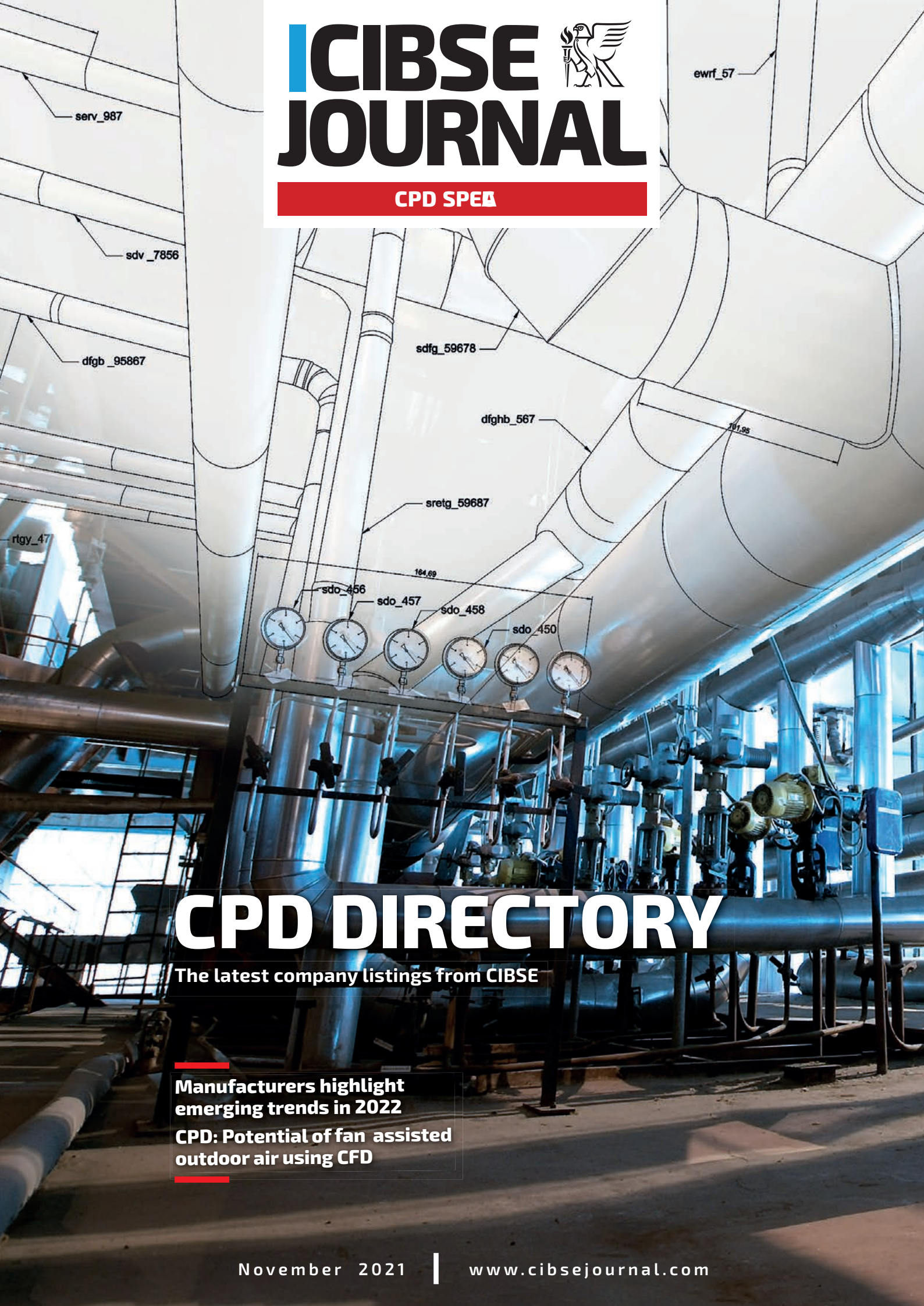
For a discussion of low loss headers see 'Separate ways' by David Palmer and Ryan Kirkwood in *CIBSE Journal* May 2021.
For a more comprehensive discussion of boilers and associated hydronics see CIBSE Guide B1 *Heating* 2016, particularly chapters 7 and 8.
To read about refurbishment needs and methods see CIBSE TM53 *Refurbishment of non domestic buildings*, 2013, particularly section 4.1.

References:

1 Collected private notes from field engineers – Baxi.

CIBSE JOURNAL

CPD SPECIAL



CPD DIRECTORY

The latest company listings from CIBSE

Manufacturers highlight emerging trends in 2022

CPD: Potential of fan assisted outdoor air using CFD

DOMUS VENTILATION

SOLUTION BASED VENTILATION PRODUCTS

Mechanical Ventilation with Heat Recovery (MVHR)

Mechanical Extract Ventilation (MEV)

Comprehensive range of high quality ducting

In-Line and Purge fans

From project concept through to completion, Domus Ventilation can guide you through the whole process

CPD CIBSE APPROVED

With the changes in building regulations, Domus Ventilation offers a **FREE CIBSE approved CPD** which runs through building regulations and how the new non-combustible air brick can integrate into your projects.

Dedicated to providing **efficient**, **quick** and **reliable** delivery

An assigned designer, **FREE drawings available** and ongoing technical support.

YOUR VENTILATION SPECIALIST

03443 715 523

www.domusventilation.co.uk

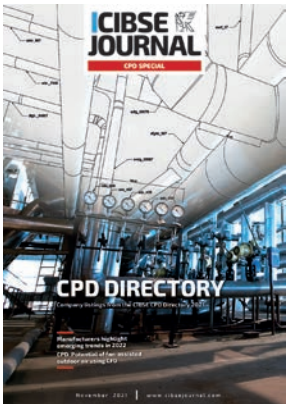
domusventilation_

Supplement
www.cibsejournal.com
#B ild2Perform

Editorial
Editor: Alex Smith
Tel: 01223 378034
Email: asmith@cibsejournal.com
Deputy editor: Liza Young
Tel: 01223 378048
Email: lyoung@cibsejournal.com
Technical editor: Tim Dwyer
Designer: James Baldwin

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

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



How CIBSE s new CPD portal will clearly reflect all activities

The CIBSE directory of CPD course providers continues to grow as companies recognise the value of our approval, says chair of the CPD panel **John Aston**. Each course is reviewed by a CPD panel of volunteers and must meet high standards in technical content and objectivity

Undertaking CPD is a fundamental part of being a professionally registered engineer. Members of CIBSE make a commitment to maintain their competence through CPD.

The 2021 Audit of Members' CPD Records has been carried out and feedback is being given to those whose records were selected this year. At present, the MyCIBSE CPD Portal does not accommodate reflections on the activities undertaken, which would benefit members as well as helping with the audit process. However, this is soon to change as CIBSE prepares to launch a new portal to enable reflective practice on all CPD activities taken. The ability to see how each member receives content of relevant activities gives us a better understanding of their intentions and how it matches any set objectives.

A CPD Record that includes reflection could be compared with a personal log book; a resource that can demonstrate the knowledge and experience gained by its owner. With each activity having an appropriate reflection, it is possible to see the value – or otherwise – of the time spent, and this will show more clearly the currency and quality of the individual's development in their role and their specific skills.

The use of reflection in CPD Records is likely to be encouraged by the current drive towards higher standards and competency in the engineering of buildings. We feel that a good CPD Record is part of this drive, and a practical way to demonstrate knowledge, experience, skills and many other aspects of competence of an individual to carry out specific tasks.

To assist our members, CIBSE offers a diverse range of opportunities to maintain CPD. Within this CPD Directory special, you'll find listings from some of the 250 companies listed in our directory of CPD course providers. This directory has been compiled to assist members in identifying suitable courses to suit their CPD needs. All courses are reviewed by CIBSE's CPD Panel to ensure that the technical content is of a high standard and offers valuable CPD to delegates.

A full list of companies in the directory can be found from page 72 in this edition and at www.cibse.org/directory

CONTENTS

For a list of all companies on the CIBSE CPD Directory, visit **www.cibse.org/cpddirectory**

***CIBSE Journal* has more than 80 CPD modules available to complete at www.cibsejournal.com Our website makes it easier than ever to continue your professional learning online.**

CIBSE CPD DIRECTORY

This directory lists all the accredited organisations providing modules on a range of areas, including: electrical, fire, lighting and sustainability

All the CPD courses in this directory have been approved by CIBSE. They are reviewed and assessed to ensure that the technical content is of a high standard and offers valuable CPD to delegates.

The directory of CPD course providers has been compiled to assist members of the Institution in identifying suitable courses in respect of their CPD needs.

The directory embraces many different areas suitable for CPD and will continue to be updated to incorporate new entries and revisions.

Members of CIBSE are required by the Code of Professional Conduct to maintain their professional competence, but this should also apply to any professional working in the industry.

The directory will help you find suitable CPD to assist with your ongoing career development.

For guidance on what constitutes as different CPD activities and how to go about recording your CPD, visit **www.cibse.org/cpd**

CIBSE's online portal, **http://cpd.cibse.org/**, allows you to record your CPD in one place and link your progress to set objectives.

ACV UK

Phone: 01383 820100
Email: uk.sales@acv.com
Web: acv.com/gb

ACV has been designing, developing, manufacturing and distributing heating and hot-water products for commercial and residential heating since 1922. It specialises in stainless steel products and is home of the patented tank-in-tank concept, which gives a safe, clean and reliable domestic hot water performance to match the largest of hot-water demands. The company's motto 'Excellence in hot water' is not only reflected in its product range, but also in its technical support.

While heating requirements have decreased over the years, the demands of modern life have increased the need for a reliable, but economical and environmentally friendly, hot-water supply.

ACV has been delivering CIBSE-accredited CPD seminars for many years, sharing its specialist hot-water knowledge. Its course – **Domestic hot water (DHW) sizing principles** – looks at the disparity that can be found between hot-water sizing guides, and is suitable for anyone involved in the management of hot water in commercial buildings, including consultants, contractors, public health engineers and specifiers.

Previous course attendees said: 'Thorough overview of industry standards'; and 'very informative and useful content. The calculations shown were very useful.'

AIC Heating UK

Phone: +44 0300 303 4169
Email: sales@myaic.co.uk
Web: myaic.co.uk

AIC Heating UK is a specialist in stainless steel. It offers a complete range of commercial heating and hot-water products up to 840kW output from a single boiler, which can be cascaded for higher-output projects.

AIC Heating UK also manufactures fully stainless steel hydraulic cascade systems up to 900kW to complement the Nesta Chrome wall-hung boiler.

All AIC Heating UK boilers are built around its self-designed and in-house manufactured stainless steel fire tube heat exchanger. This ensures high efficiency and reliability, achieving NOx class 6 and high modulation ratio.

AIC Heating UK offers a CIBSE-approved CPD on the benefits of stainless steel and Firetube heat exchanger technology. The CPD can be delivered in your offices or online.

Airedale International

Phone: 0113 2391000
Email: connect@airedale.com
Web: airedale.com

Airedale International, working with its sister company Barkell Air Handling Units, offers a choice of CIBSE-approved CPDs, covering a wide range of legislative, environmental and technological topics related to cooling, ventilation and general HVAC. It has significant experience of the data centre, healthcare, pharmaceutical and telecoms industries, and its courses are most suited to consultants and engineers in the HVAC industry, or those looking to join the industry who need more detailed insight into a particular subject.

Delivered by Airedale's experienced HVAC engineers, whose substantial history in the industry affords them a wealth of knowledge on its subject areas, the company can tailor courses to specific needs, and offer a mixture of practical and theoretical courses, subject to Covid-19 restrictions. Airedale also offers all of its courses remotely, allowing it to deliver training to a large team that may be based at different sites.

Below is a selection of its most popular approved courses, but you can contact Airedale to discuss your needs:

- **F-Gas**
- **MVHR units**
- **Eco design and Tier 2**
- **HTM 03-01 compliance in ventilation units**

Airedale's CPDs are free of charge and available at a time to suit you and your team.

Armstrong Fluid Technology

Phone: 08444 145145
Email: uksales@armstrongfluidtechnology.com
Web: armstrongfluidtechnology.com

Armstrong Fluid Technology is a leading global player in HVAC. It designs and manufactures innovative fluid flow equipment and high-efficiency energy solutions for a broad range and scale of applications, including district energy, data centres, fire systems, gas transmissions, high-rise, and mixed commercial buildings.

The company's solutions deliver optimum lifetime building performance combined with the lowest first cost and life cost. Armstrong is committed to helping building owners, consultants, specifiers and energy managers find low-cost solutions for reducing energy consumption and carbon emissions within their portfolios. Its expertise comes from an understanding of end-to-end fluid systems and the integration of fluid dynamics, heat transfer, variable speed and demand-based controls, which is the focus of its CIBSE-approved CPD programmes:

- **A whole-life sustainable approach to pump and equipment selection without compromising on redundancy**
- **Meeting the needs of the building life-cycle through innovative approaches to variable speed pumping in HVAC systems**

The company can provide free, one-hour 'lunch and learn' sessions at your offices or at any of its UK sites. New CPD modules are coming in 2022.

For a list of all companies on the CIBSE CPD Directory, visit **www.cibse.org/cpddirectory**

Arrow Valves

Phone: 01442 823123
Email: marketing@arrowvalves.co.uk
Web: arrowvalves.co.uk

Arrow Valves manufactures and distributes innovative water-associated products designed to conform to the requirements of the latest water regulations. All of its team are BPEC qualified in the water regulations, and its resident experts – Adrian Reeve and Richard Medlicott – have combined knowledge spanning more than 20 years in the industry.

During the free Arrow Academy training days, Arrow Valves delivers its two CPD-accredited **Water Regulations** and **Heating** seminars on rotation. In-house attendees also benefit from a factory tour and product demonstrations.

The seminars have been adapted for Zoom to keep everyone safe and comfortable during the pandemic. Alternatively, the seminars can be delivered free of charge from the comfort of your own offices.

Both seminars explore system design: the Water Regulations seminar covers interpretation and backflow prevention selection, while the Heating seminar covers hot-water efficiency and safety.

Baxi Heating

Phone: 0345 070 1055
Email:commercialmarketing@baxiheating.co.uk
Web: baxiheating.co.uk

Baxi Heating aims to be a sustainable business, committed to supporting the energy transition towards a zero carbon economy. It advocates a collaborative approach, focusing on high-efficiency domestic and commercial heating and hot-water solutions that meet its customers' needs.

The company offers a range of CIBSE-accredited CPD seminars to enable building services professionals to continue to develop their knowledge and gain invaluable CPD hours and points. Its seminars can be held on Microsoft Teams, at customer premises, or at one of Baxi Heating's offices.

The series includes:

- **Introducing bespoke prefabricated heating solutions**
- **Heat networks**
- **CHP commercial buildings – maximising CHP efficiency and savings**
- **Hot-water generation for commercial and industrial application**
- **Introducing the Heatrae Sadia installed drinking-water products**
- **Unvented hot-water systems**

Bosch Commercial & Industrial

Phone: 0330 123 3004
Email: Commercial.Industrial@uk.bosch.com
www.bosch-industrial.co.uk

Bosch Commercial & Industrial offers a complete range of energy-efficient heating, cooling and hot-water technologies suited to commercial buildings and large industrial projects. It is also one of the only manufacturers that can provide both plantroom and end-user technology in district heating projects.

The company offers a number of CIBSE-accredited CPD modules, with more in development:

- **District heat networks: design considerations & CP1 (2020)** – key elements of heat network system design.
- **Flue gas recirculation** – the principles of flue gas recirculation to lower NOx levels for >1MW plantrooms.
- **Heat interface units (HIUs): selection and best practice use in heat networks** – choosing and operating HIUs within a heat network system, plus BESA certification.

Other available CPDs include:

- **Hydrogen: the future of heating in a decarbonised gas grid** – learn how heat generation from hydrogen appliances can play a significant role in decarbonisation of future developments, including the background of the HY4Heat programme and innovations in domestic boiler hydrogen development.

For more information, visit **bosch-thermotechnology.com/gb/en/commercial-industrial/home**

Condair

Phone: +44 (0)1903 850200
Email: uk.sales@condair.com
Web: condair.co.uk/CPD

Manufacturer of commercial and industrial humidity control systems, Condair is offering a selection of three CIBSE-approved CPD training sessions – either face-to-face, in a client's office, or via an online presentation.

The three CPD seminars are:

- **Humidification and psychrometrics** – offering an overview of humidification, an explanation of psychrometric calculations, and detailed analysis of humidifier product selection, demonstrating the pros and cons of each technology.
- **Dehumidification and drying psychrometrics** – covering dehumidification processes and calculations using a psychrometric chart, an explanation of dehumidifier types and technologies, product selection and sizing information, and a comparison of different technologies.
- **Using humidifiers for evaporative cooling in AHUs** – learn the psychrometrics of evaporative cooling, the benefits and limitations of using evaporative cooling in AHUs, and the three main AHU evaporative cooling strategies. Also analyse the energy consumption figures behind three real-life case studies, and compare the different technologies available.

Delmatic

delmatic
the lighting management company

Phone: +44 (0)20 3184 2000
Email: cpd@delmatic.com
Web: delmatic.com

Delmatic is a supplier of advanced lighting-management systems. Its smart solutions mesh wireless and wired devices across physical or cloud networks, monitoring, analysing and optimising lighting and connected building services performance. Systems are designed to conserve energy, enhance sustainability, increase comfort, simplify installation, reduce capital and operational costs, and make advanced controls intuitive and accessible to all.

Delmatic offers a selection of CIBSE-approved CPD modules, ranging from an overview of lighting management to focus sessions that offer in-depth study of individual topics, technologies and their application. Topics include:

- **Overview of lighting management**
- **IOT, wired, wireless and mixed-mode solutions**
- **Open systems and interoperability – Lon, BACnet, DALI-2, MQTT**
- **DALI-2 technology, features and application**
- **DALI-2 application – Buswire, Broadcast, Plug-in and Wireless**
- **DALI-2 emergency light testing and monitoring**
- **System architecture and application**
- **Smart, integrated solutions**
- **Biodynamic tuneable-white control**
- **Graphical management and monitoring**
- **Heatmaps, spatial occupancy mapping and dashboards**

Domus Ventilation

DOMUS VENTILATION

Phone: 03443 715523
Email: megan.bennett@domusventilation.co.uk
Web: domusventilation.co.uk

Established more than 30 years ago, Domus Ventilation manufactures high-quality and solution-based ventilation products for the domestic and light commercial building industry.

At the heart of the company's product range are high-performance mechanical ventilation systems, including HRXE-HERA and HRXE-AURA mechanical ventilation with heat recovery (MVHR) and the energy efficient CMX mechanical extract ventilation (MEV) units, which boast the best specific fan power on the market.

Domus Ventilation is also renowned for its award-winning ducting systems, which offer improved system performance through their exacting tolerances and engineered fit, which minimise pressure drops and virtually eliminate air leakage.

The company's reputation for quality product is further enhanced by excellent technical support from a dedicated, in-house team offering a range of services – from duct take-offs and estimations, to Revit MVHR and MEV system drawings – all free of charge.

Domus Ventilation also provides a detailed Specification Guide and offers several CIBSE-accredited CPD courses, including **Residential ventilation principles and building regulations**.

Elco Heating Solutions

elco heating solutions

Phone: 0345 646 0442
Email: enquiries@elco.co.uk
Web: elco.co.uk

Elco Heating Solutions is a global manufacturer of commercial heating and hot-water systems, including boilers, water heaters, heat pumps, network interface units and ancillaries. From schools and offices to hospitals, sports facilities and residential apartments, Elco has a comprehensive range of products to deliver highly efficient and sustainable systems.

Elco is committed to career development and education, and offers a range of CIBSE-accredited CPD courses to highlight the possibilities of system design across a variety of heating technologies.

This includes topics such as:

- **Maximising the effectiveness of CHP installations**
- **Best use of modern condensing boilers**
- **Introduction to and application of heat pumps**

CPD seminars can be held online or at a company's premises and are suitable for professionals from graduate to senior level, with either mechanical or electrical backgrounds.

Flakt Group

FläktGroup

Phone: 0845 608 4449
Email: Appliedsystems.uk@flaktgroup.com
Web: www.flaktgroup.com/uk

FläktGroup is a supplier of smart and energy efficient indoor air and critical air solutions to support every application area.

The company offers a range of solutions including chillers, air Handling units, IT cooling, data centre cooling, heat recovery units, residential ventilation, car park fans, smoke shaft, axial fans, box fans all underpinned by our 130 people-strong site services team. There are 12 centres of factory excellence across the globe.

FläktGroup UK provides CPDs on:

- **ERP-compliant and energy-efficient AHUs**
- **Close control systems**
- **Data centre cooling**
- **Office cool underfloor air conditioning**
- **Smoke, fire and ventilation**
- **Car park fans**
- **How to prevent recirculation in AHUs with thermal wheels – Covid-19 advice**

For a list of all companies on the CIBSE CPD Directory, visit **www.cibse.org/cpddirectory**

Fujitsu

Phone: 02087313450
Email:sales@fgac.fujitsu-general.com
Web: fujitsu-general.com

Fujitsu is a global leader in design and technology. It manufactures a broad and innovative range of heating, ventilation, air conditioning, close control and chiller systems for residential and commercial environments.
Multi-split systems – Fujitsu has continued to build on its line-up, with 2, 3, 4 and 5-unit R32 multi-split systems, allowing control of several indoor units with one outdoor, and offering a large selection of indoor finishes.
Fourth-generation VRF – applications for its VRF systems include high-end residential, light commercial and larger commercial, ranging from small offices and schools to hotels. Fujitsu's VRF systems are versatile and reliable, and recent installations include the Hoover Building in West London and HMS Belfast on the river Thames.
Applied Products – the company offers cooling systems for technical applications such as server rooms and telecommunication plants. It provides energy efficient inverter-controlled DX and chilled water close-control units, with dual fluid and dual circuit options, along with free cooling. It also has a range of air handling units and air-to-water systems that are highly dependable for sustainable solutions.

Using the internet of things, Fujitsu provides services that allow users to control their air conditioning systems from their smartphones.

Hamworthy Heating

Phone: 01202 662500
Email: enquiries@hamworthy-heating.com
Web: hamworthy-heating.com/CPD

Hamworthy Heating is a British manufacturer, supplying energy-efficient commercial heating, hot-water and renewable solutions to commercial buildings of all shapes and sizes across the UK.

Since introducing the concept of modular boilers in the 1960s, the company has been at the forefront of the commercial heating market. It is committed to sharing its industry knowledge and best practice, and all of its presenters have years of experience in the HVAC industry, with relevant professional qualifications.

Hamworthy offers the following CIBSE-accredited CPD courses:

- **Controls – unwiring the jargon** (new for 2021)
- **New boilers on old systems – hydraulic separation**
- **Best practice heating and hot-water plant refurbishment**
- **Domestic hot water (DHW) best practice** (3 modules)

Previous course attendees said: 'A lot of data and information covered in a short space of time ,which was executed very well by the speaker'; and 'very good; one of the best sessions I have been to. It was very appropriate subject content indeed. A highly intuitive lecture, well done.'

Ideal Heating

Phone: Richard Brown, head of specification sales, 07718 192161
Email: richard.brown@idealheating.com

Ideal Heating offers a range of accredited CPD sessions, covering topics such as best practice when conducting plantroom surveys to the choices available when selecting the most suitable heat exchanger for a project.

The **Plantroom Survey CPD** gives an introduction to the various stages involved in surveying a plantroom, with particular focus on surveys for retrofit boiler installations. This includes access, risk assessments and pre-survey checks, and brief information on the best practice of commissioning.

This seminar is designed for mechanical and electrical engineers, building services engineers, building contractors and consultants.

The **Commercial Boiler Heat Exchanger Material CPD** looks at: the history of boiler heat exchanger materials; why choosing the correct heat exchanger material is important; the performance and characteristics of aluminium and stainless-steel heat exchangers; and the importance of water treatment, system protection and proper commissioning.

This seminar is designed for mechanical and electrical engineers, building services engineers, building contractors and consultants.

Kohler Uninterruptible Power

Phone: 01256 386700
Email: uksales.ups@kohler.com
Web: kohler-ups.co.uk

Kohler Uninterruptible Power (KUP) has extensive knowledge and experience of designing, specifying, configuring, installing, commissioning and servicing power protection solutions across a wide range of applications. It offers a number of free 'lunch and learn' technical seminars – aimed at consultants and electrical engineers – that can be held at a client's site or virtually. KUP also runs full-day UPS Training Academy courses across the UK, which are free to attend and CPD-certified. These are suitable for graduate engineers and those looking to refresh their knowledge of UPS. The courses are designed to improve understanding of the most recent power protection specification and selection requirements, and the latest technology available, while also offering invaluable CPD hours and points. Available lunchtime CPD modules include:

- **Designing resilient UPS systems**
- **True N+1 with DPA UPS systems**
- **Configuring a UPS battery system for resilience**
- **Configuring a UPS system – checklist**
- **UPS – fault clearance and neutral earthing**
- **How does a UPS react to a downstream fault**
- **Fault clearance with and without a static bypass**
- **Four-pole changeover**
- **Earth leakage and UPS monitoring**

Lochinvar

Phone: 01295 269981
Email: info@lochinvar.ltd.uk
Web: lochinvar.ltd.uk

Lochinvar manufactures and distributes a wide range of equipment for commercial and industrial heating and hot-water applications. The current product range includes heat pumps, solar thermal systems, gas-fired water heaters and boilers as well as associated ancillaries.

Lochinvar has provided CIBSE-accredited CPD seminars for many years, and its aim is to maximise the value to its audience by frequently reviewing and acting upon attendee feedback.

While face-to-face sessions have been limited because of Covid-19, Lochinvar has been delivering live, online, CIBSE-accredited CPD webinars regularly.

Current sessions include:

- **Heat pumps for commercial heating and hot-water applications**
- **Sizing and selection of direct gas-fired water heaters**

Lochinvar is working on new CIBSE-accredited CPD content to offer insight into the latest industry trends and technologies. Keep an eye on the training section of its website to sign up for existing sessions and be the first to know about new content. Visit **lochinvar.ltd.uk/training/cpd-seminars**

Munters

Phone: 01480 432243
Email: info@munters.co.uk
Web: munters.co.uk/ukseminars

Munters' CIBSE-approved CPD seminar gives a comprehensive introduction to humidity theory and dehumidification. Learn about the impact of moisture, combating seasonal fluctuations and how to achieve the most cost-effective and energy-efficient climate solution for you or your customer. The seminar lasts approximately one hour and covers:

- **Dehumidification theory**
- **Methods of dehumidification and its benefits**
- **Introduction to the psychrometric chart**
- **Calculating moisture loads**
- **Energy-saving technology and applications**
- **Dehumidification in industry – case study examples**

Suitable for consultants, architects, specifiers, installers and industry professionals, delegates can choose to hold this seminar in person at their own office or Munters' UK office in Wyboston, or online via Microsoft Teams.
If delivered in person during a lunchtime, Munters can provide a free lunch (subject to conditions; ask for details).

Paroc

Phone: John Watt, national HVAC sales manager, +44(0)7488 305 118
Email: john.watt@owenscorning.com
Web: paroc.co.uk

As part of its increasing presence in the UK and desire to engage further with the specification community, Paroc is offering three approved CPD presentations that can be held at your offices or via Skype or Microsoft Teams:

- **HVAC services pipework insulation –** aims to give delegates increased knowledge and confidence in asking the correct questions when choosing appropriate insulation to suit a project's needs. Topics include: standards and quality; Breeam; fire; corrosion; legionella; and calculating thicknesses.
- **Pipe insulation thicknesses –** aims to enable the delegate to authoritatively calculate HVAC services insulation thicknesses, based on the relevant standards. It also gives guidance on how to deal with bespoke situations. Topics include: standards; thermal conductivity; interpreting BS5422; manufacturers' tables; calculating bespoke thicknesses; and custom insulation products entry.
- **HVAC duct insulation: thermal, acoustic and fire –** a guide to ductwork insulation topics such as applicable British standards, thermal conductivity, fire issues and acoustic issues. Topics include: introduction to ductwork insulation; thermal and condensation insulation; deriving thermal insulation thicknesses; acoustic insulation, sound absorption and reduction; and fire insulation, materials and construction ratings.

Saint-Gobain Insulation UK

Phone: 01473 822093
Email: InsulationUK.MarketingTeam@saint-gobain.com
Web: insulation-uk.com/CPD

Saint-Gobain Insulation UK is delighted to introduce Isover's CIBSE-approved CPD module: **Specification and optimisation of thermal insulation for building services**.

This CPD gives an overview of the range of HVAC applications and the drivers for insulation specification. It also offers guidance on optimising the specification, an understanding of the variability of thermal performance according to temperature ranges, and best practice installation of HVAC insulation.

Insulation products for HVAC ensure that systems function as designed, delivering the medium at the correct temperature at the required destination, limiting unwanted heat losses and gains from building services, and preventing the formation of condensation and removing the potential for long-term detrimental impacts such as corrosion and mould growth.

Saint-Gobain Insulation UK can deliver this CPD in person or digitally. If you register your interest at **insulation-uk.com/CPD**, a member of its team will contact you to arrange a time and date to deliver the training.

For a list of all companies on the CIBSE CPD Directory, visit **www.cibse.org/cpddirectory**

Socomec

Phone: 0333 015 3002
Email: info.uk@socomec.com
Web: socomec.co.uk

Regardless of industry or sector, everyone is now required to undertake CPD. The updating of skills and knowledge is vital for keeping abreast of industry changes, maintaining professional competence, and ensuring that qualifications do not become obsolete.

Socomec offers 10 comprehensive professional development seminars delivered by highly experienced critical-system application engineers. Hosted online via Microsoft Teams or at your offices for between four and 40 participants, the seminar takes about one hour, and delegates will receive an individual presentation pack and a certificate on completion.

Sontay

Phone: (0)1732 861200
Email: enquiries@sontay-academy.com
Web: sontay-academy.co.uk

Sontay is proving its commitment to training and development in the building controls industry by offering a comprehensive range of accredited courses through the Sontay Academy.

Established in 2014 and a finalist in the Contribution to Training Award category at the 2021 Building Controls Industry Association (BCIA) Awards, the Sontay Academy offers a range of courses for the HVAC and climate control industry. The Sontay Academy aims to improve understanding on the application of sensing and control products for optimum energy saving and control, as well as occupancy comfort.

The Sontay Academy's CPD courses are accredited by CIBSE and Engineers Ireland and it is an official training partner of the BCIA and its industry renowned BCM01-06 courses.

Most courses are held at the Sontay Academy's purpose-built training facility in Edenbridge, Kent or online but tailormade courses for individuals and companies are also available and can be set up through local account managers.

Spirax Sarco

Email: Daniel Wells, national consultant specialist, UK.Enquiries@uk.spiraxsarco.com
Web: spiraxsarco.com/uk

Spirax Sarco offers a range of CIBSE-approved CPD sessions covering aspects of the steam and condensate loop. The following CPDs are now available virtually – contact the company to discuss requirements:

- **Steam fundamentals** – a broad, basic, entry-level presentation giving an introduction to, and overview of, the physical properties of steam, why it is widely used as a heat-transfer medium, and typical applications.
- **Basic design considerations** – design of systems, good working practice, and differences from other media.
- **Steam and heat exchange** – the benefits of using steam for heat-exchange applications, how fully packaged instantaneous plate heat exchanger systems operate, and their benefits.
- **Steam trapping** – the importance of trapping steam, steam trap types and operating principles.
- **Condensate management** – sizing, layout of condensate lines; design considerations; condensate pumping.
- **Steam quality** – different steam conditions and typical applications; feedwater and its impact on steam quality; steam quality and steam purity; design considerations.
- **Energy and steam** – energy content of steam; using steam efficiently for heat transfer; heat-transfer calculations; energy and control comparisons.

Swegon

Phone: (0) 800 093 7929
Email: sales.uk@swegon.com
Web: www.swegon.com/UK

At Swegon, we are passionate about helping you create the best indoor environments and we love sharing ideas, knowledge and experience. So, we have created a collection of CPD seminars to help you create an efficient, safe and flexible indoor climate.

To create maximum comfort at minimum expense is not about choosing the right product. Success requires deep knowledge and a good understanding of how different components and systems must interact to create a good indoor climate. Through our training, you can learn how to approach, plan, build and create the ideal indoor climate.

Attending one of Swegon's free seminars contributes towards your CIBSE CPD requirements. To find out more about Swegon's accredited CPD modules, visit **swegon.com/uk/support/training-cpd**

Systemair

■ **Phone: +44 7475 886642**
Email: david.mcdermott@systemair.co.uk

- **Energy-efficient ventilation** – ventilation running cost and carbon footprint savings using demand-control EC motor technology and energy-recovery components.
- **Low energy air conditioning with indirect adiabatic cooling** – alternative methods of air conditioning that can reduce or eliminate the use of refrigeration-based cooling.
- **Residential ventilation and MVHR** – introduction to different types of residential ventilation systems and how they are designed and integrated into a building.
- **Swimming pool ventilation and heat recovery** – technical seminar suitable for mechanical and electrical services engineers designing swimming pool hall ventilation systems or carrying out energy surveys on swimming pools.
- **Data centre cooling** – direct and indirect free cooling and its benefits.
- **Passivhaus ventilation systems** – design and comparison of ventilation systems for Passivhaus buildings.

Toshiba Carrier

■ **Phone: Paul Smith, TCUK Applied sales director, 07773 642263**
Email: Paul.smith@carrier.com
Web: carrier.com/commercial/en/uk/

Toshiba Carrier UK (TCUK) offers three brands providing one total HVAC solution. Toshiba offers direct expansion (DX) air conditioning systems, with a high level of technical features and efficiency across its range of variable rate flow (VRF), split and multi-split systems. Carrier is primarily known for its leadership in chillers and hydronic solutions, and its award-winning technology.

CIAT UK completes the line-up with a comprehensive range of airside systems and airside solutions, with the firm aiming to deliver quality and reliability at a competitive price point.

TCUK offers a complete range of HVAC products, all backed by technical support and underpinned, TCUK says, by the company's core values: customer service, quality and environmental awareness.

Tapping into the knowledge and expertise of these three brands, TCUK is able to offer an extensive range of CPDs covering legislation; application and design; and new technologies and innovations. These courses are delivered by a team of HVAC industry trained sales engineers that provide a professional approach and vast industry knowledge to back up the course material.

CPD PROVIDERS

For a list of all companies on the CIBSE CPD Directory, visit www.cibse.org/cpddirectory

Name: **299 Lighting**
Web: **www.299lighting.co.uk**

Name: **2G Energy**
Web: **www.2-g.co.uk**

Name: **A O Smith Water Heaters, part of Adveco**
Web: **www.aosmithinternational.com**

Name: **A1Flue Systems**
Web: **www.a1flues.co.uk**

Name: **ABB Group**
Web: **www.abb.com**

Name: **Acrefine Engineering Services**
Web: **www.acrefine.com**

Name: **ACV UK**
Web: **www.acv.com**

Name: **ADEY**
Web: **www.adey.com**

Name: **Advanced Air UK**
Web: **www.advancedair.co.uk**

Name: **Advanced Smoke Group**
Web: **www.advancedsmoke.co.uk**

Name: **Adveco**
Web: **www.adveco.co**

Name: **Aermec UK**
Web: **www.aermec.co.uk**

Name: **Aic Heating**
Web: **www.myaic.co.uk**

Name: **Airedale International Air Conditioning**
Web: **www.airedale.com**

Name: **Airsys UK**
Web: **www.air-sys.uk**

Name: **Alfa Laval**
Web: **www.alfalaval.co.uk**

Name: **Altecnic**
Web:**www.altecnic.co.uk**

Name: **AMG Systems**
Web: **www.amgsystems.com**

Name: **Andel**
Web: **www.andel.co.uk**

Name: **Anolis Lighting**
Web: www.anolis.eu/home

Name: **Applied UK**
Web: **www.applieduk.net**

Name: **Aqualeak Detection**
Web: **www.aqualeak.com**

Name: **Aquip**
Web: **www.aquip.com.au**

Name: **Armacell UK**
Web: **www.armacell.co.uk**

Name: **Armstrong Integrated**
Web: **www.armstrongfluidtechnology.com**

Name: **Arrow Valves**
Web: **www.arrowvalves.co.uk/**

Name: **Aurora Lighting Group**
Web: **www.auroralighting.com**

Name: **BACnet Interest Group Europe**
Web: **www.big-eu.org**

Name: **Andrews Water Heating (Baxi Heating)**
Web: **www.baxiheating.co.uk**

Name: **Aquabion UK**
Web: **www.aquabion-uk.com**

Name: **Beckhoff Automation**
Web: **beckhoff.co.uk/building**

Name: **BEG (UK)**
Web: **www.beg-luxomat.com/en**

Name: **Belimo Automation UK**
Web: **www.belimo.co.uk**

Name: **Biddle Air Systems**
Web: **www.biddle-air.co.uk**

Name: **Bold Communications**
Web: **www.boldcommunications.co.uk**

Name: **Bosch Commercial and Industrial Heating**
Web: **www.bosch-industrial.co.uk**

Name: **Breathing Buildings**
Web: **www.breathingbuildings.com**

Name: **Brightwater Environmental**
Web: **www.bwater.eu**

Name: **Bronz-Glow UK**
Web: **www.bronz-glow.co.uk**

Name: **Building Controls Industry Association**
Web: **www.bcia.co.uk**

Name: **Business Sprinkler Alliance**
Web: **www.business-sprinkler-alliance.org**

Name: **Caice Acoustic Air Movement**
Web: **www.caice.co.uk**

Name: **Calor Gas**
Web: **www.calor.co.uk**

Name: **Calor Gas NI**
Web: **www.calorgas.ie**

Name: **Camfil**
Web: **www.camfil.co.uk**

Name: **Carel UK**
Web: **www.careluk.com**

Name: **Carrier Fire & Safety**
Web: **www.auroralighting.com**

Name: **Cassian Compliance**
Web: **ie.firesecurityproducts.com**

Name: **Cetetherm**
Web: **www.cetetherm.com/uk**

Name: **Colt International**
Web: **www.coltinfo.co.uk**

Name: **Commercial Hot Water Solutions**
Web: **www.chwsltd.co.uk**

Name: **Complete Ventilation Solutions**
Web: **www.completeventsolutions.co.uk**

Name: **Condair**
Web: **www.condair.co.uk**

Name: **Conex Bänninger**
Web: **www.conexbanninger.com**

Name: **Cool Designs**
Web: **www.cdlweb.info**

Name: **Cori-Seal Systems**
Web: **www.cori-seal.co.uk**

Name: **Corsair Engineeringd**
Web: **www.corsairengineering.co.uk**

Name: **CPA Engineering Solutions**
Web: **www.cpa-group.com**

Name: **CPV**
Web: **www.cpv.co.uk**

Name: **Crane Building Services & Utilities**
Web: **www.cranebsu.com**

Name: **D C Professional Development**
Web: **www.cranebsu.com**

Name: **Daikin UK**
Web: **www.daikin.co.uk/cpd**

Name: **Dehn UK**
Web: **www.dehn.co.uk**

Name: **Deif**
Web: **www.deif.com**

Name: **Delmatic Lighting Management**
Web: **www.delmatic.com**

Name: **Designplan Lighting**
Web: **www.designplan.co.uk**

Name: **Destraitair**
Web: **www.destratair.co.uk**

Name: **Dextra Group**
Web: **http://dextragroup.co.uk/**

Name: **Diamond Systems**
Web: **www.diamondsystems.co.uk**

Name: **Diffusion Group**
Web: **www.diffusion-group.com**

Name: **DMS Metering Solutions**
Web: **www.dmsltd.com**

Name: **Domus Ventilation Systems**
Web: **www.domusventilation.co.uk**

Name: **Dosafil**
Web: **www.dosafil.co.uk**

Name: **Durapipe UK**
Web: **www.durapipe.co.uk**

Name: **Dutypoint**
Web: **www.dutypoint.com**

Name: **Eastman**
Web: **www.eastman.com**

Name: **Ebm-papst UK**
Web: **www.ebmpapst.com**

Name: **ECE**
Web: **www.eceuk.com**

Name: **Elco UK/Atag**
Web: **www.elco.co.uk**

Name: **Elta Group**
Web: **eltagroup.co.uk**

Name: **EnOcean Alliance**
Web: **www.enocean-alliance.org**

Name: **Environmental Site Supplies**
Web: **www.esaircon.com**

Name: **EnviroVent**
Web: **www.envirovent.com**

Name: **Excel Networking Solutions**
Web: **www.excel-networking.com**

Name: **eyrise**
Web: **www.eyrise.com**

Name: **Fagerhult Lighting**
Web: **www.fagerhult.com**

Name: **Fire Design Solutions**
Web: **www.firedesignsolutions.com**

Name: **Fire Safety Training Group**
Web: **www.fstg.org.uk**

Name: **Firemac**
Web: **www.firemac.com**

Name: **FIRESAFE Fire Rated Ductwork**
Web: **www.firesafeductwork.co.uk**

Name: **Flakt Group UK**
Web: **www.flaktgroup.com/uk**

Name: **Flexej**
Web: **www.flexej.co.uk/expansion-joints**

Name: **Fratelli Pettinaroli**
Web: **www.pettinaroli.com**

Name: **Frenger Systems**
Web: **www.frenger.co.uk**

Name: **Fujitsu General (UK) Co**
Web: **www.fujitsu-general.com/uk**

Name: **Fulton Boiler Works**
Web: **www.fulton.co.uk**

Name: **Future Designs**
Web: **www.futuredesigns.co.uk**

Name: **Geberit Sales**
Web: **www.geberit.co.uk/services/training/cpd-training.html**

Name: **General Environmental Services (GES Water)**
Web: **www.ges-water.co.uk**

Name: **George Fischer Sales**
Web: **www.georgfischer.com**

Name: **Geo-Zero, part of the Excool Group (Ecoairbox)**
Web: **www.geo-zero.com**

Name: **Giacomini UK**
Web: **www.giacomini.co.uk**

Name: **Glamox Luxonic Lighting**
Web: **www.glamoxluxonic.co.uk**

Name: **Glen Dimplex Heating and Ventilation**
Web: **www.gdhv.co.uk**

Name: **Global Water Solutions**
Web: **www.globalwatersolutions.com**

Name: **Global Associates**
Web: **www.global-associates.co.uk**

Name: **Gripple**
Web: **www.gripple.com**

Name: **H. Guntner UK**
Web: **www.guntner.co.uk**

Name: **Halton Products**
Web: **www.halton.com**

Name: **Hamworthy Heating**
Web: **www.hamworthy-heating.com**

Name: **Heating Appliances & Spares**
Web: **www.hasl.co.uk**

Name: **Herz Valves UK**
Web: **www.herzvalves.com**

Name: **Honeywell Gent**
Web: **www.gent.co.uk/education/CPDs**

Name: **Humidity Matters**
Web: **www.humiditymatters.co.uk**

Name: **Hydrotec (UK)**
Web: **www.hydrotec.co.uk**

Name: **Hysopt**
Web: **www.hysopt.com**

Name: **Ian A Kernohan (N.I.)**
Web: **www.iakonline.com**

Name: **Ideal Commercial Boilers**
Web: **idealcommercialboilers.com**

Name: **IMI Hydronic Engineering**
Web: **www.tahydronics.co.uk**

Name: **IPU Group**
Web: **www.ipu.co.uk**

Name: **IPS Flow Systems**
Web: **www.ipsflowsystems.com**

»

CPD PROVIDERS

For a list of all companies on the CIBSE CPD Directory, visit www.cibse.org/cpddirectory

» Name: **IV Produkt**
Web: **www.ivprodukt.com**

Name: **Jaga Heating Products UK**
Web: **www.jaga.co.uk**

Name: **Jeremias UK**
Web: **www.jeremias.uk**

Name: **Kampmann**
Web: **www.Kampmann.co.uk**

Name: **KingspanWater and Energy**
Web: **www.kingspanwaterandenergy.com**

Name: **Kingspan Technical Insulation**
Web: **www.kingspantechnicalinsulation.co.uk**

Name: **KNX UK**
Web: **www.knxuk.org**

Name: **Kohler – SDMO**
Web: **www.kohler-sdmo.com/EN**

Name: **Kohler Uninterruptible Power**
Web: **www.kohler-ups.co.uk**

Name: **KSB**
Web: **www.ksb.co.uk**

Name: **Lifescience Products**
Web: **www.lifescience.co.uk**

Name: **Lindab**
Web: **www.lindab.co.uk**

Name: **Lochinvar**
Web: **www.lochinvar.ltd.uk**

Name: **Logstor UK**
Web: **www.logstor.com**

Name: **Mansfield Pollard & Co**
Web: **www.mansfieldpollard.co.uk**

Name: **Marley Plumbing and Drainage**
Web: **www.marleypd.co.uk**

Name: **Merck Life Science UK**
Web: **www.merckgroup.com**

Name: **MHI Specifications (3D Plus)**
Web: **www.mhispec.co.uk**

Name: **Mixergy**
Web: **www.mixergy.co.uk**

Name: **Mobotix**
Web: **www.mobotix.com**

Name: **Monodraught**
Web: **www.monodraught.com**

Name: **Munters**
Web: **www.munters.co.uk**

Name: **Narec Distributed Energy**
Web: **www.narecde.co.uk**

Name: **Nuaire/Nuaire Group**
Web: **www.nuaire.co.uk**

Name: **nVent Raychem**
Web: **www.raychem@nvent.com**

Name: **Operational Intelligence**
Web: **www.dc-oi.com**

Name: **Ormandy Rycroft Engineering**
Web: **www.ormandygroup.com**

Name: **Otter Vacuum Systems**
Web: **www.ottervacuum.co.uk**

Name: **Oventrop UK**
Web: **www.oventrop.co.uk**

Name: **Parker Hannifin**
Web: **www.parkertransair.com/Transair**

Name: **Parking Ventilation Equipment**
Web: **www.pveuk.com**

Name: **Paroc UK**
Web: **www.paroc.com**

Name: **Paragon Building Consultancy**
Web: **www.paragonbc.co.uk**

Name: **Pegler Yorkshire Group**
Web: **www.pegleryorkshire.co.uk**

Name: **Philip Payne**
Web: **www.philippayne.co.uk**

Name: **Piller UK**
Web: **www.piller.com**

Name: **Plasma Clean**
Web: **www.plasma-clean.com**

Name: **Potter Signal**
Web: **www.pottersignal.com**

Name: **Powermaster**
Web: **www.powermaster-ltd.co.uk**

Name: **Powerpipe Systems**
Web: **www.powerpipeuk.co.uk**

Name: **Prihoda UK**
Web: **www.prihoda.co.uk**

Name: **Priva UK (Building Intelligence)**
Web: **www.priva.com/uk**

Name: **Prolojikd**
Web: **www.prolojik.com**

Name: **Purmo Group (UK)**
Web: **www.purmogroup.com**

Name: **Recotherm**
Web: **www.recotherm.co.uk**

Name: **Rehau**
Web: **www.rehau.com/uk-en/discover-knowledge**

Name: **Reliance Worldwide Corporation**
Web: **www.rwc.co.uk**

Name: **Renson Fabrications**
Web: **www.renson.eu/en-gb**

Name: **Riello**
Web: **www.rielloburners.co.uk**

Name: **Rinnai UK**
Web: **www.rinnaiuk.com**

Name: **Rittal**
Web: **www.rittal.co.uk**

Name: **Robus Lighting (LED Group**
Web: **robus.com**

Name: **Rolls-Royce Solutions UK**
Web: **www.mtu-solutions.com**

Name: **Rochester Midland Corporation**
Web: **www.rmcorpltd.co.uk**

Name: **RP Technik**
Web: **www.rp-group.com**

Name: **S&S Northern**
Web: **www.snsnorthern.com**

Name: **Safegard Systems**
Web: **www.safegard.ie**

Name: **Sager AG**
Web: **www.sager-technical-insulation.co.uk**

Name: **Saint-Gobain Pam**
Web: **www.pamdrainage.co.uk**

Name: **Saint-Gobain Insulation UK**
Web: **www.insulation-uk.com**

Name: **Sauter Automationd**
Web: **www.sauterautomation.co.uk**

Name: **SAV Systems**
Web: **www.sav-systems.com**

Name: **Schako**
Web: **www.schako.co.uk**

Name: **School of Architecture, Building & Civil Engineering, Loughborough University**
Web: **www.bispa.org**

Name: **Securiton**
Web: **www.securiton.com**

Name: **Secure Meters**
Web: **www.securemeters.com**

Name: **Seeley International**
Web: **www.seeleyinternational.com**

Name: **Sensing Precision**
Web: **www.sensing-precision.com**

Name: **Sentinel Performance Solutions**
Web: **www.sentinelprotects.com**

Name: **Shenton Group (Global)**
Web: **www.shentongroup.co.uk**

Name:**Siemens Building Technologies (Holdings)**
Web: **www.siemens.co.uk/buildingtechnologies**

Name: **Signify**
Web:**www.signify.com**

Name: **Smoke Control Association FETA**
Web: **www.smokecontrol.org.uk**

Name: **Socomec Innovative Power Soloutions**
Web: **www.socomec.com**

Name: **Socotec (previously ESG)**
Web: **www.socotec.co.uk**

Name: **Solray**
Web: **www.solray.co.uk**

Name: **SolarEdge Critical Power UK**
Web: **criticalpower.solaredge.com**

Name: **Sontay**
Web: **www.sontay.com**

Name: **SPC (S & P Coiled Products)**
Web: **www.spc-hvac.co.uk**

Name: **Spirax-Sarco Engineering**
Web: **www.spiraxsarco.com/uk**

Name: **Star Refrigeration**
Web: **www.star-ref.co.uk**

Name: **Stelrad**
Web: **www.stelrad.com**

Name: **Stoane Lighting**
Web: **stoanelighting.com**

Name: **Stokvis Energy Systems**
Web: **www.stokvisboilers.com**

Name: **Strategic Media Asia**
Web: **www.stmedia-asia.com**

Name: **Strebel**
Web: **www.strebel.co.uk**

Name: **Stuart Turner**
Web: **www.stuart-turner.co.uk**

Name: **Stulz UK**
Web: **www.stulz.co.uk**

Name: **Swegon**
Web: **www.swegon.com**

Name: **SWEP International**
Web: **www.swep.net**

Name: **Systemair (Frico)**
Web: **www.systemair.co.uk**

Name: **Tamlite Lighting**
Web: **www.tamlite.co.uk**

Name: **TEV**
Web: **www.tevlimited.com**

Name: **Thorlux (Lighting)**
Web: **www.thorlux.com**

Name: **Titon**
Web: **www.titon.com**

Name: **Toshiba Carrier UK**
Web: **www.carrieraircon.co.uk**

Name: **Trent Control Panels**
Web: **www. trentproducts.com**

Name: **Tridonic UK**
Web: **www.tridonic.com**

Name: **Trox UK**
Web: **www.troxuk.co.uk**

Name: **Uponor UK**
Web: **www.uponor.com**

Name: **Vaillant Group**
Web: **www.vaillant.co.uk**

Name: **Vectaire**
Web: **www.vectaire.co.uk**

Name: **Vector Air & Water**
Web: **www.vector-airandwater.co.uk**

Name: **Verano Global s.p. z.o.o**
Web: **www.veranoconvector.co.uk**

Name: **Vertiv (previously Emerson Network Power)**
Web: **www.vertivco.com/en-emea**

Name: **Vexo International (UK)**
Web: **www.vexoint.com**

Name: **Victaulic**
Web: **www.victaulic.com**

Name: **Viega**
Web: **www. viega.co.uk**

Name: **Viking UK & I**
Web: **www.viking-emea.com**

Name: **Vilicom**
Web: **www.vilicom.com**

Name: **Vimar**
Web: **www.vimar.com**

Name: **Vortice**
Web: **www.vortice.ltd.uk**

Name: **Warm Up**
Web: **www.warmup.co.uk**

Name: **Warmafloor (GB)**
Web: **www.warmafloor.co.uk**

Name: **Waterloo Air Products**
Web: **www.waterloo.co.uk**

Name: **WB Power Services**
Web: **www.wbpsltd.co.uk**

Name: **Whitecroft Lighting**
Web: **www.whitecroftlighting.com**

Name: **Wilo (UK)**
Web: **www.wilo.com/gb/en**

Name: **Wireless Alert**
Web: **www.wasol.co.uk**

Name: **Xtralis (UK)**
Web: **www.xtralis.com**

Name: **Xylem Water Solutions UK**
Web: **www.xyleminc.com**

Name: **Zehnder**
Web:**www.zehnder.co.uk**

Name: **Zeta Compliance Services**
Web: **www.zetaservices.co.uk**

Name: **Ziehl-Abegg UK**
Web: **www.ziehl-abegg.com/en**

Name: **Zip-Clip**
Web: **www.zip-clip.com**

Name: **Zip Water UK**
Web: **www.specify.zipwater.co.uk**

Future focus

What will be the big trends emerging in 2022, and what game changing technologies will help meet carbon reduction targets in the UK? We asked seven professionals to share their views

Stephen Wilson, managing director at AIC

The building services engineer of tomorrow needs to be prepared for continual learning

Which big trends do you see emerging in 2022?
We will see a continuation of heat pump technology growing within the commercial sector. The ambitious targets set out by government to reduce emissions and increase renewable technology can only be achieved by making existing buildings more efficient and reducing emissions by introducing renewable energies. AIC has been developing products and systems that will deliver higher efficiency and reduced emissions, and increase renewable technology into existing buildings.

What new skills and knowledge does the building services engineer of tomorrow need to develop?
They need to be prepared for continual learning. We are going through one of the biggest shifts in energy usage and application in generations, and will be using technologies that are not even used in the field at the moment. As manufacturers, we invest in research and development of new products and technologies to try to stay ahead of the curve and supply products that will meet the government's emissions targets. The knowledge that manufacturers can bring to the building services engineer will be invaluable when they are designing projects.

What are the game-changing technologies that will help meet carbon-reduction targets?
The main technology that will be a large influence in reducing carbon emissions is hydrogen fuel – ideally, green hydrogen – although this is a mid- to long-term solution within the commercial sector. We continue to develop products that will function with blended hydrogen and can be converted to 100% hydrogen.

In the short term, heat pump hybrid systems are a perfect way to reduce emissions by incorporating an AIC thermal management unit, which manages the system to use as much renewable energy as possible, with the comfort of a high-efficiency gas appliance to meet demand if required.

Mark Ferris, specification manager at Elco Heating Solutions

In many cases, heat pumps could supply the majority of the annual heating energy requirements

How extensive do you see the inclusion of heat pumps being as a retrofit on existing systems?
The initial thought may be that the flow temperature from most heat pumps would not suit older systems. However, looking at the required temperature on a typical compensation curve (if such a curve were suitable for a particular system) may suggest that – down to a given outside temperature (the bivalent point at which a heat pump may switch off and a boiler switch on) – the heat pump(s) could operate and supply the system needs on their own. Given that the mean UK temperature (in the south at least) is around 10°C, heat pumps could, in many cases, supply the majority of the annual heating energy requirements. We might refer to this as a bivalent 'switch' system.

Will using heat pumps on central plant prohibit the use of heat interface units (HIUs) as we've come to know them?
CIBSE's 2020 document CP1 *Code of practice for heat networks in the UK* states that the domestic hot water generated by an instantaneous hot-water heating system (such as an HIU) shall be set to achieve 50°C at the plate heat exchanger outlet of the HIU. Clearly, this means that the primary temperature to the plate heat exchanger needs to be higher than that; however, with careful selection, larger plates can be chosen to offer a suitable secondary flowrate at lower primary temperatures that would still be within the capabilities of heat pumps to deliver.

What about heat pumps generating stored domestic hot water (DHW)?
Specific units are available for this purpose, but, in many cases, it may be felt that – for flexibility and standby – the DHW primaries are off the main heating system, in which case a preheat coil or plate heat exchanger can feed preheated potable water into a calorifier. An electrical element – or, in the case of a hybrid switch system, a boiler – can then be used to raise the water to the desired temperature.

Chris Caton, head of commercial product management, Group Atlantic UK, ROI and North America (parent company of Hamworthy Heating)

A mix of product types will be required to meet our 2050 target

What is the future mix of heating?

Until relatively recently, the UK's pathway to net zero in 2050, and the decarbonisation of heating, has focused on residential rather than commercial applications. We've all heard the headlines – 'No gas boilers in new builds by 2025'.

In December 2020, however, the government's 10-Point Plan and the Climate Change Committee's 6th Carbon Budget – and, most recently, the *Heat and Buildings Strategy* – started to include commercial, public buildings and network heating in more detail.

So, what are the options? As well as broadening the scope of efforts to decarbonise this country's heating infrastructure, these publications indicate – in line with our own views – that a mix of product types will be required to meet our 2050 target.

Previously, the focus was on transitioning from gas appliances to electric solutions, including heat pumps, electric boilers and panel heating. But there's also talk of the potential for a natural gas/methane blend and, eventually, 100% hydrogen to replace the methane supplied through the traditional gas network. Hydrogen has far more in common with the performance of today's gas boilers, with a higher operating temperature that's better suited to older buildings, where upgrading building fabric isn't easy or affordable.

The world of commercial heating is changing, however; there is no clear path yet and we're awaiting further guidance from government. That doesn't mean we're standing still, however – far from it. Our long-term vision is to support you in selecting the products best suited to your projects, regardless of fuel source.

In early 2022, we'll be bringing commercial heat pumps to the market, combining our knowledge in commercial heating with our group's experience in heat pumps. We're also working hard on the transition to hydrogen. As the policy for conversion of the gas grid to 100% hydrogen is developed, it is likely the grid will permit 20% blended hydrogen within the 2020s to reduce its carbon intensity. Hamworthy boilers will run on this mix without any modification to the existing technology.

John Watt, national HVAC sales manager, UK & Ireland, Paroc

The need for non combustible insulation material remains obvious

Which big trends do you see emerging in 2022?

Sustainability and energy efficiency are some of the most important trends for 2022. Climate change is a huge challenge, but – fortunately – the proper, sustainable and non-combustible insulation of buildings, HVAC-installations, production equipment in the process industry and ships is a valuable tool to reduce our CO_2 footprint.

Paroc has the aspiration to reduce its CO_2 emissions by 50% by 2030 and to eliminate the use of fossil fuels by then. The same engagement goes for waste: by 2030 no more waste should leave our factories.

Fire safety remains one of the key trends; looking at recent fires in buildings that caused far too many casualties, the need for non-combustible insulation material remains obvious.

Insulation can significantly increase the fire load of a building, and the choice of insulation material has a major impact on the building's overall fire safety.

The safest solution in all kinds of constructions is to use a non-combustible A1 or A2-s1,d0 class insulation. Stonewool, with its melting point greater than 1,000°C, remains the best choice. In other words: Paroc Stonewool helps save lives, property and the environment in the event of fire.

Another important aspect is noise protection: Our cities grow, and so does the desire to plan and build more dense areas with close connections to transport routes. Therefore, the importance of protection from unwanted noise also increases.

Acoustic control is an essential part of building design, and can have a significant impact on people's wellbeing, communication and productivity.

Paroc Stonewool is available in a wide assortment of products and solutions for acoustic control, and offers excellent noise reduction and sound absorption thanks to its high-density, optimal fibre structure and air permeability.

Paroc Clad-System, for internal and external use

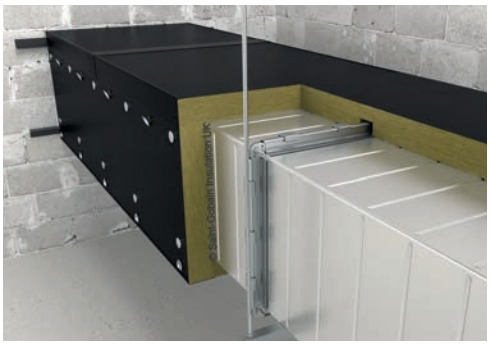
Matt Stanford, HVAC specification manager, Saint-Gobain Insulation UK

Which big trends do you see emerging in 2022?
The size of the HVAC insulation market is estimated to grow year on year. This is driven by the growth of the construction industry, escalated demand for HVAC systems, and the increasing need to reduce energy consumption in buildings.

Throughout 2022, the implementation of stricter building codes of practice and regulations to minimise energy consumption – and a focus on the UK net zero carbon targets – will continue to drive the need for efficient HVAC thermal insulation solutions to minimise the environmental impact of buildings.

There is also likely to be a stronger focus on overheating, and a need to reduce internal heat gains, which will require further optimised insulation for HVAC and DHW installations.

> There is likely to be a stronger focus on overheating and a need to reduce internal heat gains

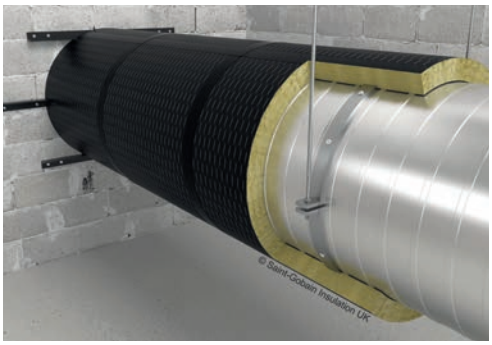


At Isover, we are committed to making the world a better home. Our Isover insulation solutions help reduce energy consumption and energy-related emissions over the life of your projects, while having minimal environmental impact during manufacturing and their life-cycle.

A key trend that Isover expects to develop further is the importance of eco credentials in the specification phase.

We strive to continuously increase the amount of recycled content in our products; our range of glass wool solutions is made of up to 70% recycled glass.

In addition, we provide solutions that will make system installation easier and less time-consuming during construction of residential, commercial and industrial buildings.



Josh Emerson, head of marketing, Swegon UK&I

What new skills and knowledge does the building services engineer of tomorrow need to develop?
As an industry, we should take great pride in some of our innovative and cutting-edge engineering solutions. The way we have tackled energy efficiency is a particular triumph, but does it matter if the people occupying our buildings are not happy and healthy? Surely, their experience must be the ultimate metric for measuring success?

Saying that 'buildings are for people' might be a statement of the obvious but, often, the behaviour of our industry suggests we have forgotten this fundamental truth. We can be guilty of failing to focus on raising and meeting the expectations of occupants and addressing their wellbeing needs.

Buildings are becoming more complex to design, operate and manage. The challenges, not least because of net zero, are growing and becoming more detailed – but also, potentially, more rewarding. A recent study found that between 30% and 40% of employees report poor health symptoms, including headaches or attention problems, at work, which suggests their indoor environment is not supporting their wellbeing and productivity. The pandemic also highlighted the relationship between indoor air and the risk of transmitting airborne disease, which thrust ventilation into an unaccustomed limelight.

On top of this, the UK's Climate Change Committee has just published a report that is highly critical of the way buildings are being adapted to deal with changing climatic conditions. 'More than 300,000 homes are due to be built each year across the UK and there is a major risk of lock-in if they are not planned and built to address overheating alongside energy efficiency and low carbon heating,' the report said.

The implications are very serious, as up to 2,500 people died in the UK last year as a result of heatwaves. We need a much more adaptable built environment, while, at the same time, protecting the natural world. The government can play a big role by using the revisions of the Building Regulations and the new Environment Bill to set policies that challenge us all to play our part.

> We can be guilty of failing to focus on raising and meeting the expectations of occupants and addressing their wellbeing needs

Proud Winner of the
HVR Awards 2021

HVR AWARDS
WINNER 2021

RANGE ZERO

Together on the journey to net zero

HVR Zero
Hybrid Ventilation Heat Recovery

Windcatcher Zero
Natural Ventilation Heat Recovery

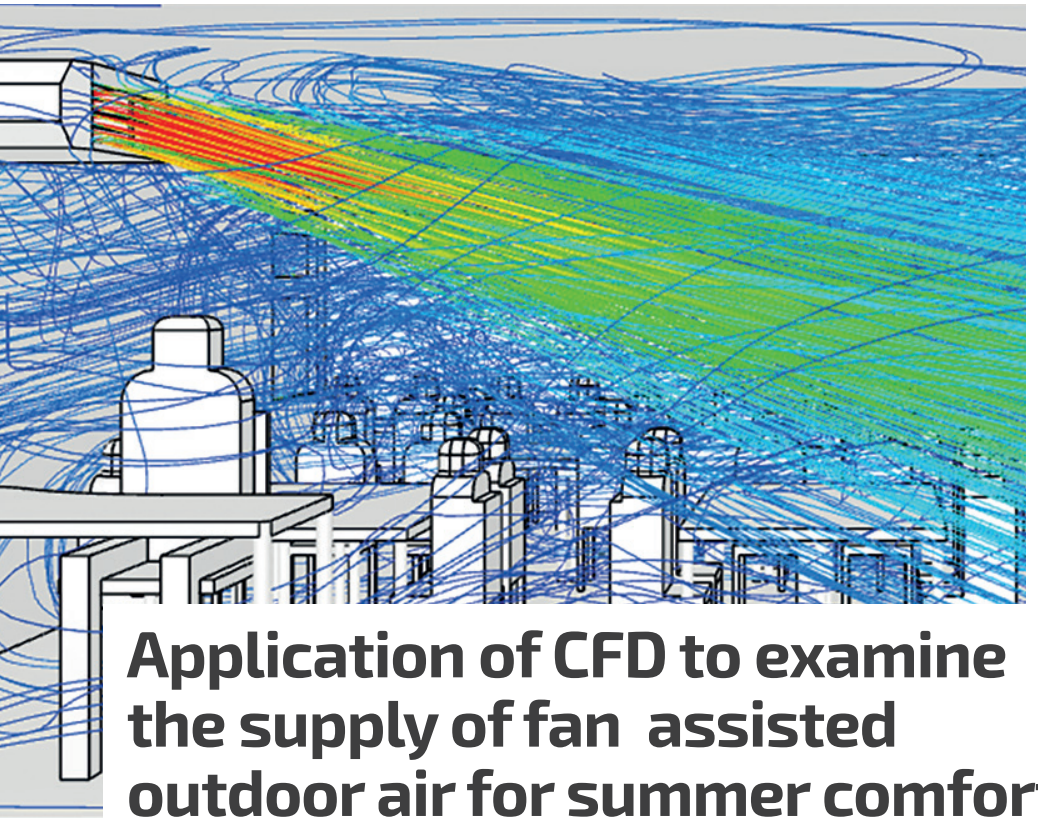
Cool-phase Zero
Natural Cooling Heat Recovery

ZERO
embodied & operational carbon

CPD
CIBSE APPROVED
UNTIL 2023

Monodraught

Find out more at:
www.monodraught.com | 01494897700



Application of CFD to examine the supply of fan assisted outdoor air for summer comfort

This module looks at the use of computational fluid dynamics (CFD) to evaluate a practical airflow issue in order to see whether summer thermal comfort can be improved

This CPD article explores an application of computational fluid dynamics (CFD) to investigate a practical airflow problem that would otherwise require extensive – and probably expensive – physical tests. CFD is employed to determine and describe the motion of a fluid (gas such as air or liquid such as water) through iteratively solving a series of numerical equations to provide the values of parameters that describe the fluid, such as velocity, pressure and temperature.

Many UK buildings utilise ventilative strategies to comply with the various thermal comfort criteria outlined by building standards. Most ventilation systems employ a fixed position air distribution method that is largely determined by wintertime requirements to ensure good mixing and prevent unwanted higher velocity air movement across occupants. This approach limits the impact that increased airflow during summer periods can have on improving perceived thermal comfort from occupants as a result of convective heat transfer. To illustrate the application of CFD, this article will focus on how CFD has been employed to examine the room air movement created through a high-level, fan-assisted outdoor-air ventilator, to determine if summer thermal comfort may be improved despite ambient temperatures being high. The example CFD exercise will compare the thermal comfort experienced by classroom occupants in a typical summer condition for two electrically controlled modulating grille outlet blade positions, upward and downward, as shown in Figure 1. In the blade 'up' position, airflow is directed 20 degrees upwards, towards the ceiling. This arrangement optimises thermal comfort during winter conditions, minimising airflow across occupants. In the blade 'down' position, the airflow leaves the grille at 20 degrees downwards, towards the occupied zone. Here, the airflow is moved directly over the occupants, and this will provide the subject for the CFD investigation in this article.

The opportunity to apply CFD tools is becoming increasingly available as the interfaces become more intuitive for the CFD non-specialist. Increasing numbers of CFD code developers offer web-based, or application specific, interfaces to their packages as software as a service (SaaS) solutions that are 'cloud-based'. This provides a great opportunity for the building services engineer to try out applications of CFD, as several vendors provide free or low-cost entry-level access. For cloud-based implementations, there is no requirement for hardware or software installation or maintenance investment, aside from a standard laptop computer or tablet. However, the underlying principles are complex, and every CFD simulation is, as the name suggests, an approximation of the real world. The methods employed and the granularity of the digital interpretation of the physical application will impact significantly on the reliability of the result.

Velocity, pressure, temperature, density, and viscosity are the main properties that are considered simultaneously when conducting an examination of fluid dynamics. The physical phenomena, such as turbulence and mass transport of air, will vary enormously and are categorised into kinematic, transport, thermodynamic, and other miscellaneous properties.[1] The Navier-Stokes equations are commonly applied to examine changes in these properties during »

» mass flow and/or thermal interactions, and are applied in investigations that include a diverse range of applications, including: weather prediction; car design; pollution and flood control; the study of climate change, blood flow, ocean currents, tides, turbulence and shock waves; the representation of water in video games or animations;[2] and, of course, building services engineering.

The set of equations is based on the principles of conservation of mass, momentum, and energy that are often solved for many thousands or millions of individual elements, or cells, that have been defined by the mesh (as discussed below) that represents the volume of the room, the content, and its boundaries. The conservation of mass is expressed in terms of the continuity equation, where the rate at which the mass enters a system is equal to the rate at which mass leaves the system plus any accumulation of mass within the system. Conservation of momentum is described by Newton's second law, such that the sum of all the forces on the element must equal the mass of the element times its acceleration. This might cause the element to speed up, slow down, or change direction, depending on the direction of the force and the directions in which the object and reference frame are moving relative to each other.[3] And, finally, the conservation of energy is an application of the first law of thermodynamics, that energy cannot be created or destroyed but is just transformed from one form into another.

The non-linearity of the governing equations means that fluids are inherently chaotic, and therefore highly sensitive to changes in initial or boundary conditions (such as the angle of the outlet blade). This means that a change in any input variable can produce a vastly different response to a seemingly small perturbation in the input variable. This non-linearity, along with the complexity of the physical geometries, means that an accurate analytical solution (such as directly employing the Navier-Stokes equations) is often not possible, and so numerical methods are used to iterate solutions within a 'discretised' domain until the simulation closely approximates the analytical solution. The numerical solution of the differential equations cannot produce a continuous distribution of the variables over the whole solution domain (such as the room volume) at a single pass, so the aim is to produce a set of discrete values at many thousands (or millions) of nodes (each one surrounded by its small volume) that cover the solution domain.[4]

This is the basis of the finite volume method that is commonly employed to handle this kind of problem. The strategy works by the 'meshing' of continuous geometries into grids of discrete, interconnected volumes known as cells. Most methods employ algorithms based on the Reynolds-averaged Navier-Stokes (RANS) equations. RANS turbulence models were derived by time-averaging the Navier-Stokes equations – this makes the process less complex to model numerically than considering every minute deviation from the average at a particular point, as the fluid properties vary chaotically in the turbulent air stream. These are then applied to iteratively evaluate fluid parameters (such as velocity, pressure and temperature) for each of these cells, until a converged solution is met. The finite volume method is a particularly popular choice for CFD, as it rigorously enforces conservation, and is flexible in terms of both geometry and the variety of fluid. It does not limit cell shape and mass, momentum or energy is conserved even on coarse grids. There are several efficient, iterative well developed 'solvers'.[4] CFD solvers transform the defining momentum and thermodynamic laws into algebraical equations, and can efficiently solve these equations numerically.

Commonly employed solvers for incompressible, steady-state flow regimes include the two-equation shear-stress transport k-omega (SST k-ω) eddy-viscosity model to provide an approximation of RANS equations (see 'Properties' boxout for descriptions). The use of a k-ω formulation in the inner parts of the boundary layer makes the model directly usable all the way down to the wall through the viscous sub-layer. The SST formulation switches to a k-epsilon (k-ε) behaviour in the free-stream, and thereby avoids the common k-ω problem that the model is too sensitive to the inlet stream turbulence properties. The SST k-ω model is by no means perfect but is likely to be more effective than employing a single k-ε model.[5]

Creating a high-quality mesh to represent the domain is a critical factor in ensuring CFD simulation accuracy. A fine mesh with a grid of small – possibly irregularly-shaped – interconnected cells will typically yield a higher-quality mesh, but the computational cost will be significantly increased. A lower-quality mesh (which might also be a coarse mesh) will not only result in inaccurate simulation results, but may also cause 'convergence' difficulties. (Convergence is a measure of how the iterations are converging towards an acceptable resolution of solution.) Where a quick solution is needed – for example, at concept design stage – it may be acceptable to employ a less-refined mesh to reduce set-up time. However, most analyses will require some time and effort to set up the mesh using the different methods and controls made available in the software. It is normal to start with a coarse mesh and then gradually refine the mesh for specific areas of interest. Fortunately, the speed of solution in simple models – particularly cloud-based systems – provide ready opportunities to experiment. To ease the process, most CFD packages include automated mesh generation tools (both static and dynamic) that, if set up correctly with good-quality definitions of boundaries – such as the walls and the grille outlet blades – and volume fluid properties, are likely to be adequate for most general building services investigations. While a mesh may contain millions of nodes, that fact alone does not necessarily equate to quality.[8]

PROPERTIES

k – kinetic energy
ω – often referred to as the turbulent frequency, the rate at which turbulence kinetic energy is converted into thermal internal energy per unit volume and time[6]
ε – specific dissipation rate at which velocity fluctuations dissipate[7]

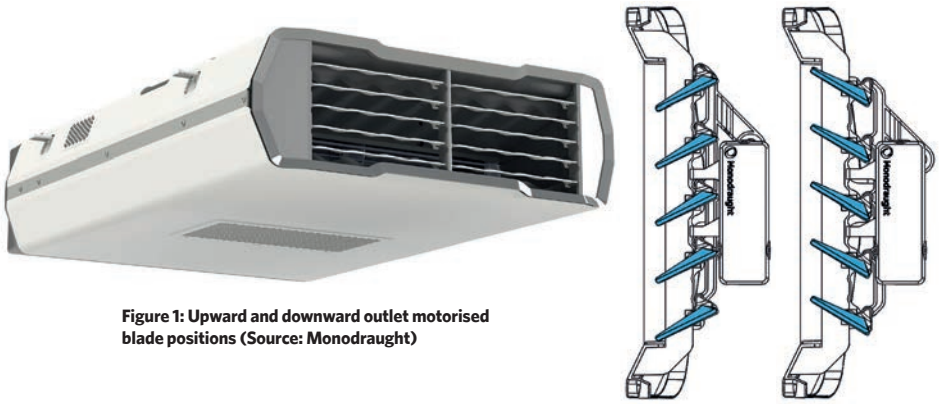


Figure 1: Upward and downward outlet motorised blade positions (Source: Monodraught)

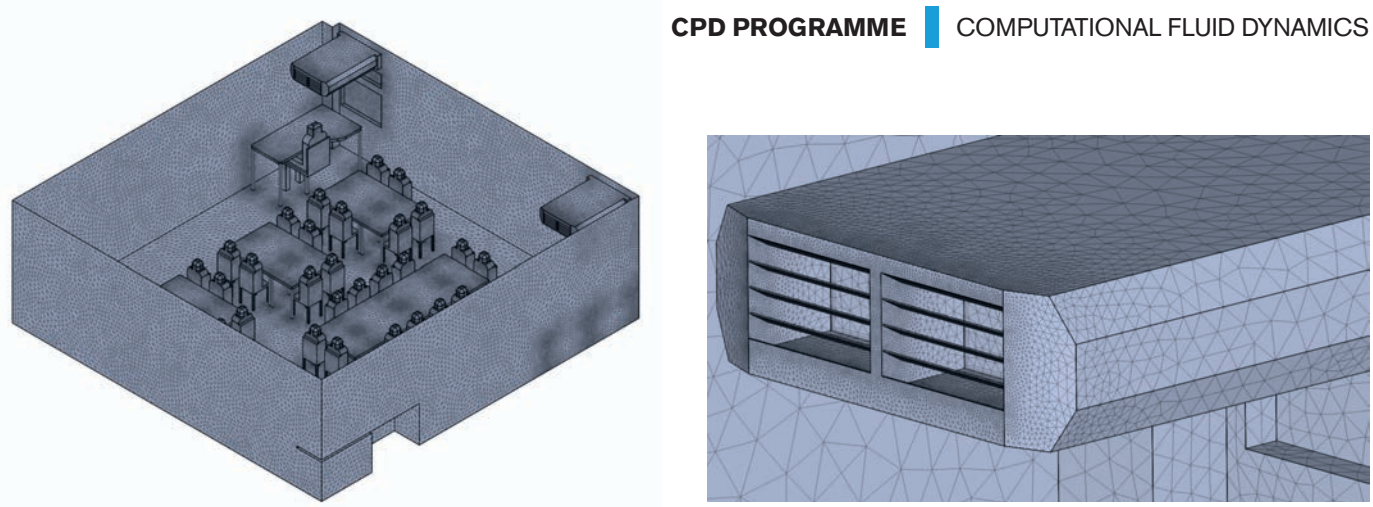


Figure 2: The surface mesh structure of the 'blade up' fluid domain. Both domains contained approximately 12 million cells (Source: Monodraught)

Having set up the geometry – which can normally be imported from CAD or created directly within the CFD package – and defined the boundaries, volumes and initialised conditions, the mesh will be generated and the pre-processing stage is complete.

During the processing stage, after each iteration, at each cell, a new value for a variable is determined from $Variable_{NEW} = Variable_{OLD} + \alpha (Variable_{PREDICTED} - Variable_{OLD})$ where α is the relaxation factor. An $\alpha < 1$ (under-relaxation) will slow down the convergence rate but increase the stability, and as α moves above 1 (over-relaxation), it can sometimes accelerate the convergence rate but will decrease stability. The difference between the previous result and the current result, the 'error', is known as the residual. As these errors decrease, the results are reaching values that are changing less and less with each iteration and so the solutions are converging. If these errors increase, the solution is said to be diverging. The generally accepted starting point is to employ the software default values of relaxation factors.

Example

Four CFD simulations were used to model the steady state airflow characteristics in the example classroom, and to use the output to provide thermal comfort profiles, expressed in terms of predicted mean vote (PMV) for the two grille-blade positions – up and down – and for two different external air temperatures – 26°C and 29°C. Under-relaxation factors were also adjusted for convergence, with the analysis stopping when global residual values for continuity, energy and turbulence were evaluated below 10^{-5}. The airflow supplied by each unit was 130L·s^{-1} and 180 L·s^{-1} (respectively, for the different external air temperatures) with two units fitted to each room, to emulate the typical response of an installed unit's control strategy.

The geometry of the room was created in CAD, and simplified block geometries were used to represent the occupants and ventilation units. The internal components of the ventilation systems were not modelled, and a simple boundary condition stating a flow velocity and temperature was used, to reduce computational time.

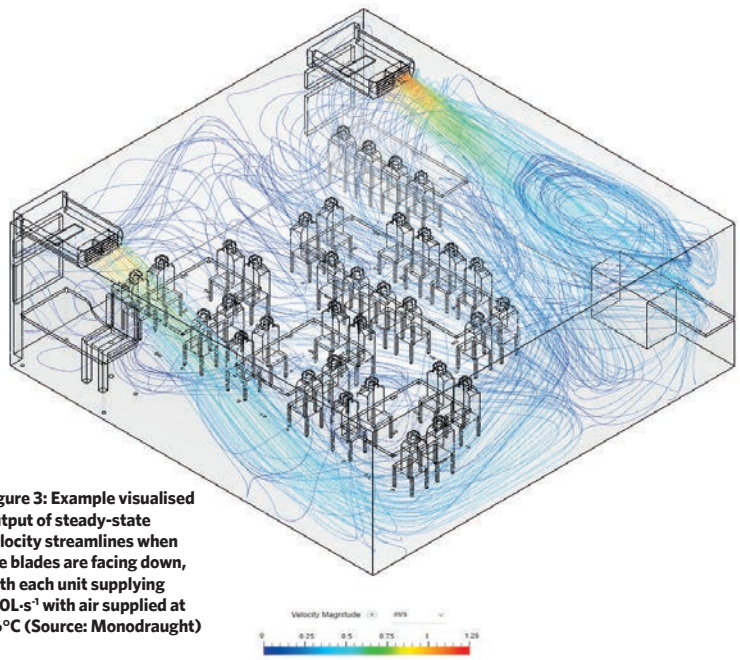


Figure 3: Example visualised output of steady-state velocity streamlines when the blades are facing down, with each unit supplying 130L·s^{-1} with air supplied at 26°C (Source: Monodraught)

The CFD automated mesh algorithm was employed, having been set to form five automatic prism layers within a close proximity to any boundary within the domain, as a means of capturing fluid-solid interaction in detail (see examples in Figure 2).

In the post-processing phase, the simulation output was used to provide data for both PMV calculations and visual interpretations, such as the velocities shown in Figure 3. This indicated that, under the modelled conditions, both blade positions are predicted to provide suitable velocity, temperature, and thermal comfort profiles to meet the criteria set out within BB101.[9] (The results of the analysis were also successfully evaluated against the CIBSE, ASHRAE and BS EN ISO-7730[10] design criteria.)

The output indicated that the distribution of incoming airflow within the room would be even, and throws should cover the width and depth of the room. Thermal comfort was indicated as remaining between a PMV of -0.5 and +0.5 within the occupied zone at a height up to 1.4m. Compared with the 'upward' position, the 'down' position for the blades improved the PMV score by 34% for the 'normal' summertime analysis with an external temperature of 26°C, and improved it by 28% for the 'adverse' summer analysis when the external temperature was 29°C.

This article provides a small fraction of the depth and complexity that CFD analysis requires, and the solutions that it offers. To create meaningful and reliable output requires the user to develop expertise, or to utilise the services of a professional who specialises in the field of CFD for building services engineering.

With appreciation for the technical input by Dr Esfand Burman of IEDE, UCL.

Turn to page 84 for references. »

Module 188

November 2021

» **1. What is the meaning of SaaS as referred to in this article?**

- ☐ A Software as a service
- ☐ B Software as a simulation
- ☐ C Software as a solution
- ☐ D Software as a standard
- ☐ E Software as a system

2. Which of these was not identified as one of the main properties that are considered simultaneously when conducting an examination of fluid dynamics?

- ☐ A Density
- ☐ B Enthalpy
- ☐ C Pressure
- ☐ D Temperature
- ☐ E Velocity

3. What was explicitly described as being employed to describe conservation of momentum?

- ☐ A Continuity equation
- ☐ B Finite volume method
- ☐ C First law of thermodynamics
- ☐ D Newton s second law
- ☐ E RANS

4. Which of these is not true when considering the mesh for a CFD simulation?

- ☐ A Automated mesh generation tools are likely to be adequate for most general building services investigations
- ☐ B Fine mesh will typically be a higher quality mesh
- ☐ C For a quick solution, a less refined mesh can be used to reduce set up time
- ☐ D Having millions of nodes does not necessarily equate to quality
- ☐ E SST k ω transforms the physical model into a digital mesh

5. By how much was the PMV improved in the normal summertime scenario with downward pointing blades compared with upward blades?

- ☐ A 26%
- ☐ B 28%
- ☐ C 29%
- ☐ D 34%
- ☐ E 50%

Name (please print) .....

Job title .....

Organisation .....

Address .....

.....

.....

Postcode .....

Email .....

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

The *CIBSE Journal* CPD Programme

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

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

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

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

Further reading:

There is a multitude of references (including those used in the article) and numerous freely accessible online courses provided by open-source and proprietary CFD specialists.

As an example of a CFD application, this article drew on the recent report *Comparative CFD analysis of the effect of HVR grille angles on thermal comfort* by Alex Chandler and Nick Hopper of Monodraught.

References:

1 White, F, *Viscous fluid flow* 3rd Edition, McGraw-Hill Mechanical Engineering, 1991.
2 McEwan, I, **bit.ly/CJNov21CPD1**, 2017 – accessed 10 October 2021.
3 Lucas, J, **bit.ly/CJNov21CPD2**, 2017 – accessed 10 October 2021.
4 Manchester CFD team, 'What is 'Discretization'? **https://bit.ly/CJNov21CPD3**, 2019 – accessed 10 October 2021.
5 CFD Online 'SST k-omega model' **bit.ly/CJNov21CPD4** – accessed 10 October 2021.
6 CFD Online' Specific turbulence dissipation rate' **bit.ly/CJNov21CPD5** – accessed 10 October 2021.
7 Jade, M, CFD Online 'Use of k-epsilon and k-omega Models' **bit.ly/CJNov21CPD6** – accessed 10 October 2021.
8 'Simscale Blog '5 Tips on How to Create a High-Quality Mesh' **bit.ly/CJNov21CPD7**, 2018 – accessed 10 October 2021.
9 *BB 101: Ventilation, thermal comfort and indoor air quality*, 2018, **bit.ly/CJNov21CPD8** – accessed 10 October 2021.
10 BS EN ISO 7730 *Ergonomics of the thermal environment. Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria*, BSI 2005.

Products of the month

Rinnai aiming to bring clarity to net zero debate

Manufacturer to announce new low carbon technologies and hybrid solutions by end of 2021

Rinnai is to commission a comprehensive comparative review and report on gas and electric appliances using a variety of energy vectors in both residential and commercial UK scenarios.

The commission is being carried out by one of the biggest multinational consultancies in the building and construction sector, and the final report will be headed by a team of non-political and non-partisan academics.

'We simply want to see realism brought into an increasingly polarised debate that, at times, reaches levels of unbridled hysteria,' says Tony Gittings, managing director of Rinnai.

'Fact, logic and reason must be employed for the best outcome for all of us.

'We need decarbonisation – we need net zero – and we need it as soon as possible, but in such a way that is pragmatic in terms of

Rinnai managing director Tony Gittings

catering to the existing populations and markets.'

Before the end of the year, Rinnai is expected to announce its own new product development answering the net zero call, including low carbon technologies and hybrid solutions.

'We are committing substantial sums to this report, and the contract with the authors stipulates that there is no third-party doctoring or spin. The consumer needs to be given the facts to make an informed decision,' adds Gittings (pictured, left).

'We are manufacturers of proven excellence and are using our core competencies of design engineering solutions to suit all possible future needs and fuels. We have a global reach, with 650 R&D engineers, and will evolve to ensure that our customers have the very best possible product options.

'We believe, implicitly, that there will be a need for a variety of solutions to the "Energy Trilemma" – there is not one single fuel or appliance that is the answer to all the problems.

'We also believe some of the statements coming from quasi-official quarters is the drum banging of interested parties looking after their own primary financial and/or political interests.'

Visit: www.rinnaiuk.com

Rinnai CPDs focus on minimising carbon without compromising performance

Range of subjects covered by CIBSE approved courses available online or in person

Rinnai offers a range of free, CIBSE-approved CPDs for designers, specifiers and building services consultants and engineers working on commercial sites that need limitless flows of temperature-accurate hot water for personal hygiene, laundry, food production, and other cleaning and disinfecting regimes.

The CPDs focus on lowering and minimising carbon output, without compromising performance, and are available at Covid-safe premises or via Microsoft Teams or Zoom. Subjects currently available direct from Rinnai include:

- Hydrogen – energy source for the future
- Energy-efficient on-demand water heating
- Bio-LPG – a technical and economically viable route to decarbonisation now
- Low-temp DHW – carbon analysis across all energy vectors
- Continuous flow appreciation
- Continuous flow hot-water system design
- L8 and continuous flow

Through its CPD and training programmes,

Rinnai looks to clarify and engage with the market to assist decision-making and understanding with CIBSE consultants, engineers and designers.

Chris Goggin, operation director, says: 'We can demonstrate how innovation can reduce the use of fossil fuels while maximising renewable gains. One example is our N Series range, which can be used with a renewable heat source – solar or heat pump – to maximise gains from this technology. The Rinnai system will precisely boost the water to the required temperature, saving fuel without compromising performance.

'We also have CPDs that look at continuous flow technologies and how this can benefit the industry versus traditional storage systems. We analyse water-heating system design and specification in discussing design issues and best practice for G3 and legionella prevention. We can prove that continuous flow means value engineering that lasts a long working life.'

Rinnai has also invested in a fully equipped training facility, where its CPD courses are supported by a state-of-the-art multimedia suite that can be used to deliver one-hour courses to suit the needs of any organisation.

Rinnai products offer end users a limitless supply of instantaneous temperature-controlled hot water, as long as water and gas supplies are constant. Temperature accuracy ensures hot water can be supplied to support anti-legionella regimes, thermal disinfectant, and comfort. More information can be found on Rinnai's website and its Help Me Choose dedicated webpage.

Call 01928 531 870, email sales@rinnaiuk.com or engineer@rinnaiuk.com, or visit www.rinnaiuk.com

Products of the month

Daikin s VRV 5 air conditioning leading the charge in sustainable technologies

System offers installation flexibility and can be fitted in rooms as small as 10m²

Innovative strides are continuously being made in the development of light-commercial and residential air conditioning technology, to improve the sustainability, reliability and performance properties.

One such product leading the charge is Daikin's VRV 5 system.

For building services professionals, using sustainable technology is crucial for meeting increasingly strict environmental targets. Daikin's VRV 5 system has been specifically developed to use R-32 refrigerant, which has a global warming potential (GWP) that is 71% lower on a system level than alternative sources.

The VRV 5 makes use of Daikin's innovative Shîrudo technology, which offers design versatility.

The system encompasses a complete package of advanced developments, all standard, integrated and configured.

Shîrudo technology allows for complete installation flexibility, offering the ability to install the system into rooms as small as 10m² without the need for additional design considerations. Furthermore, it offers exceptional protection in the unlikely event of a leak. Should this occur, the built-in sensor will activate an alarm integrated into the system's Madoka controller.

The culmination of this technology and other protective functions has granted the VRV 5 system full compliance with the necessary legal requirements under IEC60335-2-40 (Ed.6).

Having been developed to deliver remarkable environmental performance, as well as installation versatility and integrated leak detection, Daikin's VRV 5 system takes full advantage of today's most innovative air conditioning technology.

With straight-out-of the-box sustainability, reliability and performance properties assured, it is hard to look past the VRV 5 system for residential and light-commercial use.

Visit: www.daikin.co.uk/vrv5

New names welcomed to sales team

NICOTRA Gebhardt

Leading fan manufacturer Nicotra Gebhardt has made two key appointments ahead of the launch of its next generation of high-efficiency products.

Gary Brookes has joined as sales manager (OEM and distribution). He will work with existing and new customers to develop end-to-end solutions tailored to customers' individual requirements.

Ryan Gillvray has been appointed as internal sales engineer, responsible for customer relations and supply chain management.

Call +44 (0)1709 780760 or email g.llewellyn@nicotra gebhardt.com

Vent Axia shortlisted for two awards

Leading ventilation manufacturer Vent-Axia has been shortlisted in two categories in the prestigious *H&V News* Awards 2021.

The Vent-Axia 'Lo-Carbon Multivent MEV Family' is a finalist in the Domestic Ventilation Product of the Year category, while the company's COVID-19 Support Campaign has been shortlisted for the Covid Frontline Achievement of the Year award.

Call +44 (0)344 856 0590 or visit www.vent axia.com/multivent mev family

Breathing Buildings offers CIBSE approved CPD on school ventilation

Breathing Buildings, a UK provider of controlled, hybrid ventilation systems, is offering a CIBSE-approved CPD on meeting the requirements of BB101: *Guidelines on ventilation, thermal comfort and indoor air quality in schools* and TM52: *The limits of thermal comfort; avoiding overheating*.

This course – delivered by one of the company's experienced ventilation experts – is particularly timely with the current focus on schools and ventilation to improve indoor air quality and help mitigate Covid-19 transmission.

Call +44 (0) 1223 450 060 or email info@breathingbuildings.com

Trilux illuminates medical research centre ›

Trilux's LC60 LED light channel forms the backbone of a lighting scheme at the UCL Institute of Immunity and Transplantation in London.

A collaboration between the Royal Free London NHS Foundation Trust, the Royal Free Charity, and University College London, the world-class institute develops new treatments for conditions including leukaemia and diabetes. Its new home in the Pears Building includes laboratories, patient accommodation, a car park, and offices, and was designed to achieve Breeam Excellent. Trilux's lighting scheme met the technical specification and the client's budget.

Suspended and recessed, clean, continuous lines of light are installed throughout the laboratories and offices. The infill spaces are ideal for adding sensors and services, and the wiring from one end helps with maintenance.

The building's atrium is designed to foster interaction among researchers and, here, more than 200 bespoke, diffused-glass LED pendants have been installed to stunning effect. Further Trilux luminaires have been used in the back-of-house areas, car parks and circulation routes.

■ **Visit www.Trilux.co.uk**

‹ Space saving Aquasub water booster range launched

Aquatech Pressmain has introduced its new space-saving Aquasub range of packaged water-booster sets.

Smart submersible pumps have been placed into the water storage break tank, so the unit is small enough to fit through a door. This makes it ideal for use in any building with restricted access to the plantroom.

■ **Email sales@aqpm.co.uk or visit www.aquatechpressmain.co.uk**

Breathing new life into historic building ›

Condair's steam humidifiers are playing a vital role in maintaining the exceptional craftsmanship involved in producing Steinway's famous pianos.

Steinway & Sons, which has been building pianos for more than 160 years, recently refurbished its London showroom in Marylebone. The company required the optimum environmental conditions to prevent the wood used to craft these precision instruments from warping.

Condair's resistive steam (RS) humidifiers were specified and then installed in three rooms, including the basement workshop. All feed steam into air handling units to maintain the vital humidity levels required.

Steinway's UK managing director, Craig Terry, says: 'Incredibly rare and expensive wood is used in some of our models – but, actually, any type of wood is susceptible to changes in environmental conditions. Dryness is the enemy of pianos, so humidity is really important. We need 40% to 50% humidity all the time to protect the wood. Condair's units are ideal for the job.'

■ **Visit www.condair.co.uk**

‹ From heat pumps to horse power

Two high-efficiency 1.5MW Carrier heat pumps are being used to dry Lucerne hay, a premium feed that is in demand by UK racehorse breeders and trainers.

The ground source heat pump system was installed at a specialist farm near Coventry by OMNI Heat and Power, and with support from the Renewable Heat Incentive scheme.

The hay-drying facility uses two Carrier AquaForce 30XWHV water-source, variable-speed screw heat pumps to upgrade energy extracted from a series of boreholes, which tap an underground aquifer.

The heat pumps upgrade the water temperature from 0°C from the boreholes to 35°C exiting the system. It is then used to evenly and consistently dry Lucerne hay.

■ **Visit carrier.com or follow @Carrier on Twitter**

‹ Panasonic introduces Aquarea Designer online tool

Panasonic Heating & Cooling Solutions has introduced its Aquarea Designer, an easy-to-use online tool to help heating and cooling designers, architects, design offices, installers, and distributors alike.

The newly developed air-to-water design tool is optimised to help professionals easily identify the most appropriate Aquarea air-to-water heat pump for a particular application, to calculate the savings compared with other heat sources, and to calculate CO_2 emissions very quickly.

■ **Visit: www.panasonicproclub.com/GB_en/tools/aquarea_software/ or Register for ProClub**

Health Trust depends on Gilberts to support care for vulnerable patients

Improved care and patient experience are being achieved at Wirral University Teaching Hospital Trust, with the opening of a new high-dependency unit (HDU).

A key component of the £1m project at Arrowe Park Hospital has been a new ventilation system, installed by Mechair Building Services and featuring supply and extract diffusers from UK air movement manufacturer Gilberts.

The HDU ventilation forms part of a wider building services upgrade delivered by Mechair, including enhanced mechanical ventilation, air conditioning, medical gases, water, and plumbing and drainage. The Gilberts system serves each of the HDU's six bays, which are used to take patients when they step down from intensive care but who still need more extensive care than on a ward.

Janelle Holmes, chief executive at Wirral University Teaching Hospital, said: 'It is fantastic that the new high-dependency unit has opened, and this will help us provide the best care we possibly can for our most vulnerable patients.'

Visit gilbertsblackpool.com

Expert source for floor mounted lifting stations

Commercial buildings require an extensive and varied range of sewage pumping systems.

Pump Technology is the UK's leading independent wastewater and sewage pumping expert, and with many years of specialist experience can quickly select the best option for any situation. The company deals with all major pump suppliers, so is able to recommend equipment from an extremely large selection, with many products held in stock for next-day delivery.

Call 0118 9821 555 or visit www.pumptechnology.co.uk/www.jung pumps.co.uk or www.saniflo pumpshop.co.uk

DIRECTORY Your guide to building services suppliers

Tel: 020 7880 6245 Email: cibsedirectory@redactive.co.uk

Air Handling

Energy Efficiency

Fire Protection

Glasgow will host COP26 between 31 October and 12 November 2021

Sorcha Breslin

Common cause

As a volunteer at next month's COP26 conference in Glasgow, ChapmanBDSP's Sorcha Breslin is keen to support an event that has the potential to unify nations in preventing extreme climate change

Out of the 10,000 people who applied to be a volunteer at the UN Climate Change Conference COP26, only 1,000 were accepted. One of them is Sorcha Breslin, a graduate mechanical engineer working in Glasgow for CIBSE Employer of the Year ChapmanBDSP. We ask Breslin about her the role and what she would say to world leaders if she was given the opportunity.

What will you be doing at COP26?

My role at COP26 will be as a volunteer providing assistance and information to attendees transiting between travel hubs. I will be representing Glasgow City Council and the COP26 organisation itself. This will be a public facing role that will involve assisting attendees and members of the public, and answering questions relating to the conference and city. I will be at various locations across the conference area to facilitate delegates and members of the public travelling between zones, and travelling to and from the conference.

Why did you volunteer?

My main motivation is my interest and concern with regard to the steps required by industrialised economies to address the climate crisis.

Having lived in Glasgow for the past five years, I had heard about the preparations for the conference and researched how I could get involved. I am extremely passionate and motivated when it comes to sustainability and raising awareness of the impact of climate change. For these momentous discussions to take place effectively and efficiently, the city needs a large amount of support. I wanted to have as much impact on the running of the event as possible.

How closely does your work relate to the Paris Agreement's aims?

The Paris Agreement, which aims to limit global warming to 1.5 C, among other things, is reliant on a wide variety of factors, and depends on many sectors of industrial economies (established and emerging) achieving challenging targets. This is, of course, heavily dependent on reducing carbon emissions. The build and construction sector is responsible for 39% of all global carbon emissions. ChapmanBDSP is committed to achieving net zero carbon and encouraging clients to follow suit when it comes to projects they are working on. By being a part of a building services engineering company that focuses intensely on the sustainability of its projects, and reducing the environmental impact, there is real potential to have a significant positive impact on carbon emissions within the UK. Hopefully, this will provide a positive example, and other countries can learn from the UK experience.

Are you hopeful of a positive outcome from COP26? What is your greatest fear?

I am a positive person, and I am sure those attending COP26 are aware of the urgency of the task of limiting the hazardous effects of climate change. However, any talks or negotiations surrounding the state of our planet are not always entirely positive. It is quite easy for conversations to be negative, and to demonstrate resignation at the scale of the challenges facing the planet.

At COP15 in Copenhagen, countries spent more time casting blame on each other than addressing ways in which they could agree positive steps to address the climate crisis, and I am concerned that history may repeat itself.

It is easy to become despondent in the face of a global challenge, particularly in international discussions, but it is important to remember that, even though global warming is currently an inevitable by product of modern economies, there are still things we can all do to limit climate change.

What would you say if you had a chance to address world leaders at COP26?

Three things:

1. **Listen to the scientists and the data they provide in relation to the urgency of the situation**
2. **Invest more in research and development**
3. **Take personal responsibility and initiative when it comes to dealing with these problems.**

The climate crisis cannot be wished away. It can only be solved through individual countries taking responsibility for the whole planet, and all of them acting collectively and in collaboration. The crisis needs strategic attention and engagement so that the ingenuity of science and engineering can have maximum impact.

EVENTS

NATIONAL EVENTS AND CONFERENCES

SLL Young Lighter 2021
November (date tbc)
The annual Society of Light and Lighting (SLL) Young Lighter of the Year 2021 will be announced in November, at an online event. The four shortlisted entrants will present their papers, before the winner is crowned. The winner will receive a £1,000 cash prize. The four finalists and their papers are:

- Kate Turley – Biodynamic lighting to support wellbeing in dementia
- Maria Englezou – Do we need to change the design of healthcare facilities' rooms?
- María Teresa Aguilar Carrasco – Lighting optimisation in 24-hour work centres to promote a good circadian rhythm
- Remedios María López Lovillo – Adaptive lighting control system – user-oriented

www.cibse.org/society-of-light-and-lighting-sll/sll-events/sll-young-lighter

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**

SLL and Signify: In conversation with Eleonora Brembilla and Kynthia Chamilothori
3 November, online
Brand new series from SLL and Signify, featuring leading figures from the lighting industry. This session features Dr Eleonora Brembilla, assistant professor at Technical University Delft, and Dr Kynthia Chamilothori, assistant professor at Eindhoven University of Technology.

SLL and Signify: In conversation with Roger Sexton and Michael Grubb
10 November, online
Continuing the series featuring leading figures from the lighting industry. This session features Roger Sexton FSLL, of Stoane Lighting, and Michael Grubb FSLL, creative director of Michael Grubb Studio.

CIBSE Scotland: Chain of infection a reservoir of organisms
14 December, online
Pete Tyson, from the Water Hygiene Centre, will present details on the background to legionella and Pseudomonas aeruginosa, including those who are most susceptible, favourable conditions, and control strategies.

CIBSE JOURNAL PODCASTS

In the latest *CIBSE Journal* podcast – 'How heat pumps are changing the future', sponsored by Mitsubishi Electric – consultants and industry experts discuss how heat pumps are transforming heating and cooling.

All *CIBSE Journal* podcasts are available on the CIBSE Soundcloud – at **soundcloud.com/build2perform** – Apple Podcasts and Spotify.

LIVE ONLINE TRAINING COURSES

CIBSE training courses have been reformatted to work online, with a live trainer, so you can expect the same interaction and participation as you would in a classroom setting.

Upcoming courses:

Designing water efficient hot and cold supplies
2 November

Design of ductwork systems
4 November

Earthing and bonding
9 November

Electrical distribution design
10 November

Low and zero carbon technologies
10 November

Above ground building drainage
11 November

Heat networks (CP1) half day update
15 November

Standby diesel generator
16 November

Low carbon consultant design
16-18 November

Fundamentals of drainage
17 November

Embodied carbon in MEP design: how to use CIBSE TM65
17 November

Building services explained
23-25 November

Air conditioning and cooling systems
24 November

Heat networks code of practice (CP1)
6-7 December

Mechanical services explained
7-9 December

The importance of energy efficient buildings
9 December

Below ground building drainage
9 December

Electrical services explained
14-16 December

Low carbon consultant design
14-16 December

Emergency lighting to comply with fire safety
15 December

Overview of IET wiring regulations (18th edition)
15 December

Design of ductwork systems
16 December

For details and the full programme visit **www.cibse.org/training**

ONLINE LEARNING

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

STUDENT WEBINARS

Student webinars offer information about CIBSE membership. The focus is on the benefits of membership, including resources, societies, events and awards. Each webinar will also include a Q&A.
Upcoming dates:
14 December

For details, and to register, visit **bit.ly/CIBSEOct21briefing**

CIBSE JOURNAL WEBINARS

The *Journal* webinar series is all available to access on demand at **www.cibsejournal.com/cpd/webinars**

CIBSE Training

Online Learning

CIBSE online learning is a flexible alternative to live training that offers you a wide variety of building services topic areas to choose from.

How else can I benefit from CIBSE online learning?

Does not require you to travel

You can log into your CIBSE online learning account from anywhere you want in the world and in whichever place you find comfortable and easy to work from.

Offers you time flexibility

You can dip in and out of an online learning module or course whenever you want so you can fit your personal development within your daily schedule.

Interactive content

CIBSE online learning has quizzes and supportive visuals or videos to keep you engaged along your learning journey.

Discussion forums

The forums give you the opportunity to ask questions and create topic discussions with other fellow learners around your learning experience.

Counts towards your CPD hours

Each of our online learning modules and courses offer you an allocated number of CPD hours. Upon completion, you will receive a CPD certificate.

Accessible content

The content of each module is designed to enhance the learning journey; topics are broken into sub-topics, improving the flow and making it more organised and memorable.

> **Explore your online learning training options at cibse.org/onlinelearning**

CMR

in complete control

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

DPC CONTROLLER

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

DPM PRESSURE SENSOR

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

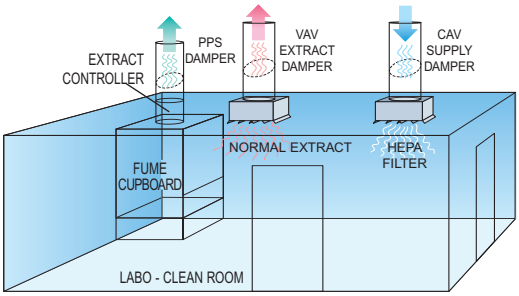
CAV AND VAV DAMPERS

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

Metal Damper

AIR MANAGEMENT SYSTEM

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



PPS EXTRACT DAMPER

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

PPS Damper

PRECISION COMPONENTS FOR VENTILATION AND PROCESS CONTROL

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

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

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

CMR®