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An uncertain new era

It has been an extraordinary few weeks. The death of Her Majesty Queen Elizabeth II overshadowed all other events, including the election of the new Conservative leader, Liz Truss, who was asked to form a government by the Queen two days before her death.

Liz Truss' policy announcements were put on hold during 10 days of mourning for the woman who had been a reassuring constant in the lives of people in Britain and the Commonwealth for over 70 years.

The new King Charles III has long been a campaigner for the environment and has taken a keen interest in buildings and their influence on the wellbeing of communities and the wider environment.

Past CIBSE President Terry Wyatt FCIBSE saw evidence of the King's interest when he met him at the opening of a business park. He and Hoare Lea's Stephen Edwards were introduced to the then Prince of Wales as the designers of the heating, ventilating and air-conditioning systems for the building. Wyatt takes up the story: 'Charles told us that he was very aware of those systems as there was so often a problem with them at his home and at the Palace.'

Later Wyatt recalls the Prince making a beeline for the two engineers, and telling them: 'It's rather warm and stuffy in here, wouldn't you say?' Such a question would have ruffled some but Edwards' response was the epitome of clear-headed, engineering cool, according to Wyatt. 'He agreed that it was, and calmly explained that the system for the room was not designed to cope with so many people, camera lights and equipment, and that to have done so would be an over-design for normal use – wasting material, money and making difficult its efficient operation.'

Prince Charles, listened attentively, nodded, and said: 'Fair enough'. Reassured, and armed with insight into occupancy density, he completed the ceremony.

The new King's weekly meetings offering counsel to Liz Truss are sure to touch on the threat of climate change and what the UK is doing to meet its 2050 net zero targets. While His Majesty's government is committed to net zero, there is now much uncertainty about future policy direction.

Former climate minister Chris Skidmore has been asked to look at whether net zero policies are 'pro-business and pro-growth', and the government has announced an end to the moratorium on fracking and an acceleration in North Sea oil and gas production. The aim is to cut energy bills and reduce reliance on fossil fuels from 'malign actors'. But there is a danger that continued backing for carbon-intensive energy will slow the momentum towards the decarbonisation necessary to avert the very worst effects of climate change.

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Hywel Davies
The challenges and problems facing Liz Truss, and why industry must continue to focus on net zero carbon

Bianca Laura Latini
Industry experts debate how to minimise whole-life carbon of cooling buildings

Rickesh Miyangar
Why water neutrality in new developments is becoming critical as droughts increase in severity

Tim Dwyer
CPD Module 203 looks at mild steel pipe and connection techniques for building services systems

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Chancellor Kwasi Kwarteng on his way to deliver his mini Budget

Chancellor pledges £1bn for energy efficiency measures

Kwasi Kwarteng relaxes planning rules for renewables and makes acceleration of infrastructure projects a priority

Kwasi Kwarteng has promised more than £1bn of funding for energy efficiency in his mini Budget.

The recently appointed Chancellor's economic growth plan, published on 23 September, says the government will bring forward legislation to extend energy efficiency obligations on suppliers. Support, worth £1bn over the next three years and starting from April 2023, will be targeted at the most vulnerable, but will also be available for the least energy efficient homes in the lower council tax bands.

The government will also open applications 'imminently' for up to £2.1bn of funding over the next two years to support local authorities, housing associations, schools and hospitals to install energy efficiency and renewable heating measures.

The growth plan includes a pledge to relax planning rules in England for onshore wind farms, bringing them 'in line' with other infrastructure so that they can be deployed 'more easily'. This relaxation is part of a wider drive, outlined by Kwarteng, to accelerate priority infrastructure projects, such as roads and offshore wind farms.

The plan was published the day after Jacob Rees-Mogg, Kwarteng's successor as Secretary of State for business, energy and industrial strategy, announced that the government is lifting its moratorium on fracking for shale gas.

Environmentalists have expressed concern over the appointment of Rees-Mogg, who has been accused by shadow climate change secretary Ed Miliband of 'flirting' with denial of the climate crisis.

However, they have welcomed the appointment of Graham Stuart as minister of state for climate; he has called for 'immediate global action' to tackle global warming.

The mini-Budget follows the government's announcement, on 7 September, that it will cap household energy bills at £2,500 for the next two years, while offering equivalent support for businesses over the next six months.

EC proposes winter cut in electricity demand of 10%

The European Commission (EC) has proposed an overall reduction in electricity demand of at least 10% across EU member states this winter, to help reduce dependence on Russian gas imports.

A package of measures – published on 14 September, when the Commission's president, Ursula von der Leyen, gave her annual State of the Union speech to the European parliament – includes a proposed one-tenth cut in electricity demand until the end of March 2023. In addition, the EC proposes member states reduce electricity consumption by at least 5% during peak-price hours, to reduce demand when consumption is most reliant on expensive gas-fired power generation.

As well as cutting gas consumption by up to 1.2 billion cubic metres, reducing demand will help the EU to meet climate commitments under the European Green Deal, the EC said. It has also suggested that member states could use revenue from its windfall tax on the excess profits of energy companies, proposed as part of the package, to promote investment in renewables and energy efficiency. They can also finance cross-border projects in line with the REPowerEU plan from the temporary 'solidarity contribution' levied on these firms' profits, 20% above the average for the previous three years.

IN BRIEF

Prime Minister: Planning Inspectorate has too much power

Liz Truss has said it is 'too easy' for councils to be overruled by the Planning Inspectorate. In her first Prime Minister's Questions in the House of Commons on 7 September, Truss – responding to backbench Conservative MP Sir Peter Bottomley – said: 'There is not enough power in local hands at the moment. It is too easy for local councils to be overruled by the Planning Inspectorate, and that is certainly an issue that I expect my Secretary of State for housing to look at.'

Number of new homes with highest EPC ratings falls

The number of homes built by large and medium-sized housing associations that meet the highest Band A energy performance certificate (EPC) rating has fallen over the past year. According to a new survey carried out by *Inside Housing* magazine, the largest 157 associations built 607 homes that achieved an EPC rating of Band A, down from 650 last year. The 607 homes achieving EPC Band A rating made up 1.2% of total completions by the associations surveyed.

Pollution worse in non-white areas of US

Nitrogen dioxide pollution levels in the poorest black, Hispanic and Asian communities in Los Angeles were more than a third higher than for their white counterparts in the city, according to new research. Using satellite data, a team of researchers led by Professor Sally Pusede, of the University of Virginia, examined concentrations of nitrogen dioxide in neighbourhoods in 11 big US cities.

In another study on air pollution published in the *Environmental Pollution* journal it was found exposure to polluted air in the womb and during the first eight and a half years of a child's life can alter the brain.

The research, led by the Barcelona Institute for Global Health, established an association between air pollution and white matter structural connectivity in the brain.

Vaillant and Baxi announce pure hydrogen boilers for R&D pilot

Vaillant and Baxi are providing 100% fired hydrogen boilers for the HyStreet heating demonstration village at RAF Spadeadam in Cumbria.

Baxi has announced its first hydrogen boiler for commercial applications, while Vaillant's unit has been fitted in a purpose-built, terraced home.

Previously, Baxi had installed 100% hydrogen boilers for residential use at the hydrogen pilot homes in Low Thornley, Gateshead, and HyStreet.

The HyStreet project is part of the H21 scheme, led by Northern Gas Networks and DNV, and includes a one-kilometre, purpose-built polyethylene microgrid.

The microgrid mirrors a typical UK gas distribution network, comprising pipework of various pressures, and is being used to understand how networks can be managed and operated on 100% hydrogen.

In March this year, Vaillant installed its first 100% hydrogen boiler in the UK at the H21 South Bank site in Middlesbrough, where testing is taking place on disused land.

Hydrogen focus must be on greatest gains, says report

Fuel should be prioritised for industrial heating processes, according to engineers

Blending hydrogen into the gas grid may not be the best use of the fuel, according to a new report that calls for a focus on end uses that deliver the widest decarbonisation benefits.

The report by the National Engineering Policy Centre (NEPC) says hydrogen is likely to play a 'critical role' in a net zero energy system. However, the partnership of 42 professional organisations, led by the Royal Academy of Engineering, warns that achieving this goal will rely on a 'rapid scaling up' of low carbon hydrogen infrastructure. It says production should be focused on end uses where greatest gains can be delivered in terms of wider-system decarbonisation.

Given that the availability of low carbon hydrogen will be 'limited' while production is scaled up, the report recommends that the fuel be used where it is the only available low or zero carbon option, and where it can achieve the highest carbon savings and cost efficiencies from a whole-system perspective.

As a short-term measure, blending may not be the best use of available hydrogen, given that there is a lack of low carbon alternatives in other areas, such as some industrial processes.

The report also flags up risks that consumers will have to pay more for heating because of the high cost of producing low carbon hydrogen, delaying decarbonisation of heat by locking in demand for gas boilers.

However, blending could help hydrogen production get off the ground by creating an 'off-taker of last resort', it added, reducing the risk for investors by providing a constant demand.

The NEPC report also calls for further assessments to establish standards to safeguard health and safety in hydrogen production, transportation, storage, and end use.

HDR APPOINTED ON CITI TOWER UPGRADE

Global consulting engineer HDR is to help overhaul Citi Tower, the 20-year-old, 42-storey HQ of Citigroup. It will be the first significant upgrade of a major building in east London's Canary Wharf district.

HDR will provide building services, structural design, IT infrastructure design, lifts, and energy modelling. The MEP services and design will expand occupancy levels and increase ventilation rates. The number of lift cars will be increased to 55 and six escalators added. New elements include a multi-floor winter garden.

Main construction works are due to start in February 2023, with completion scheduled for late 2025.

Competency standards will bring radical change, says CPA

White paper sets out requirements to demonstrate construction product competence (CPC)

Radical change is needed in competence standards for individuals who supply, use, or otherwise work with construction products, according to a white paper issued by the sector's trade association.

The *Built environment – proposed construction product competence standard – white paper* bit.ly/CJOct22CPA has been developed by Competence Working Group 12, which is led by the Construction Products Association (CPA).

The white paper is the working group's response to the competence issues raised in Dame Judith Hackitt's building safety report following the Grenfell Tower fire disaster and the requirements set out in subsequent legislation.

Misuse of construction products can lead to dangerous and potentially fatal outcomes, says the white paper, but there is currently no universal way to demonstrate that an individual has the correct competence for the tasks for which they are accountable and responsible.

It adds that individuals who work with construction products across the supply chain, including designers, must be properly assessed and deemed competent to do so.

The white paper sets out a single, agreed standard to determine, demonstrate and recognise construction product competence.

The proposed standard comprises five core levels of competence, as well as a methodology that defines how these can be mapped consistently by different industries to their competence frameworks. The application of this framework will include those procuring, specifying or designing construction products, as well as principal designers.

The levels outline fundamental knowledge bases applicable to tasks associated with all construction products. Industries can then map these against their training and qualifications, and create any additional training infrastructure.

Peter Caplehorn, chief executive of the CPA, said: 'The Building Safety Act is making clear that regulators will no longer tolerate an industry that does not evidence its competence. The CPC levels have been designed to provide a single framework for everyone to work to, and I would urge the industry to read this white paper and get involved in testing it together.'

CPA chief executive Peter Caplehorn

IN BRIEF

Ramboll launches boiler appeal for Ukraine

Ramboll is appealing for used boilers to help repair a combined heat and power plant in Kremenchuk, Ukraine damaged by Russian bombardments.

Together with the Nordic Environment Finance Corporation and the Danish Embassy in Kyiv, the company is appealing to UK boiler and district heating companies to supply natural gas or oil boilers, which could be put into operation by December. It says district heating companies often put older, but usable, boilers in 'stock' when converting from gas and oil.

Contact Ramboll at ross.connell@ramboll.co.uk

LED lights altering animal behaviour

Greater use of LED lighting for buildings across Europe is resulting in more blue light emissions, with knock-on 'substantial biological impacts', according to a new study.

Using images produced by the International Space Station before and after the rollout of LED lights over the past decade, University of Exeter academics have found that orange-coloured emissions from older sodium lights are rapidly being replaced by white emissions produced by LEDs.

The study says increased exposure to blue light in the white segment of the spectrum can alter the behavioural patterns of night animals, such as bats.

IN BRIEF

Partnership to deliver sustainable homes

Modern methods of construction specialist Edaroth has partnered with housing association the Hyde Group to deliver new, sustainable homes. Edaroth, which is a wholly owned subsidiary of Atkins, will provide development management, design and engineering expertise, as well as its latest accredited offsite manufacturing techniques. Hyde is one of the largest housing associations in south-east England.

EU heat pump sales up by 35% in 2021

According to analysis in the journal *Nature Energy*, heat pump sales in the EU grew by 35% during 2021, to 1.99m. In the US, they expanded by 15%, to 3.9m. Global sales of heat pumps grew by 3% in 2020, but this was down on previous growth rates of around 10% in previous years.

Decarbonising energy will save £11tn by 2050, says study

Oxford research says costs of renewables will be much lower than expected

Completely decarbonising the energy system by 2050 is expected to save at least £11.23tn ($12tn) globally, compared with continuing with current levels of fossil fuel use, according to a new study by researchers at the Oxford Martin School Institute for New Economic Thinking.

Published in the journal *Joule*, the study shows that a 'fast transition' to a fossil-free energy system by mid-century would provide 55% more energy globally than today. This would be generated through ramped up deployment of solar, wind, batteries, electric vehicles, and clean fuels, such as green hydrogen.

Concerns about costs have been a 'barrier' to implementing such technologies, the study says, but past modelling has 'badly overestimated' the future costs of key clean energy technologies over the past 20 years.

The real cost of solar energy has dropped twice as fast as the most ambitious projections in past models, it adds.

The study was conducted using data that predates the war in Ukraine, say the authors. However, the subsequent skyrocketing price of gas and oil underscores the study's finding and demonstrates the risks of continuing to rely on 'expensive, insecure' fossil fuels.

'A rapid green-energy transition will likely result in overall net savings of many trillions of dollars – even without accounting for climate damages or co-benefits of climate policy,' the study says.

Professor Doyne Farmer, who led the team, said: 'Renewable costs have been trending down for decades. They are already cheaper than fossil fuels in many situations, and our research shows they will become cheaper than fossil fuels across almost all applications in the years to come.'

WOLFSON COLLEGE OXFORD SWITCHES TO ELECTRICITY

Oxford University's Wolfson College has completed the switchover from gas to electricity on its 1974 estate designed by Powell & Moya. With the help of a £5m Salix government public sector decarbonisation grant, the college has filled its underground car park with seven new air source heat pumps and evaporators, and installed more than 1,000 triple-glazed bespoke windows and 1,000m of electricity cabling. In enhancing its electricity supply it also laid more than 600m of new pipework. The insulation and electrification works will stop the emission of 20,000 tonnes of carbon from the main estate over the next 20 years. Max Fordham is the decarbonisation adviser to Wolfson and helped to secure the Salix grant. It is managing the installation and commissioning of the heat pump system, which it designed.

Max Fordham did an energy audit and decarbonisation plan for Wolfson College

Construction output down for second month running

July fall of 0.8% in UK follows 1.4% slump in June, according to ONS

Construction output shrunk in July for the second month in a row, according to two of the most closely watched benchmarks of activity in the sector.

According to the Office for National Statistics' (ONS's) latest monthly construction industry update, published on 12 September, the sector's output decreased 0.8% by volume terms in July 2022.

Following the 1.4% decrease in June, this marked the second consecutive fall in monthly construction output after seven consecutive months of growth.

July's fall in construction output stemmed solely from a decrease in repair and maintenance (2.6%), as new work increased slightly, by 0.3%, during the month.

At a sector level, the main contributors to the decrease in July 2022 were new public housing work, and public and private housing repair and maintenance, which decreased 13.1%, 8.0% and 2.6% respectively. However, the level of construction output in July 2022 was still £300m, equating to 2.1% above the pre-pandemic level in February 2020.

Despite the monthly decrease, construction output increased 1.4% in the three months to July 2022, which came solely from an increase in new work (2.7%).

The ONS figures follow the publication, on 6 September, of the S&P Global/CIPS UK Construction Purchasing Managers' Index, which also showed a second successive monthly decline in activity.

The index, which measures month-on-month changes in total industry activity, was at 49.2 in August. While up fractionally from 48.9 in July, this was still below the 50 mark – which shows no change – signalling a fall in construction activity over the month.

New orders increased only marginally in August, with respondents indicating that customers were holding back on committing to projects amid cost pressures.

In a further sign of a slowdown, S&P and CIPS said construction firms scaled back their input buying for the first time since the initial wave of the pandemic.

IN BRIEF

New office for CPW

CPW has opened a new office in Oxford. The mechanical, electrical, and acoustics consultancy has previously relied on its London and Midlands-based offices to deliver projects across Oxfordshire. However, it has now set up in the city after several big project wins and positions on major university frameworks, including a state-of-the-art Institute of Global Health for the University of Oxford and an extensive decarbonisation study for St John's College.

Electricity supply chain group launches

The UK Electricity Products Supply Chain Council has been launched. Led by Beama, the council's membership is drawn from across the energy and contracting sector, and will be supported by the UK government. The council, which was launched on 7 September, will help tackle the immediate pressures on the supply of equipment, while looking to the future and how to ensure the longer-term investment needs of the supply chain.

HM Queen Elizabeth II

The Board of Trustees, members and the staff of the Institution were deeply saddened to learn of the death of Her Majesty Queen Elizabeth II. CIBSE sends its condolences to all members of the royal family.

CIBSE received its Royal Charter from the Queen in 1986. One of the last laws to be given Royal Assent during her reign was the Building Safety Act. This will bring radical changes to the way the construction industry designs, constructs and operates buildings.

Professor Michael Gallimore and CIBSE President Kevin Mitchell (right)

Anniversary visit to help inspire next generation

CIBSE President Kevin Mitchell FCIBSE signs agreement with De Montfort University Dubai

As part of CIBSE's 125th anniversary year commitment to engage and inspire the next generation and strengthen international ties, CIBSE President Kevin Mitchell FCIBSE and CIBSE CEO Ruth Carter visited the United Arab Emirates last month.

The five-day trip included a visit to De Montfort University Dubai, and included the signing of an agreement to launch a CIBSE student group at the university.

The agreement, signed by the CIBSE president and Professor Michael Gallimore, the university head of campus, is a testament to the mutual commitment of both parties to deliver a sustainable, safe and healthy built environment through the building services profession.

Accompanying Mitchell and Carter on the visit were CIBSE UAE committee member Marc Lynch and CIBSE YEN UAE representatives Fahim Ahmadi and Mohammed Shamroukh. CIBSE would like to thank the faculty and students of De Montfort University Dubai for their hospitality and look forward to a mutually beneficial partnership.

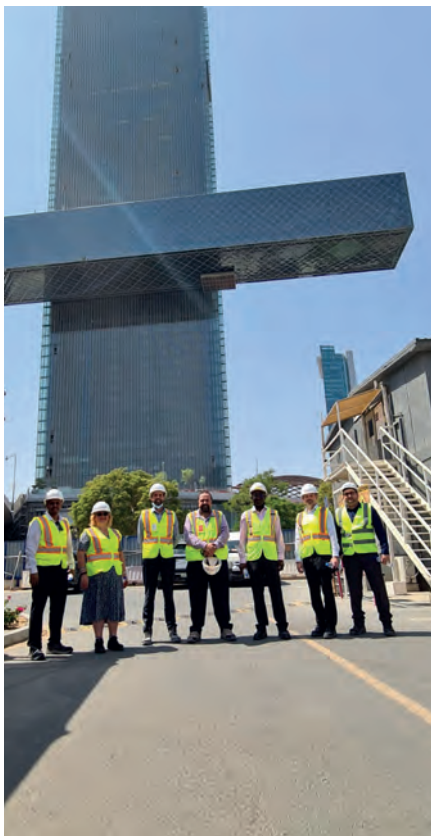
The trip also saw Mitchell and Carter visit the One Za'abeel project site along with CIBSE UAE committee members Mohd Imran Shaikh FCIBSE and Isaac Coker FCIBSE. The guests were given a tour of the building and an overview of the building services system.

A visit to the Manipal Academy of Higher Education, Dubai, provided another opportunity for Mitchell and Carter to engage and inspire the next generation. They addressed the students delving into the CIBSE 1-2-5 Challenges: Celebrate, Inspire, Boost, Share and Engage.

An agreement was signed by Mitchell and Dr S Sudhindra, academic president, of Manipal University, to launch a CIBSE student group. The visit concluded with a question and answer session with Mitchell and Carter fielding questions from the inquisitive and curious minds in the audience.

Mitchell also participated in a UAE panel discussion on the topic 'Cross-collaboration for Net Zero transition'.

This included embodied carbon statistics for the region; a discussion on cross-disciplinary communication at university level; the need to create platforms to promote ideas around sustainable development; and the need to reduce current energy consumption rates by retrofitting buildings.


CIBSE guests were given a tour of One Za'abeel, Dubai

Mitchell and Carter also visited Ramboll Middle East, where the President and Michael Rimmer MCIBSE, director of MEP at Ramboll, signed a letter of intent to develop their CIBSE training and development scheme, to attract and qualify more building services engineers. Upon successful implementation, Ramboll Middle East will be the first in the region to achieve this milestone.

The full itinerary included visits to Masdar Institute, the Louvre Abu Dhabi museum – a building Kevin Mitchell worked on – and a trip to the Jumeirah Living Marina Gate Hotel, also in Abu Dhabi.

Speaking about the trip, Mitchell said: 'It was a privilege to visit the UAE and see the scope and impact the UAE region and committee have.

'As CIBSE's global reach grows, it is imperative we continue to strengthen our international relationships and build on the work of building services engineers in ensuring our buildings are safe, healthy and delight the occupants while mitigating the effects of climate change. And we must inspire the next generation of engineers to future-proof the industry.'

The trip was organised to coincide with the UAE Awards, which took place on 8 September at the Armani Hotel, Burj Khalifa, Dubai, and was the final event of the President's and CEO's visit.

CIBSE reveals annual UAE Award winners

The annual UAE awards, which this year took place in person at the Armani Hotel, Burj Khalifa, celebrated and showcased the outstanding individuals, companies and projects across the UAE region.

This year's winners were:

- **Graduate of the Year**

Winner: Suvarna Kumar, Buro Happold
Runner-up: Krishna Ajith, Manipal University Dubai

- **Young Engineer of the Year**

Winner: Munis Hameed, Black & White Engineering
Runner-up: Sumith Sunil, AECOM

- **Manufacturer of the Year**

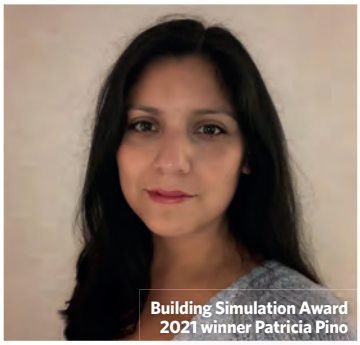
Winner: Grundfos
Runner-up: Trosten

- **Consultancy of the Year**

Winner: Cundall
Runner-up: WSP

The President's Prize – the CIBSE Undergraduate Award– was also presented on the night to winner Khushbu Mankani of Heriot-Watt University, Dubai.

IN BRIEF



Building Simulation Award 2021 winner Patricia Pino

Simulation and modelling awards open for entries

The CIBSE Building Simulation Award 2022 and the CIBSE Young Modeller Award 2022 are open for entries.

The Simulation Award focuses on the use of building simulation in projects and aims to encourage innovation in building simulation techniques.

Entries should provide information on a project that has a simulation or modelling aspect, giving details of why this was important. A panel of experts will review the entries and select six to be presented at the Build2Perform event in November, after which the winner will be announced.

The CIBSE Young Modeller Award recognises the outstanding contributions of young engineers, apprentices and sustainability consultants working with building simulation, and encompasses all types of simulation for the built environment. The competition is open to anyone who holds a position in academia, industry or the public sector, and who is within three years of completing their highest degree. It is also open to undergraduates, apprentices or those graduating in 2022-23.

Entrants should submit samples of their work, a CV and a referee's testimonial by 16 October. To enter, go to **bit.ly/CJOct21BSG** and watch past events at **cibsebsg.blogspot.com**

Employers recognised for nurturing engineers

Employer of the Year winner will be revealed at RIBA on 11 October

Six employers have been shortlisted for the CIBSE Employer of the Year award for their dedication and commitment to supporting and developing young engineers.

Those on the list have each demonstrated how they nurture, encourage and boost the development of their early years engineers.

The award is split into three categories for small, medium and large companies, and there is an overall winner. Employers were asked to demonstrate how they place young engineers at the centre of their business and invest in their career progression, with clear strategies for recruiting, nurturing and empowering them.

FairHeat and Rybka have been shortlisted in the small company category, CPW and Elementa Consulting in the medium company section, and Aecom and Hoare Lea in the large company category.

'This year's Employer of the Year was packed full of employers who really care about the sector and promoting talent, whether that's through accredited training schemes, creating their own college, promoting in-house talent or training on the job,' said the judges.

In CIBSE's 125th anniversary year, the Employer of the Year awards form part of the CIBSE Young Engineers Awards, which also include the CIBSE ASHRAE Graduate of the Year and CIBSE Apprentice of the Year. Collectively, they shine a spotlight on the pool of new talent and future leaders who are vital to the future of our industry, while celebrating those who champion, mentor and support them.

Winners will be unveiled on 11 October, at the Young Engineers Awards event at RIBA London, in partnership with CIBSE Patrons, and sponsored by ACV, Ideal Heating, Lochinvar, Swegon and Viega.

● For full details go to **www.cibse.org/yea**

ChapmanBDSP was the 2021 Employer of the Year

A paper on modelling elevator traffic with social distancing won the Napier Shaw Bronze Medal

Medals awarded for researchers' work

The winning papers were published in *BSER&T* in 2021

Four technical papers have been recognised with awards by CIBSE.

The Dufton Silver Medal for research went to *Towards active buildings: rating grid-servicing buildings*, by Ian Walker, Stephen Allen, Matthew Roberts, Daniel Fosas, David Coley and Elli Nikolaidou. Referring to buildings that provide energy network services by timing their use and production of energy, the study aimed to develop and test a code to encourage minimisation of energy consumption, building-integrated generation, and the provision of grid services.

The Napier Shaw Bronze Medal for research was won by *Modelling elevator traffic with social distancing in a university classroom building*, by David Swinarski, which studied the potential negative impact of social distancing on vertical traffic in a university building, and the effect of four interventions to improve it.

The Barker Silver Medal for application and development was awarded to Joseph Lingard for *Residential retrofit in the UK: the optimum retrofit measures necessary for effective heat pump use*. This uses dynamic simulation modelling to determine the optimum retrofit to minimise energy use and electrical demand for a semi-detached dwelling using a heat pump.

The Carter Bronze Medal for application and development went to *Evaluating the perception of thermal environment in naturally ventilated schools in a warm and humid climate in Nigeria*, by Yingchun Ji and Charles Munonye. This looked at the thermal comfort perception of young children and thermal conditions in the classrooms.

The awards will be presented at this month's CIBSE President's Awards dinner.

The papers were published in *Building Services Engineering Research and Technology* (*BSER&T*) in 2021. CIBSE members can read *BSER&T* at **www.cibse.org/knowledge**

New title on embodied carbon calculations for ANZ region

A new publication focusing on calculating embodied carbon in building services for the Australia and New Zealand (ANZ) region has been published.

TM65: Embodied carbon in building services: a calculation methodology for Australia and New Zealand provides country-specific assumptions to be used when carrying out embodied carbon calculations for building services equipment when no environmental product declarations are available. It is an addendum to 2021's TM65 *Embodied carbon in building services equipment: a calculation methodology*, which is targeted primarily at engineers and consultants working in the UK, and has been led by the Green Building Council of Australia and CIBSE Australia and New Zealand.

TM65 is a simple, cost-effective and consistent methodology for approximating the embodied emissions of MEP equipment, and allows for aggregated data to be collected for benchmarking purposes. CIBSE will roll out a series of technical sessions for the ANZ region to assist with the application of this methodology.

- TM65 is available at **cibse.org/knowledge**

CIBSE Build2Perform Live to address net zero and embodied carbon

CIBSE has announced the key themes for Build2Perform Live, which takes place at London Excel on 29-30 November 2022.

Dozens of industry experts will present on topics related to the net zero carbon standard, the future of heat, the all-electric building, the circular economy, and embodied carbon.

Those on the net zero stage will look at the details of the standard and its likely impact on the industry. Seminars and CPDs will address the challenges of delivering all-electric buildings and there will be sessions on the decarbonisation of heat in homes.

Tackling embodied energy and following circular principles of construction is currently high on the agenda at the moment and Build2Perform Live will be looking at the opportunities for early adopters. Speakers will discuss the urgent need to regulate the calculation of embodied energy during the lifetime of a building.

To register for Build2Perform, visit **build2perform.co.uk**

President's blog examines how we promote ourselves

The latest blog post by CIBSE President Kevin Mitchell, looks at how building services engineers communicate their roles and their impact.

Mitchell says the term 'building services engineering' does little to convey the variety or specialisms covered within the sector, or the impact and importance of the work engineers do. Referring to the role engineers play in delivering safe, healthy and more sustainable buildings is far more engaging, he adds.

Emphasising the importance of representing the diverse and varied routes into building services, Mitchell says he has been inspired and touched by the response from others when he has shared his journey into the industry.

Read the blog in full at: **www.cibsepresidentsblog.co.uk**

To find out more about the CIBSE 125 Challenges and to **#Share your story** go to **bit.ly/CJOct22CN1**

New committee heralds more inclusive CIBSE

Inclusivity committee aims

- **Create greater awareness in CIBSE about diversity and inclusion (D&I) issues**
- **Identify and address barriers to improving D&I**
- **Encourage greater equity in CIBSE and in the industry**
- **Ensure that fundamental aspects of a person's identity are not barriers to progression within CIBSE and the industry, whether it is race, colour, gender, sexuality, disability or neurodiversity**
- **Engage with partners and support groups and employers in our industry to improve equity, diversity and inclusion**
- **Encourage all our members to be allies, mentors and supporters of disadvantaged minorities**

The CIBSE Inclusivity Committee aims to create opportunities for all members

CIBSE has launched a new inclusivity committee that will increase diversity within the building services engineering sector.

Chaired by immediate past presidents, the committee replaces the diversity and inclusion (D&I) panel.

CIBSE says the formation of the committee is the beginning of a 'new chapter'. It is part of a push for improved diversity and greater inclusion within the Institution, and it aims to create greater awareness of the issue in the building services industry generally.

The goal is to provide greater opportunities for those from minority groups to become Board members and award nominees.

Four sub-panels will inform the committee: Women in Building Services Engineering (WiBSE) and three new panels representing LGBTQI+, neurodiverse and ethnic minority communities within CIBSE. The panels will not be limited to four; the goal is to eventually represent and support all under-represented communities.

Feedback from the D&I and WiBSE chairs and members was a key driver in the new structure of the inclusivity committee and groups, says CIBSE.

The first chair of the committee is immediate past president Kevin Kelly FCIBSE, who said that fostering a diverse environment was key. He added that there were many benefits in acknowledging the strengths and potential of all members.

Implemented as part of the process for the nomination's procedure, the committee aims to generate solutions to problems through open conversation, highlighting issues and pinpointing the needs of members for greater equity.

CIBSE is recruiting for the four panels and urges members with experience and/or expertise to come forward.

Committee chair Kevin Kelly FCIBSE

It is our intention as a standing committee of the Board to ensure that CIBSE follows best practice to improve diversity and inclusivity in the Institution.

We want CIBSE to be a warm and welcoming place, with greater equity. We realise that equality of opportunity is not enough; there must be equity.

Equity is about giving equal opportunity to those who need it. For this, positive action is needed. If you are a manager or senior engineer, think about who needs a step up to gain equality of opportunity, and try to provide it.

CIBSE has implemented a new process for its nominations procedure to ensure equal opportunities are provided to those from minority groups to become members of the Board and council, and to be nominated for awards. They will be actively encouraged to participate.

This will also apply to other areas of CIBSE as we begin what will be a never-ending journey towards inclusivity.

Felicity Hassan and Suki Sandhu, in their book *A judgement-free guide to diversity and inclusion for straight white men*, argue that greater inclusion is not about disadvantaging straight white men, but about them becoming allies, mentors and sponsors to members of minority groups.

We want to talk about and understand issues, listen to what people need for greater equity, and generate solutions. It is our intention to have the difficult discussions, build bridges, and be creative in our responses.

We will make mistakes along the way, and so will individuals who buy into this as allies and mentors and supporters – but we will listen and learn.

> "Equity is about giving more opportunity to those who need it to ensure there truly is equality. For this, positive action is needed"

Annette Ash, WiBSE chair

Women in Building Services Engineering (WiBSE) aims to inspire the next generation of engineers and create a support network to enable more women to join, stay and progress through the industry.

Among its goals are to increase and retain the number of women within the building services industry, provide advice, encouragement, support, mentoring and training for those already in the sector, address gender imbalance issues, and provide networking events for members.

Membership is free and open to anyone – men and women - within the industry. You don't have to be a CIBSE member. For more details, visit: **bit.ly/CJOct22WIBSE**

David Stevens FCIBSE, LGBTQI+ panel chair

I am excited to be chairing this panel with Gina Barney, and to be joined by some fantastic members of the LGBTQI+ community and their allies. The panel truly reflects the diversity of the LGBTQI+ community. Each member brings their own lived experience and, by participating, we can illuminate those experiences for the benefit of the wider community to help eradicate what are often invisible inequalities.

We intend to collaborate with professional engineering institutions, networks and LGBTQI+ organisations to bring best practice and ideas to CIBSE and help the Board understand issues relating to people with minority sexual orientations and gender identities.

We want CIBSE to be able to celebrate and cherish the diversity of its members. We hope that it will advise and make recommendations to the inclusivity committee, as well as being a point of contact for LGBTQI+ members and allies.

CIBSE has global reach, and some of our members may live in parts of the world where simply being who you are is illegal. CIBSE should be a safe space for our members in those areas.

Hakeem Makanju MCIBSE, minority ethnic groups panel chair

It is an honour to be elected as the inaugural chair alongside the honorary secretary, Emeka Osaji. Our panel of around eight members is a diverse team that brings the breadth of experience needed to champion and offer solutions to issues affecting ethnic minority members.

CIBSE recognises that it is a white, middle-aged and male-dominated Institution. Therefore, the primary aim of the panel is to work collaboratively with the diversity and inclusion committee, and others, to help to unlock CIBSE's wealth of diversity.

We can do this by identifying and removing barriers inhibiting representation of ethnic minority members on the CIBSE Board, nominations panel, in senior membership, at careers fairs, and on role model and mentorship schemes, to mention but a few.

On this note, and in the coming weeks and months, we want to engage and encourage CIBSE members from ethnic minority backgrounds and allies to step forward and join us on this exciting journey to create a truly diverse and inclusive CIBSE of which we can all be proud.

Regime change

In his first column of the reign of Charles III, Hywel Davies considers the range of problems and challenges that face His Majesty's government under new leader Liz Truss

The death of Queen Elizabeth II after an unparalleled 70 years of faithful Christian service is truly the end of an era. Every Sunday, the Church of England prays for the Sovereign, and that their counsellors may be given wisdom.

So, what wisdom might we pray for the new Prime Minister and her newly appointed ministers of the Crown as they seek to address the challenges they have inherited?

We heard a great deal of campaign talk in August, but the constraints of government now come to bear on the new administration. We have already seen significant changes – the cap on energy bills, the end of the moratorium on 'fracking', and tax reforms 'to stimulate growth'.

Some commentators have suggested that this is the first truly Conservative government since 1990, with a clear commitment to deregulation and free-market solutions. There are clear indications of intent to build more homes and many suggestions of a changed approach to net zero carbon ambitions. This is clearly a significant topic for readers.

Will we see government easing off the push to achieve the 2050 zero carbon target? Will we see a change to the commitment to end the connection of new homes to the gas grid in 2025 – and will there be a Future Homes and Buildings Standard?

With the commitment to net zero, we have a huge task ahead. There are 28-30 million existing buildings in the UK, all but two million of them our homes. Most will still be standing in 2050. Net zero by 2050 is simply impossible without embarking on a massive national programme that has the capacity to deliver a million refurbished homes a year, each and every year, from now until 2050.

While it will be easy for government and the media to focus on the very real and urgent problems facing millions of people struggling to pay their energy bills this winter, we must not allow genuine concern for their plight to distract us from the significant long-term demands of climate change.

Our current energy supply problems date back decades and are squarely down to governments of all persuasions ducking difficult decisions. As we now regret that failure of wise leadership – the fiasco of the Green Deal and the failure to address the energy performance of public building stock when the Energy Performance of Buildings Directive landed in 2004 – it is vital not to make similar mistakes now.

"Our current energy supply problems date back decades and are down to governments of all persuasions ducking difficult decisions"

Industry must do what it can to prepare for the future. Last month, the Net Zero Carbon Buildings Standard (NZCBS) partnership announced the appointment of David Partridge to chair its governance board. This initiative brings together nine organisations from across the construction and property sectors to develop a clear standard that identifies a net zero carbon building and allows its owner or operator to demonstrate the truthfulness and accuracy of that claim.

Partridge has been appointed to oversee the initiative and to take it to clients, developers and financiers who are already crying out for it.

Anyone not familiar with his track record of delivering an ambitious, challenging, long-term project need look no further than the area around London's King's Cross and St Pancras. The transformation of that district over the past two decades is a testament to Partridge's capacity to drive and deliver real change.

He will need all the wealth of experience, commitment and determination he brings to the NZCBS work to drive it forward to deliver an agreed and widely accepted industry standard.

CIBSE is fully committed to the technical steering group and the detailed development of the standard through a number of our members. The most exciting aspect of the scheme is that it is being developed by the industry for the industry.

When complete, NZCBS will give government an industry solution to the problem of recognising net zero buildings. It will provide a solution, not a problem. We think it would be wise to adopt it.

Keep an eye on the *Journal* and CIBSE websites for further details.

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

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Getting under the skin of statutory maintenance

Building owners, occupiers and managers risk non-compliance if they do not monitor maintenance activities closely, says Sodexo's Will Borthen

Operating buildings and delivering maintenance services not only comes with the responsibility to ensure systems are functioning effectively and efficiently, but also to make sure they are safe, and building occupants are not put at risk.

Failure to undertake appropriate maintenance activities can result in severe injury or loss of life, so legislation has been put in place to protect against this. Maintenance services could include the inspection and testing of lifts, fire alarms, sprinklers, water tanks, cooling towers, and so on.

The legislation is supported by Approved Codes of Practice, guidance, regulations or standards, which determine the frequency of maintenance tasks and the competency required for those doing the work. Further guidance can be found in *Guide M: Maintenance engineering and management* (bit.ly/CJOct22WB1) which is due to be updated this year.

Defined roles and responsibilities ensure there is accountability for the management and delivery of statutory maintenance. It is common for owners and occupiers to outsource planned maintenance activities; however, it should not be assumed that this means all responsibilities are discharged to the service provider. As duty holders, it is vital that owners, occupiers and managers have a good understanding of the statutory and mandatory maintenance requirements, and have a reliable and definitive way to monitor the compliance of their buildings and the competence of their supply chain.

"Systems can help monitor performance, but they often don't give the full picture, which can lead to a false sense of security"

A well-established performance method for maintenance contracts is to measure and report on the number of planned statutory and mandatory tasks due, and whether they were completed on time.

On the face of it, this seems like a suitable approach – and as long as all of the tasks are completed on time, the building would, logically, be compliant. However, this only focuses on the completion of one stage of the process, when there are actually several stages that need to be completed.

Insufficient visibility of the full end-to-end maintenance process means owners, occupiers and managers are often unknowingly at risk of non-compliance. This 'watermelon effect' presents the compliance position as green on the outside, but, below the surface, the unreported and actual position is entirely red and non-compliant.

As shown in Figure 1, a typical maintenance task – such as an annual boiler inspection – will require an

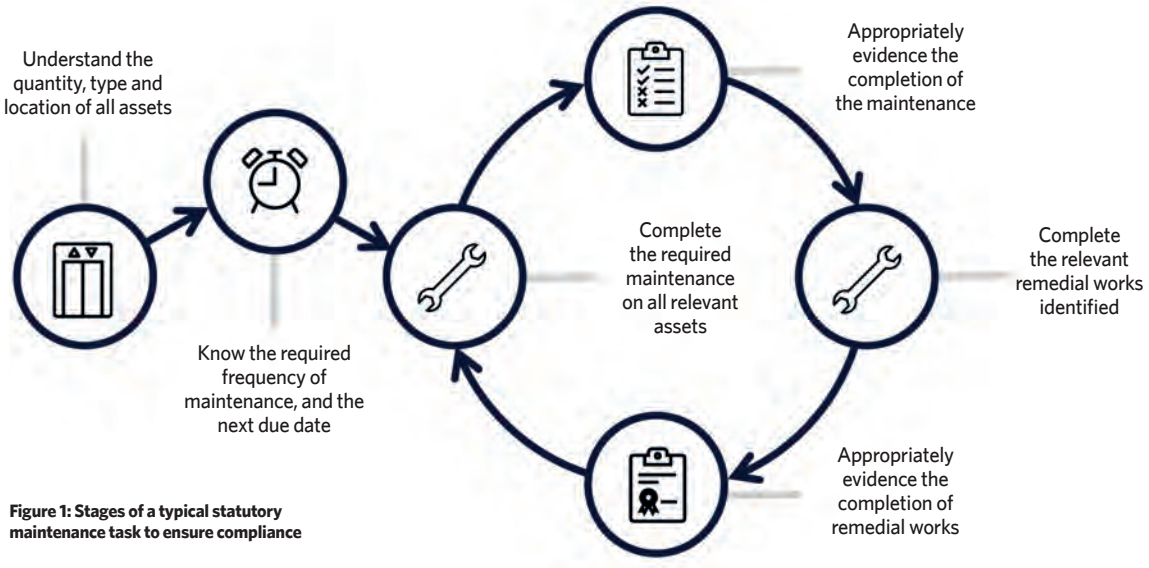

Figure 1: Stages of a typical statutory maintenance task to ensure compliance

WILL BORTHEN
is head of asset management at Sodexo, Property Professional Services

understanding of the quantity, type and location of all relevant assets to be known, so that the maintenance tasks can be instructed.

Knowing the next due date of the task allows the work to be scheduled in advance and delivered within time to the right standard. Evidence of the work should be provided, with the relevant information, date, and signature from the engineer.

If issues are identified during the inspection, a remedial action will be recorded and shared; this will generally need to be completed if it presents a risk. On completion of any remedial works, a final certificate should be issued demonstrating that the defects have been resolved.

It is necessary, therefore, for duty holders and other stakeholders to have a clear and fully representative view of all stages and activities in the maintenance process.

Sodexo's Property Professional Services team has developed an interactive compliance reporting tool called the Compliance Performance Index. This provides full transparency to the team and their clients of all these activities in real time, allowing subcontractors to be managed proactively, rather than retrospectively.

This exceptional level of compliance visibility allows the root cause of problems to be identified quickly, decisions to be made, and issues resolved before they become significant risks. Artificial intelligence (AI) is even used in the trend analysis of the data, with algorithms reading the compliance documentation to verify it as a pass or fail.

In summary, systems can help monitor performance, but they often don't give the full picture, which can lead to a false sense of security.

Inadvertently failing to meet statutory maintenance obligations can lead to serious harm, as well as personal or corporate prosecution, fines and damage to brand and reputation. Ensuring the full visibility of the end-to-end process within a robust management framework allows full and complete assurance of compliance.

BENEFITS OF THE COMPLIANCE PERFORMANCE INDEX

- **Provides a holistic view of the compliance of a whole estate, against every asset type**
- **User-friendly reporting dashboard, enabling users to interrogate the information by building, asset type, supplier, trade, and more.**
- **Provides AI functionality to read every evidence document, flagging non-conformances, which enables a focus on risks, issues and themes**
- **'System agnostic' tool, allowing mapping from existing data sources (CAFM, IWMS and so on) to be configured, avoiding the need for system development and providing agility**
- **Tested and proved on large portfolio occupiers**

What will new BS 9991 mean for smoke ventilation systems?

There may be a choice between designs with two staircases or a pressurised stairwell, says Exyte's **David Fitzpatrick**

BS 9991 lays out specifications and practices for suitable fire-safety measures within residential buildings. Some of the biggest changes being recommended focus on smoke ventilation systems and, for anyone in the industry, it's vital to understand what these changes mean. How will the industry react to the requirements?

We will see the full impact of the standard in the months ahead, but it's already clear that M&E consultants and architects will have to make some very early decisions on either pressurisation or two-staircase options when designing.

Any building services engineer with an understanding of pressurisation, and what's involved in designing the systems, will already be able to make a good assessment about whether it's beneficial to go for one pressurised staircase or opt for an additional staircase. They will be able to weigh up the safety, design and build-cost perspectives.

Right now, however – because such systems are so rare – there are very few smoke specialists in the residential sector who have experience of designing schemes with pressurised systems.

BS 9991 also gives us an opt out. It states that, if you have more than one means of escape, you don't need to have a pressurised stairwell. In this instance, the designers can go back to the more common mechanical solution.

But why would any developer looking to maximise their financial investment seriously consider a second staircase? Well, the equation is not clear.

For one thing, pressurisation systems require more space than conventional systems and are very complex in commissioning. Just assuming having two staircases will be more expensive may not be the case.

Over the coming months, it will be interesting to see if designers start looking at the solution solely from a cost perspective driven by the client or at the complexity of the two options.

This is why we believe it is really important to engage with experts early on in the project design, as this will make for better-informed decisions.

David Fitzpatrick is smoke fire systems operations director at Exyte Hargreaves

With the arrival of the new Building Safety Act, CIBSE has launched a series of events to inform professionals of the impending changes. **Molly Tooher-Rudd** reports

PICKING UP THE THREAD

'The Building Safety Act is a significant change and it is rapidly approaching. There will be no excuses for non-compliance. The time to start preparing is now.'

This was the rallying call from CIBSE technical director Hywel Davies at CIBSE's first Golden Thread conference last month.

He told delegates that everyone working in the industry would be affected by the legislation and he warned that they risked potential liability if they did not comply with the law to ensure the safe delivery and operation of buildings. 'What is clear is that we can no longer do a bad job and simply walk away; it will be noticed,' said Davies. 'The Act is intended to keep both buildings and people safe, now and in the future.'

The first of a series of CIBSE events on the Building Safety Act took place at RIBA's headquarters in London. The one-day conference, *The Building Safety Act: the consultation period and the golden thread*, featured experts from across the industry in a series of keynote speeches and panel debates.

The golden thread, as defined by the Department of Levelling up, Housing and Communities and Local Government is the 'information that allows you to understand a building and the steps needed to keep both the building and people safe, now and in the future'.

It was recommended by Dame Judith Hackitt in her report *Building a Safer Future*. She said that a 'robust golden thread of key information' needed to be passed from the project teams to the building owners so they could 'underpin more effective safety management throughout the building life cycle'. The government committed to implementing Dame Judith's golden thread recommendation and said it would apply to all buildings that fell within the scope of the regime described in the Building Safety Act. (See panel on page 25, 'What is the golden thread?')

In the first keynote of the conference, Davies stressed that the main Building Safety Act regime applies to all buildings, not just higher-risk buildings (HRBs). The Act names the Health and Safety Executive (HSE) as the new Building Safety Regulator in England, which will oversee building control bodies and advise on existing and emerging building standards and safety risks.

HRBs are covered by a new regulatory framework that introduces requirements around competence, inspections, mandatory reporting, and keeping a golden thread of information. (See panel on page 24, 'Measures for higher-risk buildings').

Legislation to make the collection of 'golden thread' building performance information mandatory is expected to be published as early as spring 2023.

The Building Safety Act – what will it change?

Hanna Clarke, digital and policy manager at the Construction Products Association (CPA), said she had a 'strong sense' that people did not understand the urgency of the situation. She told building service engineers in her keynote that it was vital to understand now what the practical implications of the Act are.

'When the Act comes into the picture, there will be real-life penalties,' said Clarke, who described how managers could be liable for unlimited fines and up to two years in prison.

'If you haven't got it right, you will be in bother,' agreed Davies. 'If something goes wrong, the HSE will be round, and they will crawl over everything.'

Clarke, who sits on the CPA competence steering group, discussed how a legal requirement will be imposed on clients to ensure building and works are properly monitored in compliance with regulations. She explained how Part 4 of the Act creates the new role of 'accountable person', the duty holder in occupation. Appointees must not start work until they are satisfied that the client is aware of their

duties. It is vital to understand individual levels of accountability and responsibility to determine who is qualified to do what, said Clarke.

Anyone appointed to carry out building or design work must be competent, she said. 'The moment anyone recommends a product, makes a procurement, a decision, they become a designer, and it is necessary for them to demonstrate competence,' she warned.

There was a mistaken belief that everyone in the industry is competent, Clarke added; however, identifying competence in another industry sector is difficult. 'To do this, we must be able to speak a similar language when we talk about competence,' she said.

A new white paper from the CPA proposes a competence standard for construction products. Clarke said the paper effectively proposes a single language for discussing products and helps meet Part 5 of the Building Safety Act, which states that all construction products on the UK market should be regulated (see News, page 9).

The BSI has also drafted a core criterion for building safety in competence frameworks, which is to be used by regulators. This standard details how to look at experience and behaviours through

Aman Sharma, Totus Digital

Judith Schulz, Arup

Hanna Clarke, CPA

"If you haven't got it right, you will be in bother. If something goes wrong, the HSE will be round, and they will crawl over everything"

an established checklist. Behaviour is construction's biggest challenge, said Clarke, who believes behaviour is a skill that can be improved, and that there are ways for companies to address this. She finished her keynote by asking delegates whether they can demonstrate their own competence.

In discussions about the key impacts of the new regime Anthony Burd, associate director and head of built environment at BSI, said requisite competency would be more important to ensure that buildings comply with regulations – and he predicted that some people would no longer be able to operate in the industry as they did before.

'The most significant thing will be a culture change, where people actually design buildings that prioritise safety,' added Richard Clark, senior fire engineer, National Fire Chiefs Council.

In the past, Clark said building safety information that was handed over did not have to be understood by the occupier. However, with the golden thread, information must be understandable by all.

Burd agreed: 'We saw systemic failure across the industry, with a dearth of understanding of who is responsible for what – the act will make it very clear who is responsible'.

The responsibility and competence of the designer regarding construction products was a recurring theme. Davies referred on multiple occasions to Part 2 Section 6 of the Act, which states that any product substitution on a HRB will have to be approved by the regulator.

'You cannot substitute without approval; the contractual mayhem this could wreak is huge,' he said.

The panel suggested that engineers will now have to account for multiple products with similar performance data, so, if one fell through, there would be another to fall back on.

'Products are specific, they are not general. If you change a product, you change the system,' said Clark. 'There may be significant repercussions, even with insignificant changes.'

The question of how the regime will be enforced was discussed. Davies said that it's not just about prosecution, and he suspects the HSE will give constructors a chance to revise compliances. However, the HSE will not offer a solution. 'Push back is where the enforcement starts,' says Davies.

The 2018 Hackitt report raised unanimous concern about the ineffective operation of the current rules on fire safety. Aman Sharma, managing director at Totus Digital, addressed the challenges of onboarding new knowledge and skills for better management. »

The golden thread should allow the right people at the right time to have the information to support compliance with all applicable building regulations, he said, adding: 'Managing information is a key part of the golden thread, to ensure that people can trust that the information is accurate and up to date.'

BS8644-1 is a new standard for digital management of fire safety information, drafted as a strategic information management approach for the fire safety sector. It can be considered part of the framework for the golden thread.

The standard is relevant to buildings using BIM and non-BIM protocols. It aims to enhance knowledge and understanding of the BS EN ISO 19650 series and the UK BIM Framework. Crucially, it demands that information should be usable and accessible at any point during a built asset's life-cycle.

Sharma introduced FIREie, which he called a 'suitcase by which information moves from one point to another'. It is the non-proprietary information structure for sending and receiving fire safety information about an asset for all relevant parties. The framework is made up of seven suggested information exchange points, dealing with who, what, when, where and why.

Sharma emphasised again that the golden thread during design and construction should facilitate the availability of the information that is needed to support compliance with all applicable Building Regulations.


Hywel Davies, CIBSE


Richard Clark, National Fire Chiefs Council


Dan Rossiter, BSI

There are many standards that can help create a golden thread of information, according to Dan Rossiter, interim head of built environment at BSI. He reiterated Sharma's point about the importance of digitised information and the Information Management Mandate, published by the Infrastructure and Projects Authority, which recommends BIM as a means of achieving the golden thread.

The UK BIM Framework is the holistic process of creating and managing information in the built environment, integrating structured, multidisciplinary data to produce a digital representation of an asset throughout its life.

There are eight standards set out within the UK BIM Framework, which offers free guidance on complying with regime requirements.

Rossiter outlined some of the requirements of the golden thread, including how information is reviewed and managed. To support this, he recommended BS EN82045-1, which specifies principles and methods to define metadata for the management of documents associated with objects throughout their life-cycle.

He also emphasised the requirement for the golden thread to be stored as structured digital information, and spelled out the documentation recommended for long-term storage.

MEASURES FOR HIGHER-RISK BUILDINGS

- **Competence requirements: those appointed to work on a higher-risk project must have the relevant skills, knowledge, experience and behaviours necessary to undertake the role. Organisations must have the right organisational capability**
- **Dutyholders: these will have accountability and statutory responsibilities when buildings are designed and constructed**
- **Gateways 2 and 3: at these points there will be rigorous inspection of Building Regulations requirements, ensuring that building safety is considered at each stage of design and construction**
- **A 'golden thread' of building information must be created, stored and updated throughout the building's lifecycle. Mandatory reporting is required to the new Building Safety Regulator of fire and structural safety occurrences that could cause a significant risk to life safety**

The golden thread in practice

Johnny Furlong leads the BIM strategy for housing association L&Q, and is vice-chair of the Golden Thread Initiative, launched in 2020. He investigated the test phase synergy of collecting and storing golden thread information throughout the life-cycle of a building and produced a process map for creating a golden thread.

Testing in a real-world scenario, L&Q – in partnership with industry – piloted the production of a standard, digitised golden thread for existing property assets and new builds. Furlong said it was essential to have a safety case regime in place from the start, and to be managing all the information on a golden thread.

L&Q commissioned 10 subgroups, divided into major categories including design consultancy, technology, and procurement. Each group went off to develop a subsection of the building thread and came up with proposals for the ways it would operate. These could then be tested in existing and new buildings going through the gateway process.

'The groups reported back to us, and we have got some really interesting takeaways, the details of which will all be in the final report,' Furlong said.

The final debate asked what the implications would be on working lives, and the consequences for product specification was flagged by Arup's Judith Schulz.

'If change in construction material is not controlled very carefully, there will be lots of unintended consequences,' she said. 'While change control might be quite expensive, uncontrolled change might cost us a lot more.'

Davies asked whether innovation would be inhibited if designers became wary of taking risks. Schulz said engineers needed to be 'very cognisant of how innovation is enabled based on proper understanding of the regulations'.

Ultimately, the panellists recognised that the Building Safety Act is trying to create an environment that delivers on the fundamentals of making buildings safe for the various users for whom they are being designed.

In his concluding remarks, CIBSE's head of digital engineering, Carl Collins, said: 'We shouldn't be fearing this challenge, we should be embracing it.' **CJ**

■ For future events in the series visit: **bit.ly/CJOct22GT**

WHAT IS THE GOLDEN THREAD?

1. The golden thread will hold the information that those responsible for the building require to identify, understand, manage and mitigate building safety risks to prevent or reduce the severity of the consequences of fire spread or structural collapse throughout the building lifecycle. Information stored will be reviewed and managed so that the information retained at all times achieves this purpose.

2. The golden thread covers both the information and documents and the information management processes used to support building safety. The government has defined the information as including all the information necessary to understand and manage risks to prevent or reduce the severity of the consequences of fire spread or structural collapse in a building.

3. The golden thread information should be stored as structured digital information. It will be stored, managed, maintained and retained in line with the golden thread principles. The Government will specify digital standards which will provide guidance on how the principles can be met.

4. The golden thread information management approach will apply through design, construction, occupation, refurbishment and ongoing management of buildings. It supports the wider changes in the regime to promote a culture of building safety.

5. Building safety should be taken to include the fire and structural safety of a building and the safety of all the people in or in the vicinity of a building (including emergency responders).

The 2022 CIBSE Young Engineers Awards will recognise a graduate and two apprentices for their skills and passion as building services engineers. For the first time, the awards will be held at RIBA headquarters, on what will be a memorable night for all 21 shortlisted engineers

21 YOUNG GUN SALUTE

The shortlist for the 2022 CIBSE Young Engineers Awards features 21 apprentices and graduates working for the cream of the building services industry.

There are eight engineers shortlisted in the CIBSE ASHRAE Graduate of the Year award, which has been running for more than 25 years.

In the CIBSE Apprentice of the Year award – now in its third year – there are six engineers shortlisted in the Technician (Level 3-4) category and eight in the Degree (Level 5-7) category. To determine the winners, judges will evaluate video entries from the shortlisted candidates.

The CIBSE Young Engineers Awards take place on Tuesday 11 October at RIBA headquarters in London. They aim to reward the innovative thinking, hard work and skills of graduate engineers, while also showcasing employers who are truly committed to developing and encouraging young talent. (See page 14 for the shortlist for Employers of the Year.)

The Graduate of the Year in 2021 was FairHeat's Lucy Sherburn, while the winners of the Apprentice of the Year awards were NG Bailey's Harry Playfair (Technician) and WSP's Josie Cheeseman (Degree).

To book your free place at the awards evening, visit **www.cibse.org/YEA** CJ

CIBSE ASHRAE Graduate of the Year

1 Anna Donaldson

Mechanical engineer, Foster + Partners

Anna graduated last year from the University of Sheffield, with a degree in architectural engineering, before joining the environmental engineering team at Foster + Partners, as a mechanical engineer. She works in an integrated design team, across a variety of international projects, designing and optimising MEP systems, energy modelling, and doing environmental analysis. She contributes to research, including developing methods to estimate embodied carbon in HVAC systems, and finding ways to reduce the performance gap in buildings.

2 Apurva Jaishankar

Graduate building services engineer, Atkins

Apurva joined Atkins' building services team with a BEng (Hons) in

architectural engineering from Heriot-Watt University and a MSc in smart buildings and digital engineering from UCL. She is interested in thermal simulations, energy efficiency and digital innovation, and enjoys participating in competitions such as Solar Decathlon and ASHRAE LowDown Showdown. She is due to take part in TeamBuild later this year. Apurva is passionate about embedding sustainability in the building services industry, and she is currently working on an innovative project called 'Decarbonomics' (see 'Delivering on the net zero promise, *CIBSE Journal* March 2022), for which she has been leading technical and design tasks.

3 Conor Deane

Project engineer at JV Tierney & Co

Conor is a sustainable engineer with a leading consulting engineer in Dublin. He received a research Master's scholarship in sustainable engineering from the University of Galway, and co-published research on implementing a smart grid on the Aran Islands. He won the ASHRAE Student Award in 2021, and was a founder of Ireland's first student-led Energy Summit. In 2022, as ASHRAE Ireland YEA chair, he co-founded the joint ASHRAE CIBSE Mentorship Programme, which pairs younger engineers with industry leaders to guide and foster their early career growth. Conor is now a certified Building Energy Rating assessor with the Sustainable Energy Authority of Ireland and is a Home Performance Index-accredited professional with the Irish Green Building Council.

4 Eyob Kibrom

Graduate electrical engineer, Aecom

Eyob has worked across all design stages and a variety of end markets since joining Aecom. He is a well-rounded engineer, leading electrically on multiple projects. He coordinates internal and external CPDs, participates in STEM events, and engages in corporate social responsibilities.

5 Jean-Baptiste Clochet

Sustainability and building physics engineer, Cundall

Jean-Baptiste is a multi-curriculum architect engineer, with a background in architecture, and structural and environmental engineering. Having worked in France, Switzerland and the UK, he has a unique and strong understanding of sustainability principles in the built environment. He implements thorough sustainability strategies, to deliver durable, healthy spaces and shape the built environment through organisations such as the London Energy Transformation Initiative.

6 Maria Zagorulko

Development and operations engineer, Naked Energy

Employed by a hybrid solar-thermal manufacturer, Maria works on technological changes to the product and optimisation of the company's supply chain. Her background is in chemical engineering (MEng from Imperial College London, 2021) and she is passionate about product life-cycles and environmental, social and governance standards in the supply chain. Maria volunteers as an enterprise adviser at a London school, where she is working to develop a careers programme.

7 Prince Isofi

Graduate mechanical engineer, Mott Macdonald

Before joining Mott Macdonald, Prince studied at the University of the West of England, where he obtained a first-class BEng (Hons) in mechanical engineering and a MSc Distinction in façade engineering. He has worked on decarbonisation studies for North Bristol NHS Trust and led on the mechanical and electrical design for five new offices for the Department for Environment, Food and Rural Affairs. Prince is passionate about combining his mechanical and façade engineering knowledge to produce high-performing, energy-efficient, functional designs that are resilient to the need for greener infrastructure.

8 Sana Hafsa

Sustainability coordinator, AESG

Sana Hafsa is an architectural engineering graduate, currently working to deliver sustainable and smart megaprojects in the Middle East and North Africa region. At Heriot-Watt University, she was leader of a group of more than 100 students who designed and constructed an innovative home for the Solar Decathlon 2021. Sana was a panellist at the Future Skills Conference at Expo2020 Dubai, volunteers for Class of Your Own, and is an ambassador for Women in STEM.

CIBSE Apprentice of the Year

Technician (Level 3-4)

1 Alim Chaudhri

Apprentice mechanical engineer, Aecom

Alim started at Aecom in 2021. He is currently working towards a HNC in building services and will be aiming to progress to a BEng degree. Alim was seconded to GSK in the science sector for 11 months and is a STEM ambassador.

2 Billy Robson

Apprentice mechanical engineer, ChapmanBDSP

Billy joined ChapmanBDSP's Kent office in September 2021, after studying maths, physics and geography at A Level. He aims to gain a degree in building services engineering with ChapmanBDSP.

3 Harvey Hudson

Building services apprentice, Vital Energi

Harvey is one of the first cohort studying Vital Energi's renewable energy and heat network apprenticeships, in partnership with the City of Liverpool College. He has worked on solar farms and energy centres.

4 Ryan Goode

Apprentice installation engineer, Otis

Ryan joined the Otis Lift and Escalator apprenticeship programme in 2020, to explore his passion for electrical and mechanical engineering. He is in his final year of an installation engineer apprenticeship and is working in the firm's modernisation department.

5 Tommy Treanor

MEP assistant, Mace

In his role as MEP assistant, Tommy won Mace Apprentice of the Year 2021. He is currently working as part of the MEP project delivery team on the UCL East Marshgate project, while studying towards a HND in building services engineering at London South Bank University.

6 Xantha Smee

Lift and escalator servicing apprentice, Otis

Xantha has been an apprentice at Otis for two years. Since she stepped on site Xantha has been determined to learn all she can – whether it's fault finding on printed circuit boards or servicing components twice her age, hidden in the top of repurposed mills. Xantha is grateful for this apprenticeship and the vital, rewarding career ahead of her.

Degree (Level 5-7)

7 Daniel Bailey

Junior mechanical design engineer, Derry Building Services

Daniel Bailey is a student at Leeds College of Building, in the final year of a HNC qualification in building services engineering (BSE).

8 Kai Devani

BSE design apprentice, Elementa Consulting

Kai has developed a wide range of skills and knowledge in BIM and mechanical and electrical engineering. He has worked on various group projects and presented to local schools about being an apprentice.

9 Lewis Coleing

Apprentice electrical design engineer, CPW

Since joining CPW, Lewis has achieved a BTEC ONC and HNC in building services engineering at Solihull College. He is now in the final year of his building services engineering degree at Coventry University.

10 Louis Kimber

Apprentice mechanical engineer, Atkins

Louis joined Atkins in 2017, as a level 3 apprentice mechanical engineer. He is in year four of his building services degree at the University of the West of England, and achieved his EngTech and LCIBSE membership status in 2019. He became a certified Passive House Designer in 2021.

11 Matthew Nash

Mechanical apprentice, Jacobs

Matthew is in his fourth year of a level 6 building services degree. After A Levels, he joined Jacobs and London South Bank University (LSBU), and is currently working in HVAC design and thermal modelling roles.

12 Matty Brady

Building services engineering apprentice, Arup

Matty is in his final year of a BEng building services engineering degree apprenticeship at Leeds Beckett University. He has delivered a range of large Arup multidisciplinary projects, primarily data centres.

13 Musab Mahmood

Apprentice building services engineer, Atkins

In year four of a degree apprenticeship at LSBU, Musab is on track to complete his BEng with first-class honours and obtain IEng ACIBSE. He started his apprenticeship after his GCSEs and went on to complete a BTEC level 3 and obtain an EngTech LCIBSE.

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More than 3,120m² of double glazing was removed and recycled during the refurbishment of the Burrell Collection

The Grade A-listed Burrell Collection houses important works of art, but poor fabric performance had made the museum unsustainable. **Andy Pearson** explains how the building's glazed façade was restored to make the gallery fit for a low carbon future

A GLAZING SUCCESS

PROJECT TEAM

Client: Glasgow Life
Architect: John McAslan and Partners
Building services, fire, environmental engineer and Breeam: Atelier Ten
Civil and structural engineer: David Narro Associates
Main contractor: Kier
MEP contractor: FESx

'The greenest building is... one that is already built.' This phrase, attributed to Carl Elefante, former president of the American Institute of Architects, may well be true for the newly refurbished Burrell Collection building, in Glasgow's Pollok Country Park. Green, however, was not an epithet that could have been levelled at the Grade A-listed art gallery before its refurbishment.

Originally opened in 1983, as the new home for the art collection donated to Glasgow by shipping magnate Sir William Burrell, the building was suffering from a myriad of issues, the most significant of which was its failing envelope. Its faults were consistent with a building of its time: low levels of insulation; a leaking roof; poor airtightness; and high solar gains, from expanses of south-facing glass, putting a heavy strain on cooling systems. The faults were so bad, that the museum was no longer able to provide a suitable home for the art collection.

In 2016, Glasgow City Council appointed building services consultant Atelier Ten, architect John McAslan and Partners, and Arup Façades as part of £68.25m project to refurbish and improve the Burrell. 'It was a fairly unsustainable museum to operate, in terms of cost and so on, and the building services were pretty much shot,' says David Cameron, director at Atelier Ten. 'Our brief was to revive the building to make it more sustainable from an economic, social and environmental perspective.'

Improving the envelope of the building was key to the success of the refurbishment. 'We started by writing a brief for Alba, who went to site and did a thermographic survey, as well as general resistance tests, to determine the current fabric performance,'

"After we found out that the building couldn't hold pressure, we got really paranoid and re-engineered the heating and cooling batteries to cope with a leakage figure of $15m^{-3} \cdot m^{-2} \cdot h^{-1}$ @50Pa"

says Cameron, who describes the findings as 'disappointing'.

Tackling the problem was far from straightforward, however. The building's listed status meant many fabric elements, such as the stone walls, could not be touched, so improvements had to be focused on the flat roof and the glazed façades. 'We targeted significant improvements on these 1980s elements, to bring them up to current standards and a bit beyond,' explains Cameron.

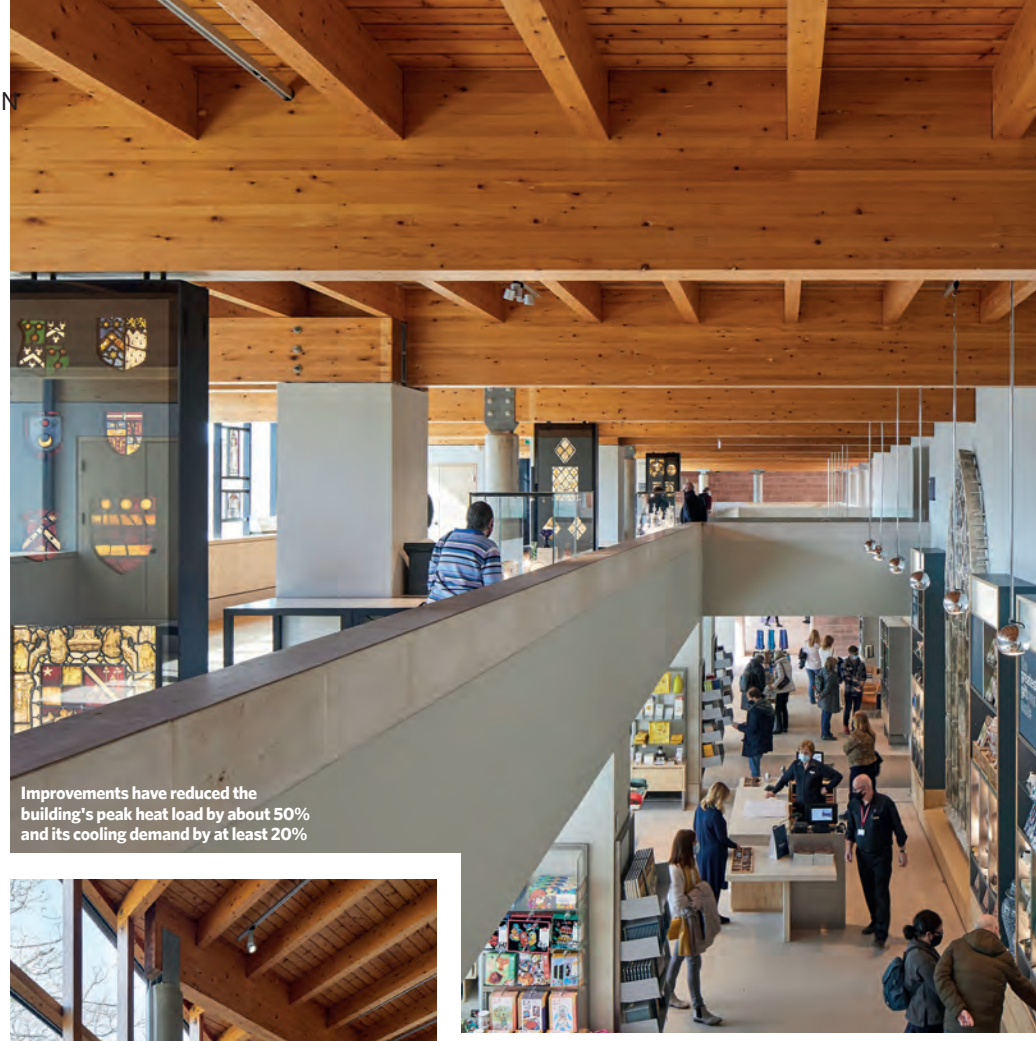
As part of the initial design development, the team did an airtightness test on the building – but it leaked air so badly that it was unable to hold sufficient pressure to provide the testers with a reading. The estimate was that the building's leakage rate was 'in excess of $20m^{-3}{\cdot}m^{-2}{\cdot}h^{-1}$@50Pa', says Cameron.

This underscored the challenge facing Atelier Ten. Design conditions were 6°C, 100% relative humidity (RH) in winter, rising to 24°C, 100% RH in summer. 'After we found out that the building couldn't hold pressure, we got really paranoid and re-engineered the heating and cooling batteries to cope with a leakage figure of $15m^{-3}{\cdot}m^{-2}{\cdot}h^{-1}$@50Pa' explains Cameron.

However, having built a contingency into the capacity of the heating and cooling plant to allow for excessive air ingress, the target air-leakage figure given to the main contractor, Kier Construction Scotland, was $5m^{-3}{\cdot}m^{-2}{\cdot}h^{-1}$@50Pa. 'The figure they actually achieved was $5.3m^{-3}{\cdot}m^{-2}{\cdot}h^{-1}$, which was a very impressive improvement,' adds Cameron.

One reason for the dramatic improvement in airtightness was the specification and careful detailing of the new glazing, its aluminium frame and gasket system, developed by Arup. More than $3,120m^2$ of double glazing was removed from the site and recycled (see panel, 'Arup implementing circular principles with glass recycling').

The original glazing system was typical of its time, with a monolithic outer glass pane and a clear laminate internal pane, which, Cameron says, had an average U-value of about $3W{\cdot}m^{-2}{\cdot}K^{-1}$. This was replaced with glazing with a U-value of $1.6W{\cdot}m^{-2}{\cdot}K^{-1}$, which included the heat loss through the refurbished aluminium frames.



Improvements have reduced the building's peak heat load by about 50% and its cooling demand by at least 20%

» The flat roof was the other major fabric element targeted for improvement. Resistance tests showed its average U-value to be around 2.2-2.3W·m^{-2}·K^{-1}.

The old roof was removed, and replaced with a new, highly insulated construction, originally specified with PIR insulation, which gave a U-value of 0.18W·m^{-2}·K^{-1}. After the fire at Grenfell Tower, however, the PIR was ditched in favour of non-combustible mineral wool at the client's request. This increased the roof's U-value slightly, to 0.25W·m^{-2}·K^{-1}, which, Cameron points out, still delivers 'an 80-odd per cent improvement'.

The new roof also supports 384 photovoltaic (PV) panels generating up to 140kW electricity. To make the most of these panels, a 250kWh battery is being installed so that electricity generated by the PVs can be stored when the building doesn't need the energy. Electricity can also be taken from the Grid when tariffs are low and stored for use in charging the park's electric buses.

The services solution

An all-air system, based on eight main air handling units (AHUs), is housed in a sub-basement in the middle of the building. This provides the bulk of the heating and cooling to the galleries and other spaces. Internal conditions in the galleries must be maintained between 20°C and 23°C and 40-60% RH to comply with the insurance requirements for the exhibits.

In total, the AHUs move between 60,000 and 80,000 litres of air a second. While they provide fresh air for the occupants, about 90% of the air is recirculated via an integral mixing box. At night, when the museum is unoccupied, the system is designed to operate on full recirculation.

'Covid hit just when we had started to design the air handling system, which called into question the fact that we are recirculating air,' says Cameron. 'But if you don't recirculate air, you might as well shut down the museum because its energy bills will be through the roof.'

Gallery temperatures are being kept at a constant 21°C initially

Fresh air quantities are controlled by CO_2 sensors. Because the building is relatively open plan, the AHUs mix fresh air into the recirculated air supply to all zones served by the unit.

A thermal wheel transfers heat and coolth from the exhaust air stream to temper the incoming fresh air. When cooling is required this is then cooled and dehumidified using chilled water supplied by two 300kW high-performance heat pump chillers, which recover heat from the cooling cycle. The outdoor air is then mixed with the recirculated air in the AHU and reheated as necessary by the primary heating coil. Primary coils run at a temperature of 40-60°C using the chiller-recovered heat.

'If we need to boost the temperature further, the boilers can kick in; they can also boost to 80°C-60°C but, so far, that high temperature demand has never materialised,' says Cameron. With all coils and heat emitters sized for 40-60°C, the infrastructure has been developed to allow for full heat pump changeover in the future.

Unusually for a museum, the Burrell has a significant amount of south- and east-facing glass, plus an equally significant area of north-facing glazing. 'I know this is in

ARUP IMPLEMENTING CIRCULAR PRINCIPLES WITH GLASS RECYCLING

Arup, the project's façade consultant, found that elements of the original glazing due to be replaced could be reused for architectural glass production. As a result, more than 16 tonnes of glass was recovered for processing into new architectural glass, saving CO_2 by eliminating the need to extract new material. Body-tinted, laminated and large-scale glass units that could not be recycled were 'processed into other building products' under a new glass industry network of manufacturers, research institutions and end-of-life/recycling facilities. Arup claims that no glass material removed from the building was sent to landfill.

More than 4.5km of glazing frames were also reused through what Arup describes as a 'painstaking process' of detailed inspection, structural calculation, cleaning, repair and strengthening of fixings to support the new high-performance glazing units. The frames' refurbishment involved the addition of new thermal breaks and the use of a bespoke gasket system. The frames' re-use reportedly saved 8.5 tonnes of aluminium.

Scotland, but the southern and eastern glass gets bombarded with solar gain, while the northern element is constantly losing heat because it is not exposed to the sun,' explains Cameron. Atelier Ten's solution is to use the heat-recovery chiller to move the passive solar heat from the southern galleries to provide heat for the colder northern galleries.

The building's listing meant the engineers had to use the original distribution ductwork. Incredibly, 430 ducts leave the basement plantroom through the soffit, and are all concealed in the walls of the floor above.

'We had no option but to reuse these ducts because we couldn't demolish the entire internals of a listed building,' says Cameron.

Atelier Ten's concern was that the original ductwork would no longer be airtight. These concerns were realised when the ducts were pressure tested; most were found to leak, some by as much as 60%. 'The reality is that, if we pump air into the duct, 60% of it would end up in the cavity, which was a real concern,' adds Cameron.

The solution was to use Hasman's Aeroseal duct sealing system. This uses a fan to pressurise the ductwork, and an aerosolised sealant is then blown through it. The sealant particles attach to the edges of any hole, quickly and effectively closing it from inside the ductwork.

The manufacturers claim gaps up to 25mm can be sealed and that the repair will withstand a pressure of up to 2,000Pa.

The system worked. According to Cameron, Reduced leakage to less than 5%. 'It's quite an expensive process, but it is guaranteed for 30-odd years, so, in effect, we've just given those ducts an extra 30 years' life – and we've saved 30 tonnes of embodied carbon,' he says.

The refurbished building reopened to the public in March 2022. It is estimated that the improvements have reduced the peak heat load by 50% and its cooling demand by at least 20%. Post-occupancy evaluation and optimisation of the building is being undertaken by Atelier Ten, working with Glasgow-based digital modelling and building physics specialist IES, over the next three years. The work involves the use of an IES-created digital twin, which is calibrated using actual data from more than 80 energy meters, all of which are linked to the digital building management system.


An aerial view of Pollok Park and the Burrell Collection

"The heat-recovery chiller is used to move the passive solar heat from the southern galleries to provide heat for the colder northern galleries"

Initially, the building is being run with the gallery temperatures at a constant 21°C. 'We've proved the system works well in winter and the conservation guys have given us a big thumbs-up for summer,' says Cameron.

The next phase in the museum's optimisation will involve letting temperatures freewheel slightly, to save energy. 'We've got a meeting with the conservation and energy teams to look at the data and agree where they might let conditions flex a wee bit,' Cameron adds.

Currently, two 750kW gas boilers provide full back-up and top-up heat for the AHU heater batteries and domestic hot water. Over time, Glasgow City Council hopes to provide the park and its buildings with some degree of energy independence by generating power and heat locally.


Atelier Ten will evaluate the museum's performance over the next three years

Working with IES, the wider Pollok Park Estate project has been commissioned by the council as part of its commitment to become net zero carbon by 2030. This includes options of turning the park's historic water mill into a water turbine power station. If the council can pull this off, the Burrell Collection building really will be one of the greenest already built. CJ

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AN INTELLIGENT STANDPOINT

The CIBSE Intelligent Buildings Group was founded in 2006 by **Professor Derek Clements-Croome FCIBSE**. He speaks to newly elected chair **Dr Yangang Xing** about how the group has evolved to meet the needs of building occupants and the wider environment

Can you tell me why you founded the Intelligent Buildings Group and why the term intelligent, rather than smart, was used?

My work on intelligent buildings goes back a long time, to my work with Ted Happold at Bath University in the 1980s. I came to Reading University as professor in 1988, and in 1996 was awarded a five-year Engineering and Physical Sciences Research Council grant for developing an MSc course focused on the design and management of intelligent buildings.

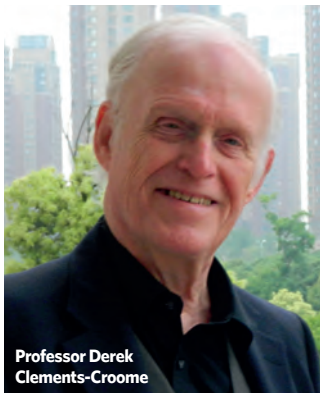
A few years later, I wrote a book on intelligent buildings, which was published in 2004 by the Institution of Civil Engineers. I had co-founded the CIBSE Natural Ventilation Group in 1992 and noted other groups tended to focus on specific issues but did not address intelligent buildings in a holistic, systemic and strategic way. I put forward a suggestion to CIBSE and, in 2006, the Intelligent Buildings Group (IBG) was born.

The name was decided after much consideration. Intelligent and smart do not have the same meaning. You can be intelligent in a cognitive way, in a practical hands-on way, or in terms of emotions – so-called emotional intelligence. The word smart tends to be associated with hi-tech, such as smartphones or the internet of things – but intelligent buildings are not necessarily hi-tech. You can have low-tech intelligent buildings with passive approaches, such as the museum in Nouméa, designed by Renzo Piano, which is a simple, low-tech, naturally ventilated building.

Smart tends to be associated with high-technology applications and this doesn't represent the true history of intelligent buildings, because it excludes the simpler passive approach to environmental design.

Smart is an important property of intelligent buildings, but they also have to be resilient, sustainable and liveable – and this includes connecting with nature via biomimetics and biophilia, which offer a biological design that can also lead to sustainable solutions.

Biophilic design helps connect people with nature



Professor Derek Clements-Croome

What is the focal point of the IBG community?

Currently, we have the climate change challenge of keeping global warming to 1.5°C, but we have a health and wellbeing challenge too.

Covid-19 was a warning to us that we must think more carefully about how we arrange work settings and – whether it is at home or in an office, school, or other type of building – this means considering much more deeply the impact of the environment we create on physical and mental health. Intelligent buildings must address both.

On climate change, there is a lot of talk about energy– but water, waste and pollution are important too. Pollution affects health so makes a direct link with climate change. How do we achieve a net zero economy for carbon and waste?

The use of new or modified materials and the move towards hydrogen, are some of the many examples of smart technologies that will enable the challenges to be overcome. Others, such as artificial intelligence, 3D printing, robotics and biomimetics, will help to integrate and optimise systems used in buildings.

Three pillars provide a foundation to the design, management, and operation of intelligent buildings: smart technologies as enablers; sustainable solutions, including nature-based ones; and improving »

"It is important to blend the freshness of youth with the experience of older people… work across generations"

» the quality of life for people living or working within them.

What has the group achieved?

Our diversity, in terms of countries, gender and disciplines, is outstanding. We now have 14,000 members worldwide, and the connection we have made with the International Council for Research and Innovation in Buildings and Construction (CIB), as an associate body, has been valuable.

On behalf of CIBSE, I toured Australia, New Zealand and South Africa, debating and talking about the nature of intelligent buildings. I visited many CIBSE regions around the UK, again lecturing on intelligent buildings, including Newcastle, Liverpool, Manchester and London when I was a vice-president in 2007-09.

We issued a roadmap in 2018 in collaboration with CIB, and we have held seminars and webinars over many years. We also publish twice-yearly Newsletters, which are highly informative.

The committee communicates in a variety of ways, through media such as podcasts, blogs and videos. We have a lot of devoted people of all ages on our committee. We are now trying to develop what I will call a circular knowledge economy.

Too often, older people get dropped off by default. It is important to blend the freshness of youth with the experience of older people. Let us work across generations.

What is the strategy of the group?

The 2017 Grenfell tragedy showed us that all is not well in the construction industry. There are still lots of areas that need resetting, and one of those is the tendency to think in silo groups.

Distilling knowledge down to specific factors and dealing with those thoroughly is fine to a certain point, but you have to be connected. Silo thinking brings about fragmentation, which is too prevalent in our industry.

We need a more transdisciplinary approach. Our knowledge can be enriched by working across sectors, otherwise there is a danger of becoming too inward looking, which can happen in institutions.

Interventions from other fields – medicine, for example – can extend our thinking and help us to champion change confidently. The division between industry and universities has reduced, but there remains some way to go.

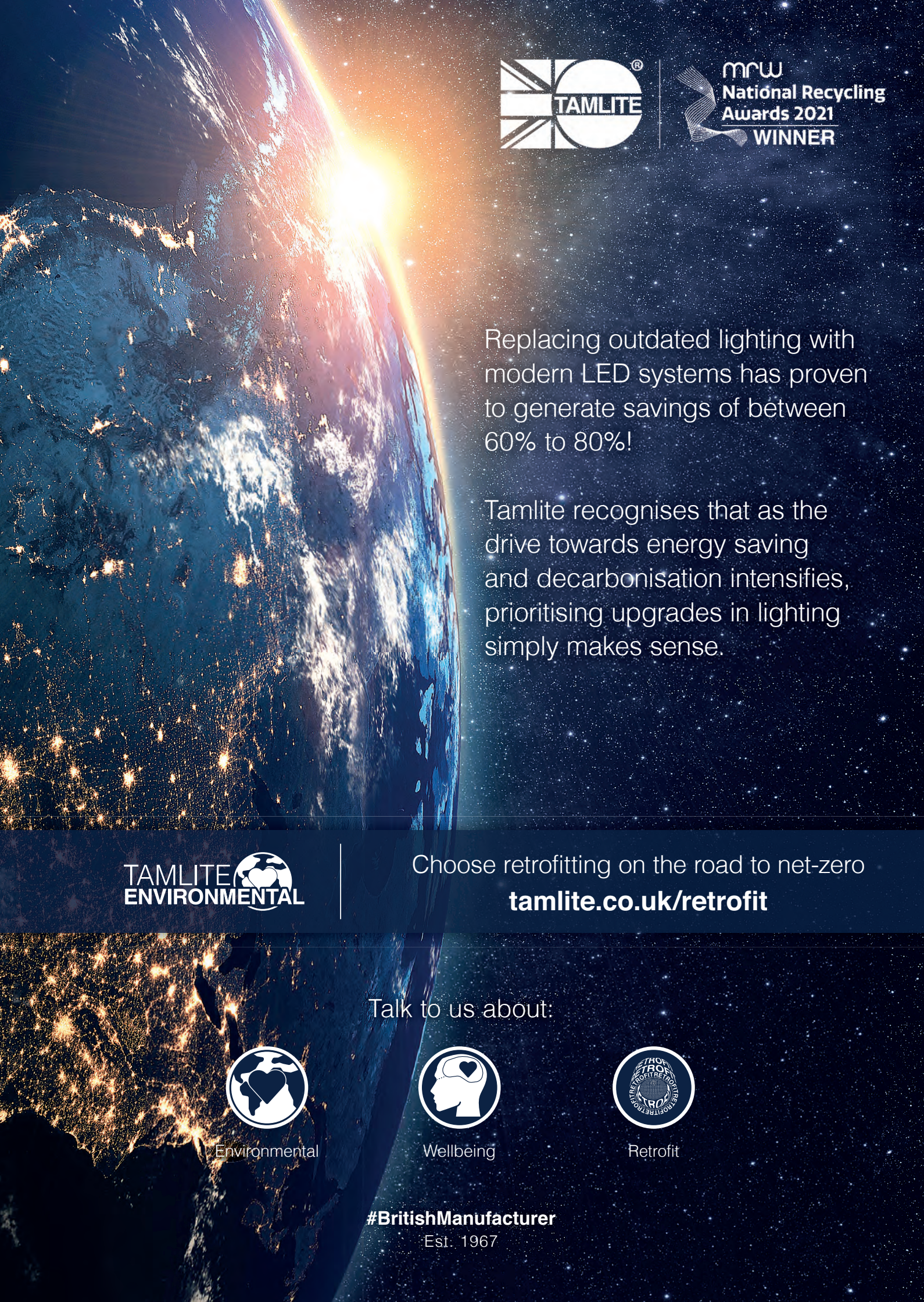
Knowledge is often marred by media or politics, making information unclear, incomplete and just wrong on occasions. Quick fixes and low-cost options are too often used as a basis for selection. In the end, cheap becomes more expensive, as systems wear out quickly and break down frequently. We must communicate better with our clients too. User-centric design is becoming more accepted.

Can you please introduce the new book *Designing buildings for People* you are working on?

There are eight chapters covering various aspects of design—topics such as holistic sustainability approaches, nature-based solutions, important enabling technologies, health and wellbeing and decision-making. In the last chapter, I present a gallery of 19 case studies with firms such as Arup, PLP Architecture, SOM, Atelier Ten, and many others. Each photo is accompanied by a few paragraphs by the designers.

The book is quite personal and based on my experiences since I started working as an apprentice, aged 16, in the building services industry. Along the way, I have had inspiring mentors, as well as students, to whom I owe much.

In 2018, I edited *Creating the productive workplace* – 28 chapters from 15 or so authors from industry and academia worldwide. I also wrote four chapters. Two books were published in 2013. One was an *Introduction to intelligent buildings*, which was written largely by members of the CIBSE IBG. This was accompanied by the 2nd edition of the 2004 book. There is a third edition being planned for publication in 2023-24. **CJ**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THE PANEL

From left: Stephen MacLoughlin, regional director at Faithful + Gould; **Amy Punter**, associate director at Hoare Lea and member of the CIBSE Retrofit in Heritage Buildings Committee; **Ben Gholam**, structural engineer at Price & Myers; **Hugh Dugdale**, associate principal at Elementa Consulting; **Alex Smith**, editor at *CIBSE Journal*; **Matteo Dall'Ombra**, VRV specialist at Daikin (hidden); **Richard Cobb**, associate, net zero, at Atkins Global (hidden); **Bianca Laura Latini MCIBSE**, senior sustainability engineer at Buro Happold

COOLING FOR LIFE

Decarbonising cooling involves passive design measures, efficient cooling and a robust approach to refrigeration leakage, according to members of a *CIBSE Journal* roundtable on a whole life approach to cooling, sponsored by **Daikin**

Industry experts at a *CIBSE Journal* roundtable on cooling have unanimously agreed that the industry can take big steps towards decarbonisation if new buildings and systems are well designed to take building loads into account.

The event, *Decarbonisation: a whole life approach to cooling buildings* sponsored by Daikin, looked at the complex challenges and potential solutions to staying comfortable on a warming planet. Refrigerant leakage, the challenges of cooling existing buildings, and embodied carbon were some of the topics debated.

Hugh Dugdale, associate principal at Elementa Consulting, kicked off the roundtable by describing his involvement, as one of the authors, in the TM65.1 addendum, which investigated the embodied carbon impact of heating and hot-water equipment for use in residential buildings. He is also exploring the implications of refrigerant leakage, which can have a huge impact on global warming.

'It's so strange that there's so little information about refrigerant leakage, yet it's a controlled substance,' he said. 'It should be easy to record how much refrigerant is topped up and poured into systems each year, but there's no central database. We have contacted installers to get this information, but it's very poorly documented.'

Bianca Laura Latini MCIBSE, senior sustainability engineer at Buro Happold, has also looked at refrigerant leakage and explored what will be available at the F-Gas Regulation phases. She has talked to manufacturers about refrigerant development and making low global warming potential (GWP) refrigerants more feasible for clients. Latini has also done work for Bristol City Council on its heating and cooling policy, and a whole life carbon and cost assessment of seven different systems in commercial and residential buildings was carried out.

'They were all electric, because we started from the premise that they have a net zero carbon city target, and we looked at different kinds of heat pumps versus domestic heating and district heating networks,' said Latini. 'The Council was interested to know the feasibility of low-GWP refrigerants. It's a call to manufacturers to develop low-GWP refrigerants.'

Matteo Dall'Ombra, VRV specialist at Daikin, said refrigerants are key to reducing the carbon footprint of leading air conditioning manufacturers. Daikin has adopted a two-tier strategy for how refrigerants are used and the type of refrigerant specified. Every new product employs the lowest possible GWP refrigerant, which now means the new R-32. This conveys heat efficiently and reduces electricity consumption by approximately 10% compared with air conditioners using refrigerant R-22.

For products that can't use R-32, Daikin adopts 100% reclaimed refrigerant. Lower GWP systems will

CIBSE RETROFIT IN HERITAGE COMMITTEE

The newly formed CIBSE Retrofit in Heritage Committee is running a series of free webinars, followed by a live event at CIBSE Build2Perform from 29-30 November at London Excel. The next webinar will be on Design Development on Thursday 13 October at 1pm. To find out more about the CIBSE Retrofit in Heritage Committee, visit: bit.ly/CJOct22RT1

require more careful design and consideration, Daikin bundles these measures with the all new R32 VRV system as default. Latini said that engineers would get used to designing with lower GWP refrigerants as their specification becomes common practice.

'Each refrigerant has different applications,' said Latini. 'Making it clear to clients which refrigerants are most appropriate is very important. I don't think there's much literacy in the built environment as to which refrigerants should be applied to which scenario. The other big issue is that we don't know much about refrigerant leakage.'

The F-Gas Regulation requires refrigerant top-ups to be recorded, but it's often challenging to get this information from firms, said Dall'Ombra. Dugdale agreed: 'It's so painful getting that data out. It's hard to get a consensus on estimating charge, which manufacturers could help with.

'With a sealed system, such as a heat pump, you know the charge because it's in the unit. But with a variable refrigerant flow (VRF) system that has pipework installed on site – that you don't know the length of and the amount of charge within it –a rough estimate on how much is in there must be made. Then a percentage of what is leaking must be calculated, which is difficult because it's not just liquid filling the pipe. Guidance is required.'

Richard Cobb, net zero carbon associate at Atkins Global, suggested making it mandatory for firms to record information about refrigerant topping up. He suggested using Display Energy Certificates. Dall'Ombra said the ongoing problem is visibility, because this vital information often gets buried in logbooks and is not easily accessible.

Amy Punter, associate director at Hoare Lea and member of the CIBSE Retrofit in Heritage Committee (see panel above), also suggested a sophisticated leak-detection system linked to a building management system (BMS) that calculates the amount of leakage and automatically records what has been topped up.

The newly published standard IEC 60335-2-40 – which allows the use of refrigerants with a lower GWP, while also ensuring a high level »

"The F-Gas Regulation requires refrigerant top-ups to be recorded, but it's often challenging to get this information" – Matteo Dall'Ombra

"Additional solar shading is key to helping cool a building and we then look at the efficiency of the cooling kit" – Richard Cobb

» of safety regarding flammability – already allows more sophisticated leak-detection systems, said Dall'Ombra, but he agreed that a central database would be very beneficial.

Asked whether recycling refrigerant was an option, Dall'Ombra added: 'Reclaimed R-32 is currently not as big yet, because it is relatively new and there's less stock that can be re-used continually. But there's no doubt there will be a solution in about two years, with even lower GWP for the smaller residential systems.'

Punter argued that the issue isn't just about refrigerant leakage; the industry should ensure that buildings are performing as intended and are designed well from the start, she said.

There has been a tripling of energy consumption used for space cooling since 1990, which is putting electricity grids under strain, especially during periods of extreme heat, such as the one experienced in Europe this summer. As a result, space cooling accounted for nearly 16% of the global building sector's electricity consumption in 2020 (about 1,885TWh)[1]. The panel agreed that, before calculating how much cooling buildings require, passive measures must be applied to minimise the energy used in cooling equipment.

Cobb highlighted some typical passive measures he employs to help cool existing commercial buildings. Taking a fabric-first approach is the first step, he said. A building's thermal mass within the fabric is then considered, as well as finding ways to upgrade its U-value.

'Additional solar shading is key to helping cool a building and we then look at the efficiency of the cooling kit,' said Cobb. 'If it's near the end of life, we look at refurbishing it or installing a new system. If the building's façade is degraded so much that it needs to be replaced, we would remove the skin, keep the structure if we can, and reclad the building with modern thermal. Historic buildings require a different approach given their façades' architectural significance.'

Cobb added that refurbishing cooling plant is preferable to replacing it. By keeping some of the components he wants to limit the amount of total carbon spent. 'I always look at carbon in terms of currency,' said Cobb. 'The industry needs to say, this is what we're going to do to this building and it will cost you this much carbon for its whole life. If we did this, we could reduce carbon by simply changing the materials.'

Stephen MacLoughlin, regional director, and net zero carbon lead at Faith + Gould, agreed that a fabric-first approach and external shading are powerful passive measures. He suggested that the UK could learn from architecture in hotter countries, which employ straightforward solutions to address solar gain.

"It's so strange that there's so little information about refrigerant leakage, yet it's a controlled substance" – Hugh Dugdale

MacLoughlin has concerns, though, about the commercial sector and the landlord/tenant situation. Providing comfortable internal conditions for employees when temperatures rise, while also addressing energy efficiencies, will present challenges.

Punter highlighted new guidance by the British Council for Offices that could have an impact on this issue, as it includes relaxing occupant densities in a post-pandemic world. She also mentioned her work with listed buildings »

"Making it clear to clients which refrigerants are most appropriate for their system is very important" - Bianca Laura Latini

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» dating from the 1400s to the 1960s. There is a real urgency to find ways to decarbonise these buildings, otherwise they will fall into disrepair. Part of the problem, added Punter, is a lack of guidance on how to decarbonise these buildings, which have complex and challenging requirements, and must be assessed case by case.

'U-value measurement in listed buildings is straightforward; measuring air permeability is the real challenge,' she said. 'There is a drive to decarbonise, but I question whether we will we see a shift in what conservation officers will accept. I hope they will be more lenient to allow decarbonisation of heritage buildings and accept cooling measures such as external shading.'

Punter added that the way to sensitively retrofit listed buildings is to share knowledge and push the boundaries.

Beyond cooling equipment, Ben Gholam, structural engineer at Price & Myers, introduced his research and software development on embodied carbon optimisation in building structures. His team has created an ambitious database and identified issues with using concrete to achieve thermal mass in buildings to regulate internal temperatures. (See panel, 'The trouble with concrete').

"Part of the problem is a lack of guidance on how to decarbonise [historic] buildings" – Amy Punter

With a predicted tripling in energy used to cool buildings by 2050, it is essential building services engineers take a holistic approach and collaborate with other engineers and manufacturers to find solutions. The roundtable demonstrated how a meeting of minds from across the sector can stimulate original thinking that might just speed our journey to low carbon cooling. CJ

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1 IEA, Cooling tracking report, Nov 2021 **www.iea.org/reports/cooling**

THE TROUBLE WITH CONCRETE AS THERMAL MASS

There is a conflict between the desire to have thermal mass in a building – which helps regulate internal temperatures – while also trying to decarbonise, said Ben Gholam. Concrete is used to achieve thermal mass, which is the worst thing to do, he added, given that concrete is high in embodied carbon. 'We shouldn't be using concrete at all,' said Gholam. 'The concept of packing mass into our buildings to save carbon over the long term is doing untold damage in the immediate term.'

Ground granulated blast-furnace slag (GGBS) has been proposed as a solution, as it's a waste product from steel production, but about 20% of GGBS is currently produced to replace cement needs and there are supply problems, says Gholam. 'We need to look at global averages for materials based on the technologies we have and consider minimising the mass of our buildings,' he said.

Latini asked whether the upfront carbon cost of using concrete is lower than the operational savings that the thermal mass of concrete provides over the average 60-year life of the building. From a structures perspective, it makes little difference, Gholam replied, as the embodied carbon is set once the structure is built and the damage is done.

He went on to say: 'If your building is designed well using limited amounts of steel, with timber and other low carbon materials for the building's mass, that can work very well for embodied carbon and circularity; they go hand in hand.'

"The concept of packing mass into our buildings to save carbon over the long term is doing untold damage in the immediate term" – Ben Gholam

"Providing comfortable internal conditions for employees when temperatures rise, while also addressing energy efficiencies, will present challenges" – Stephen MacLoughlin

Carbon & economic comparison for hot water systems using heat pumps, direct electric and hydrogen blends.

Author: Biatur Mandia, MEng

Rinnai's Biatur Mandia, also chair of the CIBSE Yen NW, compares three low carbon systems using electric, Heat pump, and hydrogen blends. This comparison guides the selection process and can be used to learn about existing and emerging technologies. The complete study is shown in the Rinnai H3 accredited CPD presentation.

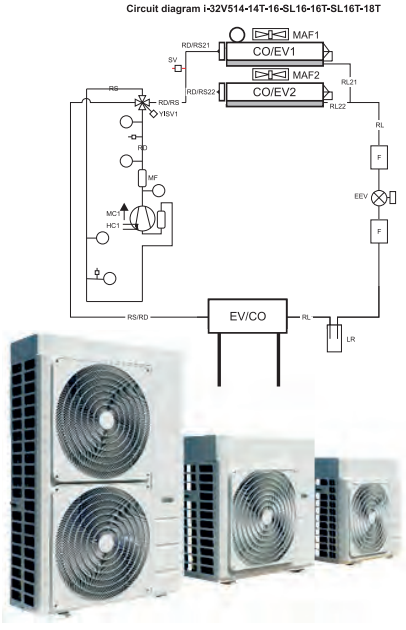
Introduction

This CPD will show the savings achieved using three low-carbon systems. The first system is a gas combustion continuous flow water heater that can run on hydrogen blends up to 20 %, as shown in figure 2. The second system is defined as a hybrid and consists of a heat pump and gas water heater 20% hydrogen blend ready, as shown in figure 3. The third system is the all-electric and consists of a heat pump and direct electric cylinder, as shown in figure 4. The study uses "notions" of buildings from previous real-life projects to compare each system. The notion establishes the building's peak loading conditions, temperature, and recovery times. In this article, a gym health centre is used as a notion. The comparison focuses on detailed schematics, carbon emissions and capital & operation costs of each system.

Low Carbon technology

The primary technology used in the three systems are: Heat pumps, considered low carbon technology because they use electricity to move heat from one location to another. The fundamental idea is to move heat from one place to another using a refrigerant fluid. The refrigerant evaporates at one location, absorbing heat, then condenses at the location where the heat is delivered. Figure 1 shows the working schematic of the air-to-water heat pump. The 4-way valve can reverse the cycle and switch to cooling mode. The air-to-water heat pump was a key technology in the Heat and Building Strategy (1).

Figure 1; heat pump working principle



Direct electric heating has no emission at the point of use. However, this type of system plays a minor role in the Heating and Building Strategy because it puts a lot of pressure on the electric infrastructure (2) (3).

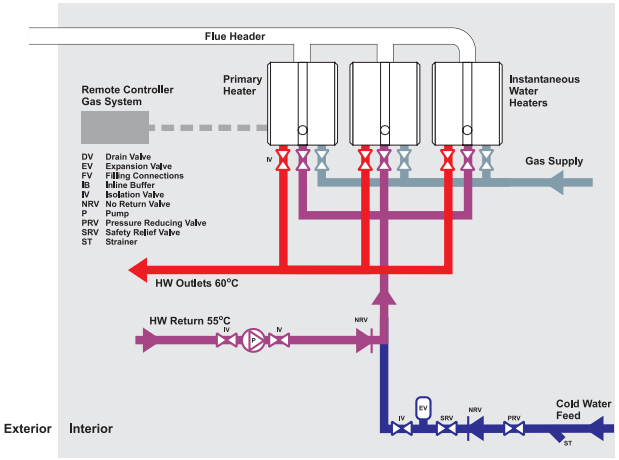
Hydrogen could replace natural gas over the coming years. Critical decisions on the role of hydrogen in heating are coming in the next 2-3 years (2). Hydrogen has a solid potential to become a zero-carbon energy source because it does not produce carbon at the point of use. Green hydrogen is still considered expensive, but current developments are decreasing the costs (4) (5). To facilitate the transition and development of the gas network, the UK government will continue to work with the Health and Safety Executive to enable up to 20 % hydrogen blending on the network by 2024, subject to the success of testing and trials.

Type 2 buildings- Gym health centre

This notion has 12 showers, and 4 wash hand sinks. The three low-carbon systems were sized accordingly to the specific requirement of the notion. The cost of the heat pump was also considered during the selection process. Three designs were generated as follows.

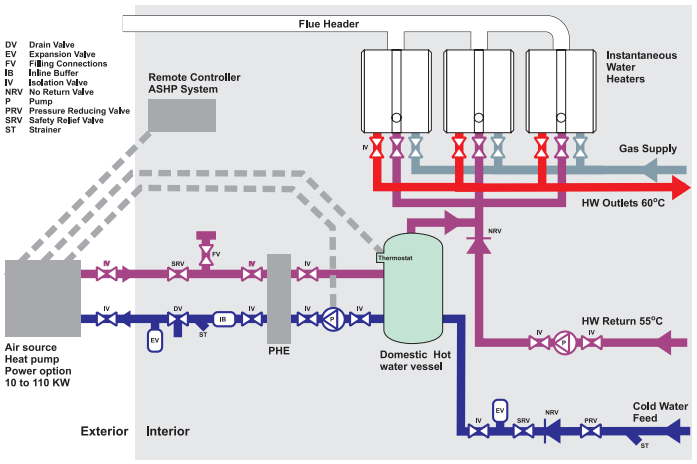
- Combustion – 3 x instantaneous water heater 56kW, as shown in figure 2
- Hybrid – 28 kW heat pump and 3 x instantaneous water heater 56kW, as shown in figure 3
- Fully Electric– 28 heat pump kW and 2 x 48 kW direct electric heater, as shown in figure 4.

Figure 2: Combustion System



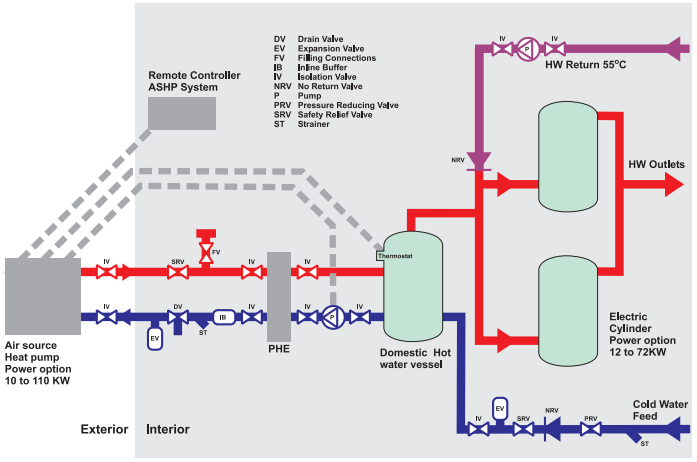
The heating load is met by using three appliances. Coldwater goes into the water heater and exits at 60, and water returns at 55 C.

Figure 3: Hybrid System



The heating water from the heat pump goes through the plate heat exchanger, which separates heating water from domestic water. The gas water heater provides the power for peak loading conditions.

Figure 4: All Electric system



The left side of the schematic is similar to the hybrid setup; it consists of a Heat pump and plate heat exchanger. Direct electric heating provides the additional power required for peak loading conditions.

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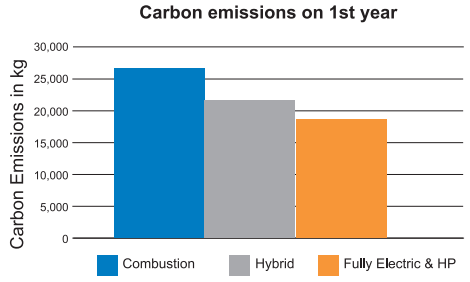
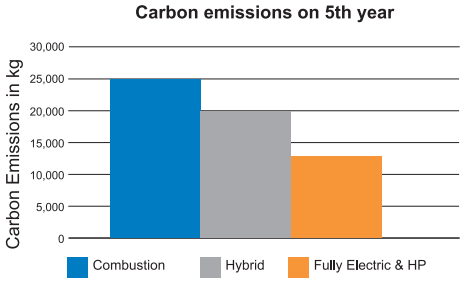
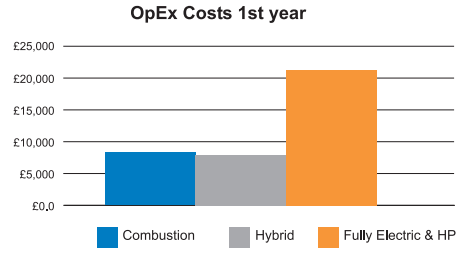
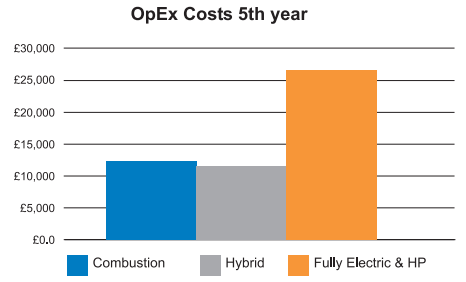
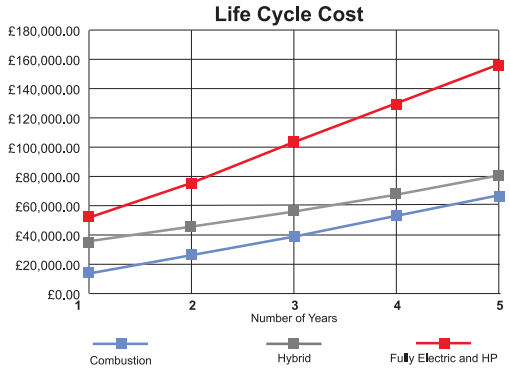
Carbon & Cost Comparison











The carbon & price factors were taken from the UK Gov publication (6) (7). Inflation was applied for the next five years. For more info, the CPD presentation shows the complete calculations and assumptions.

Life cycle costs (see left) of the three systems, including capital and cumulative operational costs.

Discussion and conclusion

The electric system is still the most expensive system to run. Heat pumps can decrease the running cost but have a massive impact on capital costs. The life cycle chart shows the capital and the cumulative operational costs. This graph evaluates the total investment of each system.

The combustion system is the cheapest option in a life cycle of 5 years, as shown above.

The hybrid system was considered the best option for running costs; hybrid is also an excellent compromise to achieve carbon savings when mindful of costs and operational performance. The electric option produces less carbon, with more savings coming in the next five years thanks to the planned grid improvement. The gas network might also become greener through a mix of hydrogen and biomethane; however, long-term development is not included in 5 years, and only a 20 % hydrogen blend was considered from 2025. It is important when considering these options that economic, practical and technological considerations are made and that multiple de-carbonisation pathways are evaluated relative to system performance needs.

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The complete study is shown in the Rinnai H3 accredited CPD presentation; please enquire engineer@rinnaiuk.com to attend the accredited CPD.

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HOTEL AND LEISURE SPECIAL

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COOL RUNNING

Optimising cooling efficiency at Dubai's first indoor rollercoaster

Lighting CPD Page 61

Riding high

An effective air condition system was essential to making the Storm indoor rollercoaster viable in Dubai's desert environment. Andy Pearson explains how Cundall minimised cooling loads by creating a temperature gradient using a tower of air handling units

Dubai has so many retail malls that anchor attractions have become an essential accessory in competing for the attention of the shopping public. The Mall of the Emirates, for example, has an indoor ski slope, while an aquarium and indoor ice rink can be found in the Dubai Mall. Now, the Dubai Hills Mall has opened, and its novel attraction is a spectacular indoor rollercoaster.

Looping a rollercoaster through a building in the heat of the Arabian Desert meant maintaining a comfortable indoor temperature was fundamental to the success of the project. 'Indoor rollercoasters of this magnitude and speed are very rare, so there were no defined environmental design criteria. Fundamentally, our approach had to be about the user experience,' says Richard Stratton, partner and managing director Cundall MENA, the lead design consultant, with responsibility for MEP, architecture, structure and lighting.

Called The Storm, the rollercoaster features a 670m long track, coiled to fit inside a cylindrical building measuring 44.5m in diameter and 62m high. Designed by rollercoaster specialist Intamin, the ride lasts one minute 20 seconds. It starts with a thrilling vertical launch; in just five seconds, a linear synchronous motor propels a 12-person car from below ground to the top of the ride, 50m up. From here, gravity pulls the car earthwards, round a twisting, turning track and back to a ground-level station.

The circular building that houses the rollercoaster is supported on a diagrid of tubular steel, a rigid structural exoskeleton. Impressively, Cundall's engineers have designed the structure to support both the building and the rollercoaster track,

The AHU stack has a staircase and lift so maintenance teams can access the upper track

so it can deal with the conventional building loads and the dynamic loads imposed by the two cars and their passengers hurtling around the track.

This diagrid is clad in a combination of triangular, composite-insulated aluminium panels and solar-controlled, vibration-isolated double-glazed panels. The glazed panels are positioned in line with the track, to give passengers views out, while the solid panels reduce solar gain. The building is capped by an insulated standing seam roof. To enhance the ride experience, the solid elements of the walls and roof incorporate an acoustic lining, helping to absorb sound.

'There is almost 9,000m^2 of building envelope for the roof and the façades, which equates to a peak cooling load of about 1.35MW,' Stratton says.

While the building is partly shaded by the adjacent mall, in unshaded areas the fabric heat load peaks at about 300W·m^2, with an average heat load of approximately 155W·m^2.

> "To enhance the experience of the ride, solid elements of the walls and roof incorporate an acoustic lining, helping to absorb sound"

The launch system and rollercoaster equipment add another 255kW to the total, while lighting, fresh air and people loads add a further 290kW. 'You can see that the fabric load is the main driver for cooling, but it's also the biggest variable because, in the evenings and during the winter, the vast majority of the load will disappear completely,' says Stratton.

The client initially wanted to maintain the interior at 24°C, the same temperature as the mall's retail spaces, but this would have required a significant amount of cooling. Instead, Cundall successfully argued that temperature control within the space could be relaxed, as the rollercoaster equipment is either direct liquid cooled or housed within contained equipment rooms. Examples of external rollercoasters in the United Arab Emirates that operate through peak summer conditions with only the loading/unloading areas enclosed were also highlighted.

Stratton says: 'Relaxing the temperature allowed us to be more creative with temperature gradients and humidity levels within the ride volume, so we could focus more on building needs to avoid condensation and large temperature variations and less on people needs'. »

The cars are propelled 50m to the top of the ride, before gravity speeds them back down to ground level

The circular building housing the rollercoaster is supported on a diagrid of tubular steel

» Cundall MEP's solution was to concentrate on what Stratton refers to as 'a temperature gradient arrangement'. This sets out to maintain temperatures of 24°C in the basement, where the maintenance team is based, and at ground-floor level, where the ride is boarded. Above the occupied zone, the temperature is allowed to increase gradually, to a peak of 30°C beneath the roof.

The temperature gradient approach leant itself to a displacement ventilation solution. This would have worked 'in principle', says Stratton, but there was insufficient space at the base of the building because of the track, station and other ride demands.

Instead, Cundall made use of the building's central core to house a stack of air handling units (AHUs). This non-structural element was needed by the maintenance team to access the upper levels of track, and includes a staircase and lift. The core's six floors now house a series of double-stacked AHUs, mounted one above the other.

Maintaining the coaster clearance zone was critical, so HVAC distribution is confined to the core. Only electrical cabling and containment was coordinated with the track and either followed the track route or was confined to designated containment routes. BIM 360 was employed throughout the design and construction to facilitate coordination and integration of the various building and track elements.

'If you consider the building in plan as a doughnut, the solid part contains the ride while the central section contains all the plant and equipment,' explains Stratton, who describes the air supply system as 'simple'.

The supply air duct leaves each AHU and immediately wraps around three and a half sides of the core. The duct incorporates drum louvres to blow cooled air 16m from the core towards the façade, which is where the bulk of the heat is generated. 'The drum louvres allow a bit of flexibility in where we direct the airflow and help create a bit of mixing, which is enhanced by the turbulence from the car charging through,' says Stratton.

Varied in capacity, the AHUs are typically between 4.5$m^3 \cdot s^{-1}$ and 7$m^3 \cdot s^{-1}$, based on vertical location and heat load. The overall supply air volume is 81$m^3 \cdot s^{-1}$, which is sufficient to deal with the diversified load. Stratton says supply and return conditions are 'pretty standard'; the supply is 13°C, with the return air temperature dependent on where on the building's vertical temperature gradient unit is located. Stacking the AHUs vertically enables the system to control the rollercoaster space air temperature in horizontal slices. Variable speed drives enable the supply air volume to be increased or decreased to regulate the temperature of each slice. 'The beauty of this solution is that you can change the setpoint of each slice to play with the temperature gradient,' explains Stratton.

> "Allowing the temperature to rise from 24°C to 30°C at the upper levels reduced energy demand by 11%"

Adopting a strategy that allows the temperature gradient to rise from 24°C to 30°C at the upper levels reduced energy demand by approximately 11%. To lower energy demand further, operators could let the temperature in the upper portion of the building rise to 40°C, which, in the cooler months, would mean 'they would probably only need to condition the lower levels', says Stratton. »

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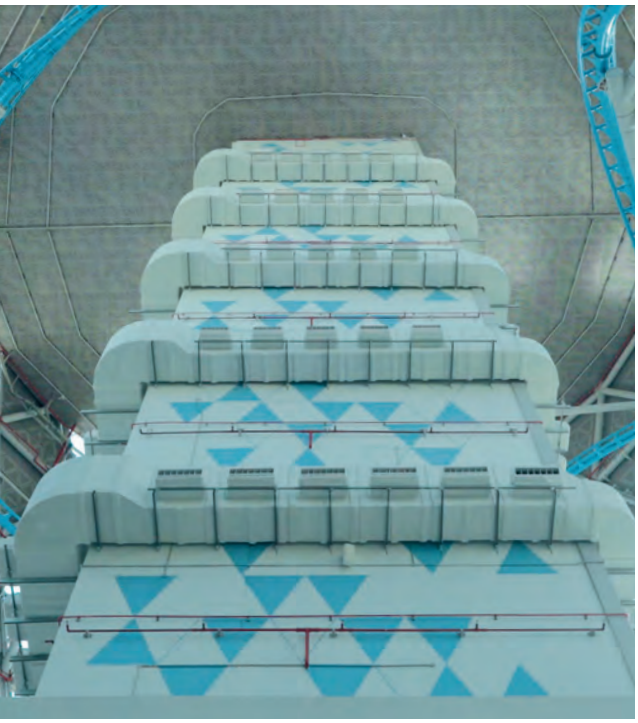

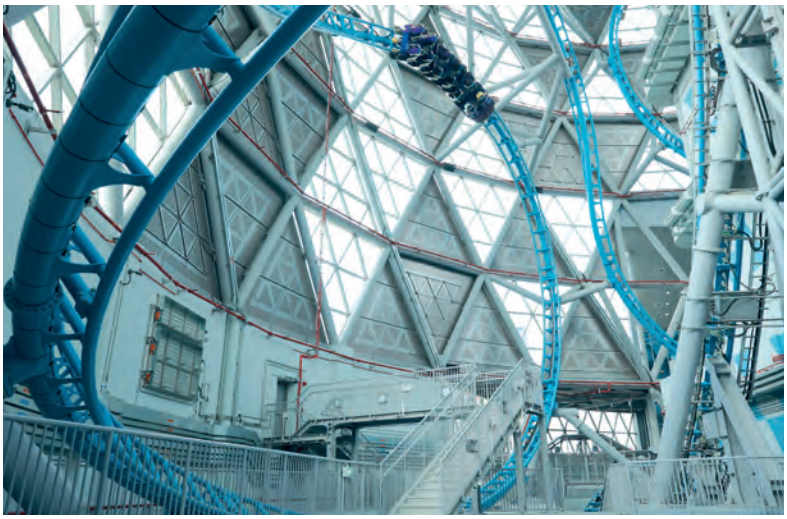

» The heat-load modelling carried out to establish viability of the layered approach meant that computational fluid dynamics modelling was not needed to predict airflows. Stratton says Cundall did not worry too much about rider comfort from an air-mixing point of view. 'The main thing was that there was a bit of air mixing and a bit of flexibility to control the direction of the air.'

All of the space conditioning AHUs operate on 100% recirculation. In a clever piece of coordination, the vertical AHU return air grilles are stacked adjacent to the ride's vertical launch. The launch system is liquid cooled by packaged cooling units provided by the rollercoaster supplier. The proximity of the return air grille ensures that heat rejected by the system is sucked immediately into the AHU before it can enter the space.

> "Internal lighting is themed and coordinated with the ride; external lighting is focused for attraction and branding..."

At the top of the AHU stack is small fresh air supply unit. 'Fresh air is not a big issue because there are only about 40 people inside the ride area,' says Stratton. The unit pulls fresh air into the space from an intake on the roof, based on an allowance of 15L·s^{-1} per person in rollercoaster space. Stratton says humidity is 'managed' by the fresh air system; 'because this is not a close-control environment, we don't need fine control'.

The rollercoaster building is illuminated by four kilometres of linear strip LED lighting. Cundall was responsible for designing the lighting scheme for the inside and outside of the building. Internal lighting is themed and coordinated with the ride; external lighting is focused for attraction and branding, and is customisable by the operator. 'There is a day and night experience, with the lighting designed to enhance the experience at night,' Stratton says.

Cooling, power and other utility services are all from the mall's centralised energy systems. 'All energy provisions are from the mall, so we had to ensure there was enough capacity in the district cooling, power and other utility services, such as fire protection systems.' Fire protection, firefighting and water services all extend from the mall central systems. Cooling is from the mall district cooling system based on a peak cooling load of 1.66MW.

Because of the magnitude of peak electrical loads, the associated operational harmonics, and compliance with local electricity regulations, a dedicated sub-station had to be constructed directly adjacent to the rollercoaster building.

Passengers start their journey in the mall, where they buy tickets and enjoy a short audio-visual show. From here, they pass into the main building, ready to be thrilled by the ride and not by Cundall's clever environmental control solution. 'If people are worrying about comfort conditions, that probably means the rollercoaster is not very exciting,' says Stratton, who knows this is not the case, having been on the ride three times already – just to make sure! **CJ**

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Are EPCs fit for existing hotel building stock?

Legislation is forcing landowners to improve the performance of buildings based on energy performance certificates. REsustain's Annie Marston compares the actual performance of hotels with their EPCs to understand the most effective improvements

With the climate and energy emergencies high on everyone's agenda and an uncertain winter ahead, our attitude to buildings and their energy usage has altered significantly over the past few years.

We can no longer maintain a business-as-usual attitude to our existing building stock. With potentially crippling energy costs, it is important that these buildings work as efficiently as possible, and that all investments and efficiency recommendations are considered thoroughly and recognised.

The majority of our existing commercial building stock runs poorly. The pandemic showed that empty buildings could not be 'turned off', and it highlighted the need to make them more flexible and efficient.

In the UK, there is a legal obligation for commercial buildings to achieve various grades for their energy performance certificates (EPCs) in order to be rented. In the 2020 Energy White Paper, the UK government established the trajectory of the minimum energy efficiency standard of all non-domestic buildings to achieve an EPC B by 2030.

This improvement is estimated to apply to 85% of the current non-domestic building stock. A summary of the current EPC requirement trajectory is shown in Figure 1. Should the buildings not reach these targets, they will no longer be able to be tenanted. With large investments readily agreed by building stock owners to meet environmental, social and governance goals it is important that this money is put into the building in the correct places.

To understand this impact on the hotel sector, a study was completed on the effect of energy improvements on the hotel stock for both EPC ratings and actual energy and carbon improvements. This study looked at 120 hotels in a portfolio built since the 1980s.

The National Calculation Methodology (NCM) is used to calculate the EPC rating for building types. It is based on benchmark data and is not supposed to reflect actual operation of the buildings. The NCM has set inputs that cannot be altered, such as domestic hot-water flowrates, occupancy and so on. (See panel, 'Set NCM inputs' for the important details for the hotel type that cannot be changed from the NCM.)

When the portfolio of hotels' actual, metered electricity, gas and domestic hot-water use was assessed and compared against these benchmarks, it showed clearly that the EPC benchmarks were overestimating domestic hot-water usage by 5-10 times their actual usage – which, from the metered data, we worked out to be approximately 30 litres per day on average.

"The majority of our commercial building stock runs poorly. The pandemic showed that empty buildings could not be 'turned off'"

The estimated carbon emissions for the 120 hotels by the EPCs was 32,000 tCO_2 a year, whereas for the metered data it showed actual total carbon emissions of 6,000 tCO_2. This difference meant that the strategy for reducing actual carbon in the buildings in real life was different from the strategy needed to achieve an EPC rating of a B.

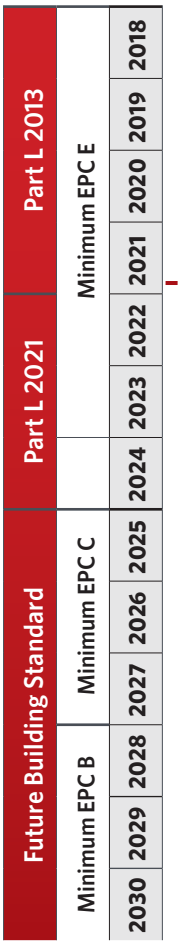
To understand the effect of different energy efficiency measures (EEMs) on the hotels, detailed models were produced in energy modelling software for a set of prototype buildings, broken down by location – city centre or roadside – age and type of HVAC systems installed, to represent the larger building stock.

The energy usage of the prototype building models was calibrated with metered data from the actual buildings to validate the energy model. These efficiency measures were then trialled on these calibrated models and the EPC models.

The measures included: installation of LED lighting throughout the building; transferring the domestic hot-water systems from instantaneous electric or gas to heat pumps; improved envelope double glazing; exterior wall insulation and roof insulation; and the installation of »

% of roof covered in PV	100%
Panel capacity (W)	400
Panel size (m^2)	1.6
Elec CO_2 factor $kg{\cdot}kWh^{-1}$	0.233
Gas CO_2 factor $kg{\cdot}kWh^{-1}$	0.184
Costs – electricity	16p/kWh
Costs – gas	3p/kWh
Increase in fuel costs year on year	
Electricity	1.0%
Gas	1.0%
Internal rate of return required	5.0%

Figure 2: The prediction tool for EPCs and operational energy



A landlord must not grant a new tenancy (including a renewal tenancy) of a property after 1 April 2018 with an EPC rating of F or G

New Part L 2021
Takes effect from 15 June 2022, carbon factors SAP10

A landlord must not continue to let any property after 1 April 2023 with an EPC rating of F or G

Part L 2021 – End of transitional arrangements
15 June 2023

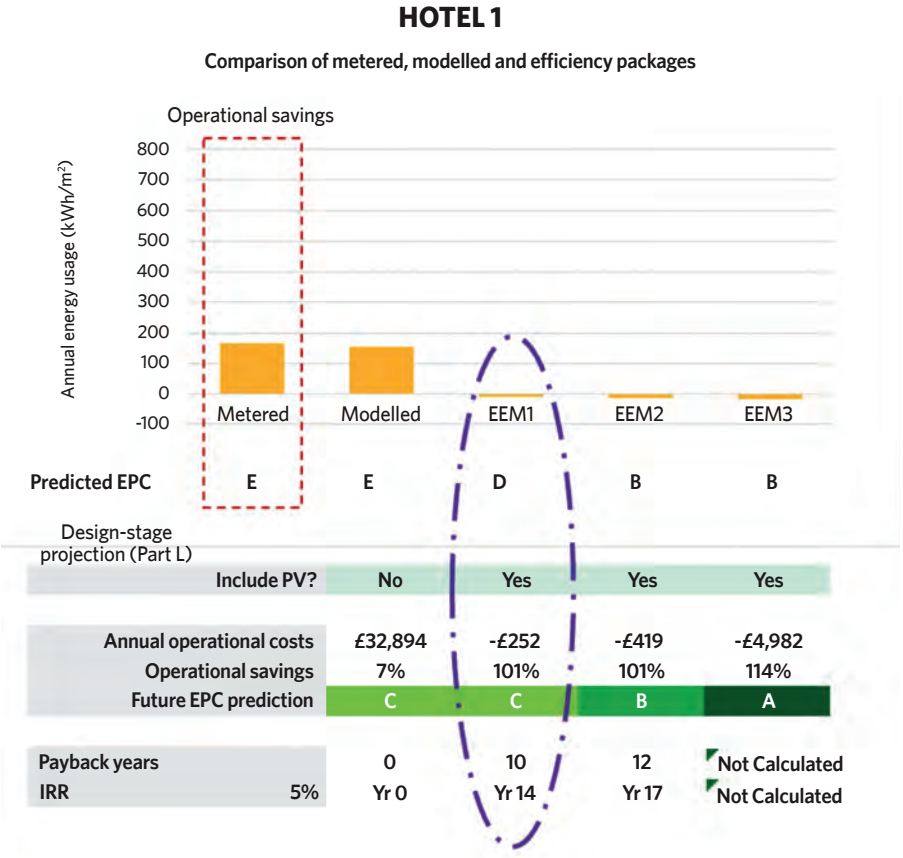
1 April 2025: **Landlords must present a valid EPC**

1 April 2027: All non-domestic rented buildings must have improved the building to an **EPC ≥ C,** or register a valid exemption

1 April 2028: **Landlords must present a valid EPC**

1 April 2030: All non-domestic rented buildings must have improved the building to an **EPC ≥ B,** or register a valid exemption

Figure 1: MEES and Part L timeline 2018-2030



"The study showed that we must find out much more about our buildings before rushing in and installing the latest fad technology"

» PV panels to the hotels' roofs and car parks. A tool was then created to look at each of the hotels individually and understand what EEMs can be added to the building. Its outputs included the old 2013 EPC prediction, the current (2021) EPC prediction, and the actual operation prediction (see Figure 2).

EEM1 is the addition of LED lighting, EEM2 is replacement of the hot water and heating system with a heat pump, and EEM3 represents fabric improvements. There is a button to include PV or exclude it for each option.

The purple dashed line around the EEM1 solution for this hotel shows that the operational energy here is predicted to be negative – this shows a 10 year payback on the LED lighting and PV installation.

The predicted EPC, using current regulations, is a D and using the future carbon factors it is predicted to be a C.

To achieve the required B, a heat pump needs to be installed; however, this is unnecessary as the hotel would already be operating at net zero carbon emissions, so the EPC improves but the payback increases, and the energy savings don't change. This was the case for multiple hotels and can be seen in the wider analysis paper presented at the CIBSE Technical Symposium 2022.

From this study, it became clear that the database for the NCM needs to be reviewed and updated especially in relation to:

SET NCM INPUTS

- **Domestic hot-water flowrate 31.68 $L \cdot h^{-1}$**
- **The domestic hot water follows the occupancy schedule; in other words, it is expected that hot water will be used at peak flowrate from 11pm to 7am**
- **Full load hours daily for domestic hot-water usage = 10.25**
- **Occupancy = 1 person/20m^2 = 0.9 people**
- **Hot water used per day per room = 292 litres**
- **The fresh air for the EPC is set at 0.932 $l \cdot s^{-1} \cdot m^{-2}$; the exterior wall area is 10.76m^2**
- **The total outdoor air entering the bedrooms is 16 $l \cdot s^{-1}$ person**
- **The heating setpoint temperature is a steady 20°C, 24 hours a day, year round**

- Domestic hot water for all categories (similar issues have been found for student accommodation and high-density apartment buildings).
- Creating different categories for hotel buildings, as roadside hotels operate and are built very differently from city centre ones.

It is my suggestion that an alternative compliance path should be created for existing buildings. In this case, a building owner can prove their year-on-year savings with actual metered and reported data.

The study also showed that we must find out much more about our buildings before rushing in and installing the latest fad technology. We need to step back and look at the whole building, measure it, analyse it, and improve it from there. CJ

DR ANNIE MARSTON is chief product officer at REsustain. This work was undertaken with Finlay Milliner, while she worked at Hydrock as technical director leading the building physics team.

The full paper can be read in the CIBSE Technical Symposium 2022 paper **bit.ly/CJOct22AM**

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BELIMO

Sandwell Aquatics Centre was one of the standout venues of this summer's Commonwealth Games in Birmingham. But how do you light such a unique environment to balance the competition's needs with those of the facility's long-term legacy? Whitecroft Lighting's Adam Hands explains

The light aquatic

After Birmingham was selected as host city for the 2022 Commonwealth Games in 2017, organisers recognised that, with only one Olympic-sized swimming pool in the region, the Midlands lacked a world-class facility capable of hosting international competition.

As a result, Sandwell Aquatics Centre, completed in April 2022, was the only new, purpose-built venue contracted for the Games, staging the swimming and diving competitions, and hosting more medal events than any other venue.

It will be reconfigured and reopened in 2023 as a community facility, to be operated by the Sandwell Leisure Trust.

Wates was the main contractor on the project, with SES the M&E contractor and Arup the design consultant. Whitecroft Lighting was chosen to manufacture and supply lighting for the facility, including the main arena, training pools and auxiliary areas, which threw up several challenges.

Not only did we have to make sure the divers wouldn't get distracted by glaring lights during their complex routines, but we also had to ensure that metal light fittings would not be affected by the highly corrosive atmosphere created by swimming pools.

The facilities required to stage a Games are very different from those needed for a community sports facility, so a substantial reconfiguration of the aquatic centre would be necessary after all the athletes had gone home – including the removal of 4,000 temporary seats.

Very different lighting would also be required; the needs of television, for example, demanded 1,000 to 1,500 Lux compared with the normal 500. This controlled level of lighting was met by the broadcasters and required temporary shades to be fitted to the windows to reduce natural light.

Minimising glare

We still had to ensure that the infrastructure lights provided the correct quality of lighting and aesthetics in and around the main competition pool – and, in particular, that the lighting aided competition use. A key element of the brief was to reduce glare in specific areas of the main arena to maintain visual comfort for competitors and spectators.

At a lower level of the arena, we had to avoid glare from the surface of the swimming pool and the lifeguard stations, while, higher up in the arena, we had to factor in the impact on high-board divers and the view for the audiences in elevated seating areas.

Once a high-board diver is standing on the platform, 10 metres above the pool, they are only metres from the roof and the lighting installations. It would be very disorientating for them to be momentarily dazzled by the lighting before or while executing a dive. We also had to avoid similar issues with spectators seated higher up, who could be facing the lights for hours at a time.

To ensure this was achieved in advance of installation, we assisted the design team with 3D digital modelling, using DIALux software and AutoCAD lighting layouts of the main pool hall. This allowed us to virtually move and adjust the hall lighting until the right levels of illuminance were achieved in the appropriate areas.

> "It would be very disorientating for a high-board diver to be momentarily dazzled by the lighting before or while executing a dive"

Left: Television broadcasters of the Games required light levels in the Sandwell Aquatics Centre to be 1,000 to 1,500 Lux, rather than the more usual 500

KEY PROJECT INFORMATION

- **Approximately 1,700 luminaires installed**
- **Five static inverter units, supplying backup power to the main and studio pools, dry dive and sports hall lighting**
- **Adjustable scene setting to main pool to allow for different lighting levels**
- **Graphical interface for lighting control system**
- **Automatic testing and reporting for emergency lighting**

Corrosive atmosphere

A further factor we had to consider was the highly corrosive atmosphere created by indoor swimming pools because of the heat and consistent high volume of moisture in the air, which condenses on, and corrodes, metals. It is even more corrosive than the chlorine by-products in the air.

To meet this challenge, we installed 155 Whitecroft Selise Maxi round floodlights. These are made from die-cast aluminium, so are highly corrosion resistant – plus, we added three layers of powder-coat paint and lacquer for extra protection. All structural fixings, such as lighting brackets, were high-grade stainless steel, in accordance with EN 13451-1 swimming pool equipment regulations, and treated with the three layers of protective powder coating.

Although the main pool hall felt like the most exciting element of the project, much of the lighting manufactured for Sandwell – including for the ancillary areas, such as gyms, studios, changing rooms, circulation zones and back offices – was more akin to a traditional project. In total, 1,700 luminaires were installed throughout the facility.

Whitecroft also supplied emergency lighting for the building, with the luminaires in the main pool, studio pool, dry dive and sports halls fed, in the case of a power failure, from static inverter systems. All other emergency lighting forms part of the general lighting system and is controlled by the onsite control and reporting system.

Circularity

At Sandwell, all the luminaires and lighting control systems have replaceable parts that should, over the years, cut down on the use of new materials and waste, and reduce the whole life carbon of each product.

Whitecroft is keen to embrace reusable and replaceable modules, and has created its first circular product (see panel, 'Circular Lighting'), which has reduced the use of plastics by an impressive 67%. **CJ**

ADAM HANDS MSLL is a project sales engineer for Whitecroft Lighting

CIRCULAR LIGHTING

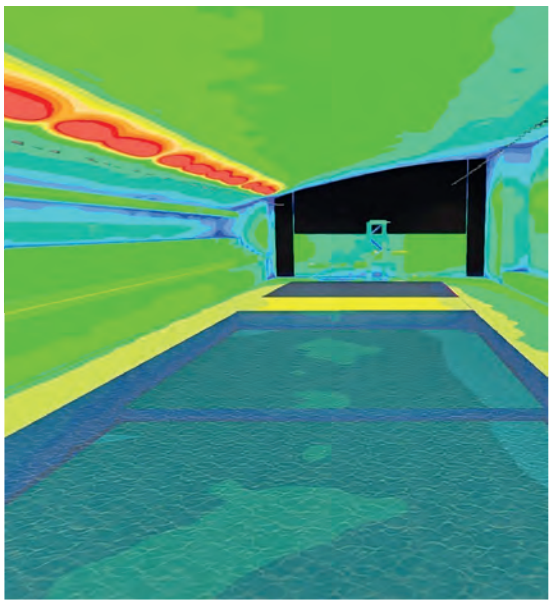
Whitecroft is aiming to reduce whole life carbon in its products. It is using data from life-cycle assessments (LCAs) to understand the long-term carbon impact of different approaches to products and projects. It is also looking to build more reusable and replaceable modules into its lighting installations (such as at Sandwell), work with existing infrastructure and materials on site, or design new circularity-inspired products.

The aim in each case is to reduce waste and extend lifespan by increasing product circularity.

According to Whitecroft, LCAs are important for three reasons: customers are increasingly valuing them; they help you to understand the carbon impact of products; and they pinpoint where the value is in circularity, or cradle to cradle.

Whitecroft's first circular product is a 600x600 recessed lighting system called Cascade Flex. This reduces the use of plastics by 67% compared with a traditional flat panel, and consists of a replaceable central cartridge that can be refurbished and reused multiple times.

Using CIBSE's TM65 embodied carbon calculator, Whitecroft has established that, over a 40-year lifespan, Cascade Flex could deliver a 46% embodied carbon reduction compared with its standard recessed flat panel.



Digital modelling was used to adjust the lighting ahead of installation

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Towards a circular economy for luminaires

This module explores recent guidance on the circular economy and how it can be applied to luminaires

Driven by the global evidence of 'climate crisis' and, more domestically, by rising energy costs and the impact of inflation on building operation, building users, owners and designers are increasingly appreciating the need to improve effectiveness and reduce the environmental impact of building systems. To succeed in engineering built environments that are more efficient – both in terms of resources and performance that will be less detrimental to future generations – requires a holistic consideration of the provision of the whole building, not least the luminaires that are employed in the lighting designs. This CPD will reflect on the recent guidance that points towards a more effective circular economy, and introduce an innovative methodology to rate products for circularity.

Recent CIBSE publications have outlined the concepts and practicalities of assessing embodied carbon and creating a circular economy for building services systems. CIBSE TM65 *Embodied carbon in building services: a calculation methodology*, published in 2021, provides an introduction to whole life carbon and embodied carbon, and delivers guidance on actions that can reduce the embodied carbon emissions of mechanical, electrical and plumbing (MEP) equipment. As well as providing guidance on standardised environmental product declarations (EPDs), it includes a method to assess the embodied carbon of MEP products where there is no reliable published information.

The 2022 CIBSE TM66 *Creating a circular economy in the lighting industry* provides a background to circular economy principles and sets out the drivers and barriers to its adoption. It notes that previous practices and models have involved 'take, make, use and waste' – a linear economy with no real way of recycling or recovering materials at end of life. The model has developed to incorporate recycling at the end of the line; however, practically, this just results in delaying the point at which luminaires are disposed of.

The commentary in TM66 explains that a product's embodied carbon and its circular economy performance are separate but linked. A luminaire with low embodied carbon is not necessarily circular economy-capable; however, by adopting the tenets of the circular economy it will very likely reduce carbon emissions. TM65 reports that a large proportion of embodied carbon from building services engineering systems is associated with the product stage (designated as sections A1–A3 by BS EN 15978:2011[1]) because of the constituent metals, electronics and plastics involved, as well as a complex supply chain – this is wholly apposite for many luminaires. This product stage includes the carbon emissions associated with extraction, transport and processing of materials, and the energy consumption used to manufacture the product. The Ellen MacArthur Foundation[2] has popularised the pressing need for action, in part with the much-copied butterfly diagram – a part of which is shown in Figure 1 – that indicates the various paths that may contribute to a product's circularity.

TM66 notes that a 'product that is manufactured thousands of miles away, in fossil fuel-powered factories, and air freighted to site may have high [embodied] carbon but, providing it is designed and supported so that it can be reused, remanufactured and repaired, then it may be circular economy-capable'. As »

» with any commodity, reducing consumption will reduce direct carbon impact – so, at its simplest, using fewer luminaires through properly considered design may provide the most effective method of lessening the environmental impact of a system. Luminaires should extend beyond their traditional life-cycle, which, ideally, will include opportunities for reuse. If not complete reuse, then parts need to be able to be recovered and used either in the next installation or kept in situ, with a few updated parts added. If not recovered, then, at the bare minimum, there needs to be proper opportunities to recycle – meaning that the materials (and components) used to manufacture luminaires should be readily recyclable. Products should be designed such that they can be repaired, modified, upgraded, reused or, at the very end of life, disassembled for component recovery. It is vital to understand that design is not limited to product design alone —systems, services and platforms are required to allow a luminaire to be repaired, modified, upgraded, reused or, at the very end of life, undergo component recovery. For example, if there are logistics in place to deliver the luminaire to site, reverse logistics must be in place to recover it.

Markedly, in his article[3] providing an overview of TM66, Bob Bohannon, immediate past president of the Society of Light and Lighting, remarks that, although the waste electrical and electronic equipment (WEEE[4]) recycling regulations have been in force for more than 15 years, the vast majority of lighting marked as recyclable is sent to landfill, with only an estimated 7.5% recovered under WEEE. He bemoans that any value in the old luminaire is literally shredded to recover materials – a process that requires energy to melt them down for reuse. TM66 provides a simplified, notably circular, development of the circular economy model – as shown in Figure 2 – that it notes as a much truer model of the circular economy: 'make, use, return', where luminaires go back to the manufacturer to be refurbished, upgraded or remanufactured as more luminaires or, at worst, for component recovery.

The luminaire marketplace has been transformed in the past 10 years with the advent of low-cost, high-efficiency LEDs. LEDs undoubtedly provide great opportunity to deliver lower operating energy use and cost, and increasingly lower capital cost compared with predecessor technologies. They also have extremely long claimed lifespans compared with other lighting technology. New LEDs might last from 50,000 hours up to 100,000 hours, compared with, for instance, fluorescent lamps at approximately 10,000

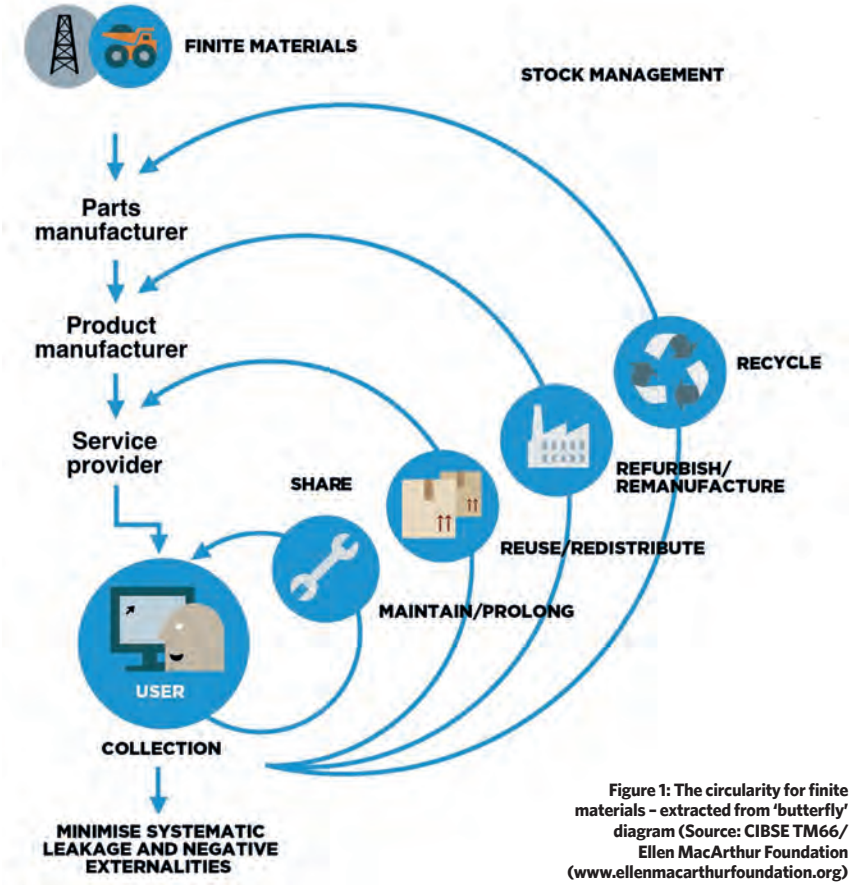

Figure 1: The circularity for finite materials – extracted from 'butterfly' diagram (Source: CIBSE TM66/ Ellen MacArthur Foundation (www.ellenmacarthurfoundation.org)

hours. However, this will be highly dependent on the design and quality of the LED, and the heat sinks and driving electronics. For example, the life of the capacitors in the power supply can be foreshortened with increased temperatures and so the failure of an LED luminaire may be ultimately down to a component that costs a few pence and, in itself, has a small carbon footprint. The popularity and promise of integrated LED luminaires has provided the opportunity for novel, compact and high-performing products. However, the disadvantage of such products is that when the LED – or any of the integrated components – fails, the whole unit needs to be replaced. Designers need to carefully assess the benefits – normally, extended lifetime, efficient, simple replacement, and novel (and often compact) design – against not being able to reuse the components (such as drivers, optics and LEDs), potential increased waste, and the likely higher capital cost. BS 8887-220:2010 *Design for manufacture,*

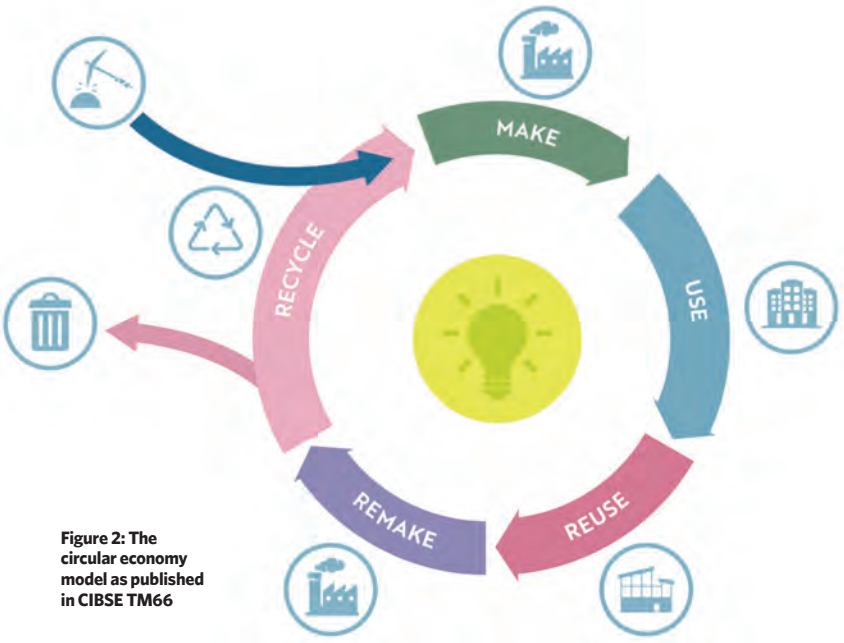

Figure 2: The circular economy model as published in CIBSE TM66

Score	Evidence	Action towards circular economy
0	No evidence	No evidence has been seen. Any product, material or service displaying typical linear economy principles is to be allocated 0 marks.
1	Some positive evidence	Design elements have been considered and evidence provided.
2	Positive evidence	Design elements/attributes have been incorporated into the product or service offered.
3	Excellent positive evidence	Design elements/attributes have been incorporated into the product or service offered, and services align with circular economy goals.
4	Outstanding	Design elements/attributes and services align with circular economy goals and deliver ecological regeneration or are regenerative to communities or via social responsibility.

Table 1: CEAM: evidence and action towards a circular economy (Source: CIBSE TM66)

assembly, disassembly, and end-of-life processing (MADE) provides the standard for remanufacturing to change a used product into an as-new product. While BS 8887-220 states that 'the new product must have equivalent performance and warranty of a comparable replacement product', TM66 notes that there may be occasions when the reuse of a mid-life LED fitting will be acceptable even when its lumen output may have depreciated, making it of lower output than new, but still fit for purpose when used in a considered way.

The Circular Economy Assessment Method (CEAM) illustrated in TM66 employs accompanying Excel spreadsheet tools to steer manufacturers towards improved product circularity, as well as providing specifiers and clients with understanding of the questions they need to ask. The Circular Economy Assessment Method for manufacturing (CEAM-Make) employs an Excel spreadsheet comprising 66 questions under four tabs – product design, manufacturing, materials and supporting ecosystem – to assess a luminaire's circular economy performance. By adding the specific product answers, products are given a rating of zero to four, as shown in Table 1, with the spreadsheet tool allowing iterative inputs to encourage and enable manufacturers to improve the rating. The baseline for a product is zero, with the intent to encourage and enable products and supporting ecosystems that score three or four.

However, manufacturers or suppliers may make generalisations, 'greenwash' products, or deliver unintended outcomes. The CEAM-Specify is a specifier support tool that may also be useful for manufacturers at the early stages of product design, providing a triage tool that highlights key issues with a product. The tool references the CEAM-Make tool, but provides a less-detailed set of 24 questions that, for example, can allow a relatively swift comparison of two or more products.

This can be applied to support decision-making when embarking on a new or existing project that is seeking to implement circular economy principles and products. It can also be used as a checklist to inform understanding and change.

There are several case studies included with TM66 that illustrate that the realities of a circular economy are not simply lofty ambitions for a better future world, but provide examples that are already taking place. Drawing on those case studies and from other industry documents, it provides some examples of good practice that contribute to a product's circularity, as shown in the boxout, 'Examples of practices that can improve a luminaire's circularity'.

The accelerated adoption of circular principles is likely to be informed from the large body of work that is being developed to advance the EU's Sustainable Products Initiative.[5] The UK government's 2021 strategy document *Net zero strategy: build back greener* clearly lays out a future where a circular economy will be part of everyday life: reusing, repairing and remanufacturing goods will be standard practice, with producer responsibility schemes embedded across the economy. The government's worthy intention will undoubtedly need the ingenuity, engineering acumen and organisation of an enthusiastic and well-informed lighting industry to have any real prospect of success.

Turn to page 64 for further reading and references. »

EXAMPLES OF PRACTICES THAT CAN IMPROVE A LUMINAIRE'S CIRCULARITY

LED luminaires should be designed to be repairable and capable of remanufacture, to allow easy access and replacement of components that are likely to fail during the life of the luminaire. Ideally, unless specifically required, superfluous detail should be minimised to avoid impact from changes in fashion and to improve opportunities for eventual reuse.

Individual products can be allocated a unique identifier that should be permanently affixed – for example, employing QR codes, near field communication (NFC) or simply a readable URL on each luminaire (or major component). This can provide a link to access a myriad of internet-connected resources, such as component drawings, manufacturer upgrades, and sources of spares and enhancements.

Products can be manufactured with extra fixing holes to allow subsequent use of different component types as technologies evolve.

Where feasible, a local resource ecosystem for design and component manufacture can significantly reduce the carbon footprint of a product, as shorter distances mean reduced transport-related energy consumption and greenhouse gas emissions. TM66 reports on a building refurbishment where the manufacturer transported linear fluorescent luminaires fewer than 40 miles to the factory and upgraded them to LED without compromising light quality and efficiency, and each luminaire was significantly cheaper to manufacture than new light fittings.

Intelligent use of materials, such as by using hollow extrusions (or, potentially, additive manufacturing techniques) rather than subtractive machining, can reduce resource use. The increasing availability and greater variety of bioplastics, including corn starch-based polycarbonates with excellent optical properties, can provide a lower environmental impact and higher performance than traditional materials.[6] It is also available as a feedstock for additive manufacture.

Additive manufacturing (3D printing) can be employed (using 'STL' or 'OBJ' descriptions sourced through product IDs and internet resources) to create components that are no longer stocked by the supplier, or possibly used to provide a transformation element for new components. The utility and flexibility of additive manufacture has been shown[7] to reduce the carbon footprint of a 'typical 3D-printed luminaire' (excluding electronics and optics) by 75% compared with a conventionally manufactured metal luminaire. This is because of their modular design that employs fewer and less-complex parts that are made from a single, low-mass material.

For components that are unlikely to be reused, materials such as aluminium can be used, which can eventually be recycled without losing any of its properties.

By employing networked control for lighting installations, luminaires can self-report their condition so that maintenance can be optimised and residual life logged, which can inform the opportunity for reuse when building systems are refurbished.

Module 204

October 2022

1. Which of these areas was not noted as being included in TM65?

- ☐ A Guidance on reducing MEP embodied carbon emissions
- ☐ B Introduction to whole life carbon
- ☐ C List of EPDs for many typical MEP components
- ☐ D Method to assess the embodied carbon of MEP products
- ☐ E Proportion of embodied carbon associated with product stage

2. In the extract from the 'butterfly' diagram, which process would appear to make the least total environmental impact for a product when the original use is completed?

- ☐ A Maintain/prolong
- ☐ B Recycle
- ☐ C Refurbish/remanufacture
- ☐ D Reuse/redistribute
- ☐ E Share

3. What is the approximate percentage of lighting that is thought to be recovered under WEEE?

- ☐ A Less than 1%
- ☐ B 1% to 5%
- ☐ C 6% to 10%
- ☐ D 11% to 15%
- ☐ E At least 15%

4. Which product CEAM rating description would indicate that a product met the method's intent of encouraging and enabling circularity?

- ☐ A Excellent positive evidence
- ☐ B Existence of critical evidence
- ☐ C Improving evidence
- ☐ D Positive evidence
- ☐ E Some positive evidence

5. Based on the discussion in this article, which of these is not likely to be true when assessing the circularity of a luminaire?

- ☐ A Extra fixing holes in products for different components as technologies evolve
- ☐ B For components that are unlikely to be reused employ readily recyclable materials
- ☐ C Intelligent use of materials, such as by using hollow extrusions or additive manufacturing techniques
- ☐ D Luminaires designed to be repairable and capable of remanufacture
- ☐ E Products with high embodied carbon cannot be circular economy-capable

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Further reading:

BS 8001 *Circular economy* provides a practical guide to the implementation of the principles of the circular economy in organisations.

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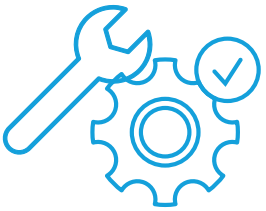

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Flamco launches FlexFiller Direct G4

Pumpless top-up pressurisation unit is designed for small commercial and residential systems

Flamco has introduced a new pumpless top-up pressurisation unit – the FlexFiller Direct G4. The unit is the second of its kind in the UK and is aimed at small commercial and residential systems requiring top-up pressurisation.

Sealed water systems may need automatic top up when pressure drops due to water loss or air purging, for example.

The slim, wall-mounted, low flowrate unit offers a maximum flowrate of 14 litres per minute, depending on the boosted mains feed water pressure. It has been designed to be connected directly to a building's incoming mains or boosted water supply via flexible hose connections (included), and fill heating or chilled water systems without the use of a pump.

The unit comes with a user-friendly controller that displays all operating and error conditions in an easily understood and straightforward interface.

It features extensive data storage for online and offline analysis, microprocessor control and self-learning with a graphics display. It comes with Modbus RTU and BACnet communication protocols so it can be integrated into a building management system if required. The unit can be used to monitor expansion-vessel health, safety valve activations and leak detection.

The unit also features backflow prevention Category 4, and the technology incorporated in the unit is designed to ensure the lowest possible power consumption, a long-service life and simple maintenance.

Flamco offers a remote commissoining service for the product, which is manufactured in the company's factory in St Helens. The unit comes with a five-year warranty and is available from this month. Sean Blandford, Flamco managing director in the UK, said: 'It's a cost-effective option with what we believe to be significant benefits.'

External CAT 5 booster set now available

KGN Pillinger has designed and manufactured an external CAT 5 Washdown Booster Set as part of its CAT 5 range of products, offering more flexibility to the end users for installations outside of buildings.

The washdown booster sets are designed to prevent backflow contamination of the mains water supply, while maintaining flow and pressure. The CAT 5 has a combined break tank and end suction booster pump system aimed at category 5 applications and is designed to be compact and lightweight for easy floor-or-wall mounting. The set is a freestanding, quiet-running unit with integrated electronic pressure controller mounted inside the housing.

The internal unit is housed in stainless steel and the external unit is housed in a glass reinforced-polyester (GRP) cabinet. The external unit also has a built-in heater for cold weather protection.

Armstrong release monitoring APP

Armstrong Fluid Technology has produced an app to give information on pump analytics and performance.

The app claims to optimise HVAC performance, as users receive instant notifications on system efficiency and issues.

Tunji Asiwaju, global manager, cloud services with Armstrong, said: 'With this new app, service technicians, facility managers and operators can receive real-time alerts wherever they are.'

Wavin's solution cuts noise for luxury apartments

Wavin's AS+ range has been specified as a low-noise soil system for a block of luxury apartments in a mixed-use development in Hove, East Sussex.

As well as apartments, the Tate Residences includes a bar-restaurant on the ground floor and a communal terrace overlooking Sussex County Cricket Club. In this mixed-use context, developer Roffey Homes had to overcome a key water management challenge – dealing with drainage acoustics in a high-end development, keeping pipework noise to a minimum. Plumbing and heating specialist Woods Heating was brought in to advise and recommended Wavin's solution.

The AS+ range is designed to reduce the sound emitted from pipework significantly, according to Wavin. For example, airborne sound is lessened because of its high mass and wall thickness, while structure-borne sound is minimised by the low elastic-modulus of its flexible material.

Wavin's high-density polyethylene range was used in the building's parking space, as the pipes and fittings are lightweight, durable and easy to install, according to the manufacturer.

The products are fully welded, providing a system highly resilient to any unexpected knocks from HGVs, said Wavin, which added that it is easy to integrate with the AS+ low-noise system used elsewhere in the development.

Low-noise drainage was a key requirement for the Hove apartments

SCOTTISH PIPERS CONNECT HOMES TO DISTRICT HEATING

Rehau pipework distributes hot water from a biomass boiler

Rehau's Rauvitherm pre-insulated pipe has been specified for the district heating system at North Ayrshire Council's Flatt Road low-carbon housing development, in Largs, western Scotland.

The flagship scheme of 122 new homes was connected to a nearby biomass plant for its heat and hot water using the pipework, which Rehau says offers minimal thermal losses and swift and safe installation.

The Rauvitherm pipe was cut to length in the factory and shipped, with fitting and shroud kits, from Rehau's warehouse in Manchester.

The company said its Everloc jointing meant the network could be pressure tested and operated at 70°C straight after joint completion.

C40 Cities confirms water-stewardship plan

C40 Cities – a network of mayors, of nearly 100 world-leading cities, collaborating to deliver the urgent action needed to confront the climate crisis – has confirmed plans to support urban areas in improving water stewardship in the coming years.

The initiative has provided details for the next phase of its Water Safe Cities work, which includes the creation of a Water Accelerator – a platform through which cities can improve their pledges to safeguard water supplies and protect residents from flooding. The platform will also support cities to embed these pledges into their climate and urban planning approaches.

The overarching aim is to help cities develop, implement and achieve targets based in science regarding water-related risks. Project partners include Grundfos and Grundfos Foundation.

New Intatec TMV boosts scalding protection

Intamix Delta can operate at 50°C hot water set temperature

Intatec has launched its new Intamix Delta thermostatic mixing valve (TMV), which is designed to work with lower temperature differentials found in heat network schemes and provide homeowners connected to modern heat networks with protection against scalding.

According to the manufacturer, Intamix Delta is currently the only TMV that can operate at the new recommended 50°C hot water set temperatures and still provide anti-scald shut down, with an operating differential of up to 5°C. It also meets all EN1111 and EN1287 requirements.

Intatec claims the risk of dangerous scalding incidents are increasing as installers fit TMVs at outlets – such as baths, taps and showers – that are not capable of operating and providing protection against scalding. It says TMV2 valves will not operate to safety standards when the temperature difference between the supply from the heat interface unit and the mixed outlet from the TMV is less than 10°C.

TMV2 recommends bath outlets to be set at 44°C, and showers and basins at 41°C, to ensure valves are safe.

Study says plastic pipes produce less GHG than alternatives

A new report from global management consultancy McKinsey & Company has suggested that plastic – including pipes used in construction – have a lower total greenhouse gas (GHG) contribution than alternatives in most applications.

The research covers municipal sewer pipes and residential water pipes in construction, as well as for other sectors. It found, for example, that PVC-U sewer pipe creates 35-45% fewer GHG emissions overall than its equivalent in concrete or ductile iron – partly because it offers the same function, but with less weight and associated lower transport and installation costs.

In above-ground water pipes, cross-linked polyethylene (PEX) pipe has 25% fewer overall GHG emissions than copper pipe. Despite copper's high recycling rates, the ongoing thermal losses from copper pipe are significantly higher than from PEX pipe.

Safe approach

Hypochlorous acid offers a safer alternative to biocides for treating water, says Guardian Water Treatment's **Ian Wedd**

During the lockdowns of 2020 and 2021, Guardian Water Treatment observed a number of large commercial buildings electing to manually run-off traps and outlets to prevent water from stagnating during periods of low occupancy. Even if this is done regularly, it is unlikely to replicate normal water usage in a building designed to host thousands of people.

We also saw a significant increase in total viable count (TVC) – which gives an estimate of the total concentration of microorganisms – failure rates and positive legionella samples compared with the same period pre-Covid. We took more than 30,000 samples from London buildings during the six months from April 2020 (the first full month of lockdown). Most of the buildings in the sample were following manual flushing regimes. Results show a significant increase in failure rates across the board, for both TVC samples and positive legionella results.

Comparing the results year on year, data shows the number of 'out of specification' TVC results (water samples that carry unacceptable levels of microbiological contamination) rose by more than 50%. The rate of detection for positive legionella samples also rose by around 20%. While flushing does help prevent stagnation and legionella growth, overall microbiological control is likely to be compromised, which is where measures such as secondary disinfection are so important.

Secondary disinfection focuses on maintaining water quality to prevent future issues. Bacteria-killing properties are delivered by biocides such as chlorine, chlorine dioxide and monochloramines.

Chlorine dioxide – a powerful, selective oxidising biocide, with robust anti-microbial properties – is the most commonly used. While it is undoubtedly effective and of particular use in systems where bacteria is already well manifested, it is tricky to maintain its efficiency. Poor storage, fluctuations in flow, exposure to light and temperature differences can severely compromise how well it works.

A new approach

There is another way that offers considerable benefits in terms of safety, sustainability and cost. Hypochlorous acid (HOCl) is a powerful disinfectant that is 100% safe for humans, chemical-free, non-toxic and naturally occuring. It has been used for more than a century and is commonly found in hospitals as a means of safe disinfection. HOCl has only recently moved over into the water-treatment industry.

As well as much-improved safety, it offers benefits in terms of storage and handling. There is no need for PPE and no reduction in quality when stored for a period of time or exposed to sunlight. Environmentally, it has lower CO_2 emissions, less wastage and low production costs – all in all, the perfect choice for many buildings.

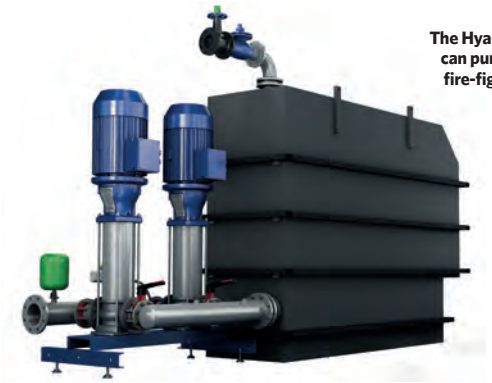
Fire fighting boosted by hydrant break tank package set

KSB's system uses one main pump to deliver water to above- and below-floor hydrants

Pump manufacturer KSB has complemented its portfolio of hydrant break tank package booster sets for fire fighting with its new Hya-Duo D FL-R pressure-booster system.

Designed to conform with DIN 14462, the system uses only one main fire-fighting pump to supply hydrants installed above or below floor with up to 192m^3 of fire-fighting water per hour.

The automatic break tank package booster set is fitted with two fully redundant pumps, each of which has its own power and control circuit. The redundant control systems continuously monitor pressure and limit switches for broken wires and short circuits. Motor and dry-running protection are disabled in the event of fire, ensuring the pumps do not stop before fire fighting has ended. If one of the pumps fails, the redundant control system takes over and starts up the second pump.



The Hya-Duo D FL-R can pump 192m^3 of fire-fighting water per hour

Hevasure develops corrosion monitoring system for Elysator

Closed-loop water monitoring specialist Hevasure, working with original equipment manufacturer partner Elysator, has developed real-time monitoring technology for chemical-free closed-water systems.

According to Hevasure, its ClearView solution provides technologies that can immediately detect and record deviations in water characteristics that can cause catastrophic corrosion.

By using high-purity water of low conductivity, controlling pH, and reducing dissolved oxygen, Elysator can ensure that closed heating and chilled-water systems operate in a healthy condition, without the use of chemicals, delivering stringent water quality in line with the VDI 2035 standard

ClearView continuously and remotely tracks these critical parameters, providing confirmation to engineers and managers. Low oxygen conditions without nutrients ensures bacteria cannot survive, and that corrosion is not an issue.

New valve's precision offering

Comap product is said to save more than 8% energy compared with standard control valves

Manufacturer Comap has launched a new dynamic balancing valve that it says saves more than 8% energy compared with standard control valves. The NexusValve Vivax G2 EQM consists of a differential pressure-independent flow limiter and control valve, for hydraulic balancing in heating or cooling systems.

Equipped with 100% control authority, Comap says the valve reacts immediately to changes in the upcoming differential pressure, regulating the flow according to the signal from the building management system or room thermostat.

Without an actuator, the NexusValve Vivax G2 EQM is an automatic flow limiter, says Comap. 'In this way, the valve ensures the intended flow in the end units, regardless of requirements from other consumers or strings in the system,' says Maxcens Fernandes, product line sales director, balancing and control, at Comap.

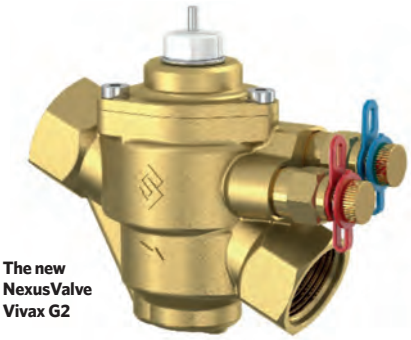
The valve has an equal percentage modulating valve characteristic (EQM), which means the flow control is particularly precise and independent of the differential pressure, and the unfavourable performance curve of a typical heating system is compensated, says Comap.

Complex hydraulic balancing is no longer necessary, as the valve keeps the set flow constant regardless of the load conditions in other parts of the system. Once set, there is no need for readjustment, says the company.

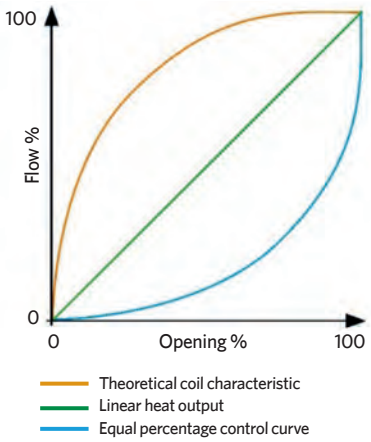
'The EQM curve of the NexusValve Vivax G2 and the typical characteristic curve of heating and cooling systems result in a linear overall characteristic curve that allows efficient control of the system,' says Fernandes.

As the stroke is independent of the presetting, there is always full valve authority for precisely regulated flow control, adds Comap. As a result, room temperatures can be kept constant and an oversupply in the system is prevented.

Actual volume flow through the valve can be checked, so system faults can be more easily detected and rectified without changing the flow in the terminal units already in operation.



The new NexusValve Vivax G2



The typical logarithmic characteristic curve of the heating system (orange) is balanced by the EQM characteristic curve of the valve (blue), resulting in a linear overall characteristic curve (green) that enables optimum control of the system

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On neutral ground

Prolonged droughts are making water scarcity a global concern. Ramboll's Rickesh Miyangar says new projects should aim for water neutrality, where water abstraction is no higher than existing levels

Over the summer this year, much of the UK experienced record spells of dry, hot weather, with hosepipe bans imposed in Yorkshire and much of South East England as the country grappled with mitigating its water-scarcity issues.

Despite a damper September, two new reservoirs are being considered in Cambridgeshire and South Lincolnshire to provide water for 750,000 homes and help secure the region's water supplies. Multiple water companies are reportedly also considering further drought measures. Emerging from this is a new concept for local authorities, developers and planners – water neutrality.

Water neutrality is, essentially, the idea of water use in the area of a new development being equal to, or lower than, the previous total water use: that is, where water abstraction is not above the area's existing levels.

Many considerations need to be factored in when it comes to water neutrality. While existing measures can help improve the water efficiency of a site, more needs to be done to incorporate the idea of water neutrality into the planning stages of a development, especially as water abstraction can have an impact on the surrounding area, including the wildlife.

Additionally, where drinking water is provided to a development by the local trunk mains, connecting larger developments to existing infrastructure needs to be assessed carefully to mitigate any adverse effects of a potential increase in water abstraction.

Achieving water neutrality

The reality is that water neutrality is far from simple to achieve. Setting stricter regulations could add an incentive for water neutrality to be planned into a project, but we cannot be too restrictive at this stage.

Current Part G Building Regulations set a mandatory daily consumption of 125 litres per capita for new builds, which is a relatively easy goal to achieve. However, a more ambitious target of 80 litres per capita would require very strict measures. Currently, improving water efficiency is costly, and not all technologies are readily available or suitable for some developments.

Water neutrality may seem a distant goal, but steps to improve efficiency can still be taken, and there are a number of ways we can reduce a site's water consumption.

"Reclaimed water systems offer the greatest water-saving benefits, reducing stress on aquifers"

Water efficiency techniques

'Simple' measures that can be easily implemented to improve the water efficiency of a development, including smart meters, flow restrictors and low-flush toilets. However, these alone cannot achieve the reductions required for water neutrality, or even a consumption figure close to it. As such, some developers may wish to consider reclaimed water technologies for their sites.

Rainwater, for example, can be harvested for re-use in the building for flushing toilets and irrigation (RWH), or greywater can be reclaimed from wash basins, showers and baths (GWH) before being filtered and treated, and passing into a clear-water storage tank. Strategically designed site-wide strategies may provide the greatest benefit to developers by linking the sustainable drainage system features to active/hybrid RWH/GWH systems.

Reclaimed water systems offer the greatest water-saving benefits, reducing stress on aquifers from over-abstraction, and reducing mains water costs. However, the equipment required for these systems can come at an increased cost for implementation and maintenance, so thought should be given to which measures are the most effective for each site.

The wider picture

The UK's climate is changing and our summers are becoming drier. Water consumption and the idea of water neutrality will become an increasing focus for many stakeholders – it is only a matter of time before best practice is embedded in legislation as further water-consumption technologies are invented.

At this stage, however, we should not be aiming for 'net zero' water. First, we need to better understand water demand and usage in prospective developments, and work to reduce demand in existing properties by offsetting, providing there is local stock against which to create the offset.

Greater scrutiny of water efficiency is on the horizon, so stakeholders should take steps now to reduce a site's consumption. Developing greater understanding of the available technologies and existing research, and embedding the water-saving methods best suited to a site, will help. If we take one lesson from this summer, it is that we must all start making that difference now.

RICKESH MIYANGAR is a director at Ramboll

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By monitoring water quality remotely, expensive remedial works can be avoided. FairHeat's **Peter Horne** looks at the costs of keeping a close eye on district heating systems

MONITORING THE SITUATION

Water quality management within new and existing UK district heating schemes is a costly process that is often not carried out to industry guidance standards. These include *BSRIA BG 29 Pre-commission cleaning of pipework systems; BS 8552:2012 Sampling and monitoring of water from building services closed systems* and *BSRIA BG 50 Water treatment for closed heating and cooling systems.*

It has been found that 15% of heat networks within the UK require unbudgeted remedial works within the first two years, and the majority of these are probably because of a lack of understanding of the importance of maintaining water quality [1]. If suitable procedures are introduced via additional technology, it can only improve the cost and operating efficiencies of heat networks and play a large part in decarbonising heat in the UK.

Other qualitative benefits include: removal of sampling ambiguity at the pre-commissioning phase; instantaneous identification of changes to water quality via alarms; improved visibility on system water chemistry throughout a project lifetime; and increased accountability and improvement of contractual lines and accountability.

The qualitative benefits highlighted above, however, can only be realised if the installation and operation of online monitoring equipment shows cost improvements when compared with conventional sampling and monitoring methods.

The study [1] investigates the key parameters that are most influential in determining water quality and the ability for the system water to deteriorate system components. These have been categorised as a lead indicator (identifying when a system moves towards corrosive conditions) or lag indicator (identifying when corrosion has already occurred) across oxygenated and de-oxygenated systems, to enable targeted selection of parameters for online water-quality monitoring.

The financial assessment of two online monitoring arrangements have been conducted across three different-sized residential heat networks over a 20-year period (Table 1). Each online monitoring regime has subsequently been compared against the recommended sampling approach stated in *BSRIA BG 29* and *BSRIA BG 50*.

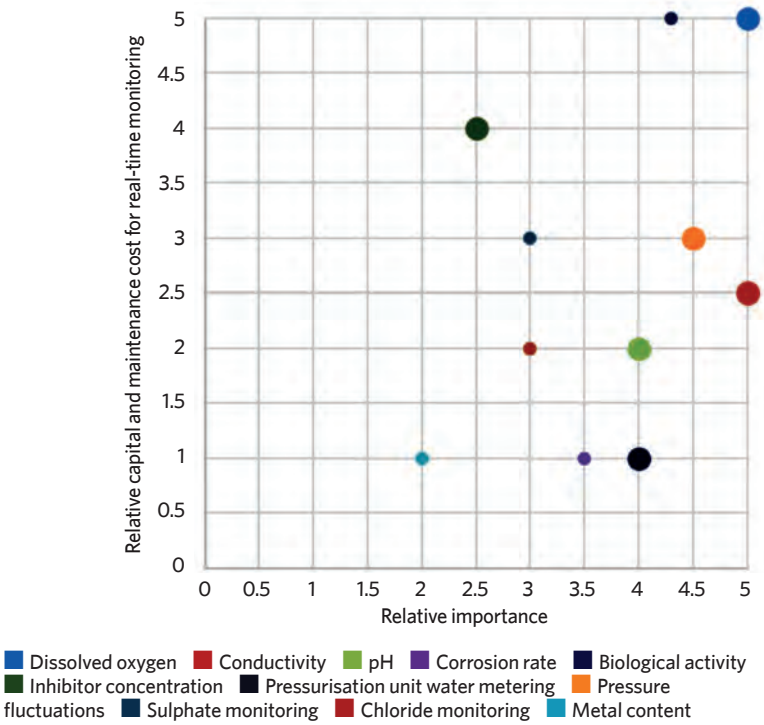

Figure 1: Relative importance and cost of lead (large markers) and lag indicators (small markers) for conventional oxygenated systems

It is well documented that three key parameters can identify if conditions are favourable for corrosion to occur: pH, electrical conductivity, and oxygen content[2]. Additionally, system pressure »

System size	No. of dwellings	System volume (l)	Piped network length (m)
Small	80	7,000	1,250
Medium	235	11,500	2,590
Large	484	18,000	5,840

Table 1: System size of residential heat networks being financially assessed over a 20-year period

control and fill-water monitoring are identified within literature as of high importance to ensure the system is adequately protected from oxygen ingress and inhibitor depletion (where applicable).

Introducing high volumes of fill water into the system can also indicate if leaks are occurring, providing insight as to whether the system is watertight. To maintain control over water quality, the amount of fill water entering a system should be measured and routinely checked, regardless of the methodology – de-oxygenated or chemically dosed – used to maintain water quality.

Categorising all water-quality parameters into lead and lag indicators adds weighting to the parameters that identify when system water trends towards corrosive conditions before corrosion occurs. Therefore, monitoring lead water quality parameters continuously increases the effectiveness of the online monitoring equipment, enabling proactive maintenance works to take place before (significant levels of) corrosion takes place.

Because of the increasing uptake of de-oxygenated systems within the UK, this study was conducted over conventional dosed and de-oxygenated systems.

De-oxygenated systems provide a more clear-cut set of monitoring parameters because of the lack of complexity within the water chemistry. De-oxygenating a district heating system would shift the relevant guidance documents from BSRIA BG 29 and BSRIA BG 50 to the German water standard VDI 2035.

Monitoring options

Regardless of the system type, the monitoring parameters with the highest relative importance are consistent and in line with literature findings.

The following combinations of monitoring options have been selected for life-cycle analysis based on the key parameters highlighted above across both systems.

Option 1 monitors all the parameters with a relative importance deemed greater than a value of 3, shown in Table 1 within a single monitoring unit.

Option 2 provides analysis on a hybrid monitoring regime with standalone probes for all key monitoring parameters with a relative importance greater than 4.

The results from the financial assessment show there is good economic feasibility for online real-time water quality monitoring. The increased capital investment upfront is quickly recovered by the reduced requirement for sampling to BSRIA BG 29 standards during the commissioning phase before system handover.

From an install and commissioning perspective, installation of online monitoring would be economically viable in cases where larger system sizes and longer commissioning phase durations are present, as the cost variation from sampling is improved.

The overall net present value observed at system handover and year 20 are significantly impacted by an increase in commissioning phase duration of a project, regardless of system size. Although overall costs increase with extended handover periods, the financial benefits of having online monitoring installed are reduced compared to BSRIA sampling. This is because of the costly nature of laboratory sampling every fortnight.

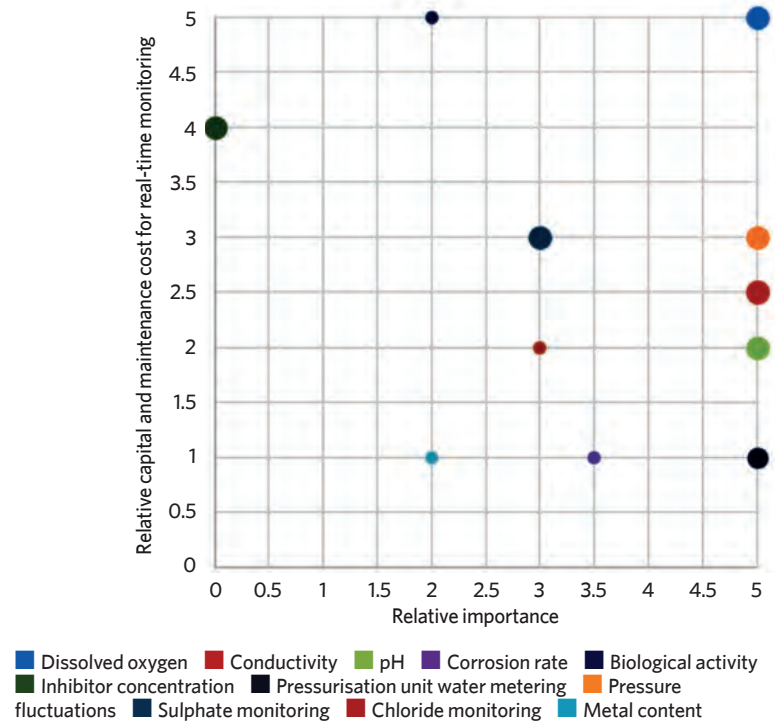

Figure 2: Relative importance and cost of lead (large markers) and lag indicators (small markers) for de-oxygenated systems

Option	Monitoring type
BSRIA sampling	**Commissioning phase:** BSRIA BG 29 fortnightly sampling between flush completion and practical completions **Post-handover operation:** Quarterly sampling with results sent for laboratory analysis. Remedial maintenance conducted, based on sample results
Option 1	Dissolved oxygen, conductivity, inhibitor concentration, pH, pressure fluctuations, corrosion rate, water metering
Option 2	pH, conductivity, dissolved oxygen, pressure fluctuations, with water meter installed

Table 2: Combinations of monitoring options selected for life-cycle analysis

There is good financial benefit for both online monitoring options over a 52-week period, regardless of system size, and it could be considered financially beneficial to install temporary monitoring during the development commissioning phase.

Post-handover maintenance of the system, with the additional maintenance costs incurred by the monitoring equipment, increases overall water quality parts per million costs by around £1,300-£3,000. However, the improved visibility and control on water quality enables cost reductions on reactive maintenance works, heat interface unit servicing time costs, and major equipment replacement costs.

It has been found that online monitoring equipment is economically viable for medium and large systems. The relative costs recovered by improved operation of small systems does not outweigh the increased equipment maintenance costs. So, installation of online monitoring equipment on small hydraulic systems is not recommended. CJ

To read the full research paper, visit the FairHeat website **bit.ly/CJOct22PB**

PETER HORNE is a consulting engineer at FairHeat

References:

1 J Greaves, *Water quality assessment in UK district heating systems*, CIBSE, Sheffield, 2019
2 R Thorarinsdottir, L V Nielsen, S Richter and T Hemmingsen, *Monitoring corrosion in district heating systems*, The Icelandic Building Research Institute, 2004.

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WHEN DRAINAGE REPLACEMENT STACKS UP

Overcoming the challenge of drainage stack replacement means coming up with new solutions, which can include prefabrication, says Polypipe's **Graham Hicks**

Drainage stack replacement is a major piece of work that can cause significant disruption

Drainage stack replacement in repair, maintenance and improvement projects can present complex challenges, particularly in public sector housing work, where a whole host of factors must be considered if the project is to be completed efficiently.

Drainage stack replacement is a major piece of remedial work, which – for public sector housing projects – inevitably means some period of time during installation when residents are without the use of their sinks, toilets and other facilities. In multiple occupancy buildings, where there are perhaps 100 or more individual homes, this can mean a significant level of disruption.

Replacing old drainage with prefabricated stacks can save time on site compared with the traditional approach of replacing individual components that need to be welded.

The use of standard loose parts will not always be suitable for an older building after it has undergone previous phases of renovation. The older it is, the more likely it is that what's on site will differ from original plans. Bathrooms may have been moved or reconfigured, and additional appliances may have needed extra drainage.

The proximity or angle of joints needed may not match standard parts, so may demand further work to address. This means more time on site and, potentially, will affect the layout of some rooms.

Potential solutions

Looking at how drainage stacks are manufactured and designed to the requirements of individual projects can make a big difference to how these problems are overcome.

Recent work carried out by Polypipe Building Service at a large, ageing tower

block in East London is a good example of this. The existing metal drainage system had reached the end of its useful life. On inspection, some of the horizontal pipework connecting the individual perimeter stacks to the main stacks on the third floor had corroded.

However, because of the layout of the building, and the alterations of more than five decades of renovations, a series of adaptation works were needed. These included designing soil stacks with very compact waste connections set at angles, often tightly spaced above each other, while avoiding any potential for cross-flow issues.

Custom engineering solutions were needed because of different layouts in some of the flats – for example, one had a different bathroom configuration from all the other flats within the building, with additional waste connections. A separate set of drawings was created for the installer, detailing all the parts of the stack and part numbers for that specific area.

> "Standard loose parts will not always be suitable for an older building after previous phases of renovation"

Because of the complexity of the project, several test stacks were created to overcome initial installation issues that were experienced. This allowed the right size and configuration of stacks to be prefabricated off site, and minimised the amount of time required during installation to overcome problems that might otherwise have added days or more to the schedule.

All of the stacks provided were pre-air pressure tested to offer complete peace of mind to the contractor, and are designed and manufactured to the existing BS EN 12056 (Parts 2 and 3) and Building Regulations Part H standards and regulations.

An efficient solution

The problems outlined are not uncommon for work of this type, with the need to consider minimising disruption to occupants and addressing decades of changes and renovations potentially adding significant time to a project. This can be largely avoided, however, by using an offsite, prefabricated approach for drainage stacks. CJ

GRAHAM HICKS is project development manager at Polypipe Building Services

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Mild steel pipe and connection techniques for building services

This module considers the processes for making different types of steel and evolving methods of connecting steel pipework for building services systems

The application of mild steel pipe for building services systems is long established. This CPD explores the process of creating steel, explaining terminology that is often used but possibly not fully understood, particularly in creating 'black' steel pipe, as commonly employed in commercial and institutional applications. Evolving methods of connecting steel pipes are considered, with a focus on recent advances in the application of 'press-fittings' that can provide swift and robust connections for new and refurbishment installations.

Steel has been made for several thousand years, originally by the fortuitous introduction of carbon to molten iron and, in modern times, by employing carefully controlled processes to produce precise qualities of steel. Iron is commonly found around the world as ore, a stone comprising iron oxide and a mixture of other minerals known as 'gangue minerals'. Crushed ore is heated in a blast furnace together with carbon, commonly in the form of coke, and other minerals, such as limestone, which acts as a flux in the removal of the gangue materials to create slag by-product. Preheated air, and gas or oil, is blasted from the base of the furnace, so that the temperature is as high as 1,700°C, and the carbon – being more reactive with oxygen than iron – displaces the iron from the iron oxide through a reduction reaction. The resulting molten 'pig iron' that is taken directly from the base of the furnace can be used as 'cast' iron. However, as it contains around 2% to 4% of carbon, it is not only very hard, but very brittle and not weldable. (If less than about 0.1% of the carbon remained, the resulting metal might be considered as wrought iron, which is quite soft and easily worked, but has little structural strength.)

To transform the pig iron into usable steel, the impurities in the iron – including some of the carbon, sulphur, phosphorus and silicon – are selectively removed by employing several well-established minerals and processes. In particular, oxygen is blasted through the molten iron, which reacts with the remaining impurities to form various oxides, including carbon monoxide gas. Higher amounts of residual carbon increase hardness and tensile strength, as well as improving the response to heat treatment (hardenability), but with reduced weldability. The resulting alloy of iron and carbon – known variously as 'carbon', 'plain carbon' and 'ordinary' steel – is likely to contain small residual amounts of additives such as silicon, aluminium and manganese that have been used to assist in the deoxidisation, plus cerium, which is added to control sulphur in the steel that otherwise can make it brittle. Carefully regulated regimes of heating and cooling are employed to produce the required crystalline structure of the resulting steel.

Carbon steels are typically classified, based on their carbon content, as low, medium and high. Low-carbon steel, which is also known as mild steel, has typically 0.05% to 0.25% carbon and is malleable and ductile, but has a relatively low tensile strength; medium-carbon steel has 0.25% to 0.6% carbon; and high-carbon steel ranges from around 0.6% to 1.5% carbon, which is very hard and increasingly brittle as the carbon content increases. To enhance specific properties, alloying elements other than carbon may be added to create what are »

known as 'alloy steels', such as stainless steel. Molten mild steel can be made into slabs for later processing, or produced in a continuous process, employing hot rolling techniques, to form sheets, bars and coils of steel. Mild steel is typically employed for pipe fabrication.

There are two main methods to create steel pipes from mild steel – seamless and welded. Seamless pipe is formed by two principal techniques: hot rolling for larger pipes and cold drawing for smaller pipes. The hot rolling method forces a solid billet (a precise length of steel bar) that has been heated to approximately 1,250°C over a 'piercing rod' to create the hollow shell.

The hot, hollowed billet is then passed through successive sets of concave rollers that form a pipe of the appropriate external diameter and pipe wall thickness. It is then cleaned and cooled.

Cold drawing takes a previously produced large diameter tube 'blank' and then, following a series of intermediate treatments, draws (or stretches) the pipe into a precisely dimensioned, smaller diameter pipe.

Welded pipe is typically formed from a continuous feed of sheet steel (from rolls of mild steel that are butt-welded together as they are unrolled), passing between pairs of increasingly convex/concave rollers, and the resulting U-shaped steel channel then passing between pairs of progressively concave rollers to form a pipe. The seam is electrically welded and the weld cleaned and smoothed.

Having created the pipe with appropriate dimensions, after straightening (through rollers) and some quality assurance checks, it is sometimes lacquered/painted, and then marked to indicate the specification of pipe. The characteristic 'black' finish on unpainted mild steel pipe is iron oxide that naturally occurs in air.

Seamless pipes are perceived to be stronger and more reliable. However, modern processes and quality assurance tests have minimised the difference in robustness. Welded pipe is smoother, more uniform and cheaper to manufacture than seamless pipe, so is commonly used in building services applications for non-potable water such as low-pressure water, heating, cooling, and gas. The inherent strength of welded pipe is formally taken as being around 20% less than the equivalent seamless pipe (as required by standards).

The 'nominal' pipe bore (the diameter of the hollow core) is the approximate internal measurement. External diameters are standardised internationally – identified in terms of the nominal bore – to allow universal fitting. Metric sizes of steel pipework are specified by 'diamètre nominal' (DN), which is dimensionless but indirectly related to the physical size, in millimetres, and imperial sizes by 'nominal bore' (NB), in inches. Owing to different weights (wall thicknesses) – also known as 'schedules' – of steel pipe, the true bore size of pipes will vary.

DN	NB (inch)	Outside diameter (mm)	Wall thickness (mm) and mass (kg) per linear metre pipe to BS EN 10255:2004					
			Heavy		Medium		Lightweight (L2)	
DN15	½"	21.3mm	3.2mm	1.44kg	2.6mm	1.21kg	2.0mm	0.947kg
DN20	¾"	26.9mm	3.2mm	1.87kg	2.6mm	1.56kg	2.3mm	1.38kg
DN25	1"	33.7mm	4.0mm	2.93kg	3.2mm	2.41kg	2.6mm	1.98kg
DN32	1 ¼"	42.4mm	4.0mm	3.79kg	3.2mm	3.10kg	2.6mm	2.54kg
DN40	1 ½"	48.3mm	4.0mm	4.37kg	3.2mm	3.56kg	2.9mm	3.23kg
DN50	2"	60.3mm	4.5mm	6.19kg	3.6mm	5.03kg	2.9mm	4.08kg
....								
DN100	4"	114.3mm	5.4mm	14.5kg	4.5mm	12.2kg	3.6mm	9.75kg
DN125	5"	139.7mm	5.4mm	17.9kg	5.0mm	16.6kg	-	-
DN150	6"	165.1mm	5.4mm	21.3kg	5.0mm	19.8kg	-	-

Table 1: Example steel pipe sizes indicating wall thicknesses and mass per linear metre

Figure 1: Example of a press connection on a thick-walled carbon steel pipe. The steel pipe is cut to length, cleaned and deburred. The insertion depth is marked and the connector slid on the pipe. The press jaws on the portable machine press the fitting to complete the connection (Source: Viega)

In the UK and Europe, mild steel pipe that is suitable for heating, cooling and non-potable water services up to DN150 is standardised with BS EN 10255:2004.[1] It is categorised as heavy (H), medium (M) or light (L), and made to the standardised external diameters, but with different wall thicknesses (and so strengths and resistance to corrosion), as shown in the examples in Table 1. As noted by CIBSE Guide B1: 'The main drawback of steel pipe is that it will corrode rapidly in the presence of water and oxygen. Hence, external surfaces should be painted with an anti-corrosion paint while internal surfaces should be protected by corrosion inhibitor chemicals.' As part of the manufacturing process, suitably prepared pipe can be galvanised by being hot-dipped – submerged in a hot bath of molten zinc at around 500°C – to make the steel pipe more resistant to corrosion. However, galvanised pipe has limited application in contemporary buildings – it is mainly restricted to legacy use in water systems for building fire protection.

There are several tried and tested methods for connecting mild steel pipe. The first two employ welding. The most popular method for welding pipe is the shielded metal-arc process, where a coalescence of metals is produced by heat from an electric arc maintained between the tip of a consumable electrode and the surface of the pipe or fitting. **Butt-welded** joints are commonly used for DN50 and larger steel pipes - the welding process creates a weld bead, both internally and externally. These are often left in place, but can be removed using special tooling if necessary. **Socket-welded** joints are formed by inserting socket connections onto the ends of each of the pipes to be joined, which are then welded in place. These joints are almost exclusively used in joining small-bore piping. An advantage with this type of joint is that the filler metal (from the weld) cannot enter the main pipe bore, so resulting in a smooth internal surface. It is cheaper than the butt-weld (as it is easier to set up), but includes an expansion space between the end of the pipe and the fitting's shoulder, which can cause corrosion problems. In general, welded pipe joints offer less resistance to flow than the mechanical connections (which are discussed on the next page). A properly completed welded joint has a high temperature and pressure rating for the resulting 'inseparable' connection. The basic costs of materials and

fittings are lower than many of the other connection methods, but welding can be a time-consuming method that requires skilled and properly protected pipe fitters. It has been concluded[2] that welding fumes cause cancer, and ultraviolet (UV) exposure from arc-welding processes causes melanoma in the eye and may increase the risk of skin cancer. As a result, there are recently revised Control of Substances Hazardous to Health (COSHH) Regulations requirements[3] that relate to providing specific ventilation control and respiratory protective equipment (RPE).

Bolted **flange** joints are typically used for DN50 and larger mild steel pipes, and are common where pipe, piping components or equipment must be disassembled for maintenance. Flanges, to BS EN 1092-1:2018,[4] can be added to the end of mild steel pipes by welding (typically using 'slip-on' flanges) or, in smaller sizes, by threaded flanges (which do not require any 'hot work' – use of naked flames – on site) that include a thread in the flange bore to connect to threaded pipe. Flanged components are connected using bolts, and the flange pressure rating will increase with the number of bolts, the flange outer diameter and the flange thickness. Opposing flange faces are tightened against a rubber, fibre, composite or metal gasket.

The remaining connection methods do not require any 'hot work'. **Threaded** or **screwed** joints are commonly used for smaller-sized steel pipes – typically DN50 or smaller. These are screwed together on site using fittings and pipes with threads to BS EN 10226-1:2004.[5] Tapered pipe threads are cut by dies, frequently on site using a portable electric machine, and the resultant threads are rough and imperfect. A pipe jointing compound or thread sealant must therefore be used to prevent leakage from around the threads. This also acts as a lubricant when tightening the joint.

Grooved-end joints may be used for jointing steel pipes, and are readily removable for component maintenance and repair. Grooves are cold rolled or cut into the ends of the two pipes to be jointed, which are used in conjunction with proprietary fittings. The pipes are aligned, with a gasket bridging across the two joining ends A two-part coupling is fitted over the gasket to engage into the grooves. The two parts of the coupling are connected and tightened around the gasket by fixing bolts to create a secure, watertight seal.

Cold press-connection technology has seen significant development in recent years, both in terms of components and, with the revolution in battery-powered equipment, in the method of application. In recent years, systems have also become available for thick-walled heavy steel pipes that are able to work with both water and gas services employed in building systems. Using proprietary fittings, plain mild-steel pipes can be swiftly connected, as illustrated in Figure 1, using a portable, hand-held, battery powered pressing machine. A standard sealing element – for example, EPDM – in a press-fitting would typically enable use in water systems between -25°C and +110°C with working pressures of up to 1.6MPa. Fittings are designed so that there is a clear leak path (and so quickly visible during system testing and proving) if they have not been pressed. Press-fittings are available that can convert between legacy systems and new pipework that may be found in refurbishment works – for example, when replacing a boiler or simply when used to replace faulty components (as illustrated in Figure 2).

On behalf of a press-connection manufacturer, BSRIA conducted a study[6] for a nominal small installation with a variety of 116 pipe connections of thick-walled steel tube, comparing the time required to prepare and complete the connections using welded, screwed, grooved and press methods. As illustrated in Figure 3, the study indicated significant differences in overall installation times.

Figure 2: Example of press connection being used as a replacement for a faulty cooling installation (Source: Viega)

Each of the outlined installation methods provides robust connections for mild-steel pipework and each has particular attributes. The choice of the method that is most appropriate for a specific application should be made by taking a holistic view of the advantages and disadvantages of each. This will include health and safety (including restrictions on hot work); need for demountability; temperature and pressure requirements; material and equipment costs; skills needs of pipe fitters; access for fixing equipment; location and size of pipework; impact on operational costs (such as pressure drop and ongoing maintenance); and the total cost of installation. Pragmatically, real-world solutions may need to employ more than one method across a building services project.

Turn to page 84 for further reading and references. »

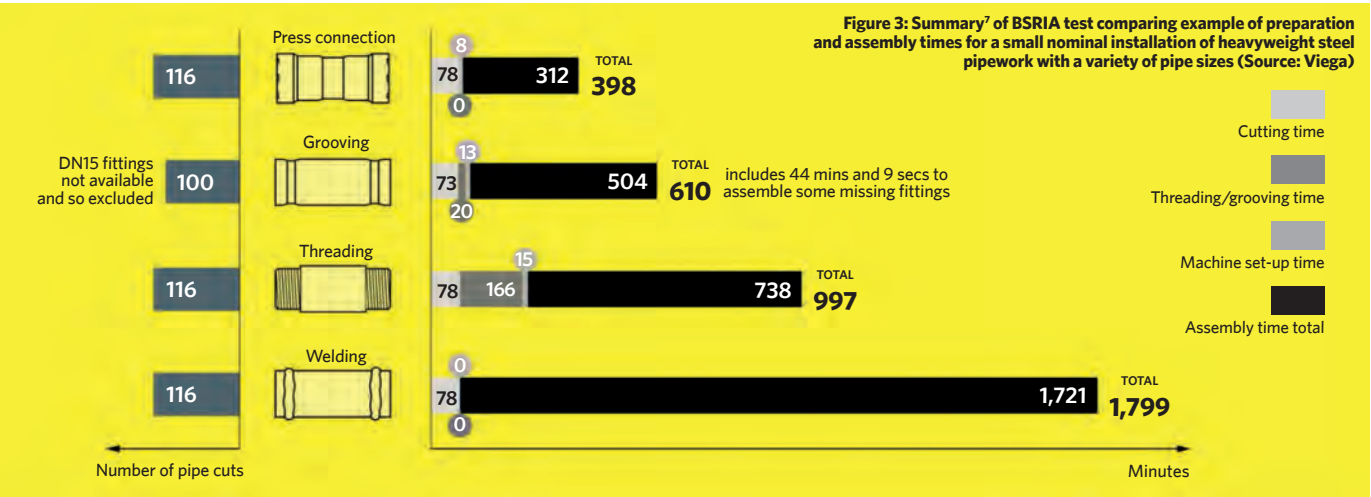

Figure 3: Summary[7] of BSRIA test comparing example of preparation and assembly times for a small nominal installation of heavyweight steel pipework with a variety of pipe sizes (Source: Viega)

Module 203

October 2022

1. Which of these steels is most likely to be termed mild steel?

- ☐ A Steel that cannot readily be welded
- ☐ B Steel that emerges directly from the base of a blast furnace
- ☐ C Steel that is typically hot-dipped in zinc
- ☐ D Steel with good resistance to corrosion
- ☐ E Steel with less that 0.25% carbon

2. Which of these attributes is least likely to apply to welded steel pipe, particularly when compared with seamless pipe?

- ☐ A Cheaper
- ☐ B Formed from continuous feed of sheet steel
- ☐ C More uniform
- ☐ D Smoother
- ☐ E Stronger

3. Approximately what mass is heavy steel pipe compared with lightweight (L2) steel pipe?

- ☐ A 110% the mass of lightweight (L2) steel
- ☐ B 130% the mass of lightweight (L2) steel
- ☐ C 150% the mass of lightweight (L2) steel
- ☐ D 170% the mass of lightweight (L2) steel
- ☐ E 190% the mass of lightweight (L2) steel

4. Which booklet provides guidance on welding fume control?

- ☐ A WL0
- ☐ B WL3
- ☐ C WL15
- ☐ D WL18
- ☐ E WL21

5. In the example of preparation and assembly times for a small nominal installation of heavyweight steel pipework, what was the lowest value of total complete preparation and assembly time?

- ☐ A 20 minutes
- ☐ B 78 minutes
- ☐ C 116 minutes
- ☐ D 312 minutes
- ☐ E 398 minutes

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Further reading:

CIBSE Guide B1 Heating: 2016 provides an extended discussion on piping types and connection methods (including a useful appendix).

References:

1 BS EN 10255:2004
2 *HSE Workplace Health Expert Committee (WHEC) Assessment of the strength of evidence underpinning the IARC reclassification of welding fume as carcinogenic to humans*, WHEC-11a, 2019.
3 *Welding, hot work and allied processes – WL3 – Welding fume control*, HSE 2021.
4 *BS EN 1092-1:2018 Flanges and their joints – circular flanges for pipes, valves, fittings and accessories, PN designated. Steel flanges*, BSI 2019.
5 *BS EN 10226-1:2004 – Pipe threads where pressure-tight joints are made on the threads. Taper external threads and parallel internal threads – dimensions, tolerances and designation*, BSI 2010.
6 *BSRIA report summary – Traditional pipework methods vs Viega Megapress*, Viega – **bit.ly/CJOct22CPD1**

Product of the month

Rinnai adds heat pumps to hydrogen line-up

Water heaters available with hydrogen, heat pump and hybrid energy source

Rinnai is offering hydrogen, hybrid and heat pump versions of its water heating systems. Known as H1, H2 and H3, the product list makes up Rinnai's array of present and future low carbon products, to simplify the decarbonisation of any building.

Having H1, H2 and H3 solutions allows any site, at residential or commercial locations, to maximise energy efficiency and performance in striving for net zero.

Rinnai's H3 range of products includes a wide selection of commercial heat pumps, as well as hydrogen blends-ready and hybrid hot-water heating systems:

H1 – Hydrogen blends-ready, renewable liquid fuel-ready, and electric water heating equipment.
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H3 – Market-leading, low GWP heat pumps.

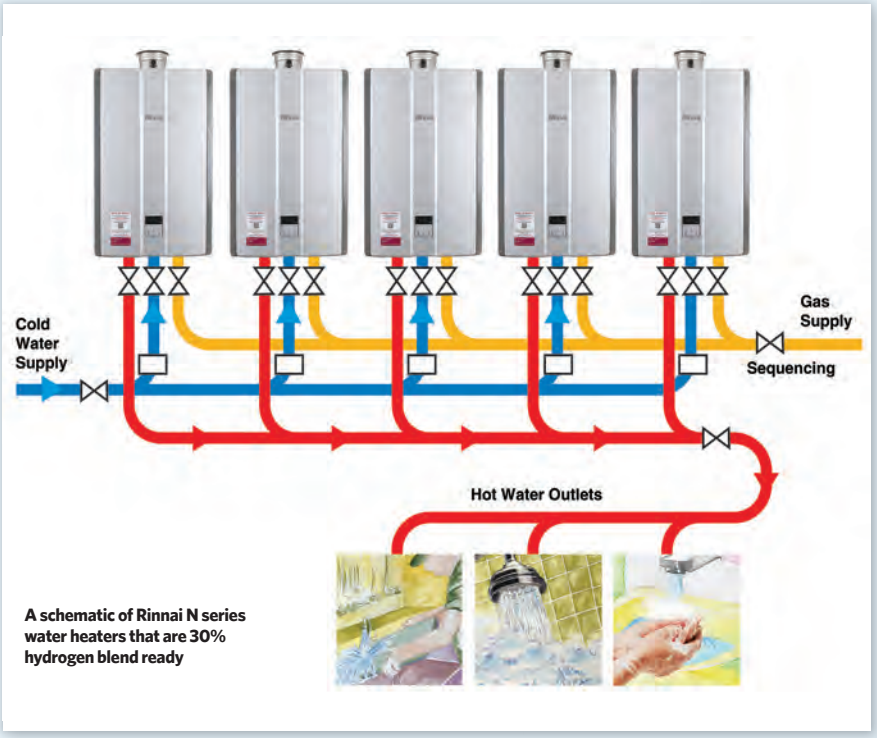
This expansive product portfolio is enhanced by design support and the precise modelling of capital expenditure, operational expenditure, and carbon. This format will help establish the practical, economic, and technically feasible solutions needed and required for any site.

Hot-water provision is a foundation for lifestyle comfort, so Rinnai has made this an area of specific expertise. There is an understanding that hot water and heating provisions are key requirements of modern lifestyles – services that can be considered as contributing factors towards maintaining societal cohesion and continuity.

Through the H3 range, Rinnai is committed to continuing its work towards delivering products that improve customer convenience and health.

All major international economies are seeking sustainable alternative energies that improve domestic energy security and negate the release of harmful emissions. Rinnai's H3 range of products coincides with the current approved direction of future energy distribution and consumption.

H3 products consist of hydrogen, rDME, heat pump or hybrid options in all energy vectors – natural gas, electrical, rDME and BioLPG. All methods of heating and hot-water provision are designed to ensure they run at a lower carbon intensity, leading to decarbonisation and a higher standard of living at affordable prices and costs.



A schematic of Rinnai N series water heaters that are 30% hydrogen blend ready

"Rinnai is continuing its work towards delivering products that improve customer convenience and health"

All models are designed to reduce costs and provide efficient working quality across an entire product life-cycle. Rinnai's internal practices are constantly refined to ensure it retains a focus on technological innovation, heating and hot-water dispersal.

Its H3 range is designed to reflect the corporate values and directions that the organisation is keen to project.

Sourced product materials and manufacturing conditions, and the effect these have on local environments, are crucial issues that are under constant revision. If found to be non-compliant with Rinnai's current and future brand promise to deliver cleaner living, the problem will be rectified accordingly.

Within the coming months, Rinnai will be developing and introducing electrical formats to all existing product ranges.

The company has maintained a reputation for technological innovation and creating a healthier way of living for more than a century. Through the development of commercial products that accept clean energies, customers will be able to identify Rinnai as a trusted brand that delivers customer convenience and health.

Employing 650 design engineers, the company constantly initiates new working behaviours and corporate practices that update and add to employee knowledge of product and manufacturing processes. Rinnai also reinvests 6% of its annual sales revenue into research and development.

Rinnai's H3 range represents an organisation capable of producing cost-reducing technologies in response to the sensitive financial demands perpetrated by the global energy market towards the customer. It is a pragmatic, socially conscious and innovative solution for customers who seek products that accept clean energy for home heating and hot-water appliances.

For free training and design support/ free CPDs, call **0300 373 0660** or email **engineer@rinnaiuk.com** for a consultation with sustainability specialists.

For more information on the Rinnai product range, visit www.rinnaiuk.com

Adveco develops new Ardent electric boilers for commercial DHW applications

Hot-water specialist Adveco has announced its new Ardent range of commercial electric boilers. These offer easy-to-integrate, high-capacity, reliable, and compact electric hot water and central heating solutions for commercial buildings.

'Designed to serve an indirect water heater or heating system, multiple electric heating elements immersed into Ardent's integrated water-storage tank provide a rapid and reliable source of thermal energy for those seeking to avoid a reliance on gas energy supplies,' said Bill Sinclair, technical director, Adveco.

Ardent systems can be combined with heat pump systems to provide a high-temperature energy source. Alternatively, the boiler can be commissioned as part of an indirect hot-water system, to eliminate scale buildup commonly seen on direct electrical immersion heaters.

The compact wall-hung boiler range offers outputs from 9kW to 36kW, with multiple heating elements for built-in redundancy. Ardent is also available as a floor-standing appliance with 60kW to 100kW outputs.

Call 01252 551540 or visit www.adveco.com

Vent-Axia introduces new decentralised mechanical extract ventilation

Vent-Axia has launched the Lo-Carbon NBR dMEV C, a highly efficient decentralised mechanical extract ventilation (dMEV) unit. The system achieves Building Regulations with minimal noise and fewer, efficient fans.

Tested to the new SAP 10 performance requirement, the Lo-Carbon NBR dMEV C achieves its low specific fan powers and sound power levels through its air pathway design, which promotes turbulent airflow.

Designed to offer a more relaxing environment for the homeowner, the system provides easy installation and quick commissioning

Call 0844 856 0590 or visit www.vent-axia.com

New HR manager starts at Condair

Humidity control specialist Condair has appointed Louise Kelly as its new HR manager. Having worked in progressive HR roles previously, she brings a wealth of valuable experience to the company.

Tony Fleming, head of sales cluster Northern Europe at Condair, said: 'I am so delighted to welcome Louise on board. We feel very lucky to have her join.'

Kelly added: 'I'm greatly looking forward to getting to know the people at Condair and continuing to support and develop a working environment that is collaborative, challenging, motivating and rewarding'.

Visit www.condair.co.uk

Pump Technology supports SoPHE annual dinner

Pump Technology is again sponsoring a table at the Society of Public Health Engineers' (SoPHE's) Annual Dinner, which is being held in London in November.

Joined by manufacturing partner Jung Pumpen, the event provides a great opportunity for public health engineers to meet the companies' representatives – David Johnson, Pump Technology business development manager (pictured, left), and Sebastian Kropp, area manager, UK & Nordic regions, at Jung Pumpen (right).

Specialising in the specification of wastewater and floor-mounted sewage pumping systems, Pump Technology and Jung Pumpen look forward to continuing their support for SoPHE and its membership.

Call Pump Technology on 0118 9821 555 or visit www.jung-pumps.co.uk

New Trilux multi-use luminaire launched

Trilux has launched the Tugra luminaire, a new design that adds a retro aesthetic to a wide variety of workspaces. Reminiscent of the fluorescent tube, Tugra luminaires make for a distinct design, securing accolades from Red Dot, IF, and the German Innovations Award.

With its cylindrical shape and distinctive end caps, Tugra brings a new level of design to demanding applications such as car parks, warehouses and production facilities.

IP66 and IK10 protection ensure continued safe operation, with an IP69K variant to meet high industry standards and HACCP requirements for the food industry. With up to 189lm/W and a service life of up to 100,000 hours, the system also ensures that energy bills stay low for longer.

Outstanding quality of light is achieved with the Varizon optic kit, presenting five primary optics, a prismatic profile and various prismatic foils.

Helping to move the industry further towards circularity, Trilux has designed Tugra to offer reuse, refurbish and recycle strategies.

Visit www.trilux.com

Samsung Climate Solutions appoints new training manager

Samsung Climate Solutions has welcomed Scott Young TMIET as lead of its expanding training programme. His experience as a qualified gas engineer brings valuable insights into delivering industry-leading training programmes, particularly those upskilling engineers to install heat pumps.

Young said: 'Samsung's commitment and drive to being the market leader in many different technology categories was one of the main attractions of this opportunity.'

The need for training of this type has escalated in recent years, with the heat pump market in the UK growing by 64% from 2020 to 2021.

By 2025, the Future Homes Standard will make installing a low carbon heat source, such as a heat pump, mandatory in all new builds.

Young added: 'Since the Covid-19 pandemic, we have seen the way changes to product training have developed.

'I am currently creating e-learning modules to help give that flexibility to the Samsung heat pump installers of the future, along with other exciting projects to come.'

Visit samsung-climatesolutions.com

Condair podcast on improving food productivity

Condair has released a new podcast on how food manufacturers can enhance their productivity by controlling their production area's humidity.

In an interview with Dave Marshall-George, sales director at Condair, the podcast investigates how paying more attention to a manufacturing or storage area's ambient humidity can greatly improve manufacturing yield and profits.

It is available on Spotify, Google Podcasts, SoundCloud and Apple iTunes by searching for 'Condair Podcast', or you can listen to it via the Condair website.

Visit www.condair.co.uk

Aquatech supplies pressurisation units for large heat networks

The Aquatech Pressmain Aquaspill pressurisation units reliably maintain the water pressure in heating and chilled water systems for large heat networks. This makes it a first choice for hospitals, universities, retail parks, technology centres and district heating systems.

Aquaspill will maintain a near-constant system pressure regardless of the temperature. The unit is supplied with stainless steel spill tanks for low maintenance and manages high-temperature systems of 150°C or more, with special active buffer vessels that minimise space requirements. .

Email: sales@aqpm.co.uk or visit www.aquatechpressmain.co.uk

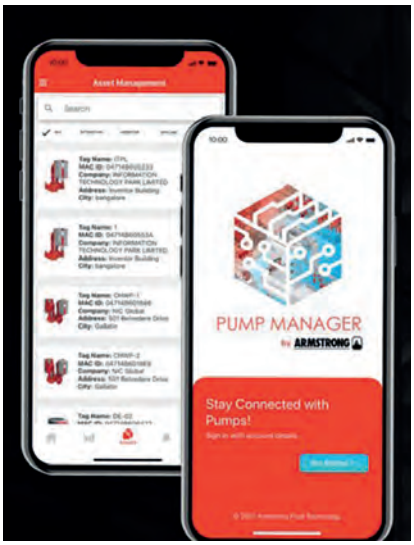
Elco heat pump installed at high street bank

Staff at Lloyds Bank in Chatham, Kent, are benefiting from sustainable heating, thanks to the installation of a 48kW Aerotop M heat pump from Elco Heating Solutions.

Gas boilers were replaced with the new unit, providing a zero NOx system and highly efficient heating throughout the building. Located on the roof, the heat pump is providing space heating to the main office areas.

The M&E consultants for the project were Mitie, with the Elco Aerotop heat pump specified by project manager Steve Bell.

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



Armstrong mobile app optimises pump performance

Armstrong Fluid Technology has announced a mobile app for users of their Pump Manager subscription service.

Leveraging the intelligence and connectivity of Armstrong Design Envelope pumps, Pump Manager is a cloud-based service that provides pump analytics and performance insights, along with real-time alerts. The service supports active performance management in HVAC systems. Users can check a mobile device and know immediately what issue a pump is experiencing.

The app, named Armstrong Pump Manager, is available in Google Play and the App Store.

Call +44 (0)8444 145 145, email sales@armstrongfluidtechnology.com or visit www.armstrongfluidtechnology.com

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Sebastian Gray

The future's certain

The new head of CIBSE Certification Sebastian Gray outlines his plans

Sebastian Gray was appointed the new head of CIBSE Certification in August 2022. Over the past decade, he has been a director of energy management consultancy 2EA Consulting. He has focused on providing advice on energy policy and legislation to a range of organisations including FTSE-listed companies, SMEs, public sector organisations and charities. He also serves on the scientific committee and was previously a member of the CIBSE Council. With more than 14 years' experience in marketing, communication and business development, and 10 years in energy policy and energy management, he is now seeking to build on the success of CIBSE Certification, as he explains to the *Journal*.

What is CIBSE Certification?

CIBSE Certification is a wholly-owned subsidiary of CIBSE. It operates a personnel certification scheme covering low carbon consultants, non-domestic energy performance certificates (EPCs) assessors, display energy certificates (DECs) assessor, air conditioning inspectors, Energy Savings Opportunity Scheme (ESOS) lead assessors, energy management system (EnMS) specialists, heat network consultants, and Section 63 advisers.

CIBSE Certification is also UKAS accredited to certify organisations for management systems ISO 50001, ISO 9001, ISO 14001 and ISO 45001 globally, including in the UK, USA, Europe and Middle East.

Why did you apply for the role?

I have been a member of CIBSE and registrant of CIBSE Certification since 2012. It's partly because of CIBSE Certification that I have been able to achieve so much within this industry.

During that time, I've been registered through CIBSE Certification as a low carbon consultant, low carbon energy assessor for DECs, ESOS lead assessor and EnMS specialist. I have always tried to give back to both organisations where possible, serving on CIBSE's Council, reviewing technical papers for the scientific committee for the annual Technical Symposium, and delivering webinars for CIBSE Certification.

Being able to put my experience to use in moving forward the organisation that has played a big part in my professional development is a real honour.

What are your plans for CIBSE Certification?

I intend to continue maintaining CIBSE Certification's personnel schemes and, where feasible, expanding into new areas as markets develop. Andrew Geens, the outgoing head, has built a solid foundation from which we can expand our integrated management system business. We have a great team in the office that I know can deliver on both these fronts.

At an industry level, it's my duty to continue to promote the wider use of energy certificates in government initiatives to improve the energy performance of buildings. We are working with Phil Jones [independent energy consultant and winner of the CIBSE Gold Medal] and the Department for Business, Energy and Industrial Strategy (BEIS) on developing a new technical heat network scheme. This fits in well with our already established Heat Networks Consultant scheme.

How can CIBSE Certification help companies with certification, and why should they bother?

We are able to certify to UKAS standards 9001, 14001 and 50001, and we will soon be able to certify to 45001. So whether an organisation is looking to implement a new ISO or move from a current certification body, we have the capability and capacity to help. We also have the resource to certify internationally – we have clients around the world.

Are there policies or market forces that are affecting the future direction of certification?

The decision on whether to move the minimum rating of EPCs to a B by 2030 for privately rented non-domestic buildings is currently on the table. This may drive an uptake of EPC lodgements nearer the time if this goes ahead.

There is an ongoing debate about a minimum energy efficiency standard for private properties. This is likely to be Nabers UK, run by BRE. It is not currently mandatory. The industry did voice its opinion on adapting DEC/EPC for this new initiative but that has not happened. Finally, we are all keeping a close eye on the new Secretary of State for BEIS, as the new Prime Minister's team sets out its policies and priorities.

- For more information: **www.cibsecertification.co.uk**

EVENTS

NATIONAL EVENTS AND CONFERENCES

Young Engineers Awards
11 October
Encompassing the Apprentice, Graduate and Employer of the Year, the awards recognise the best new talent entering the building services industry, as well as those businesses that go the extra mile to support and nurture them. The 2022 Awards will be held at the new location of RIBA, London. Enter now: **www.cibse.org/yea**

Façade Design and Engineering Awards 2022
3 November, London
The shortlist has been announced for these awards, which recognise and reward excellence and achievements in façade engineering, and raise the profile of the importance of this discipline. Join the industry on the night to celebrate and see who takes home the trophies. **www.cibse.org/facadeawards**

Build2Perform Live
29-30 November
The flagship event returns to a face-to-face event for 2022, at London Excel. The two days will feature a carefully curated CPD programme with more than 160 speakers and more than 70 exhibitors. Register your interest to be kept up to date with the latest news. Visit **www.build2perform.co.uk**

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**

CIBSE YEN Gala and Careers Networking Day
13 October
An opportunity for up to 450 student, apprentice and graduate engineers to meet employers. The day is followed by the YEN Gala, bringing together young engineers to celebrate their hard work and make lasting connections in the industry.

SLL Ready Steady Light 2022
18 October
In this annual SLL event, in partnership with Rose Bruford College, teams are challenged to create an exterior light installation with a limited range of kit.

West Midlands: HIU sizing – UK compared with Europe. District heat the Nordic way
25 October
With speaker Russell Hillman, of Cetetherm.

CIBSE JOURNAL WEBINARS

The next *CIBSE Journal* webinar, sponsored by Kohler, takes place on 18 October, and is titled 'Getting the elephant in the room – effective design of resilient UPS facilities'. Register for this and all previous webinars on demand at **www.cibsejournal.com/cpd/webinars**

LIVE ONLINE TRAINING COURSES

CIBSE training courses have been reformatted to work online, with a live trainer, meaning you can expect the same interaction and participation as you would in a classroom setting. Upcoming courses:

Design of ductwork systems
4 October

Fundamentals of drainage
6 October

Low and zero carbon energy technologies
11 October

Heat Networks Code of Practice (CP1)
12 October

Mechanical services explained
18 October

Electrical services overview
18 October

Air conditioning and cooling systems
20 October

Overview of IET wiring regulations (18th edition)
27 October

Designing water-efficient hot and cold supplies
3 November

Earthing and bonding systems
8 November

Building services explained
8 November

Energy Savings Opportunity Scheme (ESOS)
8 November

Residential fire sprinkler design:BS9251:2021
9 November

High-voltage (11kV) distribution and protection
15 November

Above-ground building drainage
15 November

Energy efficiency-related building regulations: Part L
15 November

Electrical services explained
22 November

Standby diesel generator
29 November

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**

Membership webinars

CIBSE Membership hosts free two-part webinar series to support members with applications for the Associate and Member grades and registration with the Engineering Council at Incorporated Engineer and Chartered Engineer level.

To register for these and for all other membership webinars, go to: **www.cibse.org/webinars**

Upcoming webinars:
- 11 and 18 October
- 15 and 22 November
- 6 and 13 December

For further details and to register: www.cibse.org/webinars

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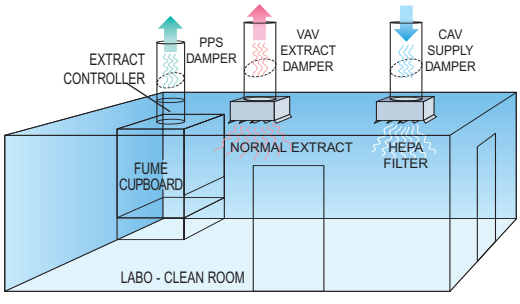

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