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August 2019

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Electrifying design



A textbook example of a successful electric building is Cambridge Central Mosque, which opened its doors to worshippers earlier this year (see page 24).

Nine years ago, the design team and client decided not to connect to the mains gas and, instead, decided to use ground source heat pumps to generate electricity for its heat, power and hot water.

The building services engineer minimised the heating and cooling loads by creating a naturally ventilated prayer space. The elaborately carved ventilation grilles were inspired by Islamic art; they prove it is still possible to beautify everyday components, as the Victorian designers did in their

heyday. The elaborate timber columns supporting the structure are lit from above by large circular rooflights, which contain fans to help draw cool air over the worshippers below.

Among the most prominent features are the garden and fountain at the front of the building, which not only screen the busy road, but also encourage air to be drawn into the building on warmer days. Visitors can enjoy the garden even on rainy days, as a large canopy over the southern entrance creates a seamless transition between the indoor and outdoor spaces.

CIBSE's 5th Build2Perform conference takes place at Olympia on 26 and 27 November, and we will profile some of the speakers before the event. This month, on page 57, we feature a Q&A with Robert Prewett, of Prewett Bizley Architects, who has been working on Passivhaus retrofit designs for almost 10 years.

Prewett will be speaking at a seminar on using surveying tools for existing buildings. With the government proposing to make digital records mandatory for high-rise accommodation, it's a topic that should grab the attention of anyone working in this market. Prewett also speaks about the need to consider the reuse and recycling of materials, and he has attempted to uphold these principles in a retrofit of a south London 1960s townhouse.

A new Passivhaus housing project has made the shortlist of the RIBA Stirling Prize (page 7). Norwich City Council's Goldsmith Street development, designed by Mikhail Riches with Cathy Hawley, is the first council house scheme to make the shortlist.

The Passivhaus consultant advising on the scheme is Warm, which won Consultancy of the Year (up to 100 employees) at the 2019 CIBSE Building Performance Awards. Look out for our upcoming issue to find out how its expertise is helping to increase the adoption of Passivhaus in the UK.

ALEX SMITH, EDITOR asmith@cibsejournal.com

Editorial

Editor: Alex Smith

Tel: 01223 378034

Email: asmith@cibsejournal.com

Deputy editor: Liza Young

Tel: 01223 378048

Email: lyoung@cibsejournal.com

Technical editor: Tim Dwyer

Designer: James Baldwin

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Advertisement sales

Display and sponsorship Jim Folley

jim.folley@redactive.co.uk

Tel: +44 (0) 20 7324 2786

Products & services Jonathan Adebayo

jonathan.adebayo@redactive.co.uk

Tel: +44 (0) 20 7880 6217

Recruitment advertising

cibsejournaljobs@redactive.co.uk

Tel: +44 (0) 20 7880 6215

Advertising production Jane Easterman

jane.easterman@redactive.co.uk

Tel: +44 (0) 20 7880 6248



CONTRIBUTORS



Hywel Davies

The policy challenge facing industry following the government's fire-safety proposals and net-zero targets



Julie Godefroy

What is the government doing to make its own building estate net zero by 2050?



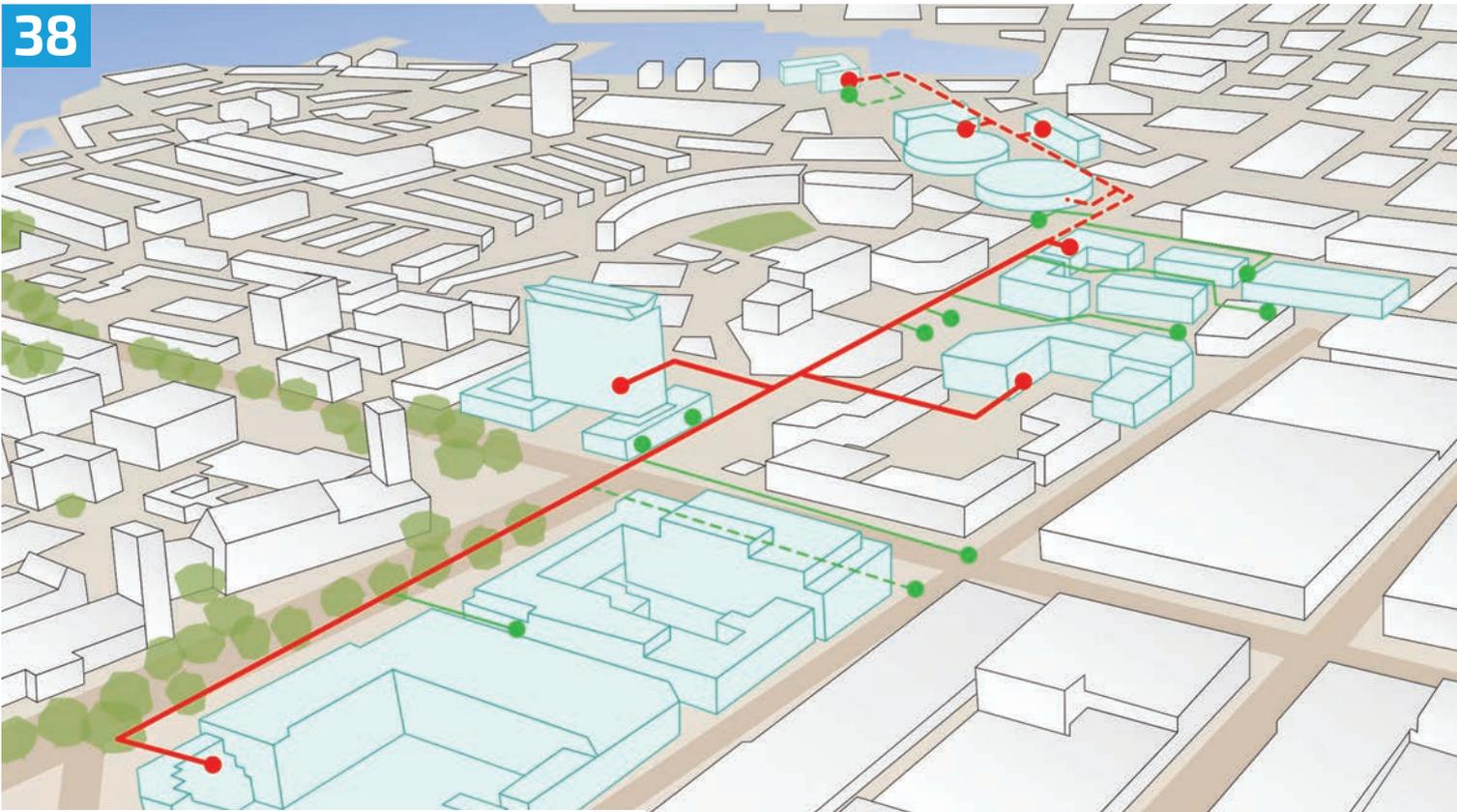
Andy Stanton

The challenge of delivering zero carbon buildings from an engineering viewpoint



Tim Dwyer

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FOR CIBSE

Journal production manager: Nicola Hurley
Tel: 020 8772 3697, nhurley@cibse.org

CIBSE, 222 Balham High Road,
London SW12 9BS

Tel: +44 (0)20 8675 5211

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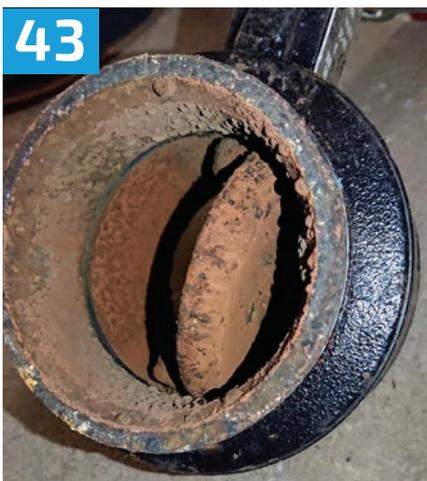
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SIX ON SHORTLIST FOR STIRLING PRIZE



Six buildings have been shortlisted for the 2019 RIBA Stirling Prize, including Goldsmith Street, a development of 105 Passivhaus social houses in Norwich designed by Mikhail Riches with Cathy Hawley (left).

Also shortlisted are: London Bridge Station, Cork House, Nevill Holt Opera, The Weston and The Macallan Distillery (see *Spiritual Dome*, *CIBSE Journal*, July 2018).

The Passivhaus consultants on the Goldsmith Street project, Warm: Low Energy Building Practice, won a 2019 CIBSE Building Performance Award – Consultancy of the Year (under 100 employees).

‘Dad’s Army’ in charge of UK’s climate response

CCC chair insists government can’t continue with ‘ramshackle system’

The Committee on Climate Change (CCC) has accused the government of acting like Dad’s Army in response to the climate change emergency.

It said it had delivered just one of 25 emissions-cutting policies identified as essential to meeting long-term goals and risked ‘embarrassing itself’ when it hosts next year’s UN Climate Summit.

CCC chair Lord Deben said ministers should face legal action if they fail to act and that emissions-reduction targets for 2025 and 2030 were likely to be missed by an even bigger margin than predicted last year – making the new zero carbon goal by 2050 look increasingly remote.

The committee also said the number of government officials working on climate change had been cut from several dozen to ‘a handful’ since 2013, when the first national adaptation plan was published.

In its latest annual *Progress in preparing for climate change* report, the CCC called for a detailed policy that could deliver a 20% improvement in energy efficiency in all buildings by 2030. It also wants a targeted low carbon heat strategy to run alongside plans to phase out fossil fuels from buildings not connected to the gas grid. In addition, the CCC is urging government departments to publish an

integrated plan to reduce overheating risk in existing and new homes, to avoid 4,500 potential premature deaths. The government should complete the Future Homes standard by 2022 and take action to improve indoor air quality, the report said.

The committee also wants a much stronger compliance and enforcement culture across the UK’s building stock to close energy performance gaps.

‘The whole thing is run by the government like a Dad’s Army,’ said Lord Deben. ‘We can’t possibly go on with this ramshackle system that doesn’t begin to face the issues. It is a real threat to the population.’



Lord Deben, chair of the Committee on Climate Change

Government ‘off track’ in energy efficiency bid

A report from the Business, Energy and Industrial Strategy (BEIS) select committee says the government is a long way off the energy efficiency targets it needs to achieve to deliver its low carbon vision. It identifies problems with how current regulations are being enforced and the slow progress in upgrading existing buildings, which mean the journey towards net-zero emissions is ‘off track’.

The committee wants a more coherent national policy package and a plan to deliver energy efficiency across the existing UK building stock. Stronger compliance and enforcement, with people being placed at the heart of policy development, is key, it concluded.

The report found that the demise of the Green Deal and a lack of access to funding was holding back efforts to tackle poor performance in the private rented sector. Property owners in England and Wales must achieve a minimum EPC rating of E before letting their properties for new tenancies; this will also apply to existing tenancies from April 2020. Previously, landlords could apply for a no-cost exemption from this where funding was unavailable. However, the government has tightened the rules and, now, only landlords whose required energy efficiency improvements are higher than the £3,500 cap are exempt. The report recommends raising the cost cap to £5,000 per property.

CIBSE technical director Hywel Davies said the existing regulations were not being enforced properly, and he highlighted the criticism of the apparent ‘bias in the minimum energy efficiency regulations towards minimising costs to landlords, not tenants’.

Gavin Dick, of the National Landlords Association, said: ‘A more strategic and long-term plan is needed to help landlords and homeowners achieve the end goal.’

Deadline set for cladding removal

Private sector buildings must have a clear timetable for the remediation of unsafe aluminium composite material (ACM) cladding by the end of 2019, or owners will face enforcement, the housing secretary has said.

In a written statement to parliament, James Brokenshire said he expected the removal of unsafe ACM by June 2020. Brokenshire highlighted the fact that remediation in the private sector has been slow, which has motivated the government to announce a £200m fund to unblock progress.

He also confirmed that planning permission may not be required where the external appearance of a building is not materially altered by new cladding.

Brokenshire announced the results of a series of recent fire tests, conducted in accordance with British Standard 8414. A cladding system consisting of a Class B, fire retardant, high pressure laminate rainscreen with a non-combustible rock fibre insulation met the relevant pass criteria. Meanwhile, all timber fire doors tested met the required 30-minute fire performance standard.

New regulator should oversee low-rise homes, say MPs

Committee supports plans for safety body but says it should apply to more homes

Any new regulatory regime created in response to the Grenfell fire in 2017 must be expanded to include all buildings where there are vulnerable people, MPs have said.

This was a key conclusion of a report from the Housing, Communities and Local Government Committee, published last month.

The committee was responding to the government's June 2019 proposals for the reform of the building safety regulatory system.

While the report acknowledged the government intended to bring more buildings within the scope of the proposed regulatory regime, the committee said that height should not be the sole determining factor, and that it should include all buildings with vulnerable people.

The committee also said the government was 'absolutely right' to prioritise measures to

strengthen the voices of residents concerning building and fire safety, but voiced concerns at a perceived lack of progress in this area.

Moreover, the pace of change set by the government in reforming the sector, and progress in removing potentially dangerous cladding, was 'far too slow'.

However, James Brokenshire, housing secretary, has said his department was working to allow the regulatory functions to exist prior to any new legislative regime being in place.

The MPs called for clarification on how the national regulator will operate at the local level. The report said: 'It will be important to ensure that local authorities and fire and rescue authorities continue to play a central role in the new regulatory system, and their influence in local decision making is not diminished.'

It also called on the government to ensure there was adequate funding available for public bodies taking on new responsibilities.

Read report at bit.ly/CJAug19News

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GRUNDFOS

New BESA president calls for social justice

Intech Engineering Services' John Norfolk has been elected president of the Building Engineering Services Association (BESA) for 2019/20. He takes over from Tim Hopkinson, of E Poppleton & Son, who served for two years.

Norfolk has pledged to build on the 115-year-old body's technical legacy, to help tackle the challenges created by climate change and the need for better buildings to address social problems. 'Never has our sector's specialist knowledge been more in demand and more valuable,' he said.

'We are in the midst of major technical and philosophical change in this country. Part of the political upheaval - which dominates headlines and conversations - are the critical challenges we face around climate change. This will transform the way we work and thrust our industry into the limelight.

'It also creates an opportunity to address more fundamental social issues affected by building performance.'

Aiming for low and zero carbon development would 'have a hugely positive effect on the economy', added Norfolk, who urged the industry to see the climate change agenda as an opportunity to address social justice.

'A civilised society is founded on how it treats its people - and, specifically, the most vulnerable,' he said. 'A low carbon built environment will also be a high-quality one that can offer a way out of poverty and poor health.'



John Norfolk



IN BRIEF

Bath course founder Stephen Edwards dies

It is with great sadness that *CIBSE Journal* learned of the death of Stephen Edwards MSc FCIBSE in June. Edwards was senior partner of Hoare Lea from 1973 to 1998, but will also be widely remembered by a generation of architects and engineers from Bath University as a founder - in 1967 - of the combined School of Architecture & Building Engineering, where he remained a popular lecturer and mentor until the 1990s. 'Stephen followed and delighted in the achievements of all "his" graduates,' said Hoare Lea consultant Paddy Conaghan.

ASHRAE publishes 2019 handbook

The latest edition of *ASHRAE Handbook - HVAC Applications* has 65 chapters covering a broad range of facilities and topics. Written to help engineers design and use equipment and systems described in other Handbook volumes, the main sections cover comfort, industrial, energy-related and general applications, as well as building operations and management. The latest edition also has three new chapters covering indoor swimming pools, indoor airflow modelling and occupant-centric sensing and controls. See www.ashrae.org

Protect heat-network customers, says CA

People face being overcharged by heating suppliers in the push to decarbonise the market, says Citizens Advice (CA). A 'lack of clarity' in government policy for the regulation of low carbon technologies, including heat networks, is leaving consumers open to abuse, the charity claims.

Accelerating the adoption of heat networks is a key part of the government's decarbonisation strategy and, currently, there are 14,000 across the UK.

CA believes that policy is not robust enough, however, and is likely to lead to confusion, infrequent and inaccurate billing - and, so, overpayment.

It fears those on low incomes could pay a disproportionate share of the cost of decarbonisation, and wants an independent commission to ensure the transition to low carbon energy and heat is carried out in a socially just way.

US firm buys Hurley Palmer Flatt to grow presence in UK

Paul Flatt to become MD of combined business with 1,200-strong workforce

US multidisciplinary engineering company HDR has bought UK building services consultant Hurley Palmer Flatt (HPF).

The Omaha-based firm has a \$2bn turnover and employs more than 10,000 people working out of 200 offices worldwide. It had been looking to expand its presence in the UK after securing a number of major projects here.

Combining the firms will create a building engineering services workforce of 1,200 and the business will trade as HDR | Hurley Palmer Flatt. HPF chief executive Paul Flatt will become managing director of the business.

HDR chair Eric Keen said the acquisition would help the company expand its multidisciplinary services.

'Hurley Palmer Flatt Group brings strong client relationships and specialised skill sets to

HDR that, when combined with our capabilities, offer tremendous possibilities.

'By combining our teams of professionals, we will develop a stronger building engineering practice globally.'

HPF Group is based in London and had a turnover of almost £40m last year. It employs 240 staff and the acquisition includes its subsidiaries Andrew Reid, Bradbrook Consulting and Concentre Consulting.

Its services include mechanical, electrical and plumbing; civil and structural engineering; and management of commissioning, as well as tailored works for 'smart' buildings, green building design and data centres.

'HDR is the perfect strategic fit for the Hurley Palmer Flatt Group,' said Flatt.

'The desire to have a meaningful impact on the organisation and to achieve strategic growth moving forward makes HDR the ideal partner.'

Paul Flatt (left) and HDR chair Eric Keen

M&E engineer is most searched job in the world – but not in Britain

Mechanical engineering is the most 'Googled' job in the world, according to analysis by manufacturer Brother UK - but it ranks below teachers, estate agents and prison officers in the UK.

M&E was put into the search engine 511,440 times out of more than 10 million specific job searches last year. Accountant was second and teaching assistant third, followed - at some distance - by chemical and civil engineer, graphic designer and social worker. The largest volume of overall searches came from India, the Philippines and Saudi Arabia, with high volumes from Bangladesh, Lebanon and Ethiopia.

However, M&E engineering jobs came well down the list in the UK, where teaching assistant came top. Estate agent is the second-most Googled job in the UK, followed by project manager and prison officer.



Durtnell's collapse rings alarm bells

The Specialist Engineering Contractors' (SEC) Group says the collapse of Britain's oldest building company is further confirmation of the financial crisis hitting the industry. Durtnell & Sons, owned by the same family for almost 430 years, went into insolvency in July, becoming 'just another statistic in a wave of insolvencies affecting the construction industry', according to the lobbying group.

'The extremely weak balance sheets of the largest UK contractors are creating a ticking time bomb. Trade credit insurers are withdrawing cover from many of these companies, leaving their supply chains exposed,' it said.

Construction is the industry with the most insolvencies, with payment retentions often to blame, SEC added. Durtnell was believed to have been owed £630,000 in retentions.

SEC Group chief executive Rudi Klein said there was now concern for Durtnell's subcontractors, mostly SMEs. He called on the government to adopt the Peter Aldous Bill to 'protect these monies from upstream insolvencies'.

Construction worker deaths at new low

Construction deaths in the UK last year were at their lowest since records began in 1981, but it is still the second-most dangerous sector behind agriculture.

The Health and Safety Executive, said 30 workers were killed in 2018, below the annual average of 36. But the fatal injury rate in construction is 1.31 per 100,000 workers – four times higher than the average across all industries.

Industry suffers sharpest output fall in a decade



Projects delayed because of lack of clarity from policy-makers, survey found

New construction work orders suffered their steepest fall for more than 10 years in June, while demand for products and materials slumped at the fastest pace since the start of 2010. That's according to the IHS Markit/CIPS UK Construction Total Activity Index, which tracks buyers' activity.

Housebuilding experienced its slowest period for three years, while commercial work fell for the sixth consecutive month. Civil engineering recorded its fastest rate of contraction since October 2009. Clients delaying projects because of 'lack of clarity from policy-makers' was the underlying cause, said the survey.

'The abrupt loss of momentum in 2019 has been the worst experienced across the sector for a decade,' said associate director at IHS Markit Tim Moore. 'Greater risk aversion has now spread to the residential building subsector, as concerns about the near-term demand outlook contributed to a reduction in housing activity for the first time in 17 months.'

Moore added that the continued lack of new work to replace completed projects illustrates the 'degree of urgency required from policy-makers' to rebuild confidence.

Duncan Brock, of the Chartered Institute of Procurement & Supply, said the figures showed a 'change in the sector's ability to ride the highs and lows of political uncertainty' and that Brexit had 'finally taken its toll'.

Modular halves project time, says study

Modular construction can reduce project costs by 20% and delivery time by up to 50%, according to a report from analysts McKinsey & Company.

Having more work carried out in a factory allows for greater use of precision parts that improve energy efficiency and make the process safer, the report concluded. Construction had remained largely 'immune to changes', the authors said – despite the widespread disruption experienced by other industries – but offsite work was a disruptor that was starting to make progress.

The research was based on the US market and established that around \$135bn out of total construction expenditure of \$1tn was spent on modular designs in 2017.

McKinsey estimates additional savings of around \$22bn could be achieved with greater uptake of modular. Use of 3D design might require greater upfront investment, it added, but would deliver long-term savings with the development of more customisation and repeatability.

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Young Lighter 2019 shortlist announced

The shortlist for the Society of Light and Lighting (SLL) Young Lighter of the Year 2019 award has been announced.

Representing the best new talent in the industry, the list includes eight young lighters, who make up a very international group, coming from Stockholm, Germany, Estonia and the UK.

They were selected by a panel of judges from across the lighting industry, representing design, academia, sales and manufacturing. The shortlist is:

- **Anna Tomschik, Black Ljusdesign**, Stockholm, *Daylight inspired lighting – design concepts aligned with nature*
- **Anna Wawryzniak, Peter Andres Lichtplanung**, Germany, *A light booster metro car for the commuting workforce: human-centric lighting in underground transportation*
- **Beatrice Bertolini, GIA Equation**, London, *Urban lighting meets people: social engaging lighting settings for sustainable cities*
- **Fatemeh Dastgheib, KTH Royal Institute of Technology**, Stockholm, *Outdoor lighting and perception of safety from a female perspective*
- **Jie Xu, University College London**, *Will and how the ETFE and glazing materials influence the light distribution of roof gardens?*
- **Joan-Tähven Vene, DeltaE Engineering**, Estonia, *Lighting passport for the city of towers and the ways to achieve it*
- **Melissa Kennedy, WSP**, London, *Texture within the light: evaluating the impact of textured light upon the sensual atmospheres within art, architecture and design*
- **Nils Voerste, Bauhaus-Universität Weimar**, Germany, *Evidence-based lighting design for urban environments: natural and artificial lighting impacts on people's experiences of public space.*

This year marks the 25th anniversary of the competition, which offers a unique platform for young lighters to illustrate their knowledge and research, hone their presentation skills, and raise their profile within the industry.

LIGHT GRAFFITI MAKES MARK IN LONDON

The Society of Light and Lighting welcomed back artist and photographer Michael Bosanko for a Light Graffiti night at the London Art House in June.

The night began with a talk from Bosanko, who displayed examples of his work and took guests through the process and inspiration behind them. He then gave demonstrations, before handing over to the audience to have a go at creating their own art.

Bosanko discovered light painting while on holiday in Greece. After accidentally knocking his tripod, he captured a trail of light from the moon that inspired him to experiment with writing in light. On his return home, he adopted the same technique using torches.



Research into IAQ and retrofit win CIBSE Medals

Carter and Napier Shaw Bronze Medals awarded for best papers in BSER&T

Technical papers looking at indoor air quality and the implications for retrofitting and ventilating buildings have been recognised by CIBSE as the best papers published in *Building Services Engineering Research and Technology (BSER&T)* journal in 2018.

One paper examines different ventilation strategies for retrofitting buildings to ensure safe levels of indoor air quality, and their effectiveness, while the other looks at CO₂ and the effect that exposure to high levels can have on human cognitive performance.

Yiyi Chu, Peng Xu, Zhiwei Yang, Weilin Li won the Carter Bronze Medal for their paper *Retrofitting existing buildings to control indoor PM2.5 concentrations on smog days: initial experience of residential buildings in China*.

It starts with an overview of the growing worldwide attention and increasing evidence of the relationship between air pollution and adverse health effects – including on the development of lung function in children. The paper considers the effectiveness of retrofitting methods to control indoor particulate matter in existing buildings, using a case study from Shanghai. Methods

used include airtightness improvement, indoor positive pressure control with a fresh air system, and an air purifier.

The Napier Shaw Bronze Medal was awarded to Gesche M Huebner, Tadj Oreszczyn and Robert J Lowe for their paper *Possible future impacts of elevated levels of atmospheric CO₂ on human cognitive performance and on the design and operation of ventilation systems in buildings*.

Their research looks at predicted increases in atmospheric CO₂ concentration by the end of the 21st century and the possible effects on human performance, before examining the implications this has for the engineering of ventilation systems and associated energy use.

The paper highlights the very limited research done on the effect of higher levels of CO₂ on cognitive performance, as opposed to air quality in general, and the need for further study in this area.

The Carter and Napier Shaw Bronze Medals are awarded annually by CIBSE to celebrate high-quality research in the building services industry. They will be presented at the President's Dinner in October. CIBSE members can access *BSER&T* and *Lighting Research and Technology* at www.cibse.org/knowledge



CIBSE launches energy benchmarking tool

Platform developed with UCL will be updated using real building data

A new energy benchmarking tool, which aims to give relevant and reliable yardsticks of energy use trends in buildings, has been launched by CIBSE.

The online platform has been developed jointly with University College London (UCL), and will use real building energy data as it becomes available, encouraging users to submit measurements for their specific building type (this will be introduced in the second stage).

The benchmarks are presented in dynamic graphs with interactive features, making it easy for operators to see how their building compares with similar buildings. Designers will

be able to use them as targets for energy use at design stage.

The new tool will make it possible to update energy benchmarks regularly, rather than being restricted by print publication cycles. It is intended to gradually update and replace the energy benchmarks in *CIBSE Guide F: Energy Efficiency in Buildings*.

The platform is currently in Beta version, to test the user experience and inform future development. Once the full version is released, it will also give annual energy benchmarks – year-by-year snapshots that can be compared easily.

For more information, and to access the tool, visit www.cibse.org/energy-benchmarking-tool, where you will also find a CIBSE webinar on the tool.

Tool could be used for Birmingham's future buildings

Symposium call for papers

The 2020 CIBSE Technical Symposium, taking place in Glasgow on 16 and 17 April, is calling for abstract submissions. Titled 'Engineering buildings, systems and environments for effective operation', it will explore how mitigating and adapting for climate change will reshape engineering of the built environment.

The event offers an opportunity to share key research insights and present best-practice case studies to a well informed audience. Papers should focus on aspects of interest to CIBSE and ASHRAE members and the wider society, including: building-related energy; acoustics; comfort; indoor air quality; electrical systems; fire safety; IT; lighting; thermal performance; public health; internal and external transportation; facilities and information management; security; ventilation; and associated standards and systems.

Submissions from both young and experienced practitioners, researchers and building users are encouraged. They should be in the form of research papers, posters, technical reviews, case studies or opinion presentations, and based on recent or current research or application. Abstracts of 250 words must be received by 16 September. For more information, visit bit.ly/2Ye34io

Heloisa Fonseca, of Public Health England, at the 2019 Technical Symposium



Revamped SoPHE award challenges young engineers

The Society of Public Health Engineers (SoPHE) Young Engineers Award 2019 is now open for entries.

The awards have been redesigned for 2019, with teams or individuals being challenged to produce a promotional video – rather than a written submission – celebrating the work of a public health engineer.

The video could look at a day in the life of an engineer, how a particular problem was solved, or at particular aspects of public health engineering projects.

Entrants must make the videos exciting and inspiring, and they must be produced in a way that celebrates problem solving.

Individuals, or teams of up to three people, aged 18-35 on 25 October are eligible to enter. Video submissions should be between two and five minutes long, and must be received by 25 October. The winner will be announced at the SoPHE dinner in November. For more information, visit www.cibse.org/sophe

Building performance guide aims to satisfy demand

CIBSE has produced a new Guide to Building Performance aimed at those responsible for the operation and maintenance of buildings. The guide reflects the increasing demand from users for safe, healthy and efficient buildings that meet the needs of those who occupy them.

Targeted at operations, facilities, maintenance and premises managers – plus those responsible for investment in the sustainability of buildings – the guide gives information on the complexities of complying with relevant regulation and legislation, including the Energy Savings Opportunity Scheme (ESOS).

It advises on sourcing the products and services that enable clients to operate their buildings efficiently and effectively. The guide also helps them to meet the corporate social responsibility requirements and health and wellbeing standards demanded by stakeholders, staff and customers, and to comply with mandatory reporting requirements.

For more information, visit bit.ly/2Gg5ClP



New members, fellows and associates

FELLOWS

Gooding, Raymond John
Bishop's Stortford,
United Kingdom

Lee, Hui Ming
Sham Shui Po, Hong Kong

Cheng, Chor Kwan Charles
Kwun Tong, Hong Kong

Ozcurrence, Halil
London, United Kingdom

McWilliam, Alan John
Solihull, United Kingdom

MEMBER

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Dublin, Ireland

McKain, Peter
Edinburgh, United Kingdom

Jones, Duncan
Maidenhead, United Kingdom

Fung, Kar Lai Carrie
Southampton, United Kingdom

Body, Gavin David
Maidstone, United Kingdom

Evans, Philip Richard
Woking, United Kingdom

Hobson, James
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Yao, Julia
London, United Kingdom

Gill, Simon Robert
Essex, United Kingdom

Aniebonam, Uche Benedict
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Robinson, Thomas Robert
Belfast, United Kingdom

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Penn, United Kingdom

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Rugby, United Kingdom

Kootstra, Diana
Windsor, United Kingdom

Tibenham, Richard
Lincoln, United Kingdom

Smith, Scott
Birmingham, United Kingdom

Compton, Daniel
Whitchurch, United Kingdom

Warren, Lloyd
Fareham, United Kingdom

Shipway, Daniel
Romford, United Kingdom

Harris, Andy
Kent, United Kingdom

Emery, Michael John Carlton
Herts, United Kingdom

Nash, Stephen
Norwich, United Kingdom

Litchfield, Alec
London, United Kingdom

Sung, John William
Liverpool, United Kingdom

Shaw, Iain James
Manchester, United Kingdom

Dowle, John
Barnsley, United Kingdom

Neill, Rebecca
Edinburgh, United Kingdom

Pearson, Philip
Licfield, United Kingdom

Chan, Lok Shun
Kowloon, Hong Kong

Lazzarotto, Matteo Arturo
London, United Kingdom

Oikonomou, Anastasia
London, United Kingdom

Lavasa, Sotiria
London, United Kingdom

Chlela, Fadi
London, United Kingdom

Flores Vidal, Antonio
Carshalton, United Kingdom

Douloumpakis, Michail
Athens, Greece

Zisopoulou, Filothei
London, United Kingdom

Tsagkas, Kriton
London, United Kingdom

Escortell Mut, Pedro
London, United Kingdom

Zafeiropoulos, Anastasios
London, United Kingdom

Briani, Nafsika
Edinburgh, United Kingdom

Pasalidis, Lazaros
London, United Kingdom

Cheung, Chi Sum
Wong Tai Sin, Hong Kong

Keith, Dean
Newcastle upon Tyne,
United Kingdom

Chow, Yiu Cho David
Ma On Shan, Hong Kong

Wan, Kin Lam
Tseun Wan, Hong Kong

Chan, Tsz Yu
Sheung Shui, Hong Kong

Lam, Tze King
Tai Po, Hong Kong

Ash, Annette
Coventry, United Kingdom

**Shahul Hameed, Jismi
Mohammed**
Manama, Bahrain

Ridgewell, Gavin
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Harris, Mark Andrew
Rochester, United Kingdom

King, Andrew
Welwyn Garden City,
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Carroll, Anthony
Barnet, United Kingdom

Rankin, James Keith
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Connor, David
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Gul, Mehreen
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Williams, Daniel
Al Nahyan Area,
United Arab Emirates

Lynch, Marc
Dubai, United Arab Emirates

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Bangor, United Kingdom

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Tsai, Kim Chiu
Siu Sai Wan, Hong Kong

Chi Yan, Lo
Kowloon, Hong Kong

Rerak, Marta
London, United Kingdom

Longland, Mark
Southampton, United Kingdom

Karaivanova, Elida
Amsterdam, Netherlands

Allegritti, Maela
London, United Kingdom

Martins da Silva, Lilian
London, United Kingdom

Marras, Carlo
Ilford, United Kingdom

Morris, Edward James
Wokingham, United Kingdom

Sawaf, Sahn
London, United Kingdom

Kumar, Preetika
London, United Kingdom

Burns, Paul
London, United Kingdom

Youssef, Walid
Tring, United Kingdom

Cakici, Acar
Coulsdon, United Kingdom

O'Connell, James
Maidenhead, United Kingdom

Pardus, Wlodzimierz
Edenbridge, United Kingdom

Uberti, Stella
London, United Kingdom

Leary, Benjamin
Cambridge, United Kingdom

Jiang, Peng
London, United Kingdom

Moghaddar, Paria
London, United Kingdom

Matsui Janser, Kiyo Lukas
London, United Kingdom

Targonska, Emilia Agata
London, United Kingdom

Hickinbottom, Sam
Burton on Trent,
United Kingdom

Brown, David
London, United Kingdom

Muir, Alasdair
London, United Kingdom

Ezzi, Mehrdad
Bexleyheath, United Kingdom

Simpkins, Daniel
Southampton, United Kingdom

Wilshaw, Jack
London, United Kingdom

Charalambous, Adonis
London, United Kingdom

Rubio-Martin, Miguel
London, United Kingdom

Jameson, Phillip
Fleet, United Kingdom

Geoghegan, Nicolas John
Leighton Buzzard,
United Kingdom

Escher, Giulia
London, United Kingdom

O'Riordan, John Ben
London, United Kingdom

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Dickson, Alexander
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London, United Kingdom

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London, United Kingdom

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Reading, United Kingdom

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Chesham, United Kingdom

Levy Sheehan, Danny
London, United Kingdom

Issa, Nada
Southall, United Kingdom

Nissen, Peter Bryan
Upminster, United Kingdom

Zajdler, Tom
London, United Kingdom

Singh, Saurav
London, United Kingdom

Deramchi, Mamar Salim
Feltham, United Kingdom

Deneka, Andrzej Pawet
London, United Kingdom

Jagger, Daniel Harry
London, United Kingdom

Alvarez Arregui, Jose
London, United Kingdom

Pieri, Stephanie
London, United Kingdom

Ridgway, Ben
Nottingham, United Kingdom

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London, United Kingdom

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Edinburgh, United Kingdom

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Kourgozou, Vasiliki
London, United Kingdom

ASSOCIATE

Burrows, Tim
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Southend-on-Sea,
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Tunbridge Wells,
United Kingdom

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York, United Kingdom

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Cheung, Chung Man
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Stonnall, United Kingdom

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Henley on Thames,
United Kingdom

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Meccano magazine predicts a decarbonised grid... in 1937



Power of wind and sun

I stumbled across a copy of *The Meccano Magazine* from August 1937. An excerpt from 'Inventions of the future' reads: 'We are accustomed to a countryside that would seem very surprising indeed to our ancestors, with its arterial roads, its railways, its coal mines thrusting their galleries below the ground and its aeroplanes darting overhead. The people of the next century may equally be accustomed to a countryside that would astonish us by the absence of coal mines, steam trains or factory chimneys vomiting clouds of smoke. Lofty wind-towers may rise above it, and the mirrors of sun-motors may gleam here and there, while great barrages with their turbines may close the river mouths. By such methods electricity will be generated, to be transmitted by overhead cables or underground to be used in countless ways. The world will then use as much energy as it needs, but it will be cleaner, healthier and pleasanter than that in which we live.'

If we knew about this in 1937, why is the end of the world nigh 82 years later?

Dave Cooper FCIBSE

LinkedIn CIBSE Building Simulation Group discusses weather files

Can a much clearer and simpler referencing system be adopted for the plethora of weather files now available?

Chris Yates

What do you mean by referencing system? Standards? Naming conventions? There are standard formats, but files will be of varying quality. Do we need an indication of data quality, or a central source/governing body?

Dr Claire Das Bhaumik FCIBSE

This is a universal issue and will get worse as the data we have available increases. For example, access to Actual Meteorological Year data is increasing.

Chris Yates

CIBSE Journal welcomes readers' letters, opinions, news stories, events listings, and proposals for articles.

Please send all material for possible publication to:

editor@cibsejournal.com

or write to: Alex Smith, editor, *CIBSE Journal*, CPL, 1 Cambridge Technopark, Newmarket Road, Cambridge CB5 8PB, UK.

We reserve the right to edit all letters.

Invasion of the clone army

A leading political figure suggested cloning young engineers might solve our industry's recruitment problem, but CIBSE Patrons chair **David Fitzpatrick** has some other suggestions first!

There were many important people at this year's CIBSE Patrons annual lunch at the House of Lords, but, arguably, the two biggest VIPs were CIBSE Graduate of the Year

Reanna Taylor and Patrons Arkwright Scholar Laurie Maddalena.

Our host, Baroness Brown of Cambridge, spoke to them directly during her presentation, saying the UK would 'need you and many more like you to do the practical stuff... in fact, we could do with having lots of clones of you'.



As vice-chair of the Committee on Climate Change, Baroness Brown was referring to the mounting engineering challenge of delivering on the government's 2050 net-zero carbon target and recruiting the skilled workforce to make it possible. In 2017, British universities produced 23,850 engineering graduates - 22,000 less than the country needed, according to Engineering UK. Overall, engineering employers reported a shortfall of 59,000 skilled people that year, despite a dramatic rise in the total numbers attending university - from 230,415 in 1997 to 382,620 in 2017.

This suggests we do not have a shortage of graduates - rather that they are graduating in the wrong subjects. Why? Because the funding model does not work for technical subjects. It costs, on average, £2,000 a year to put a student through a humanities degree, but this rises to £12,000 a year for engineering. With tuition fees at £9,250, it is not hard to work out why universities look to grow 'cheaper' degree students to achieve a greater profit margin.

The upshot is that many thousands are emerging from three years of study with a degree that gives them limited prospects of getting a job and an average debt of £50,000. Meanwhile, the engineering industry is crying out for 59,000 more skilled people every year.

The building services sector, in particular, offers fantastic career prospects, particularly as it has been tasked with decarbonising the built environment in little more than a decade if the 2050 target is to be achieved.

We also hear that major construction employers are struggling to spend all of their contributions to the Apprenticeship Levy. Surely the solution to the financial shortfall is right there? Give the levy surplus to SME engineering firms if they agree to spend it on recruiting apprentices and/or to help pay for more expensive technical degree courses at university.

It is important to recognise that more and more of our future generations will come to us through the apprenticeship route - as Reanna did. Not everyone wants to go straight to university, and very few people like the idea of the huge debt. The apprenticeship model allows you to learn on the job and move onto a degree later if you want to.

If that doesn't work, then maybe it will have to be cloning.

- To join CIBSE Patrons and/or suggest topics for future columns, email cbrown@cibse.org

Building to perform

Pressure is growing to make our existing building stock much more energy efficient, to guard against overheating, and to deliver buildings that are safe and really work in daily use, as Hywel Davies explains

The Better Buildings Partnership recently announced a partnership to develop a UK version of Nabers.¹

'Design for Performance' aims to do just that: target design of buildings that deliver the designed performance. It is an alternative to the current 'design for compliance' culture, which is only concerned with meeting the minimum requirements of the Building Regulations, and disregards the performance of the building after handover, when Building Regulations cease to have a legal locus.

This culture was identified in the review of Building Regulations and fire safety by Dame Judith Hackitt, who described it as a race to the bottom.

Meanwhile, the government has enacted legislative change to the carbon emissions reduction target set in the Climate Change Act 2008, so the UK is now committed to a target of net zero carbon emissions by 2050.² It is one thing to have a target and to generate positive headlines for changing the law; it is quite another to have a clear plan for delivering the target.

The Committee on Climate Change (CCC) said as much in its 2019 report on the government's progress towards the 2050 objectives, which makes for uncomfortable reading.³ After last year's 'could do better' on progress towards tangible, measurable delivery, the 2019 version is close to 'couldn't do much worse'. Only one of 25 specific recommendations from last year has been met.

Lord Deben, mildly outspoken chair of the committee, likened the government's approach to climate change to 'Dad's Army'. Baroness Brown went on BBC Radio 4's *Today* programme and outlined in more detail what needs to happen. If we are to meet our climate targets, we need more buildings that are designed to perform effectively. Not just energy efficiently, but meeting user and occupier requirements, and not overheating. And not just new buildings, but across the existing stock, too.

It's not just the CCC that thinks this. Just days after its report, the Business, Energy and Industrial Strategy Select Committee issued its report, '*Energy efficiency: building towards net zero*'⁴, which calls for: public disclosure of operational energy in the commercial sector; publication of audits undertaken for the Energy Savings Opportunity Scheme; and a



"The new structure is unclear, but it looks set to separate regulation from enforcement"

commercial equivalent of the Future Homes Standard, with equal ambition for world-leading efficiency levels.

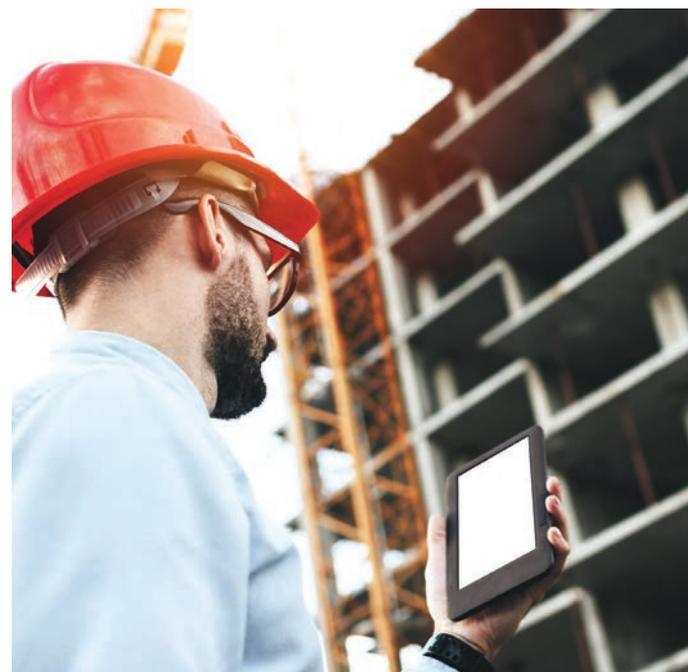
Meanwhile, the industry grapples with the Building a Safer Future consultation⁵, proposing significant change in the regulation of what we build, how we build, who builds, and how it is operated. Its call for design to target safety in operation, not just compliance at practical completion, complements and extends 'Design for Performance' – what performance characteristic is more important than safety?

There are proposals for contractors and designers of higher-rise buildings in which people sleep to sign a declaration that what they have built meets the regulations, and to provide a digital model of what they have actually built, identifying all significant changes to the approved design and agreed products.

In addition, they will make these declarations and models for a newly established regulatory body, not just local building control or approved inspectors.

More radically, existing buildings falling within the scope of the new regime will require a licence from the

new regulator to show they are safe to occupy, with a safety case for continued operation, to be reviewed by the regulator every five years. It's about management for safe performance – and with concerns over health



impacts of overheating buildings, that is a safety issue.⁶

This new regulator poses a challenge. It goes way beyond anything we have currently, and will need considerable resource that knows the regulations, understands how to build things that comply, and that can recognise a building that still complies years later.

It will need people who can approve designs, as required by the new Gateway 2, and decide whether to give a building safety licence at Gateway 3, when the building is handed over and certified as safe to occupy (not just 'practically complete').

While the new structure is unclear, it looks set to separate regulation from enforcement, with a good number of building control professionals working in the new regulatory body. What is crystal clear is that this new system needs more competent building control professionals, not fewer, to support designing for safe operation and delivering satisfactory performance through the life of the building.

It will also need to cover existing buildings – and, with the emphasis on cutting emissions, and the risks of overheating, it will need to be fully competent in the energy efficiency aspects of the regulations, so that local authorities can deliver the enforcement for which the CCC, as well as Dame Judith and the select committee, are calling.

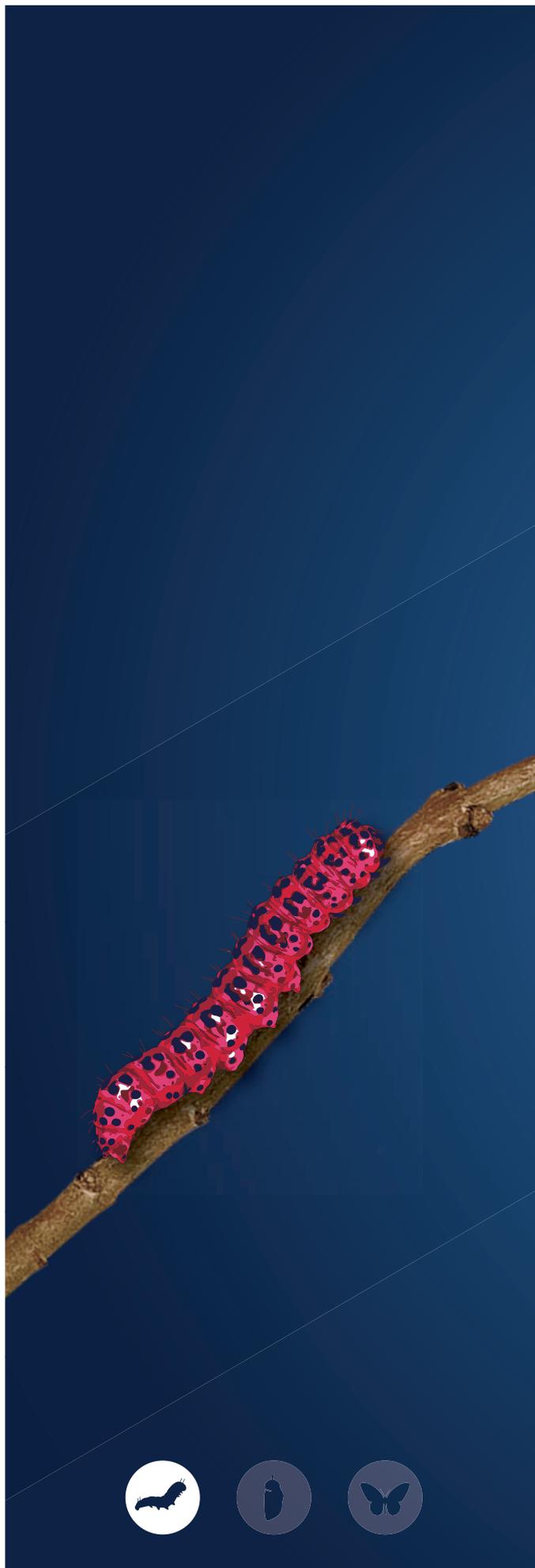
It requires the building control profession to step up and serve society even more effectively, in whatever roles the new legislation gives them.

Lord Deben and the CCC are very clear that – if we are to deliver the changes in our built environment that Dame Judith, the CCC and the select committee identify – we must adopt a 'Design for Performance' approach, to deliver buildings that are safe for occupants and for our climate, throughout their working life.

It is also clear that these reforms require significant private investment. Government needs to define a programme that inspires investor confidence and not undermine effective existing business models. The Future Homes Standard promises 'world-leading levels of energy efficiency'. We need a regulator to deliver world-class building performance.

References:

- 1 National Australian Built Environment Rating System www.nabers.gov.au
- 2 Law for net zero emissions begins passage through parliament, Minister of State Chris Skidmore, House of Commons speech, June 2019, bit.ly/CJAug19HD2
- 3 *Reducing UK emissions – 2019 Progress Report to Parliament*, CCC, July 2019, bit.ly/CJAug19HD3; *Progress in preparing for climate change – 2019 Progress Report to Parliament*, CCC, July 2019, bit.ly/CJAug19HD4
- 4 *Energy efficiency: building towards net zero*, BEIS, July 2019, bit.ly/CJAug19HD5
- 5 *Building a safer future: proposals for reform of the building safety regulatory system*, June 2019, bit.ly/CJAug19HD1
- 6 Kovats, R S, and Osborn, D, (2016) *UK Climate Change Risk Assessment Evidence Report: chapter 5 – People and the built environment*.



Walk the talk

The government is proposing that the UK become zero carbon by 2050 – so what is it doing to achieve this for its own estate and activities?

Following recommendations by the Committee on Climate Change (CCC), the UK government has legislated for the country to target net-zero carbon emissions by 2050, amending the Climate Change Act, which previously required an 80% reduction.

This will need significant effort in all sectors of the economy and society, and scrutiny of the government's plans by expert bodies and civil society. As a first step, the Environmental Audit Committee (EAC) has launched an inquiry into the government's plans for reducing its own carbon emissions to net zero. The EAC is interested in a broad range of measures that can be deployed to reach net zero emissions, covering:

- Climate change mitigation and adaptation
- Operational and embodied carbon, and water use
- Buildings, fleet, procurement, and behaviour-change measures
- Co-benefits – for example, from creating healthier and greener places
- Collaboration with the devolved administrations.

CIBSE will submit a response to the inquiry. We very much support this initiative and have advocated regularly that government should lead by example. This would show commitment and give investors and industry confidence that a transition to zero carbon is here to stay. Because of the size of the public sector, this would also help significantly in building skills, capacity and commercial viability for application in other sectors. For example, we have repeatedly highlighted:

- The failure of Display Energy Certificates to drive better energy performance, as illustrated by the fact that many prominent government buildings are E-, F- or G-rated
- The opportunity to use refurbishment of the public sector estate to support development of the retrofit sector.

To maximise the benefits of public sector leadership, it is crucial that lessons are gathered and made public, and that they are easily accessible and widely disseminated. Advocating this will be an important part of our response, and to inform our submission to the inquiry, we are interested in views from CIBSE members on:

- What must be done to achieve a net-zero focussed



"It is crucial that lessons are gathered, made public, and are easily accessible and widely disseminated"

government, including interim targets and deadlines, procurement processes, monitoring and enforcement

- How lessons from public projects can be disseminated: should government use a dedicated platform or make use of existing ones – and, if so, which one(s)? In addition, what level of information do you think is required and useful, while being manageable?
- What government is already doing towards achieving net-zero carbon for its estates, what works well, and what is insufficient or counterproductive. We would welcome examples of public sector projects with which you have been involved (anonymised, if necessary), to highlight where current policies and practices may not be delivering the desired energy and carbon performance
- How much flexibility should be provided through 'offsets', such as achieving carbon savings elsewhere and the use of 'green electricity' tariffs.
- Examples of organisations having achieved, or being on their way to achieving, net-zero status – and how this was defined and the measures used to achieve it.

For details of the inquiry, see bit.ly/CJAug19JG1
The inquiry closes on 15 August. If you would like to contribute to the CIBSE response, please send your thoughts by 8 August to JGodefroy@cibse.org

To read CIBSE's response to the recent consultation on how to better incorporate social value criteria –



DR JULIE GODEFROY
is technical manager at CIBSE

including climate change – in procurement, see bit.ly/CJAug19JG3

CLIMATE CHANGE ACTION

Edge Climate Action Roundtable: On 20 June, representatives from 25 built and natural environment organisations and other stakeholders met the chair of the CCC, Lord Deben, to discuss the need for action in the face of climate breakdown.

They accepted, in full, the CCC's recommendations that the UK must – and would – be able to achieve net-zero carbon emissions by 2050, and welcomed the government's announcement that this was to be enshrined in legislation shortly.

CIBSE and others agreed to collaborate on an urgent and concerted response to achieving the 2050 target; to continue working together to establish shared standards and practice; and keep developing professional resources, capacity and competencies within the sector, capable of achieving that aim – domestically and internationally. CIBSE has also accepted the invitation to cooperate with the CCC: see bit.ly/CJAug19JG4

CIBSE Climate Action Plan: To increase our efforts on climate change mitigation and adaptation, and identify where we can best work with others and help the industry, CIBSE has created a climate action plan, mapping its activities. A first draft was published in the *Journal* two months ago; it has since been built upon, following comments from members, collaboration activities identified at the Edge roundtable, and comments from the CIBSE Board. The latest draft is available to view at bit.ly/CJAug19JG2 Please get in touch with comments or to get involved.

Building Services Engineers Declare: Independently, and following similar initiatives in other professions – such as Architects Declare – building services engineers have created a declaration on climate change and loss of biodiversity, with pledges on actions that signatories will take. See www.buildingservicesengineersdeclare.com

PUBLIC HEALTH ENGLAND – GUIDELINES ON INDOOR AIR QUALITY

Public Health England (PHE) has recently published draft guidelines on indoor air quality in homes. These include recommendations for policy-makers and professionals operating in the health and built environment sectors, covering the design and operation of buildings.

CIBSE has worked closely with PHE on the production of the upcoming revised TM40 on Health and Wellbeing, including contributing on the topic of indoor air quality (see bit.ly/CJAug19JG6).

For details of the consultation, see bit.ly/JGAug19JG7 The consultation closes on 9 August, so to contribute to the CIBSE response, please send your thoughts by 2 August to JGodefroy@cibse.org



Preparing the road to zero carbon buildings

Atkins has signed up to the Architects Declare commitment to reduce impact on the climate and the natural environment. Andy Stanton explains what the multidisciplinary consultancy is doing to put sustainable design into practice

This year, there have been many developments in sustainability from local, regional and national governments, as well as NGOs, scientific bodies and professional organisations. Since the Intergovernmental Panel on Climate Change declared how stark the situation is and what we need to do to avert a climate crisis, a wave of reports and commitments has hit newsstands and policy-makers' desks. It has shaken all industries – and none more so than the built environment.

Behind the 'big news', we have an even bigger contingent of people pushing us to do more; the public – young and old – mobilised by the words and drive of people such as Greta Thunberg and David Attenborough, demanding we change our ways and pave the way for a more sustainable future.

As an industry, we have overwhelming evidence that our traditional compliance approach is, at best, failing to address the performance gap between design intent and operational reality. It is also costing building operators in terms of energy and carbon impact.

With the UK having led the world in embedding carbon targets into national law through the Climate Change Act – and, more recently, signing into legislation the zero carbon target for 2050 – we need to follow up commitment with real action. Local authorities have



raised the bar further, with 10% declaring a climate emergency and 42 setting targets of zero carbon by 2030, matched by some private sector companies.

The UK built environment profession is rightly recognised as world class when it comes to architecture, engineering and design. To keep this status, we must meet the challenge of the paradigm shift needed to deliver zero carbon buildings and infrastructure. We must turn headline news into action and demonstrable results. So, what can we do?

Atkins is putting sustainable design into practice in a number of ways. On World Environment Day, we joined more than 500 UK architecture practices in the Architects Declare movement, followed by the Structural Engineers Declare and, now, the Building Services Engineers Declare movements. It's a major commitment for Atkins and all the signatories, and will force important conversations internally, with clients and project funders.

"If we are to have any chance of meeting zero carbon targets, we need data and we need to share it across the industry"

ANDY STANTON
is sustainability
associate director
at Atkins

Trusted Design Partner

Beata Blachut, Head of Strategic Business Development - Technical

www.sav-systems.com

SAV

We are also developing our capability in Passivhaus, recognising its growth across the UK, Europe and the globe, with around 50,000 projects completed. The large evidence base supporting the standard's success has led to the inclusion of many of its principles in guidance from the Committee on Climate Change, the UK Green Building Council and the Future Homes Standard.

The growth in Passivhaus in education and housing is delivering for clients that demand demonstrably better buildings with a focus on comfort, cost, operational performance, and energy and carbon impact. Sustainable design can achieve these high-impact outcomes, as well as tackle health and wellbeing, avert fuel poverty and health issues, or provide environments that promote better learning and development.

Working together

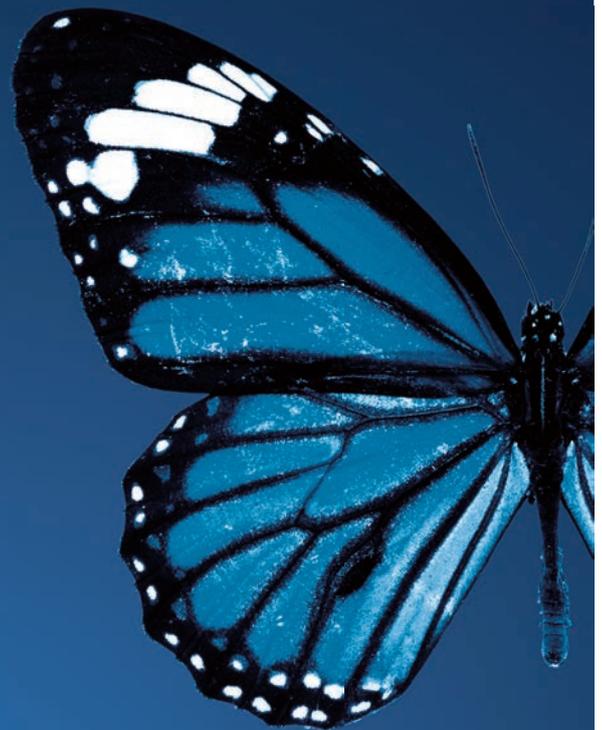
Becoming a delivery partner for Design for Performance (DfP), the collaboration between the Australian Nabers rating scheme and the Better Buildings Partnership, is another important step for us, to show what we can deliver when we work towards and, as a team, commit to actual targets.

Bringing together skills – such as more rigorous HVAC operational modelling – with design reviews and a focus on how systems, buildings and their controls operate in practice, will give us a real boost towards zero carbon. Importantly, it will help embed soft landings, with the additional rigour of returning to buildings a year after completion and disclosing their performance. With DfP, clients will get better buildings and, as a profession, we will learn which strategies and designs work and which don't, from an energy, systems and maintenance perspective.

During our Passivhaus and DfP journey so far, we've discovered how the approach brings integrated design teams together, to form demonstrably better outcomes for sustainability. Fundamental to delivering sustainable, high-performing buildings will be the disclosure of building energy performance, which has long been the missing element to improving the way we design buildings. How can we measure our progress or success if we don't have transparent metrics? If we are to have any chance of meeting zero carbon targets, we need this data and we need to share it across the industry.

The concept of disclosure on a wide range of metrics is familiar to sectors from commerce and finance to schools and healthcare. Many cities across the US require disclosure of operational energy – yet it is almost 10 years since a UK government consultation showed virtually universal support for rolling out Display Energy Certificates to buildings. During that time, many initiatives have tried to address this, including LessEn, Carbon Buzz, Leti, the BBP (with its large benchmarking scheme), and Etude's London Energy Map, which Atkins and Tower Hamlets are supporting. The forthcoming monitoring and disclosure requirement of the London Plan will also be a significant milestone.

Now is the time to shine a light on the actual performance of our buildings and to rise together to meet the climate challenge. One commitment, one action and one result at a time will help us bridge the performance gap and meet our zero carbon targets.



Worth Another Look...

[tamlite.co.uk/
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AHEAD OF HIS TIME

Ant Wilson FCIBSE has been at the forefront of building services innovation for 40 years, helping to change how engineers design buildings. After his retirement from Aecom, **Alex Smith** looks back at a prolific career

Ant Wilson's career has been remarkable. Dubbed 'Mr Building Services' by past CIBSE President George Adams, he has carried out groundbreaking research in multiple disciplines during his four decades in the industry.

Wilson has helped produce industry-leading guidance on building modelling, façade engineering, lighting, and carbon reduction, and oversaw changes to the Building Regulations that mandated much more sustainable design in new and refurbished buildings. He was also one of the first people to realise the potential of digitisation in building design, after he was asked to do a software validation exercise three months into his first job at Oscar Faber.

'I realised that what was being done by hand could all be done by software. I came to the conclusion that this was where the real engineering was,' says Wilson, who spent a large part of his early career developing design software that forms the backbone of simulations still used today – such as IES's thermal modelling software, which was originally developed by Oscar Faber.

Wilson has always been keen to share research knowledge with the wider industry. He has worked extensively with institutions and societies such as CIBSE, BSRIA and the BCO, and mentored and encouraged young people to develop a career in building services. His work has been honoured by his peers and beyond; highlights include a CIBSE Silver Medal, awarded in 2007, an Aecom fellowship, and an MBE for services to engineering. In 2015, he was elected a Fellow of the Royal Academy of Engineering.

Interviewed shortly before his retirement party at Aecom's UK headquarters in the City of London, Wilson reflected on more than 40



years at Oscar Faber and Aecom (the former was acquired by Aecom in 2001, and had a period of trading under the name Faber Maunsell).

'I joined Oscar Faber because they were really ahead of everyone. They were pioneering 3D clash-detection software in the 1970s,' says Wilson. 'Oscar Faber let me follow up my interests. I've had such good people who have inspired me ethically and technically.'

'I've worked with five former CIBSE presidents, and people such as Doug Oughton [co-author, with Wilson, of the 11th edition of the definitive text for the industry, Faber and Kell's *Heating and Air Conditioning of Buildings*]. When Steve Irving took me under his wing [at Faber Computer Operations], I really appreciated that. All my bosses have encouraged me and helped me understand the importance of what I'm doing, and I've tried to do the same for others.'

Formative years

Wilson joined Oscar Faber in 1979, after completing a building technology degree at the combined School of Architecture & Building

THE NEXT 40 YEARS

The circular economy may have become a buzzword recently, but Ant Wilson has been focused on resource efficiency in construction for many years – and Aecom produced *TM56 Resource Energy Efficiency of Building Services* five years ago. 'Circular is not going away,' says Wilson. 'Governments are only going to increase requirements in this area.'

He highlights that Policy S17 in the draft London Plan requires circular economy statements to be submitted, to explain how a building's design and construction will enable materials, components and products to be disassembled and re-used at the end of their useful life.

Wilson says the real issue will be the retrofitting of existing buildings to meet circular standards. 'We will have to change our systems,' he predicts.



Engineering at Bath University. The four-year course allowed him to study all the building engineering disciplines and, although he didn't intend to study building services, he was attracted by how it was influenced by human behaviour. 'There's far more psychology in building services and things aren't as straightforward as they are in structures. I found the people side really interesting. It excited me.'

The opportunity to spend two hours a week learning about acoustics and lighting also appealed to Wilson. He was a fan of prog-rock bands and was fascinated by their extravagant live performances that made the most of cutting-edge sound and light technology.

'I was a Yes man and they had their own artistic designer, Roger Dean, who did all the stage sets. The shows were a very visual experience and the band was the first to have a proper PA system,' says Wilson. 'I never realised there was a subject where you could study acoustics and lighting. I was into bands at school, and into lighting rigs and PA systems – so to go to university and work in an anechoic chamber measuring sounds was great. I find lighting really exciting. I can't draw, so it was an area in which I found I could be creative.'

Wilson's first job at Oscar Faber was as a public health engineer, but when Faber Computer Operations needed a graduate to validate a software programme written to analyse smoke movement in a care home, he jumped at the chance.

He had to compare the model with the smoke movement in an actual fire, and the results of his work still resonate today. 'What I learned was that no-one would have selected the parameters that could have predicted real-life conditions,' he says.

'Test data in lab conditions is always perfect. In reality, the building is nowhere near as good. Nobody is going to get it right in reality. You don't know all the parameters and we assume things are similar when they're not necessarily.'

Wilson is not anti-modelling, but wants people to understand you have to design robust buildings. 'You have to be realistic and understand building physics. If you don't know the answer, make sensible assumptions, and use wide prediction bands, such as those in TM54 [*Evaluating Operational Energy Performance of Buildings at the Design Stage.*]

Digital pioneer

His computer skills landed him a role as software expert at Oscar Faber's lighting team. He programmed lighting controls to achieve daylight savings, which was unique at the time and led him – aged 24 – to give a talk at the Royal Institution. Around the same time, Wilson became the company's youngest principal engineer.

His understanding of computer software for lighting design resulted in Wilson helping CIBSE to create a standard file format for the transfer of data for luminaires (published as TM14 in 1988). This was

followed by work on the *CIBSE Lighting Guide* for five years, with Lou Bedocs at Thorn Lighting and Ted Glenny at Philips Lighting. Working on CIBSE guides encourages collaboration, says Wilson.

'You get manufacturers, contractors and consultants working for the common good. It's not about trying to nail someone financially – it's about knowledge sharing.'

Oscar Faber had a reputation for innovation and invested heavily in state-of-the-art equipment, including – in 1984 – a 21in colour monitor, which cost £25,000. Such technology allowed Oscar Faber to carry out paid government research and, in the mid-1990s, it won the contract to update the Building Regulation governing energy use.

Wilson then worked on façade guidance because his team knew better software would be required to design airtight façades to meet the tougher energy efficiency requirements in Approved Document Part L.

'Our work wasn't research for research's sake; we spent half our time on R&D and half on real projects. It was about improving buildings and making them more comfortable,' says Wilson, who is a very engaging orator – or, in his words, a 'waffle merchant'. 'I've always been able to communicate with a vast array of people. Most of the leaders in building services are 5% engineers and 95% explainers and team workers. I thrive on people.'

Wilson may have retired, but his drive to promote the industry and its professions means he will be inspiring new generations of engineers for years to come. [C](#)

"Most of the leaders in building services are 5% engineers and 95% explainers and team workers. I thrive on people"



Ant Wilson and the view from Aecom's London office



Cambridge's elegant new mosque has comfort and sustainability at its heart thanks to the involvement of the environmental engineer at the project's inception. **Andy Pearson** looks at how Skelly & Couch's creative design worked with the grand scale of the prayer hall to provide natural ventilation and daylighting for more than 1,000 worshippers

COOL TO PRAYER



The prayer hall has space for 1,000 worshippers

The Cambridge Central Mosque has been badged by the media as Europe's first 'eco-mosque' and 'the greenest mosque in Europe'. It's easy to see why: the building is designed to be naturally lit during the day and naturally ventilated throughout the year, while its visually impressive timber columns helped minimise embodied energy in the building's structure.

Perhaps more impressively, its eco-credentials did not result from a detailed sustainability brief from the client – they are simply the result of good engineering. 'There was no defined eco-brief as such; we work with Marks Barfield Architects a lot and we always strive to develop sustainable solutions,' says Mark Maidment, director of the project's building services engineer Skelly & Couch.

The mosque, which opened its doors to worshippers in May, is certainly impressive. It comprises a long, mainly single-storey building that occupies a rectangular site in a predominantly residential area of Cambridge. Visitors enter the building after passing through a formal garden with trees and a water feature facing onto the busy Mill Road. They then pass beneath a giant entrance canopy supported on four tree-like timber

columns, each of which is lit from above by a large, glazed oculus, before entering through a row of glass doors set into a glazed façade.

Inside, visitors are greeted by a large day-lit atrium featuring four more timber piers, off which doors lead to a cafe on one side of the space and an educational area on the other. From this space they pass through a lobby housing the toilets and wash areas for ritual ablutions. After this, visitors enter the most important space of all – the giant 30m by 30m prayer hall, with its 8m-high roof supported on a forest of timber columns, which has space for up to 1,000 worshippers.

The circular timber supports are the space's most striking feature. Each is formed from a ring of perpendicular ribs, which open outwards, branch-like, as they rise upwards from the worshippers to form an intricate ribbed timber vault that supports the roof.

As with the entrance canopy, each 'tree' is lit from above by a large, circular roof light. The roof lights ensure a light level of approximately 150-200 lux is maintained within the prayer hall. 'We did not want direct sunlight in the space, so the roof lights have a deep reveal,' says Maidment. 'Our daylight studies show that there is no need for artificial lighting in any of the



‘When we were first involved with this project about nine years ago, we initially thought it would be good to use the thermal mass of the car park, combined with a mechanical ventilation system, to maintain comfortable conditions within the building,’ says Maidment. ‘However, this solution started to get pretty complicated; so when the project paused, we took a step back and decided to make this really, really simple by exploiting the volumes of the spaces in the building to take advantage of a natural ventilation solution.’

It is ostensibly a simple solution, but not one that those funding the mosque’s construction were comfortable with initially. ‘When we said we were going for natural ventilation we had a lot of explaining to do, because air conditioning is the norm for new mosques in the Middle East so we had



» The mosque’s dome and ventilation boxes reflected by PVs

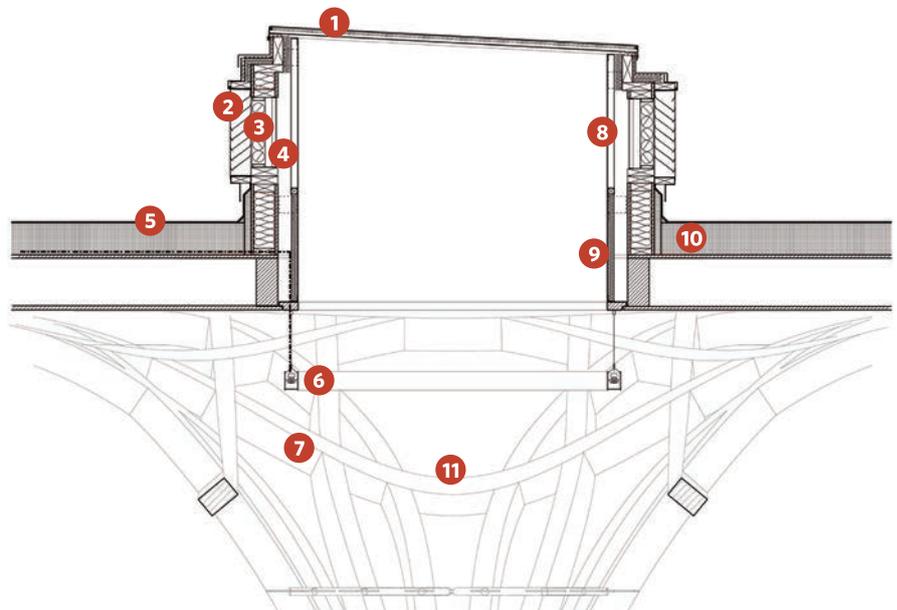
“When we said we were going for natural ventilation we had a lot of explaining to do”

spaces during daylight hours,’ he adds.

Each of the roof lights is ringed by a bespoke circular LED light fitting, so at night light will still filter down through the piers’ timber branches. The warm-white LEDs will dim according to the amount of daylight entering the building. ‘Lighting is always from above,’ says Maidment.

In addition to the timber columns, Marks Barfield’s low-embodied-energy design has walls constructed from timber cassettes and clad in brick slips, with a lightweight, timber roof structure. ‘We spent a huge amount of time at the start of the project developing the rooflight design and advising on thermal performance, which ended up being a very well insulated, lightweight, timber structure,’ explains Maidment. The timber superstructure sits on a giant, concrete box housing the mosque’s subterranean car park – a necessity in the congested neighbourhood.

Section view of the mosque’s rooflight design



- 1 Fixed glazed low g-value roof light, modelled with a deep reveal to maximise daylighting while minimising direct sunlight into the prayer hall
- 2 Attenuated external louvre, complete with access to damper motor
- 3 Thermal damper with U-value and air tightness better than façade system – opens according to CO₂ levels and temperature within the prayer hall
- 4 Axial fan located behind thermal damper to boost airflow in peak summertime conditions
- 5 Rainwater run-off used both for flushing WCs and garden irrigation
- 6 Bespoke LED lighting rings (with central battery backup) to boost daylight levels when needed, with daylight dimming and scene control
- 7 Spokes of ‘tree’ help to diffuse natural and artificial light and control reverberation times within the prayer hall
- 8 Pressure differential across the perforated lining allows opposite extract fan to run without short-circuiting
- 9 Acoustic lining to window reveal to help reduce fan noise and control noise breakout from prayer
- 10 Air tightness of $3\text{m}^3\cdot\text{h}^{-1}\cdot\text{m}^{-2}$ @ 50Pa and U-value <math>< 0.15\text{W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}</math>
- 11 Prayer hall height > 8m provides driving force for natural ventilation stack effect, and ample volume for stratification of hot air above occupants

PROJECT TEAM

Client: Cambridge Mosque Trust
Architect: Marks Barfield Architects
Main contractor: Gilbert-Ash
Structural engineer: Price & Myers
Services engineer: Skelly & Couch
Building services contractor: Munro Building Services
Cost consultant: Faithful+Gould
Landscape architect: Emma Clark Consultancy
Project manager and planning consultant: Bidwells

Section view of the mosque

- 1 High levels of insulation and airtightness
 - 2 Rooflights reduce the need for artificial lighting
 - 3 Entrance foyer maximises passive solar gain from low sun in winter
 - 4 Solar shading
 - 5 Partial green roof reduces solar heat and reduces rainwater run-off
 - 6 Sedum roof cools air next to mechanical ventilation inlet
 - 7 Gardens provide shade and cleanse air before it enters the building
 - 8 Foyer fountain provides evaporative cooling on hot days
 - 9 Demand-driven CO₂ ventilation, thermostatic heating control and occupant lighting control
 - 10 Ventilation units reclaim heat from outgoing air
 - 11 Underfloor heating
 - 12 Energy efficient lighting with controls that ensure they will be turned off or dimmed when not required
 - 13 Thermally massive ground floor slab provides some passive cooling
 - 14 Impulse fan in basement assists natural ventilation in basement during periods of low air quality
 - 15 Greywater recycling: waste water from ablutions areas is used for landscape and toilet flushing
- A Energy efficient plant (acoustically attenuated)
 B Heat pump

» to prove to the funders that our natural ventilation solution would work,' says Maidment. 'We did a lot of CFD modelling, which showed that it could get quite hot but that there would be quite a lot of air moving over the congregation, which would keep them comfortable; and the more people present in the prayer hall, the higher the volume of air drawn through.'

Fresh air is drawn into all of the mosque's principal spaces at low level through large, square grilles (both inside and out) featuring an Islam-inspired design. The grilles are set into the walls, and in the prayer hall, where up to 1,000 worshippers can be present, grilles have been incorporated into all four of its walls. 'We had no involvement with the pattern, but we did insist that the grilles had a least 50% free-area to ensure a low air resistance,' says Maidment.

The most challenging aspect of designing the ventilation system for the mosque is its variable occupancy. 'To develop an appropriate design solution, we had to understand how the mosque would be used,' Maidment explains. 'The thing that struck me most was its very sporadic use pattern: the building is pretty much empty now [at 3pm on a Friday] but, two hours ago, there would have been around 1,000 people in the prayer hall, which means an additional heat load of up to 100kW; at other prayer times there may only be around 50 people.'

To accommodate these extreme occupancy variations, each air intake incorporates a motorised damper to control the volume of air entering the building. Rooms incorporate both temperature and CO₂ sensors. 'The primary control is temperature; we've dropped the set point to 18°C so that when the occupancy level starts to rise the dampers open up

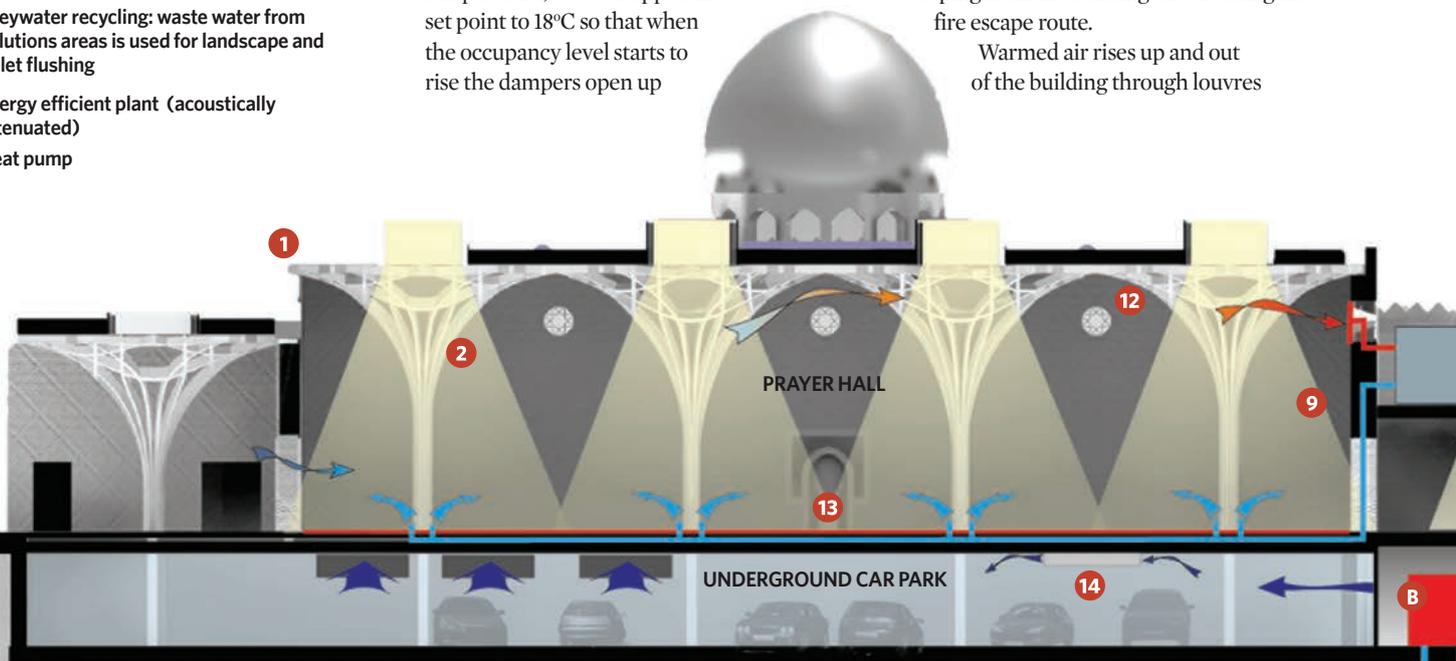


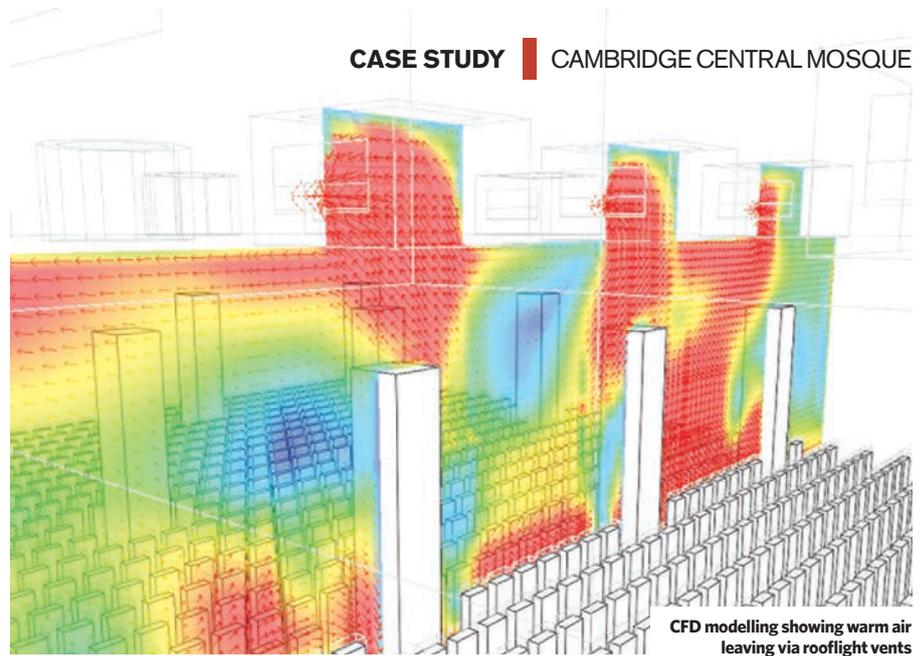
pretty quickly, which means that CO₂ levels never get very high,' says Maidment.

The air intakes also incorporate an acoustic louvre. In part, this stops external noise entering the place of worship, but it also helps prevent noise break-out disturbing the mosque's neighbours.

Unusually, some of the intake vents also incorporate smoke dampers. This is because the footprint of the mosque occupies almost the entire site, so the external fire escape routes to allow worshippers exiting from the rear of the building to make their way to the street in front, pass several intake grilles. The smoke dampers close to prevent smoke escaping from the building and clouding the fire escape route.

Warmed air rises up and out of the building through louvres





CFD modelling showing warm air leaving via rooflight vents

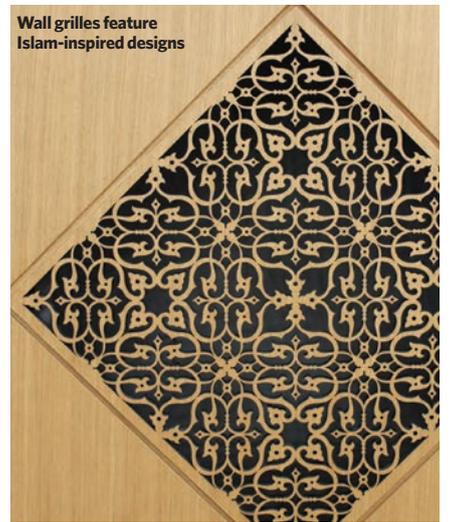
incorporated into the reveals of circular roof lights. As with the air intakes, the air exhausts include an acoustic attenuator; unlike the intakes, the exhausts also incorporate an extract fan. 'Common to each roof light is a louvre with a fan behind it that will run when the room temperature gets very hot,' says Maidment. The fans can also be operated using a manual override, although Maidment does not expect this to have to be used: 'The mosque part of the building takes care of itself most of the time because of its big volume spaces, which generally just need a bit of heat in winter,' he explains.

An underfloor heating and cooling system helps keep the worshippers comfortable throughout the year. Two roof-mounted, air source heat pumps supply the system with heat and coolth, via buffer vessels housed in

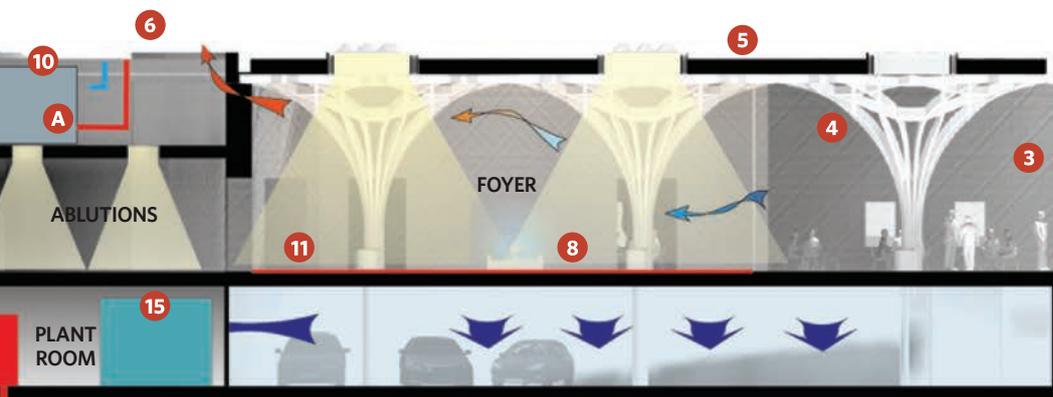
the basement plant room. 'They are operating at a coefficient of performance of more than four, which is good for an air source heat pump,' says Maidment. 'With grid electricity becoming increasingly less carbon intensive, the mosque's overall carbon footprint will reduce year on year.'

To ensure comfort is maintained in the prayer hall, the room features a bespoke carpet featuring a lined pattern to help position worshippers. 'It was very important for this carpet to have a low tog-value so that worshippers get the benefit of the slab heating and cooling,' says Maidment.

Since there is no gas on site, the heat pumps are used to provide hot water. 'There is quite a big hot water demand, with up to 1,000 people washing in a short space of time,' Maidment explains. Skelly & Couch's solution has been to create an innovative direct hot water heater, by connecting the cold water main to heat exchangers placed inside the underfloor heating buffer vessels. 'It is similar to the way water is heated in a combi boiler,' says Maidment. 'In winter it is a very efficient way of heating the water, because you'd have >>



Wall grilles feature Islam-inspired designs





One of the ablutions spaces for worshippers



The entrance lobby with the canopy beyond

A DOSE OF WISDOM

Skelly & Couch opted to use a low-level dose of chlorine dioxide as a disinfectant for the hot water supply. 'While we are heating the water to 55°C to kill off any legionella, the dosing system is there as a back up just in case, on an exceptionally cold day, the air source heat pumps don't quite get to the required temperature,' says Mark Maidment. He says no special pipework was required for the system. All the domestic water systems in the mosque are installed using Pex pipe. This was selected on the advice of the building services contractor Munro, after it had raised concerns that, if copper pipes were used, they would be likely to 'pinhole' as a result of the water quality in Cambridge.

Plant room

- 1 Low-loss header
- 2 Incoming primary heating and cooling pipework
- 3 Three 1,500L thermal stores
- 4 Primary heating pumps
- 5 Pressurisation unit
- 6 Primary cooling pumps
- 7 Rainwater harvesting tank leaf filter
- 8 Rainwater harvesting tank (10,000L)
- 9 Mechanical control panel
- 10 Chlorine dioxide treatment unit
- 11 Cold water storage tank (1,700L)
- 12 Cooling plate heat exchanger
- 13 Secondary cooling pump
- 14 Tertiary heating pumps

» to heat the building anyway. In summer it's not so efficient, but then we'd still have to heat up a large quantity of domestic hot water in any case,' he adds.

The water supply is treated by dosing with chlorine dioxide (see box 'A dose of wisdom'). 'It's quite an unusual solution, but it means that we don't have to elevate the water temperature from the heat pumps above 55°C [to prevent legionella],' says Maidment. 'The water is perfectly fine to drink, and it means that because there is a lot of sprayed water in the ablution areas there are no concerns about legionella,' he adds.

The large quantity of hot water is required for ritual washing before prayer, and the mosque's toilets feature extensive ablution spaces for worshippers. The facilities include ablutionary showers or douches on a flexible hose. These require adequate backflow protection, because the regulations say that the shower head could be dropped into contaminated water in the WC pan,

for example, at the same time as the water pressure in the shower supply drops, which could cause water to travel up the pipework.

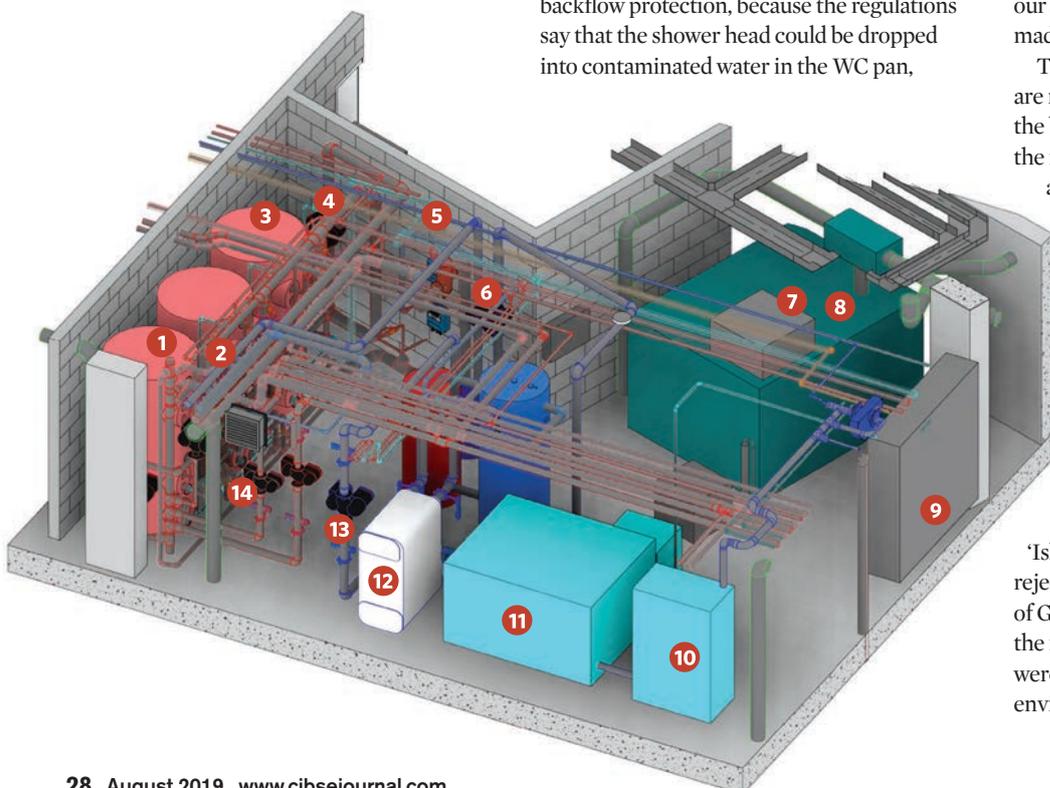
The Water Fittings Regulations classify the risk of backflow from fluids in contact with ablutionary showers as Fluid Category 5 – the highest risk level – because of the potential presence of faecal matter and other bodily fluids. Maidment says that, in response to the regulations for Category 5 installations, the design incorporates an independent supply pipe from a separate pumped system to ensure backflow does not occur.

To minimise water consumption, toilets are flushed – and the gardens irrigated – using rainwater harvested from the roof. The roof also houses a photovoltaic (PV) installation to meet the planning requirement for 10% of the building's energy to come from renewable sources. 'It's a big roof, and with our all-electric solution, the PV installation made perfect sense,' says Maidment.

The mosque's variable occupancy patterns are making it challenging to commission the building services. 'During Ramadan, the mosque was full every day so we were able to take advantage of this to make quite a lot of adjustments to optimise the system's performance,' says Maidment. He says the mosque is currently using more energy than predicted but, because 'everything is monitored and metered' over time, its performance will be optimised.

It is fitting that the building should live up to its billing as an eco-mosque. As Tim Winter, chairman of the Cambridge Mosque Trust, has noted:

'Islamic civilisation has been based on the rejection of waste as an underestimation of God's blessing so, in the construction of the new mosque here in Cambridge, we were very much in the forefront of the local environmental movement'. CJ





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A HUMAN TOUCH

Building for people and performance was announced as the new theme for ASHRAE at the society's summer conference. *CIBSE Journal* technical editor **Tim Dwyer** reports

Opening the 2019 ASHRAE summer conference in Kansas City, CEO Jeff Littleton highlighted the society's achievements over the year, including 22 new publications, 28 new – or updated – standards and guidelines, and the record-breaking funds of more than \$2m raised through research promotion.

At more than 1,400 pages, he said the latest *ASHRAE Handbook – HVAC Applications* was the largest to be released, and included new chapters on occupant sensing and controls, indoor airflow modelling and indoor swimming pools.

Littleton noted the society's budget had tightened slightly, but assured members that, overall, its financial position remained very strong. He said ASHRAE's new five-year strategic plan had also come online. The 2019-2024 plan has four core initiatives focusing on resilient buildings and communities, indoor environmental quality (IEQ), organisational

streamlining and improved chapter engagement. Littleton added that work will soon start on ASHRAE's recently purchased 1970s, 6,225m² HQ, which will be renovated into a net-zero energy-ready building, for occupation in October 2020.

Building for people

Incoming ASHRAE president Darryl K Boyce launched the theme for his year in office: 'Building for people and performance. Achieving operational excellence.'

In his address, Boyce evidenced his passion for – and understanding of – an industry that he saw as 'in need of cultural and procedural change'. (See panel, 'Design shortfalls'.)

He said he foresaw a future where the building operations team representative is included all the way through the design – not solely at the end – and where the design reflects the needs of occupiers and the capabilities of the operators, who have an effective turnover and orientation process, and understand the building after handover.

Boyce called for design decisions to be evaluated for their impact on indoor environmental quality (IEQ), concluding that humans – the occupants – are the best sensors of comfort.

An array of topics was covered in more than 100 technical sessions over the four days of the conference, ranging from fundamentals through to modelling and optimisation, systems and equipment development, health and safety, commissioning, and professional development. The challenge for each of the 1,600 delegates was to choose which of the many parallel sessions to attend.

In the session 'How the blockchain will affect you and your work in HVAC&R and buildings: don't get left behind, it's happening now!', which I chaired, the three speakers covered blockchain basics and some potential industry applications (see opposite page, for report).

The presentations of all the technical sessions are available, for a fee, through the ASHRAE virtual conference website. [CJ](#)

The conference featured more than 100 technical sessions



Darryl K Boyce

DESIGN SHORTFALLS

Referring to three Canadian buildings – using 58%, 69% and 203% more energy than the design intent – Boyce said such developments were falling short of the expectations of building designers and operators because:

- Designers are not always focused on operability during the design process. They need to transfer their designs into effective operations, as 'great designs warrant great operability'
- Buildings are more complex. 'We design technology to help improve operations, but it doesn't always end up that way,' he said, citing an engineering building with 'power over ethernet' controls and associated sensors, where control technicians were being inundated with data
- Operators are being overwhelmed. 'Generally, they do not have the skills to operate today's buildings and are not trained properly,' said Boyce.

He also referred to the UK Probe Project and Low Carbon Buildings Performance studies, which identified key causes of performance slippage, resulting in energy consumption being higher than modelled targets:

- Building systems that exceeded the capacity of the building managers to operate them
- Complex and/or innovative systems, requiring several years to refine and understand
- Insufficient commissioning.

BLOCKCHAIN: DON'T GET LEFT BEHIND

An important opening message of the blockchain session, given by Bruce Billedeaux, of Maverick Technologies, was that the infamous bitcoin is not, in itself, blockchain – it is the blockchain that enables bitcoin.

He explained that blockchain is a method to decentralise ledgers that store transaction data, and that it relied on a 'hash' to allow verification between all those who hold a copy of the digital ledger, maintained on computers distributed around an organisation, state, country or globally (see panel, 'Hash basics').

Each of those with access to the ledger share a numeric key (a very long number). The hash is created by a complex computer cryptographic algorithm that, when given a piece of (text and/or numeric) data will use the shared 'key' to produce a check number that can only be derived if both the key and the original data are used.

Don Beaty, of DLB Associates, explained that – in the same way that it is difficult to imperceptibly alter the ink entries on a traditional continuous ledger book – the hashed entries in the blockchain are very difficult to change once written and instantaneously validated and shared across many computers.

In a subsequent supplemental discussion, Beaty showed how the blockchain develops; as each new block of data is added, it is connected using a pointer to the previous block, and that pointer also contains the unique hash of the data inside the previous block (see Figure 1).

As each block is locked onto the previous block, it is practically impossible to extract or change information in the chain once it is written, unless everyone – or the majority – sharing the ledger agrees to do so. This is simplified, but many detailed explanations are available on the web.

In his presentation, Stephen Roth, of Carmel Software Corp, gave the example of refrigerant tracking as being a perfect application for blockchain.

The US Environmental Protection Agency (EPA) requires technicians to record all charging and discharging of refrigerants. As R-22 will be not be produced or imported into the US as of 31 December 2019, the EPA

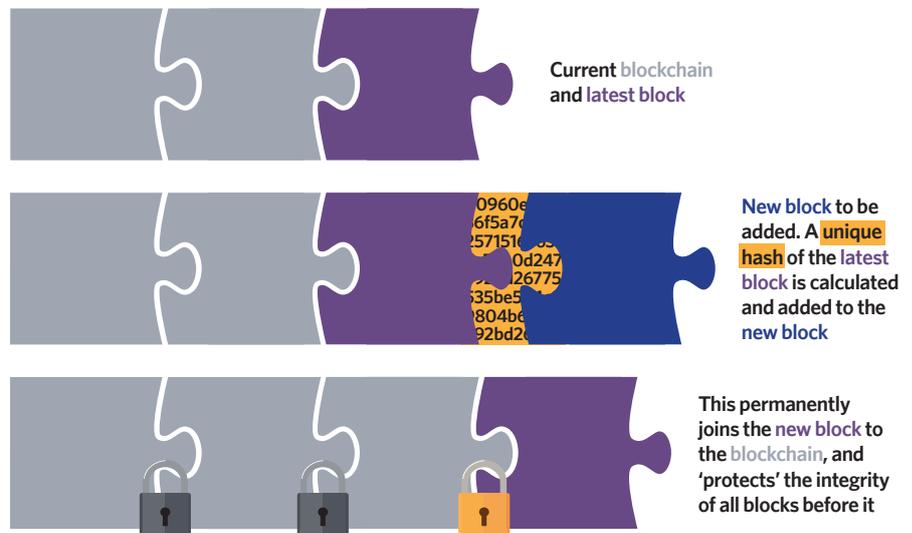


Figure 1: A representation of the blockchain process [Source: Don Beaty]

requires record-keeping of all HFC refrigerant evacuation and disposal. Roth noted that 'this kind of information is perfect for storage on blockchain, enforcing accountability and making it available to EPA and the public'.

The exploitation of blockchain accords with the appeal by ASHRAE president Darryl K Boyce that, for buildings to succeed, the occupants must be the final arbiters of the quality of their built environments.

Whether it be commissioning records, fire safety tests, proof of air quality, evidences of maintenance, or any one of the myriad links that make up the 'golden thread' of a building's life, this seminar indicated that blockchain offers the opportunity for building users to have access to immutable records of a building's lifetime performance – with a clear, unambiguous trail of provenance. **CJ**

HASH BASICS

A very simplistic example of a hash algorithm could be to multiply the – pre-agreed and shared – public key with the data. So, if the key was 13, and the data was 200 (maybe a contract value or timescale), the hash would be $13 \times 200 = 2,600$.

It is very difficult to guess that the original value was 13 without knowing the key and, if the hash was subsequently changed and compared to the original data, it would not resolve properly.

In the blockchain, the hash is stored and shared among many distributed copies of the ledger. Real hash algorithms are far more complex, and some public keys are likely to have 2,128 digits. The hash mechanism used when creating bitcoin is the SHA-256 hash.

Plain text: CIBSE Journal

SHA256 Hash:

00960eb836f5a7cf4325715167637c56b0d24792bd2677535be564c9804b68a

Plain text (missing an 'E'): CIBS Journal

SHA256 Hash:

8c99816a91daf1fe7ef2f8529b65b6fb259e9411f5bf82ad349244f1d5aabb8e

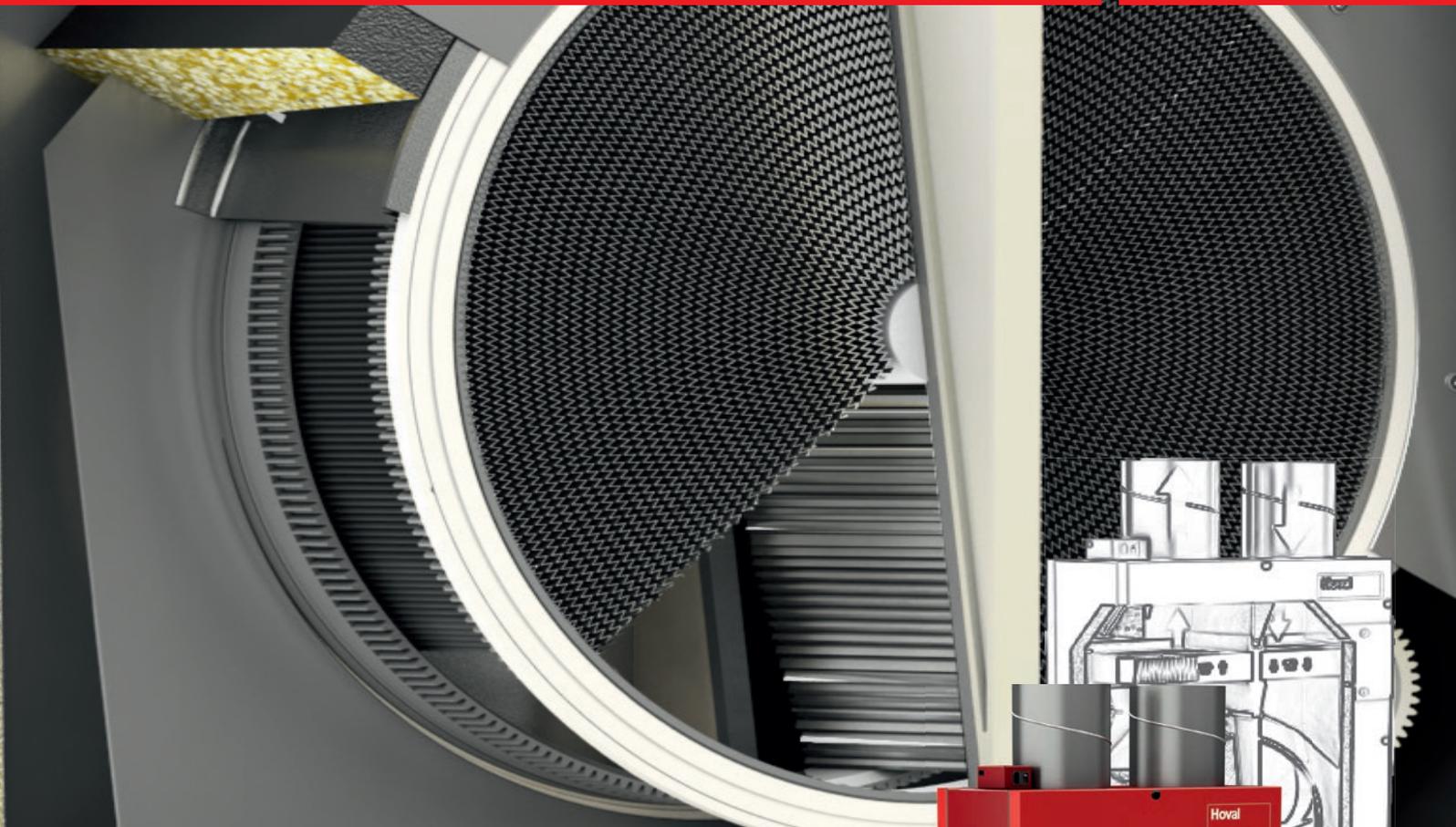
SHA256 hash of this whole box (including the hashes above):

a12658fe74d63c7ff8fe6be97e1f31f4c53179fab9901766d29418964395872d



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Responsibility for energy and environment

Manchester's Civic Quarter heat network

Network predicted to save 3,100 tonnes of carbon emissions in first five years

Construction work has begun on Manchester's £20m Civic Quarter heat network (CQHN), which will generate low carbon power, heat and hot water for the city.

It will initially serve six major council buildings, but with the potential to expand and connect further buildings across the city centre in the future.

The network is part of Manchester's strategy to become carbon neutral and climate resilient, and to achieve zero waste by 2038. It is projected to save more than 3,100 tonnes of carbon emissions in its first five years of operation, according to delivery partner Vital Energi, which claims that the energy centre will become more efficient as additional buildings are connected.

The energy centre, which will be constructed close to the Manchester Central Convention Centre, will contain a 3.3MWe CHP engine and two 12MW gas boilers. It will generate



The Tower of Light contains the energy centre's flues

electricity and harness the recovered heat from this process for distribution via a 2km district heating network, which will supply heat and hot water to the buildings.

Designed by architect Tonkin Liu, the energy centre incorporates five flues in a 'Tower of Light', which has been designed to become a sculptural landmark for the city and a symbol of its aspiration for low carbon energy.

The scheme has been part-funded by a £2.87m grant from the UK government's Heat Network Investment Project (HNIP), with Manchester City Council being one of the first local authorities to receive such funding.

The first buildings to be connected to the network will be Manchester Town Hall and the Town Hall Extension, Manchester Central Library, the Central Convention Centre, Bridgewater Hall and Heron House.

Work on the Civic Quarter heat network is scheduled to be completed by the end of 2020.

For more information on the project, visit www.vitalenergi.co.uk

Swep supplies BPHE units for innovative Copenhagen project

The Lyngby CHP plant at the Technical University of Denmark (DTU) has been connected to the regional district heating system that serves Copenhagen, with brazed plate heat exchanger (BPHE) manufacturer Swep involved in the innovative project.

Much of the heat supply for the Lyngby plant is provided by Vestforbraending, the largest waste-management company in Denmark and the biggest producer of district heating based on waste incineration in northern Europe.

Vestforbraending, which is owned by 19 local authorities, needed to increase its capacity to serve the planned expansion of the local district heating area. Incineration of waste at its CHP plant is used to generate energy, with 20% becoming power and 80% used for district heating. Towards the end of 2017, it leased an area at Lyngby CHP plant, to establish a heat exchanger station and a transmission line into the plant, enabling the associated pump system to exchange heat via an accumulation tank.

Swep provided eight fully loaded B649 BPHE units in parallel design, meaning four lines with two B649 units in series, with the maximum number of plates and a full load capacity of up to 51MW. The units transfer heat from to Lyngby CHP plant for distribution, via the storage tank, into the DTU campus and the areas of urban development. The Lyngby CHP plant can also sell surplus energy back to Vestforbraending.

The system will be able to operate at full load by the end of 2019.

■ Swep has launched a new range of BPHEs using a Sealix coating – a SiO₂-based, thin-film technology that helps prevent corrosion and keeps tap-water applications running efficiently for longer.



Vestforbraending's CHP plant in Copenhagen

Large installation design made easier

Hysopt has launched a new version of its cloud-based design and simulation software for large heating and cooling installations, with the latest release focusing on design and optimisation for citywide heat networks.

The Belgian software company claims that the software's new features make it easier and faster for engineers to create and simulate accurate, hydraulically optimised designs, taking into consideration complex combinations of low carbon energy sources and end-building scenarios.

According to Hysopt, it allows users to draw heat networks for cities and other large areas on top of a city map. The software then automatically calculates the length of the pipes that must be laid. To avoid pipe oversizing, it will provide a weighted average for the different heating applications in the district heating network, based on the diversity calculations.

It can also automatically calculate flows, pressure drops and water temperatures for each building. The heat load can be configured using heating and hot water setpoint profiles, for example to allow for different occupancy profiles in flats.

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OPENING THE LOOP

Open-loop groundwater source heat pumps are poorly understood and little used in the UK. A new code of practice, CP3, aims to raise standards, say **Phil Jones** and **Bean Beanland**

A new code of practice on open-loop groundwater source heat pumps (GWSHPs) has just been published by CIBSE in partnership with the Ground Source Heat Pump Association (GSHPA).

CP3 *Open-loop groundwater source heat pumps: code of practice for the UK* is the third in the series of guidance documents for heat networks published by CIBSE. It sets minimum standards for a technology that has huge potential to decarbonise energy use in the UK, especially as grid electricity carbon factors fall.

Harnessing renewable energy from water wells and mine water represents a huge opportunity to provide low carbon heating and cooling to buildings. However, GWSHPs remain poorly understood and under-used in the UK – so CP3 aims to help rectify this situation.

The technology

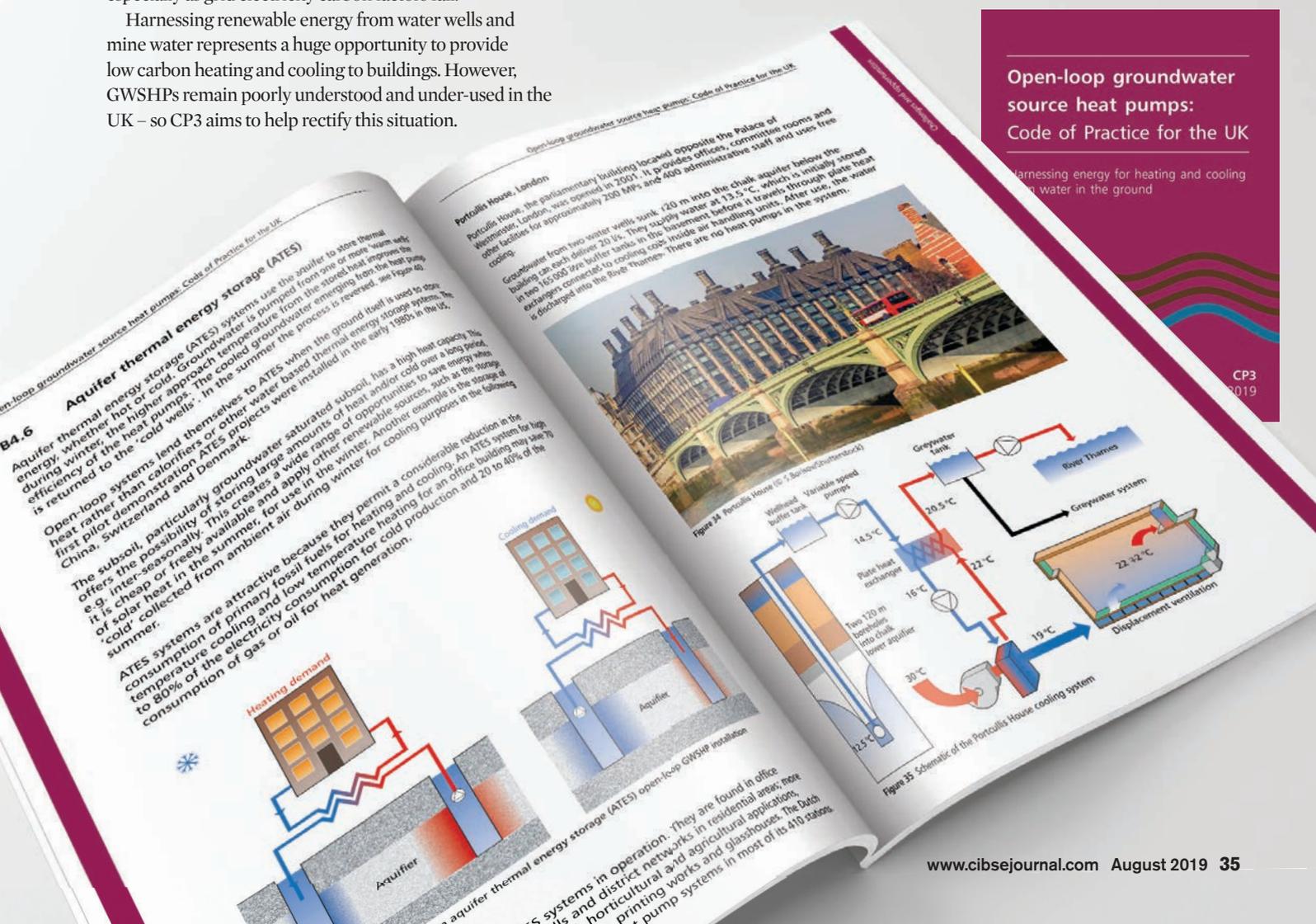
Open-loop GWSHPs use groundwater abstracted through a heat pump then returned to the ground via a reinjection borehole. This is non-consumptive, with all the water being returned, but at a different temperature (see Figure 1). An Environment Agency (EA) abstraction licence may be required, but following CP3 will help with this.

Water is usually drawn from an aquifer; but mine water is another possibility that the Coal Authority is investigating at a number of sites. Domestic-scale GWSHPs are possible, but large-scale installations – often involving heat networks – usually offer greater economies of scale.

The benefits

Heat pumps provide heating and cooling simultaneously or in switch-over between seasons. Aquifer thermal energy storage (ATES), which stores heat between summer and winter, can be achieved depending on geology. This ensures a balanced temperature within the aquifer, so avoiding overcooling/heating the groundwater. When cooling, electric chillers can be displaced, so the economics are much more compelling than a heat-only scheme. As the climate warms, this will become more important, as cooling demand rises and space heating declines.

An advantage of ATES is the fairly constant temperature of the aquifer water at 12-14°C. By comparison, surface water, rivers and lakes, fluctuate from 3°C in winter to 25°C in summer. This constant groundwater temperature offers year-round efficiencies, with seasonal coefficients of performance (CoPs) of 3 to 5 and greater. Opportunities



Open-loop groundwater source heat pumps: Code of Practice for the UK

Harnessing energy for heating and cooling in water in the ground

CP3
2019

“Local geology and borehole yield need early consideration. If the geology isn't right, you could be looking down the wrong well”

» for ‘almost free’ passive cooling offer extremely high CoPs. A better measure of these systems is the seasonal performance factor (SPF), including all the energy used and supplied, in particular the borehole pump. This is covered in detail by CP3. Although boreholes can be expensive to drill, they represent a long-term asset way beyond the life of the heat pump itself.

With the decarbonisation of the electricity grid and high SPFs, carbon savings are considerable. A number of studies (some through the BEIS Heat Networks Delivery Unit) show that large-scale heat pumps easily beat CHP on carbon savings. CHP is still generally winning on economics, however, mainly because of the low cost of gas in the UK. GWSHPs show good viability, but CHP produces high-value electricity, resulting in a client dilemma: do I go for the highest cost savings or the highest carbon savings? Given the urgency of the climate problem, the route should be long-term carbon, not short-term operational cost. However, the added potential for load shifting to run heat pumps when electricity is either lower cost or lower carbon, or both, could offer opportunities to financially outscore CHP, even at today's raw utility pricing.

The Renewable Heat Incentive (RHI) is a huge support, but why do heat pumps need this sort of subsidy? It's simply because gas is too cheap (being effectively subsidised) and this reduces the value of low carbon heat compared to electricity – the UK spark gap is one of the biggest in Europe. If gas was double the price, as in some other countries, subsidy support may not be needed.

The RHI has picked up the financial gap, but is closing in April 2021. Referee! Can we have a level playing field please? Will a follow-on scheme take its place? Work continues on this but, in parallel, changes to Building Regulations and to planning law will encourage low carbon heat in preference to low carbon electricity in the built environment.

Pitfalls to avoid

Local geology and borehole yield need early consideration. Wells may be -120m deep to reach the groundwater; if the geology isn't right, however, you could be looking down the wrong well. This needs specialist input from those who understand the detailed geology. It's about the science, and

GSHPA'S GRIDWATCH

The Ground Source Heat Pump Association (GSHPA) has information, case studies and standards on heat pumps. Its website also includes a live carbon calculator – GridWatch – comparing CO₂ emissions from different technologies. Membership is open to large and small organisations, including consultants and individuals. Visit www.gshpa.org.uk

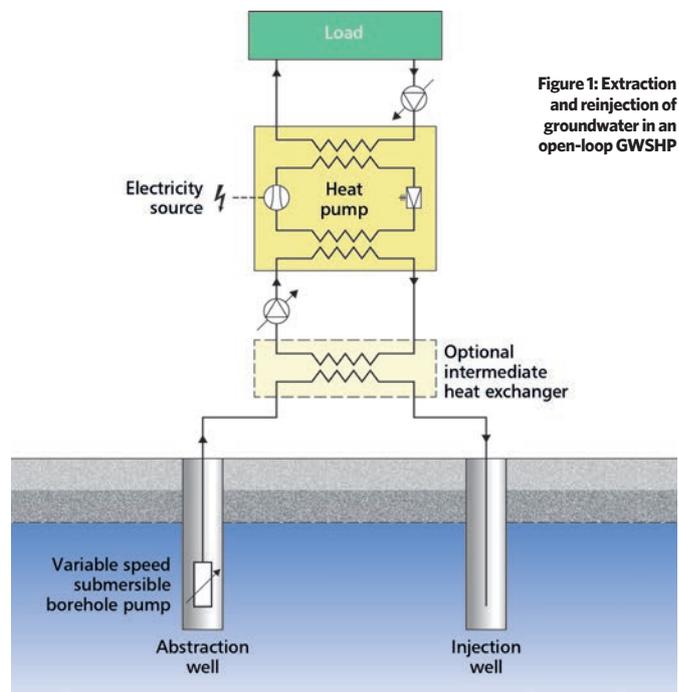


Figure 1: Extraction and reinjection of groundwater in an open-loop GWSHP

risk management and mitigation – CP3 says more on this.

Another significant factor is locating boreholes too close together, which can result in thermal breakthrough (essentially recirculation in the aquifer). CP3 discusses well spacing. Again, this is highly dependent on the local geology, so it is important to obtain advice from a specialist hydrogeologist and to consult the EA about any potential issues. The well heads can be as simple as an unobtrusive manhole cover in the street, so location can be less of an issue than people think, although drilling rig access can be a challenge.

A very early conversation with the EA is essential, long before a full application for an abstraction licence. The EA will check for obvious issues, such as others already abstracting in the same area. CP3 also addresses the temperature change between abstraction and injection, because this figure is likely to be an EA stipulation. Essentially, if you follow CP3, the EA application should go smoothly – but start early.

A code of practice to decarbonise heat

If GWSHPs are to form a significant part of our future low carbon energy infrastructure, they need to be designed, built, operated and maintained to the highest level, to deliver customer satisfaction. CP3 has been produced to help achieve these aims by raising standards across the supply chain, thereby encouraging adoption.

Setting minimum requirements for a project – and recommending best practice – will provide greater confidence to specifiers and developers. CP3 can be included in the tendering/contracting process to specify these. In turn, the adoption of this code of practice by developers will give assurance to customers and property purchasers that their GWSHP scheme has followed a set of design, installation and commissioning standards. So CP3 should have a significant effect on the GWSHP market by boosting confidence across the board.

Replacing or extending the RHI is essential if the heat-pump sector is going to compete with current gas pricing – but, more fundamentally, we've got to stop burning stuff, and move to a more renewable-based energy system. Using heat in groundwater will play a key part in this, and CP3 offers everything you need to get this technology right. May the code be with you. Go on... open the loop. [CJ](#)

■ **PHIL JONES** is an independent energy consultant and chair of CP3 Steering Committee, and a GSHPA Council member

■ **BEAN BEANLAND** is chair of the GSHPA

■ BEIS awarded CIBSE a grant for CP3 from public funds

Herz HIU passes the BESA test

Herz has become one of the first manufacturers to have a HIU tested to the BESA UK HIU Test Regime (October 2018) says Herz's **David Queen** and **Neil Gatland**

Climate change and lowering CO₂ emissions appear to be on everyone's agenda, but it's important that this is not done at the expense of efficiency of supply.

In communal or heat network schemes, heat interface units (HIUs) are being installed to deliver heating and hot water from centralised plant to individual dwellings within the network.

The BSRIA Guide BG62/2015 describes these units as: 'An essential part of the efficient delivery of heating and hot water to consumers on district and communal heating schemes.'

A poorly performing HIU can have a dramatic effect on the efficiency of a heat network. This issue has led to a desire for some standardisation and guidelines for HIUs. The BSRIA Guide BG62/2015 and the CIBSE CP1 2015 Heat Networks: Code of Practice for the UK have gone a long way in starting this process.

The BESA UK HIU Test Regime has also been developed as a benchmark and will be referred to in the newly updated CIBSE CP1.2 as best-practice guidelines.

The test regime only applies to indirect HIUs, but should be extended to cover other types of HIU in the future.

BESA's Mark Oakes says: 'One of the standard's great strengths is that it has been developed by users, for users. It provides them with a clear basis on which to evaluate HIU performance, and is rapidly becoming the default point of reference for those making procurement decisions within the industry.'

The BESA-tested Guildford indirect HIU is suitable for both radiator and underfloor tertiary systems. Herz decided to test the HIU at BSRIA, UKAS-accredited for the BESA test regime October 2018, because of its world-renowned reputation.

BSRIA Test House Manager, Tom Garrigan

says: 'We are delighted Herz chose BSRIA as its provider of choice to test the Guildford indirect HIU in accordance with the BESA UK HIU Test Regime October 2018. It is the first HIU tested by BSRIA fully in accordance with the latest version of the BESA UK HIU Test Regime.'

Herz-Armaturen, based in Vienna Austria and founded in 1896, has a global presence, and are represented in more than 100 countries. Herz UK has been supplying the UK with quality products for domestic and commercial heating and cooling systems for 50 years.

Herz, already manufacturing HIUs for Europe, found the UK market more specialised, needing its own range of products to meet the high demands required.

Herz manufactures a full complement of HIUs (indirect, direct, domestic hot water (DHW)-only and heating (HTG)-only) to meet varying installation requirements, ensuring most of the components in the HIUs are Herz-manufactured and common across all HIUs. The methods for controlling DHW and heating are identical across all units, achieving the same results.

The Herz range of HIUs complies with all relevant BSRIA and CIBSE guidelines and, unlike many others, all come with a five-year warranty as standard.

The core benefit of HIUs is the efficiency they deliver, and HERZ products deliver more than most.

■ **DAVID QUEEN** is Herz technical manager and **NEIL GATLAND** is Herz specification manager and responsible for the UK HIU business.



■ For more information on the Herz range of HIUs, visit www.herzvalves.com or call 01483 502211.



PLYMOUTH'S GENERATION GAIN

When Plymouth City Council looked at heating and cooling buildings more efficiently, it found the area's geology offered a source of energy that enabled it to use the latest heat network technology. **Andy Pearson** reports

The construction of Plymouth City Council's 5th-generation district heating and cooling (5DHC) network began last month. It started with the drilling of the first well into the aquifer that flows through the limestone strata on which areas of the city are built.

This pioneering low-carbon project will supply a cluster of buildings in the city centre with heat and coolth. It is one of several district energy schemes being explored by the council as part of its initiative to reduce carbon emissions.

'Generating heat represents the biggest energy use in the UK so, to meet our target of reducing greenhouse gas emissions by at least 80% by 2050, we will have to decarbonise nearly all heat generation in buildings and most industrial processes,' says Jon Selman, low carbon city officer in the Strategic Planning and Infrastructure Service at Plymouth City Council.

'Reducing demand for heat through improved energy efficiency will be important but it will not be enough to meet the 2050 target. This is where heat networks have a role to play.'

Plymouth City Council never set out to pioneer the use of 5DHC, which features no central energy centre and uses local heat pumps to heat and cool buildings. But it was participating in the HeatNet project (co-financed by the European Regional Development Fund) to explore the implementation of 4th-generation district heating and cooling (4DHC) networks in the city. 'Conventional heat networks typically deliver hot water at 80°C, usually heated by gas boilers or a CHP engine housed in an energy centre,' says Selman.

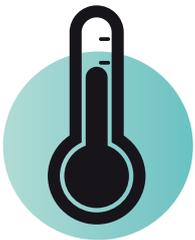
'Fourth-generation district and cooling networks feature an energy centre supplying heat outwards to buildings, but they usually

operate at a lower temperature than conventional networks [around 55°C], resulting in lower capital costs, lower heat losses and greater energy efficiency.' (See Figure 1).

The 4DHC networks were of interest to the council because their lower temperatures offered the city the opportunity to use waste heat and renewable heat sources, such as ground source. 'Plymouth is one of the pilot areas to demonstrate the application of this approach,' says Selman.

Mapping heat loads

Under the HeatNet project, the council commissioned BuroHappold and Building Energy Solutions to map the heat loads and heat sources for

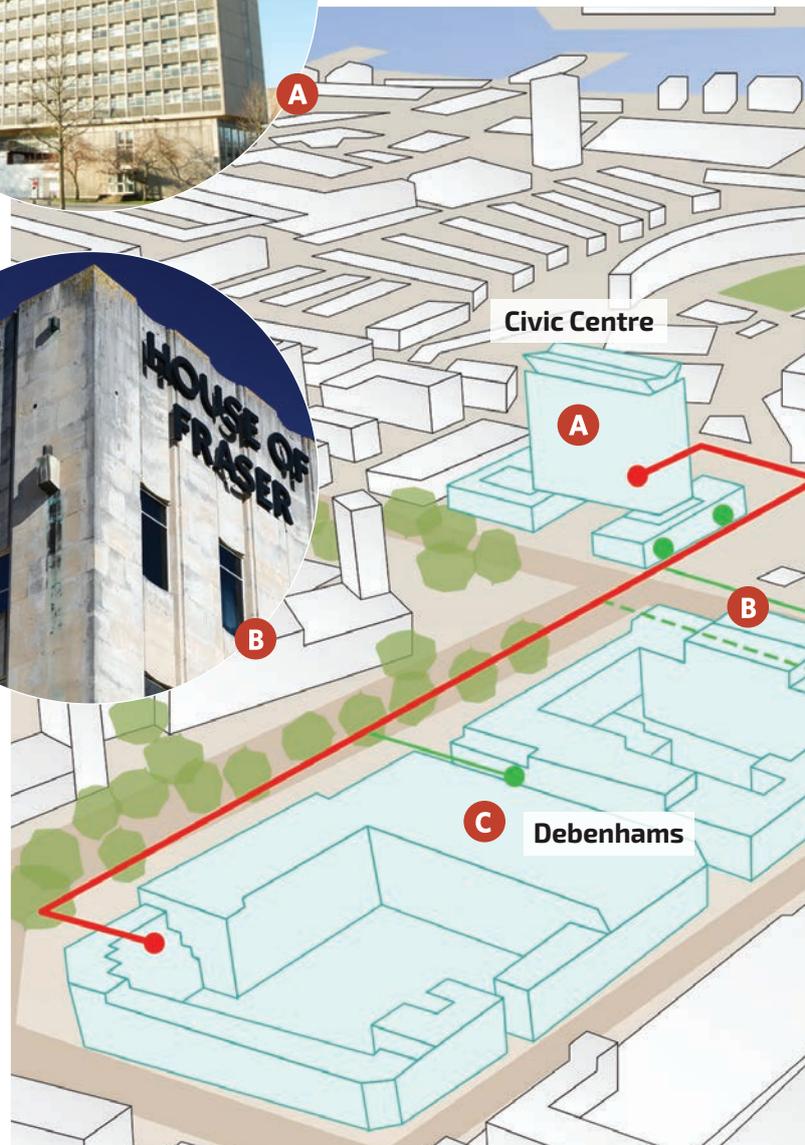
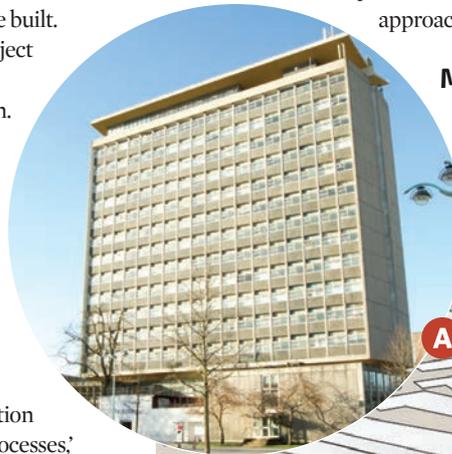


Typical hot pipe temperatures for heat networks

Conventional: 80°C

4th generation: 55°C

5th generation: 14°C



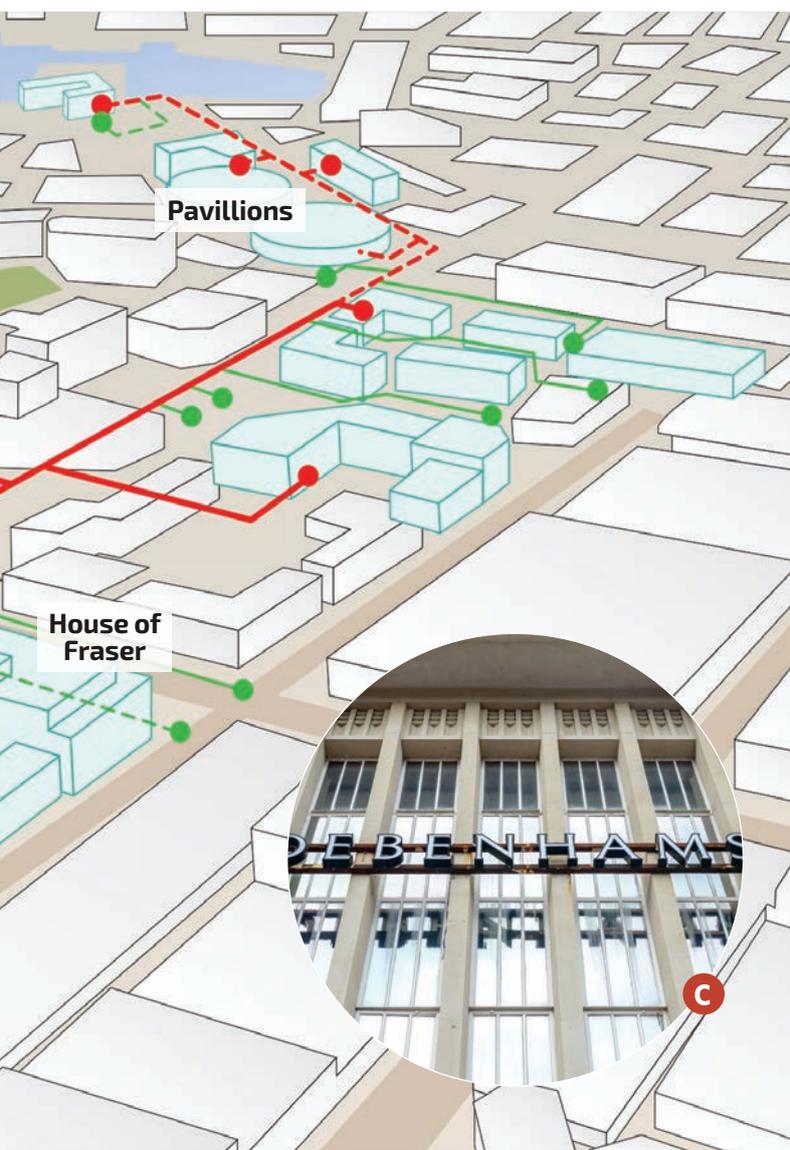
the city. The mapping indicated multiple heat sources in Plymouth including: an energy-from-waste plant; a potential sea water source heat pump; groundwater source heat pumps; data centre heat recovery; and incinerator heat recovery.

Seven clusters were defined to benefit from the heat sources. BuroHappold then developed an outline design and costing to turn these clusters into heat networks and a roadmap for the city-wide implementation of the 4DHC network.

The HeatNet project team visited a scheme in Heerlen, Netherlands, called the Mijnwater (Minewater) project. The scheme is based around two flooded mine shafts, one of which is kept warm, the other cold, to provide seasonal storage. The mine shafts are connected by a warm and cold header with a common return.

What makes the Mijnwater scheme radically different from all previous generations of district heat and energy networks is that it does not have a conventional energy centre. Instead, each building incorporates a heat pump connected to the warm and cold headers

"In each building, the heat pump is connected to a thermal store. This enables the building to meet peak demand without the need to size the heat pumps accordingly"



that supplies each building on the network with heat or coolth as required, from only two pipes. When in cooling mode, the heat pumps reject heat into the header.

'It means one person's cooling can be another person's heating,' says Selman. 'That exchange of heat might take place simultaneously or across the seasons, which is why you need the thermal storage,' he adds.

Mijnwater's decentralised heat pump approach moved the concept of thermal smart energy networks onto a new level – 5DHC (see Figure 2).

Fifth amendment

'A rough metric in deciding whether a 5DHC network will be appropriate is that more than 40% of the load must be cooling,' says Selman.

Following the visit, Plymouth City Council 'revisited its existing 4DHC proposals and viewed them through a 5DHC lens,' Selman says. It found there were sufficient commercial buildings in the centre of Plymouth with a cooling demand to meet the 40% characteristic.

'We explored the city centre idea in more detail based around some areas of the city that the council has control of, along with some new development areas over which the council will have influence,' says Selman.

'What we're trying to do to develop this scheme is to create a low-temperature building zone, centred on the city council's offices, where any new buildings will need to be designed around a low temperature heating system wherever possible.'

The scheme is particularly appropriate for this area because of the balance of heat in winter and cooling demand in summer. It is much more efficient for cooling to be provided by heat pumps, which reject heat into the low-temperature circuit, than to use chillers rejecting heat into the outside air.

Selman says the cooling aspect of 5DHC projects are 'a real bonus, particularly as the climate warms, because they can deliver cooling in a more efficient way than a traditional district energy scheme, which gives some flexibility and resilience because the business model is not just focused on heat'.

Similarly, the low-temperature thermal network is ideal for heating new buildings with underfloor heating using a heat pump. However, a higher temperature heat pump could be used to deliver heating to an older building with, say, a radiator-based heating system. 'With new buildings, you can drive down the heating temperatures more than would be possible with retrofit,' says Selman.

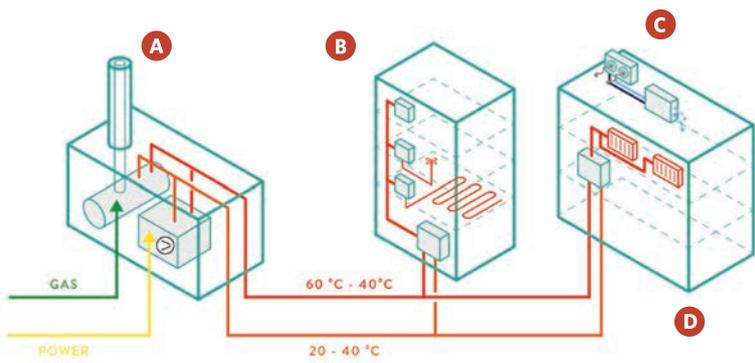
He says the current financial viability of the 5DHC scheme is based on the assumption that the Renewable Heat Incentive (RHI) will >>



Expected temperatures in Plymouth's two-pipe 5th generation network

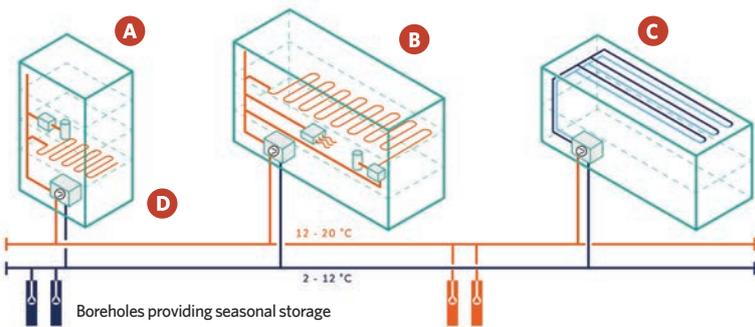
Warm pipe 14°C

Cold pipe 6°C



A Central energy centre. Heat pump and gas boilers **B** High-density residential HIU feeding direct DHW and space heating **C** Commercial/office space **D** Local air source cooling

Figure 1: 4th generation district heating and cooling



A Residential with direct space heating and DHW booster **B** Distributed heat pump plant rooms **C** Commercial/office space with direct/FCU space heating and point-of-use DHW booster **D** High-temperature cooling (chilled beams)

Figure 2: 5th generation district heating and cooling

» still be available in two years' time. 'There is a question about the existence of the RHI post 2021, without which the economics of the scheme may not stack up,' warns Selman.

Instead of using abandoned mine shafts, as in the Netherlands, the Plymouth scheme uses geology. 'We looked at the geology underneath Plymouth and found a thick belt of limestone that has a principal aquifer running through it with a significant flow of water from east to west that we could use as a

heat or cooling source or potentially for heat storage,' says Selman.

The wells being drilled by the contractor are the first step forward on the 5DHC scheme – 'the system will use an abstraction well and recharge well to balance the ultra-low temperature headers. These will require an Environment Agency licence to abstract water', Selman says. 'Eventually, we'd like to tie in the system with a marine water source heat pump as well, where the new network meets the water's edge.'

The plan is for a two-pipe network to link the developments to enable them to share energy; the warm pipe is expected to be at around 14°C – roughly the temperature of the ground – and the cold pipe at 6°C, so there is no need to insulate the pipes.

'The ultra-low temperature network will allow usually rejected energy to be recovered and shared within, as well as between, buildings that are heating and cooling, simultaneously reducing primary energy and increasing system efficiency,' says Justin Etherington, associate director at BuroHappold Engineering. Depending on the results from the well excavation, surplus energy is expected to be stored in the ground to keep the system in balance.

Building heat pumps

Heat pumps within each building provide heating or cooling as required. 'This is a very neat solution that allows a building to connect with two pipes, from which you can satisfy both the heating and cooling demand, meaning a building doesn't need flues, gas connection, roof-top chillers or plant,' Etherington says. In each building, the heat pump is connected to a thermal store. This enables the building to meet peak demand without the need to size the heat pumps accordingly.

The storage also gives Plymouth City Council the ability to decouple loads from the system, so it could use the system in a dynamic demand response mode. 'You could use the heat pumps in communication with the power grid as part of a multi-vector response, for example, power prices spike between five and seven o'clock, so you could manage the thermal store to avoid running the HPs at that time,' says Etherington.

It is early days for the 5DHC network at Plymouth. The HeatNet team is focused on identifying local opportunities to achieve a working installation of a smart thermal energy network in Plymouth. The hope is that the learning from this project can inform UK-wide guidance to encourage others to follow similar approaches. **CJ**

■ The project and the lessons for similar developments was presented at the 2019 CIBSE Technical Symposium by Phil Jones of Building Energy Solutions, who has been involved in the project, bit.ly/CJAug195DHC

■ Read about the 5DHC balanced energy network at South Bank University 'Intranets for heat', May 2019, *CIBSE Journal Commercial Heating Special*, bit.ly/CJAug19BEN

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The greatly anticipated Guide addresses the full range of fire safety issues, from evacuating the building and giving access for firefighters, to controlling the spread of smoke and fire, including new guidance on fire safety of building façades and external wall construction.

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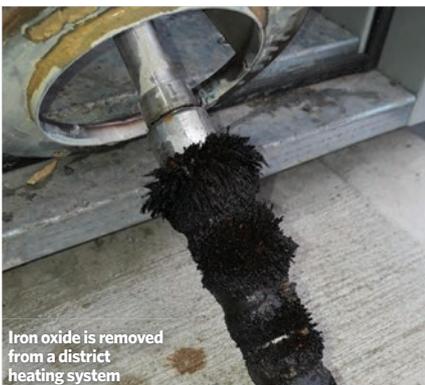
THE SCALE OF THE WATER PROBLEM

A study of 185 heat networks in the UK found that 15% had suffered significant failures as a result of issues around water quality. **Jon Greaves**, of Hydro-X Water Treatment, gives a summary of the failures and offers guidance for different stages of the system life-cycle

There has been substantial growth in the UK district energy market in the past five years. Ongoing maintenance of these networks is vital to ensure a sustainable payback of the capital investment in plant and equipment, and to keep downtime – and disruption to the end user – to a minimum.

A study carried out into heat network water quality in the UK gave examples of current system issues and offered guidance on avoiding high-cost failures within systems' lifetimes. It considered design stage, pre-commission stage and ongoing management, and 185 systems were studied, with particular interest given to failures and the root cause of these.

The study found that improvements could be made to water-treatment design and implementation throughout the process: design, build, pre-commission, handover and ongoing maintenance. Improving water treatment at these stages will lead to systems running more efficiently, minimise downtime,



Iron oxide is removed from a district heating system



The insides of a valve showing local element corrosion

avoid non-budgeted capital expenditure, minimise disruption for end users and extend the life of the system.

The 185 systems across the UK had their water quality monitored for bacterial contamination and chemical composition of the system waters for 24 months (see table on page 44). System volumes varied between 10,000 litres and 1,800,000 litres.

Key findings

Design and pre-commission:

- Inadequate pre-commission cleaning of horizontal pipe runs/ laterals before the terminal units and not in accordance with agreed specifications
- CHP and biomass not being used/left stagnant
- Lack of good practice for storage of district heating pipework, especially when laying in trenches (for example, pipework not suitably capped), allowing ingress of debris to the system during build stage
- Systems handed over with inadequate certification and reporting
- A lack of independent audit process at handover
- Metallurgy of system not considered for water treatment
- System size not considered for water treatment
- Lack of continuity in water treatment for staggered build networks
- Inadequate flushing velocities achieved in >150mm bore pipework
- Lack of automatic water-treatment dosing systems on networks
- Lack of side-stream filtration on networks



- » ■ Lack of remote water-quality monitoring on networks.

On-going management

- System leaks leading to ingress of oxygen and dissolved solid precipitation from the mains water supply feed
- Incorrect water-treatment choices for metallurgy of system
- Lack of monitoring and maintenance of filtration equipment
- Lack of monitoring and maintenance for water treatment after practical completion
- Bacterial proliferation in stagnant areas
- Over dosing/under dosing of chemistry
- Lack of live monitoring systems to flag up issues.

Conclusions

Currently, there are gaps in the design, operation and guidance for water-treatment in the UK district energy sector. The following should be borne in mind:

Considerations at design stage

- Minimise areas of potential stagnation
- Specify suitable side-stream filtration for all district energy systems
- Specify that fill water is deaerated
- Specify that district heating systems have continuous monitoring for pH and conductivity as a minimum. The system should also be able to report remotely – either via the BMS, or email/SMS – to indicate failure of the control levels to suitable stakeholders
- Water treatment should be specified to be ‘automatic’ in nature
- Water treatment, fill water quality and method and pressurisation should be considered at design stage, based on system volumes and metallurgy. If secondary and tertiary systems are to be filled from the ‘primary’ network, consideration must be given to ensuring no conflicts between the water-treatment regimes of both systems.

Consideration for pre-commissioning stage

- For pipework >150mm diameter, alternate flushing methodology to BSRIA BG29:2012 should be sought – for example, ice pigging and traditional pigging
- Improve record-keeping and audit processes during precommissioning works and implement a daily log of works on site
- Have an independent audit of the works before handover
- Consider existing water treatment when connecting new systems to ‘old’ networks.

Ongoing considerations

- Stagnation should be avoided – any

Detail	# Systems	Comment
No unbudgeted maintenance required over 24 months	157	
Loss of system water – not corrosion related	4	1 had system loss because of burst district heating pipe 2 had system loss because of failed bellows 1 system drained in error by contractor
Full loss of system water – corrosion/scaling related	4	3 systems had poor, incorrect water-treatment dosing, which lead to incorrect pH for the aluminium heat exchange 1 system had a leak for more than three months, which led to scaling and blocking of the boiler tubes
Full loss of system water – bacteria related	2	1 system had failure because of a failed de-aeration unit, causing stagnation in the pipework, which led to under-deposit bacterial pitting 1 system had failure because of poor pre-commission flushing in the horizontal sections before terminal units, which led to under-deposit bacterial pitting
Poor system water quality at handover	12	1 system handed over with sections and buffer vessels isolated 8 systems handed over with insufficient/no inhibition/general water-quality issues 3 systems handed over with high metals and suspended solids count
Systems handed over with disused plant still connected to system	6	4 CHP systems not in use and not decommissioned correctly 2 biomass boilers not in use and not decommissioned correctly
Total	185	

Issues occurring within 185 systems monitored for the UK heat network water-quality study

stagnant areas should have full velocity and heat flushed through for a minimum of two minutes every four days

- ‘Legacy’ equipment no longer in use should be decommissioned and disconnected from the system waters, leaving no ‘dead-legs’
- Side-stream filtration should be monitored and managed on a proactive basis, to ensure suspended solids are removed as required
- Continuous monitoring and automatic dosing should be installed on all district heating networks to minimise the risk of corrosion and associated water treatment issues.

Improved water-quality treatment in UK heating networks will prevent non-budgeted capital expenditure, minimise disruption for end users and extend the life of the system. **CJ**

■ **JON GREAVES** is national technical manager at Hydro-X Water Treatment



Sludge and biofilm removal from a district heating system



Filters showing the effects of progressive levels of cleaning

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Working towards net zero in hospital facilities

CIBSE Healthcare Group is helping make buildings safer, energy efficient and more comfortable. Group chair **Frank Mills** FCIBSE outlines key upcoming reports and guidance

CIBSE Healthcare Group is working with the NHS in the UK to improve patient healing experiences and to provide efficient, effective, resilient environments for patients, staff and visitors.

It also gives support to CIBSE members across the world, and works with professional technical societies to disseminate knowledge and develop solutions to the challenges facing the healthcare sector. The group has liaised on ASHRAE TC 9.6 Healthcare and ASHRAE Std 170, Ventilation of Healthcare Premises, and is helping introduce natural ventilation into ASHRAE guidance and its review of air change rates in medical facilities.

In Europe, the group is working with REHVA to develop a net-zero hospital guide, which is expected to be published in 2020 as a joint REHVA/ASHRAE publication.

NHS project

A major NHS Improvements project is reviewing the technical guidance on the heating, ventilation and air conditioning of hospitals – Hospital Technical Memorandum (HTM) 03 – and the group is giving input via the NHS Working Panel. This is developing a consultation document to be



issued for public review in September. At an open meeting at HQ last month, the group considered a range of issues: recirculation v full fresh air; application of UV air sterilisation; air filtration; methods of air flow – laminar, displacement, mixing; and selection of supply, extract, recirculation air terminals to achieve desired air movements.

The NHS is keen to reduce energy costs and carbon emissions, and work towards net-zero targets. The group will give useful input on steps to achieve these aspirations.

Legionella prevention

Legionella outbreaks in hospitals remain

an issue of high importance and the group continues to promote widescale application of CIBSE Guidance TM13 and HSE ACOP documents. Ensuring members get CPD updates will help with the control of legionella – see CIBSE courses and other CPD offerings at www.cibse.org/knowledge

The group is also considering innovative healthcare solutions and their engineering requirements, as well as their impact on the healing and wider ‘public’ environments.

Biophilia

Planting green landscapes with flowers, trees and water features, to support healing and staff productivity through natural ambience – known as ‘biophilia’ – is receiving much attention, and we must ensure building services for healthy plant growth and ‘clean’ water systems are installed and operating.

Green walls are a relatively new and particular ‘green’ feature. They ‘clean’ air via their biology and include a hydroponic system to supply water to the vertical layers of planting, and drainage, which takes away excess water from a low-level gully.

The group is also developing strategies for hospitals in response to the Hackitt review, with better emphasis on competencies, ongoing training, CPD and CIBSE events to achieve excellent outcomes and full and proper project commissioning, completion and handover.

Further information on the group’s activities can be found at www.cibse.org **CJ**

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Healthcare sector to meet in Manchester

The annual Healthcare Estates conference will this year have four streams: strategy and leadership; engineering and facilities management; planning, design and construction; and innovation.

The event will host the International Federation of Hospital Engineering (IFHE) on the afternoon of 9 October, and feature case studies from the US, the Falkland Islands, Germany, and Ireland. These will cover exemplars in hospital design, energy saving, and facilities management.

There are seven exhibition theatres:

- HVAC and engineering
- Infection control and water
- Design and construction
- Training, staffing and apprentice zone, where Troup Bywaters + Anders will discuss its experience with apprentices
- Energy and sustainability, with the Carbon and Energy Fund
- Facilities management
- Fire and security.

There will also be an awards dinner on 8 October, with categories including: Consultancy of the Year; Estates and Facilities Team; Refurbishment Project of the Year; and Sustainable Achievement.

The key speakers will be Simon Corben, director and head of profession, NHS Estates and Facilities, NHS Improvement, and Alasdair Coates, Engineering Council CEO. On 9 October, the speakers will be Professor Michail Kagioglou, dean of the University of Huddersfield, and Alan Sharp, CEO at the Mater Hospital in Dublin.

For the full shortlist, visit

www.healthcare-estates.com 

Healthcare Estates 2019 takes place on 8 and 9 October at Manchester Central Convention Complex

Healthcare Estates will feature case studies from the US, Germany, Ireland and the Falkland Islands

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Ensuring effective foul water drainage in high-rise buildings

This article provides an overview of foul water drainage systems in high-rise UK buildings and considers how enhanced geometry fittings can improve performance and reduce space requirements

As described by the approved document (AD) part H of the England Building Regulations, the prime purpose¹ of a sanitary drainage system in a building is to convey foul water to an external sewer (or appropriate alternative). Sanitary drainage systems should minimise the risk of blockage and leakage, and be accessible to clear any blockages. The installation must prevent foul air from the drainage system from entering the building, and be ventilated so that any foul gases can be released to atmosphere without adversely affecting building occupants.

Surface water drainage carrying rainwater (and melted snow and ice) from gutters and rainwater pipes is collected separately and recycled or, where available, passed into specific surface water sewers. This is discussed extensively in CIBSE Guide G, *Public health and plumbing engineering*.²

For sizing and determining appropriate piping arrangements for soil (named after the euphemism 'night soil') and waste pipes – which are collectively known as foul water drainage – UK installations should conform with BS EN 12056-2:2000 *Gravity drainage systems inside buildings*. This is referenced by the Building Regulations (for example, as described in AD part H of the England Building Regulations) and other standards appropriate to the particular building application and location. Section 3 of CIBSE Guide G² draws the information from a number of sources and provides a good reference when developing designs for building water drainage. Products used in drainage systems should conform to the EU Construction Product Regulation and national requirements – for example, in England this is defined in AD 7 *Materials and workmanship*.³

Foul water is generally defined as waste from a WC or urinal, bidet or appliance used for washing receptacles for foul waste, or water that has been used for food preparation, cooking or washing. When water flows away or is flushed from a fixture, it will first pass through a trap that employs a water seal (normally a water 'trap') to prevent gases from drains and sewers from entering the occupied space. The soil and waste pipes – also known as sanitary pipes – carry water discharged through the

branch pipework into the main vertical soil pipe, or 'stack'. The diameter of the branch pipe is determined not only by the fixtures that drain into it, but also by the distance that it runs before joining the main stack.

The foul drainage system typically applied in UK buildings is what is known – in terms of BS EN 12056-2 – as System III. Under working conditions, traps should retain a minimum seal of 25mm of water and, as specified in the national annex to BS EN 12056-2, for UK class III installations, comprise a static trap water seal of 50mm or 75mm, depending on the particular fixture.

The soil stack is continued upwards above the topmost branch (now solely a stack vent) and this combined soil and vent pipe may provide an outlet to vent foul gasses, as well as being a source of vent air to relieve pressure imbalances. Stack vents may be terminated by an automatic, one-way air inlet valve, but at least one stack vent in the building's system must allow relief of foul gas to atmosphere.

For single domestic applications, small commercial premises and some smaller groups of homes, the guidance in AD part H directly provides the design data to determine »

» the appropriate sizes of sanitary pipework. Larger installations, such as those used in high-rise buildings, are likely to require the more extensive data that is developed in BS EN 12056-2. The stack is typically sized using discharge units (relating to expected flowrates from appliances and fixtures) and a frequency factor that depends on the type of use – for example, house, school, gym, hospital or commercial kitchen. The procedure and calculation method are explained in BS EN 12056-2.

According to Jack,⁴ the UK 'has witnessed a consistent simplification of vent system design – from the use of the two-pipe system in the early 1900s through to the use of the one-pipe and modified one-pipe systems in the mid-1900s, and the development of the single-stack system (commonly used since around 1970)'. The one-pipe system is known formally as a 'primary ventilated stack system'.

The flow down a stack is normally considered as 'annular' – a ring of soil water spiralling down the inside surface of the soil stack. As shown by Jack,⁴ in reality this is not likely to be a simple smooth ring of soil water but, instead, can change shape significantly as it is affected by transients when water enters the stack pipe from the various branches (as illustrated in Figure 1).

As the water flows and swirls down the stack, air is entrained, being drawn down from the top of the stack vent (which is open to atmosphere) and being joined by the air entering as part of the flow from the branches. The flow of fluid from the branches will intermittently interrupt the free flow of ventilating air in the stack, so exacerbating transient pressure variations throughout the stack. If the pressure is sufficiently low, caused

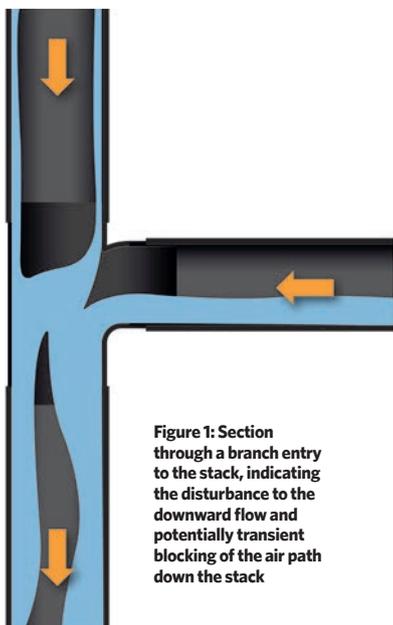


Figure 1: Section through a branch entry to the stack, indicating the disturbance to the downward flow and potentially transient blocking of the air path down the stack

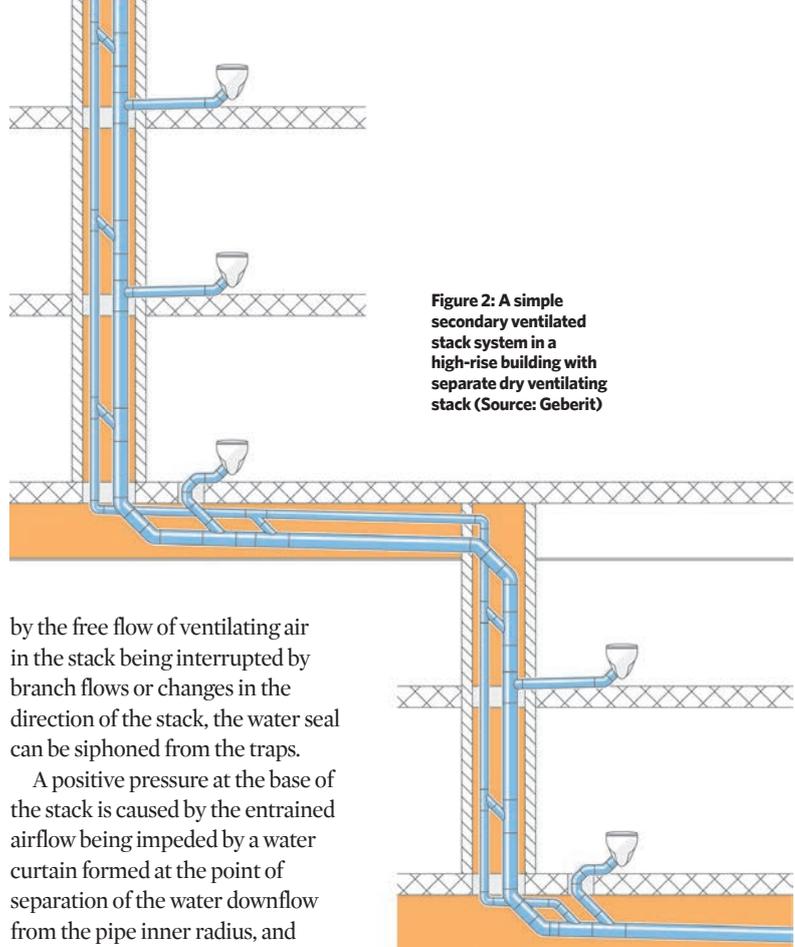


Figure 2: A simple secondary ventilated stack system in a high-rise building with separate dry ventilating stack (Source: Geberit)

by the free flow of ventilating air in the stack being interrupted by branch flows or changes in the direction of the stack, the water seal can be siphoned from the traps.

A positive pressure at the base of the stack is caused by the entrained airflow being impeded by a water curtain formed at the point of separation of the water downflow from the pipe inner radius, and by restrictions in the downstream system. A positive pressure at the base of the stack may compromise (and even 'blow out') the trap for branches close to the base, so BS EN 12056-2 limits how closely a branch waste pipe can connect to the main discharge stack, relative to the base of the stack.

A significant element of the system design process is to ensure the integrity of all water seals, and so prevent foul gases entering the occupied space. Although trap seal loss by suction pressure can be avoided by strategic positioning of mechanical devices such as automatic air valves (AAVs) and waterless traps, these effectively act as closed ends when subject to positive pressures and, therefore, are not able to relieve these positive transients. As suggested by Jack,⁴ these devices have the potential to make the magnitude of the positive transient worse, as they can increase the local airflow velocity halted by the water curtain at the base of the stack.

Transients are particular challenges for multi-storey installations where there can be significantly variable flows from branches, particularly in high-rise buildings where the pressure variations are made more extreme by the numerous and diverse branch connections. To help overcome this, the two-pipe system – formally known as a 'secondary ventilated stack system' – is often employed, where one pipe is a dry ventilating stack used to supply air at intermediate points to the soil stack (as illustrated in Figure 2). Detail and further descriptions of these systems, and variants, are provided in CIBSE Guide G and BS EN 12056-2.

Despite the tried and tested nature of such systems, however, they require significant amounts of pipework and space, as shown in the relatively simple example of Figure 3.

Proprietary systems have been developed that allow branch flows into the main stack without impacting the main downward flow or interrupting the air path. An example of such an enhanced geometry branch fitting is shown in Figure 4.

As the downward flow enters the fitting, a flow divider breaks the annular flow so that, while the flow changes direction in the curve of the fitting, a clear air path is maintained. The smoothly shaped internal profile reinstates the swirl as the water leaves the fitting, and so annular flow passes down the stack. The flow divider allows the main downward flow to continue without being adversely affected by the incoming branch flow, and the rotating movement allows the water to flow around and down the pipe wall, allowing a continuous column of air. The separation of the branch connection from the main flow of the stack maintains airflow, and avoids the negative pressures that may adversely affect water seals. A manufacturer reports that this effect increases the discharge rate of a 100mm fitting potentially by more than 70% (from 6.8L.s⁻¹ to 12L.s⁻¹). Such branch fittings may be applied in UK installations

to obviate the need for a separate ventilating stack, but any offset in the stack will need a ventilating bypass to maintain the open air path. There is increasing application of enhanced geometry fittings to ensure a continuous stack air column with no need for a ventilating bypass.

When the water comes to either an offset or the base of the stack, the water flow transfers to the horizontal. In a conventional bend (standards recommend two 45-degree bends, plus a connection pipe), the flow can break away from the pipe surface and impede the flow of air. The enhanced geometry bend (as shown in Figure 5) employs a flow divider to push the flow of water to the far side of the pipe and then into the guide channel, which maintains the airway as the water transforms to a layered flow. It also assists the flow by reducing impulse losses and, therefore, maintaining the velocity of the water along the near horizontal. As the water flow transfers back to the vertical, following the horizontal run of an offset, the air passage can again be impeded in a traditional, plain bend. The enhanced geometry bend (Figure 6) uses the smooth profiled moulding of the bend's inner surface to reinstate the swirl and provide the transition from layered flow without blocking the passage of the air, while maintaining almost all of the kinetic energy.

As illustrated in Figure 7, such systems can reduce the drainage space required in high-rise buildings by eliminating the need for the ventilating stack, and – if incorporated at an early design stage – could increase the usable floor area. This can also increase the available space under the soffit, so easing the routing of other services and, potentially, allowing more room space or reducing the required storey height.

While high-rise buildings (for example, those of 15 floors or more) increasingly dominate cityscapes in the UK, there are no standards that are specifically applicable for systems in such buildings. In the void left by the lack of specific standards, various manufacturers are bringing new solutions to the market as they identify a need and as the market demands. These can enable more effective systems, but building designers and owners are reliant on the experience of manufacturers and certifications of individual products for bespoke solutions, rather than being able to benefit from standards.

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■ Turn to page 52 for references.



Figure 3: Secondary ventilated stack system installation (Source: Geberit)



Figure 4: Enhanced geometry branch connection for stack pipe (Source: Geberit)



Figure 5: Enhanced geometry vertical to horizontal bend (Source: Geberit)



Figure 6: Enhanced geometry horizontal to vertical bend (Source: Geberit)

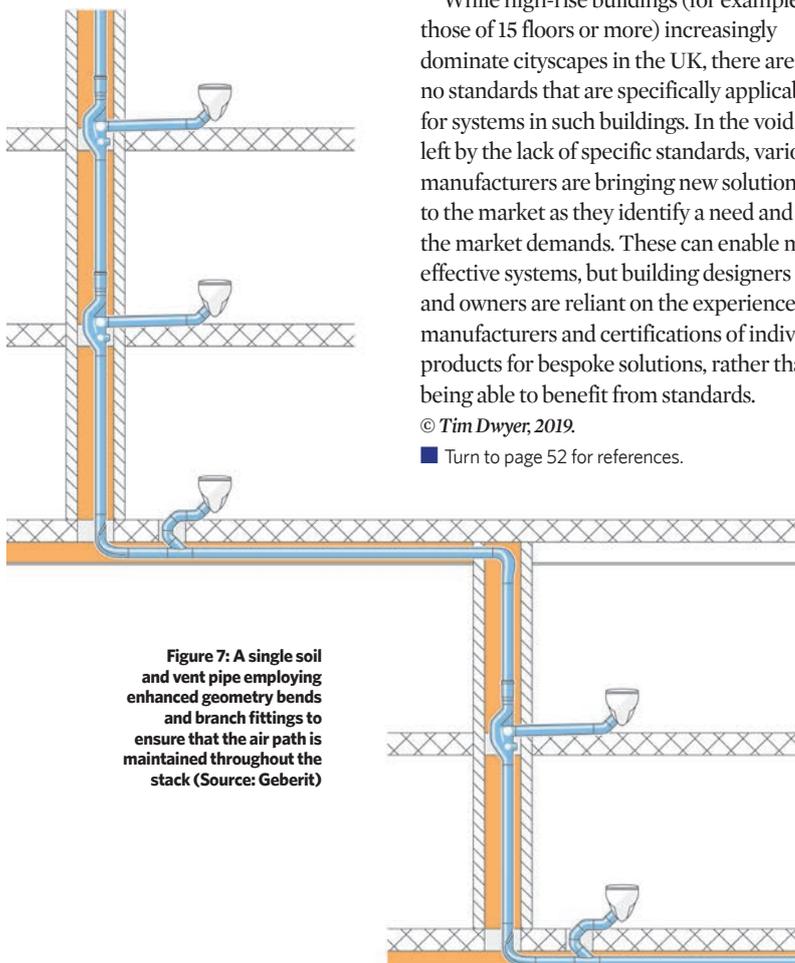


Figure 7: A single soil and vent pipe employing enhanced geometry bends and branch fittings to ensure that the air path is maintained throughout the stack (Source: Geberit)

Module 150

August 2019

» 1. Which CIBSE Guide is specifically related to public health engineering?

- A D
- B E
- C F
- D G
- E H

2. What is the formal name for a single-stack system that does not employ a separate ventilating stack?

- A Positively ventilated stack system
- B Primary ventilated stack system
- C Prime ventilated stack system
- D Principally ventilated stack system
- E Pungently ventilated stack system

3. What is the minimum depth of water seal that should be maintained under working conditions?

- A 15mm
- B 25mm
- C 50mm
- D 75mm
- E 100mm

4. Which of these is always true when considering a soil and vent stack?

- A A separate ventilating stack is inevitably needed
- B Flow is always annular
- C It should always allow air to pass from atmosphere into the stack
- D It provides a direct route for foul air to pass from the stack to atmosphere
- E Sizing is simply based on adding up attached fittings

5. Which of these is not a specific attribute of the enhanced geometry branch connection discussed in the article?

- A A separate vent stack is normally required
- B It employs a flow divider to break the entering annular flow
- C It has a higher discharge rate than a similarly dimensioned plain branch fitting
- D The annular swirl is reinstated as the water leaves the fitting
- E The flow from the branch flow does not directly interrupt the downward flow in the stack

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References:

- 1 England Building Regulations 2010 Approved Document H *Drainage and waste disposal*, NBS, 2015.
- 2 CIBSE Guide G *Public health and plumbing engineering*, CIBSE, 2014.
- 3 England Building Regulations 2010 Approved Document 7 *Materials and workmanship*, NBS, 2013.
- 4 Jack, L et al, *The generation of positive air pressure transients in building drainage vent systems*, Int symp water supply and drainage for buildings, 2002.



◀ CP Electronics' quality recognised with BSI long-service awards

BSI has acknowledged CP Electronics' commitment to excellence with two awards celebrating more than 20 years at the forefront of quality in the industry. The awards are for holding ISO 9001 (Quality) for 20 consecutive years and ISO 14001 (Environment) for 10 consecutive years.

CP Electronics received the honours from BSI's chief operating officer Maureen Smith and managing director Anne Scorey, during a ceremony at the BSI head office in

Milton Keynes on 13 June. It holds the occupational health and safety management system certification (BS OHSAS 18001:2007), and is the only lighting control manufacturer to hold all three of BSI's major standards. Mo Mohanarajan said: 'Our commitment to passing BSI audits with flying colours gives confidence and reassurance to our customers, and has helped drive our growth and success.'

CP Electronics has grown from a local start-up, employing 13 people, to a national business with more than 170 employees and a strong portfolio of products and customers.

■ Visit www.cpelectronics.co.uk

New study: dry air is flu's best friend ▶

Yale University has published a scientific study that indicates that breathing air with a low humidity reduces our immune systems' ability to fight off flu infections. The study shows the need to maintain indoor relative humidity at 40-60% in occupied spaces.

Dave Marshall-George (inset), UK sales manager at humidity control specialist Condaire, said: 'It is relatively simple to maintain a healthy indoor humidity of 40-60% RH using commercial systems.'

■ Visit www.condair.co.uk



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▶ TamLite granted ICEL certification via LIA scheme

TamLite Lighting has secured Industry Committee for Emergency Lighting (ICEL) certification for the manufacture and testing of quality luminaires.

It is the first lighting manufacturer to be given ICEL membership via the Lighting Industry Association (LIA) Quality Assurance scheme.

The ICEL is a division of the LIA, and represents the highest level of legislation in terms of luminaire quality specialising in emergency lighting. Membership confirms that TamLite's technologies and solutions are designed to be effective in the event of an emergency or loss of mains power, allowing a building's occupants to evacuate quickly and safely.

TamLite Lighting's managing director, John Allden, said: 'We were a founding participant of the LIAQA scheme. The ICEL certification is proof that we maintain extremely high standards within the manufacturing process of our emergency luminaires, and this gives our customers an added level of confidence. Reliability and quality are core aspects of our culture - we see both values as essential pillars of our business practices.'

■ Visit www.tamlite.co.uk



▶ Prestigious Partnership Award for Ethos system triumph

Star Technical Solutions was named winner of the Partnership Award at the Temperature Controlled Storage and Distribution Awards 2019 in Peterborough. The joint project with The Ice Co Storage & Logistics received industry-wide attention after Star's revolutionary Ethos energy-management system advised the company on £100,000 per year savings on electricity spend.

Ethos identifies where savings can be made and makes recommendations. The partnership has reduced carbon emissions by 310 tonnes per year at just one of The Ice Co's sites.

■ Visit www.star-ts.co.uk



NEW SMART VIEW CONTROLS

Carrier adds refrigerant monitoring connectivity and new control system to chillers

Carrier has upgraded its AquaSnap 30RBMP-30RQMP chiller range, with the addition of built-in connectivity for fixed refrigerant-leak monitoring and the company's flagship Touch Pilot control system.

The upgrade makes the chiller even easier for end users and maintenance contractors to operate, and helps to reduce the cost of ongoing maintenance by automating checks required under F-gas regulations.

A compatible, fixed refrigerant-leak detection system can now be connected directly to the chiller, linking this vital monitoring function with the chiller's control system. Carrier can supply and fit compatible refrigerant-leak detectors, including all wiring connections between the sensors and the chiller control panel.

Carrier's Prodialog+ control system has been replaced with the Touch Pilot system, which makes the latest control functions available.

The new control system offers alarm notification by email and SMS alert for rapid response, and facilitates easy connection to building management systems.

The option is now available on all new orders of the AquaSnap 30RBMP-30RQMP chiller range, available in cooling capacities from 160kW to 510kW.

■ Visit www.carrier.com

Robust Pumpen Compli comes with a variety of options

The Jung Pumpen Compli is a floor-mounted lifting station with high-quality build, that offers years of reliable operation.

It features a robust, fixed float arm; a bonded metal tank plate for easy pump removal and replacement; a large inspection hatch; and multiple inlet positions and heights.

With more than seven Compli models, and a variety of impeller options and numerous pumping curves for each, careful selection is required to ensure the best match to the application.

■ Call 01189 821555 or visit www.jung-pumps.co.uk



Lochinvar boilers heat historic Glasgow office building



Banbury-based Lochinvar has supplied three high-efficiency condensing boilers to the newly refurbished Baltic Chambers office building in Glasgow.

Three Lochinvar TTB 410 gas-fired boilers, providing a total of 1.2MW of heat output, were specified for the office retrofit because of their efficiency, flexibility and ease of operation. These stainless steel, floor-standing boilers have low NO_x emissions and can achieve efficiencies of up to 95.5% gross calorific value (CV).

Their ability to modulate during operation was of particular interest to the contractor, G8 Energy Solutions. The three-boiler modular installation offers a 24:1 turndown, allowing the system to respond precisely to changes in demand.

The contractor found that the boilers were easy to manoeuvre during installation, as they are relatively lightweight and fitted with castors for ease of handling and positioning. In addition, they feature onboard controls, twin burners for built-in standby, and a triple chamber, stainless steel heat exchanger.

Lochinvar's TTB boilers are suitable for a wide variety of commercial and industrial heating applications, and come in outputs ranging from 418kW to 576kW.

■ www.lochinvar.ltd.uk



Royal Papworth Hospital enters new era

Papworth's association with medicine began in 1918, when it was designated as a specialist tuberculosis (TB) treatment centre. Today, it is a globally renowned transplant centre, and its success over the years was formally recognised in 2017, when it was granted a royal title.

With 300 beds, five operating theatres, a critical care unit and 1,800 staff, the hospital's complex pumping requirements are met by 32 Grundfos pumps. These were carefully selected to meet the stringent requirements of the site and include inline, end-suction and variable-speed circulators, as well as pressurisation units and a range of ancillary equipment.

Ensuring that sufficient water is available where and when it is needed are two MPC-E 4 pump booster sets.

All commissioning was carried out by Grundfos Service. With such an important reputation to uphold, Grundfos is delighted to be playing its part in delivering a clean bill of health to this vital new structure.

■ Visit www.grundfos.co.uk

Reznor's Nor-Ray-Vac radiant tube heating offers uniform heat >

Reznor, part of Nortek Global HVAC, is offering the ErP-compliant Nor-Ray-Vac, a gas-fired continuous radiant tube heating system.

The system is designed to give uniform heat coverage over the entire floor area. It also caters for distinct zones, providing a varied degree of comfort level within the overall layout of the building. With increased comfort, plus a reduction in operating costs of up to 60% compared with conventional systems, Reznor will help keep end users happy.

■ Email erp@nortek.com or visit www.nortek-erp.com



Smart neo-Georgian home kitted out with Panasonic heat pumps

Energy-conscious Vincent and Jacqueline Haines wanted to create an eco-friendly home from their Georgian-style, 570ft² self-build project in Cambridgeshire. This high-spec, six-bed property is heated by two Panasonic Aquarea T-Cap air-to-water heat pumps. 'Panasonic is a well-known, reliable, efficient brand and proved excellent value for money,' said Vincent. 'Our installation was completed 2.5 years ago and, since then, the system has been consistently reliable and energy efficient, with the added benefit of a constant supply of free hot water.'

■ Call 01189 821555 or visit www.aircon.panasonic.co.uk



Minimal wastage, maximum performance with Rinnai's continuous flow hot-water unit

The Rinnai HDC 1200i continuous flow hot-water unit is now available. It has the capacity to deliver more than 1,500 litres of temperature-accurate hot water per hour, with an overall gross efficiency of more than 95%.

The internal analytical system, meanwhile, can modulate the burner from 54kW to 2.4kW.

The Rinnai HDC 1200i is engineered for minimal energy wastage and maximum energy performance. It has lower greenhouse emissions because of the new reduced-NO_x burner technology.

■ Email barryl@goodpublicity.biz or visit www.rinnaiuk.com



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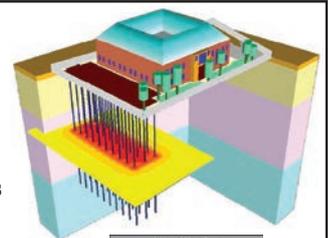
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North London, to £60k + bens

Award winning sustainability focused consultancy known for delivering new build developments and refurbishments of existing buildings, and adapting iconic and listed buildings for new uses, is seeking an engineer to lead notable projects in the UK, including the Channel Islands. Rapid progression, great benefits/package offered to a natural, client facing leader. Work will include both planning and detailed design stages. Ref: 5476

Electrical Technical Director

London, £75k - £95k + bens

My client has been established since the early 90's and has grown from a fledgling London practice to a global thought leader in environmental design. The ethos of the business is to design buildings that will tread more lightly on the planet and they take huge pride in doing so. This is evident through the number of awards on multiple projects including; RIBA London Award, RIBA Building of the Year, RIBA South Award, Sustainability Award and many more. Ref: 5505

Electrical Associate - Associate Director

London, £70k - £80k + bens

Electrically bias data centre specialist required at Associate level to join an international multi-disciplinary consultancy in their central London office. The successful candidate will possess excellent understanding of electrical building services as well as knowledge of standard practices in the design and delivery of mission critical projects, including latest ASRAE guidelines and Uptime Institute TIER ratings, be responsible for concept and detailed design, project budget, project quality management, apply company guidelines and standards across the portfolio of projects, and production of project reports. Ref: 5378

Senior Mechanical Design Engineer

London, £50k - £55k + bens

The consultancy I am working alongside employ well over 500 staff across the globe, with a network of offices in the UK, Europe, Middle East, North Africa, Asia, and Australia. They have worked on an impressive list of projects across a variety of sectors including commercial, retail, mission critical, luxury hotels, residential, healthcare, and education. Ref: 5560

For further information and to apply, please call us on **+44 (0)203 176 2666** or email cv@b-a-r.com

Senior Electrical Engineer

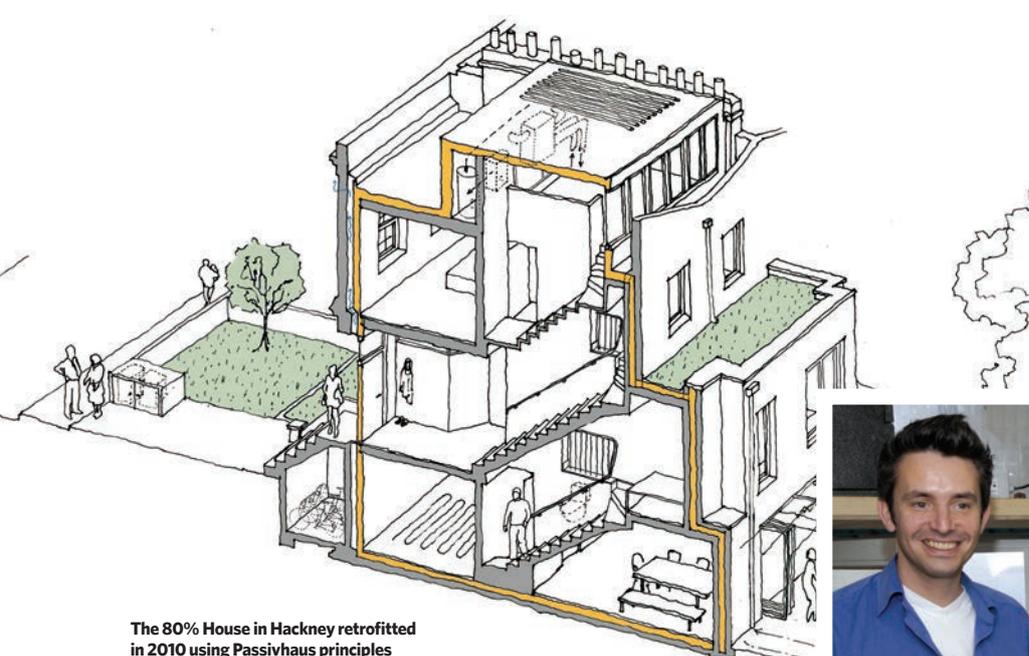
London, £41p/h

Work with one of London's leaders providing design and project management across some of the most complex projects within the commercial sector. As the electrical engineer, you will need 5 years+ experience of design within the commercial sector. You will need strong technical skills and be fully proficient using Amtech, Dialux and AutoCad. Good working knowledge of lighting & power design is essential. Ref: 5558

Senior Mechanical Engineer

London, £42p/h

A requirement for a Mechanical Engineer to work on a commercial office new build and fitout project. Part of the role is working with the client monitoring team on a 800,000 sqft new build office development which has a high level of resilience with redundant systems. The role will involve assessing tenant options, undertaking feasibility studies, monitoring the novated contractor design for compliance, attending client meetings as well as workshops with architects, and contractors. Ref: 5566



The 80% House in Hackney retrofitted in 2010 using Passivhaus principles



Retro stock response

Architect and certified Passivhaus designer Robert Prewett discusses the principles that should underpin low-energy retrofit projects

Heading up the London office of Prewett Bizley Architects, Robert Prewett has developed considerable expertise in low-carbon construction, particularly in the area of retrofit. A founder member of the Passivhaus Trust, he is a certified Passivhaus designer, as well as a technical adviser to the Sustainable Traditional Buildings Alliance. Prewett was involved in one of the earliest Passivhaus retrofit projects in the UK, completed in 2011 in Balham, London. Funding was secured from the Technology Strategy Board to develop and implement carbon-reduction measures to create a low-energy, high-comfort home for the Family Mosaic Housing Association. Since then, his firm has delivered many innovative low-energy buildings and retrofit projects. Prewett will present a seminar – ‘Surveying tools for existing buildings’ – on the second day of CIBSE’s Build2Perform event, at Olympia, London, on 26-27 November. He will explore the practicalities of planning, implementing and evaluating retrofit projects.

What have you learned since your first Passivhaus retrofit?

Ten years on, our approach is very similar, albeit more nuanced. We spend proportionally more time at the start, carrying out surveys, so that our design work can be more focussed and resolved. Getting the scheme right as quickly as possible and on budget is the real art, and it requires an intensive burst of work at the start, based on our collective experience.

What can homeowners do to improve housing stock?

Lots! Most UK homes have very little insulation and poor windows, so they tend to consume large amounts of heat. By dealing with these shortcomings, energy use can normally be reduced massively. Before piling on the insulation, homeowners should engage a specialist to survey the house and produce a whole-house retrofit plan. This might include remediation work that should be done first, and ensuring that an adequate ventilation system is fitted alongside the energy efficiency measures.

How much is Passivhaus part of the solution? Is it achievable?

We don’t believe Passivhaus heating demand is for every home, but the awareness and knowledge underpinning Passivhaus is essential. Avoiding overheating is at least as important now as heating demand in the winter. Making deep cuts in energy demand from our housing stock remains an imperative, without which we will miss

our carbon-reduction targets and be locked into fuel poverty – and health and comfort issues – for the long term.

How can government encourage more green retrofits?

For homeowners, who carry out tens of thousands of extensions and other home-improvement projects each year, the opportunity is there, but the additional cost is a major disincentive. If VAT was partly – or fully – relaxed for projects involving deep low-energy retrofit work, the cost issue would be a no-brainer, and a market delivering thousands, or tens of thousands, of deep retrofits annually could be brought into being. There is a petition to zero rate VAT on deep low-energy retrofit projects at petition.parliament.uk/petitions/264073

How do we adopt circular principles in retrofit? Can more be done to reuse and recycle?

The construction industry is profligate when it comes to waste, and the domestic refurbishment/retrofit market is very much part of that problem. A change has to start with design. In my own retrofit, we reused timber joists that we cut out as part of the reconfiguration process. This was possible because we surveyed the timbers before we carried out the design process. We have also downcycled waste from demolished block partitions as hardcore for landscaping.

Onsite management is also important in terms of sorting and storing materials for reuse. We have actively arranged the transport of floorboards from one building, where new floors were going down, to other projects where we were short of historic boards. Spare timber beyond that can often find a grateful home with community groups.

The supply chain needs to deal with the problems presented by offcuts of plasterboard and insulation, as well as packaging.

How do we ensure people manage their housing systems?

Systems need to be simple, few in number, thoughtfully located and intuitive to use. At home, I have one thermostat/programmer in the living area. We tend not to use it, as the temperature hardly varies in the cooler months. We will fit a mechanical ventilation with heat recovery programmer next to the unit, but I don’t expect to change it very often after commissioning, except for a boot button located in the kitchen.

EVENTS

NATIONAL EVENTS AND CONFERENCES

Young Engineers Awards 10 October, London

Hear the Young Engineer finalists present before the 2019 winner is crowned – and find out which companies have gone the extra mile in mentoring and supporting their staff, in the Employer of the Year awards.
www.cibse.org/yea

Build2Perform Live 26-27 November, London Olympia

The free-to-attend event brings people together to learn about, discuss and collaborate on the current issues that are vital for delivering better building performance. With more than 60 sessions delivering high-quality content from around 90 speakers, and 70-plus exhibitors from major manufacturers and suppliers.
www.cibse.org/b2plive

CIBSE TRAINING

For details, visit
www.cibse.org/training
or call 020 8772 3640

Energy Savings Opportunity Scheme 1 August, London

Practical controls for HVAC systems 1 August, London

Fundamentals of digital engineering (including BIM) 6 August, London

Sanitary and rainwater design 6 August, London

Fire sprinkler systems: design to BS En 12845 7 August, London

ISO 50001 2018 half- day update 14 August, London

The importance of energy efficient buildings 4 September, London

Power system harmonics 6 September, London

Building services one- day overview 10 September, London

Low carbon consultant design training 10-11 September, Manchester

Gas safety regulations (designing for compliance) 11 September, London

Low and zero carbon energy technologies 12 September, London

Energy monitoring and targeting 17 September, London

Building services explained 18-20 September, Birmingham

Mechanical services explained 18-20 September, London

Successful design management 18 September, London

Fire risk assessment to PAS 79 20 September, London

Low carbon consultant building operations 24-26 September, London

CIBSE GROUPS, SOCIETIES AND REGIONS

For more information
about these events, visit:
www.cibse.org/events

South West: summer social 2 August, TBC

A games night summer social.

West Midlands: summer social 3, 4, 24 and 25 August, Shrewsbury

Visit to Loton Park speed hill climb to see a wide variety of sports, classic and racing cars.

Northern Ireland: golf social

8 August, Bangor

Golf, followed by a meal at the clubhouse.

ANZ Western Australia: Mates in Construction – suicide in the construction industry

6 August, West Perth

With speaker Brad Geatches and Damien McVeigh, of charity Mates in Construction WA, aiming to reduce suicide in construction.

North West: Summer BBQ

14 August, Manchester

BBQ with CIBSE-accredited CPD from Zumbotel, entitled 'Evolving Workspace'.

West Midlands YEN: Summer Social

29 August, Birmingham

Networking, drinks and food.

Northern Ireland: golf social

5 September, Carryduff

Golf, followed by a meal at the clubhouse

Scotland: indoor air quality

11 September, Glasgow

An overview of key concepts and components of city pollution, its causes, effects, standards and solutions that reduce risk to the health and wellbeing of occupants.

ANZ Awards

12 September, Melbourne

ANZ annual Cocktail Function and Young Engineers Awards, at the Melbourne Gallery.

ILEVE Scotland & North regional events

18 September, Edinburgh

Dean Greer and Adrian Sims, will discuss how to develop ILEVE and LEV Scotland and the north of England.

HCNE: Wind design for building enclosures

24 September, London

Speaker Stefano Cammelli, WSP technical director, will give an overview of some wind engineering challenges associated with the design of building enclosures.

The 2019 Passive House Canada Conference

17-18 October, Scarborough

The University of Toronto event will cover latest projects, best practices, and lessons learned from experts in high-performance building science.

www.phcc2019.com

HIGHLIGHT



Stefano Cammelli, WSP, will speak at wind design event on 24 September

Western Australia: IoT – the neurology of building operation

- 3 September, Perth (pictured)
- 10 September, Sydney
- 12 September, Melbourne
- 17 September, Auckland
- 19 September, Queensland

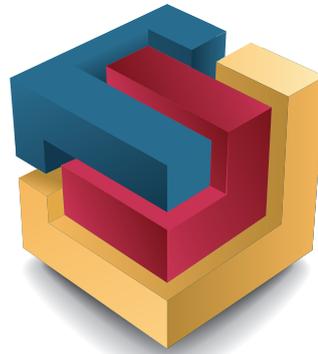
The ANZ seminar series returns with a look at the Internet of Things (IoT) for better building operation. It will help attendees navigate the magnitude of available data to maximise a building's potential and deliver a balance between occupant comfort and operational efficiency. The series will also share examples of how IoT is delivering smart precincts, smart transport integration, human-centric design and more. Presenters include: Peter Greaves, buildings of the future leader, Aurecon; Shelly McDowell, director, CBRE; Jon Clarke, head of smart building technology delivery, Dexsus; and Hywel Davies, technical director, CIBSE.

www.cibse.org/cibse-anz-2019-seminar-series





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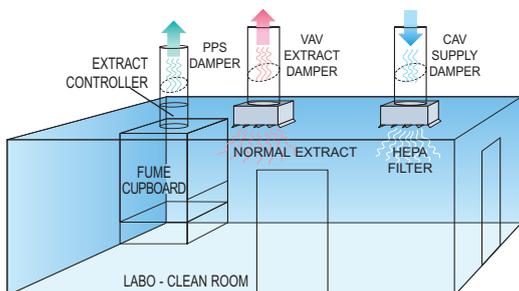


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