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The annual CIBSE Building Performance Awards are guaranteed to raise the spirits of attendees, even on the greyest of February days. The event showcases engineering best practice and, when you're celebrating the best the industry has to offer – in London's glittering Grosvenor House Hotel – it's easy to forget about the trials and tribulation of everyday construction projects.

However, the awards are an important reminder of what we are striving for: buildings that perform in operation and not just on paper. Guest speaker Dr Sarah Prichard – BuroHappold Engineering's managing director – neatly summed up the key issues. She said building performance did not happen by accident and

that there needed to be a collaborative design process, in which client, architect and a 'united' engineering team establish a vision that is referred back to constantly.

Dr Prichard said the selection of a contractor that understood the vision was crucial – as was painstaking dedication to commissioning buildings properly, which she had experienced at the Louvre Abu Dhabi. She called for post-occupancy evaluation of occupants and the mass collection of data from buildings – and not just from 'the jewels in the crown', such as the Urban Science Centre, which won Project of the Year – Public Use for BuroHappold.

Prichard also shared her experiences as a female engineer. She said she had spent much of her early career trying not to draw attention to her gender, but now wanted to encourage more women into the industry by speaking openly about the 'joy, excitement and respect I've had as a woman in building engineering'. Consulting engineering was for everyone, she added, and the 'collaborative nature displayed by women is often of benefit to teams as they look to problem solve and create optimum design solutions'. She also reminded the audience that diversity went beyond gender and that greater success would come to teams comprising people with diverse thoughts, experiences and ideas.

A prime example of such success is Clara Bagenal George, who launched the London Energy Transformation Initiative (Leti). Bagenal George was named Building Performance Engineer of the Year and her CV is an inspiration to any woman thinking about a career in the industry. She has brought together people who may only ever have come across each other in adversarial roles on difficult projects. Not only has she persuaded them to sit down and address some of the pressing issues around building energy, but she has got Leti recommendations adopted into the draft London Plan. On page 40, Bagenal George describes Leti's plans for a roadmap to net-zero carbon, and the engineering that will help decarbonise our building stock.

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CIBSE's technical manager considers the government's policy options for meeting carbon-reduction targets



Tim Dwyer

CPD module number 142 looks at carbon dioxide in building services engineering


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CPD

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Mirvac crowned overall winner at awards

Australian developer triumphs at CIBSE Building Performance Awards 2019

Mirvac has been crowned CIBSE Building Performance Champion, after judges named its 200 George Street office in Sydney the International Project of the Year at the annual CIBSE Building Performance Awards last month.

The judges described the scheme as 'an exemplary project' and praised the company's 'truly holistic approach to building performance and wellbeing'.

The tower has a 5.5 Nabers star rating for Offices Indoor Environment and a Gold rating under the Well Building Standard.

Other big winners on the night were BuroHappold Engineering and Cundall, which each won two awards.

BuroHappold was judged the best Building Performance Consultancy (over 1,000 employees) while Cundall won the equivalent category for 101-1,000 employees.

BuroHappold also won Project of the Year - Public Use for the Urban Sciences Building, Newcastle University (see 'Sensor sensibility',

CIBSE Journal, December 2018), while Cundall picked up the Learning and Development award for the Cundall Diploma.

Elementa Consulting senior engineer Clara Bagenal George was named Building Performance Engineer of the Year, in part because of her work in launching the London

Energy Transformation Initiative (see pages 40 and 73). The winner of the Building Performance Consultancy (up to 100 employees) was WARM: Low Energy Building Practice. The judges said it was developing Passivhaus with the supply chain in an innovative way.

See page 22 for details of all the winners.

Dr Sarah Prichard says diversity needs to go beyond gender



Guest speaker Sarah Prichard, managing director at BuroHappold Engineering, told the audience about her experiences as a female engineer.

She described her time in the Middle East, where there are few senior women engineers. Prichard said she was able to gain respect without 'thumping the table', by demonstrating her engineering competence and willingness to solve issues on site. Her proudest moment while there was when male colleagues told her they 'were inspired to think differently about their wives and daughters, and what they might achieve'.

However, Prichard also spoke about how inclusivity and diversity 'needs to go well beyond gender'. 'We need to have teams comprised of people with diverse thoughts, experiences and ideas,' she said, 'and all of them need to feel they can make an equal contribution to success.'



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Homes unfit for climate change challenge, says CCC

Committee calls for urgent government action to future-proof UK housing stock

Experts have warned that the UK will not meet legally binding climate change targets without the near elimination of greenhouse gases from buildings. In its report *UK housing: Fit for the future?*, the independent Committee on Climate Change (CCC) says that emission reductions from 29 million homes had stalled, and emissions from energy use in homes had increased between 2016 and 2017.

The committee's report supports the findings of Dame Judith Hackitt's review into Building Regulations. It notes that UK building standards are inadequate, overly complex and not enforced, and that local authorities have insufficient resources, and are largely failing to address the need for low-emission, climate-change resilient homes.

The technology and knowledge to create high-quality, low carbon, resilient homes is available, the committee said, but current policies and standards do not drive the scale or pace of change needed. It called for urgent regulation to address overheating risk in homes.

Baroness Brown, chair of the CCC's Adaptation Committee, said: 'This report confirms what we have long-suspected: UK homes are largely unprepared for climate change. The government now has an opportunity to act. There must be compliance with stated building designs and standards.'

The report criticises the withdrawal of the 'zero carbon homes' policy and the weakness

of the home insulation market. It notes that policies to encourage property-level flood protection, water-efficiency devices and window shading are weak or non-existent.

The committee wants government action to improve the quality of UK homes, reduce greenhouse gas emissions, and safeguard comfort, health and wellbeing as the climate changes. Its report identifies five priority areas (see below) and makes 36 recommendations.

CIBSE technical director Dr Hywel Davies said: 'We have to address the demands for change created by the urgent need to decarbonise the built environment while delivering the radical changes called for by Dame Judith's review (see page 9). The combined pressure of these, as we leave the EU, is a challenge to which we have to rise.'

Five priority areas

- 1 Performance and compliance:** The way new homes are built and existing ones retrofitted often falls short of stated design standards.
- 2 Skills gap:** The chopping and changing of UK government policy has led to a skills gap in housing design, construction, and the installation of new technologies.
- 3 Retrofitting:** Ensuring existing homes are low carbon and resilient to a changing climate is a major infrastructure priority, and must be supported as such by the Treasury.
- 4 Building new homes:** These should be built to be low carbon, energy and water efficient, and climate resilient.
- 5 Finance and funding:** There are urgent funding gaps which must be addressed, including secure UK government funding for low carbon sources of heating beyond 2021, and better resources for local authorities.

IN BRIEF

CO₂ to rise by record amount in 2019...

The amount of carbon dioxide (CO₂) in the atmosphere could rise by a record amount this year, according to the Met Office. Continued fossil-fuel burning is being exacerbated by natural climate variations, including an expected *El Nino*, which will lead to warm, dry conditions that restrict plant growth and reduce CO₂ absorption.

Greenhouse gases are said to be at similar levels to those of between three and five million years ago, when global temperatures were more than 2°C higher and sea levels up to 20 metres above where they are now. The past four years have been the hottest on record. The Met Office predicts an average rise of 2.75 parts per million (ppm) over 2019, which would be one of the fastest annual rises since records began more than 60 years ago.

... but UK carbon footprint down 38%

The UK's total carbon footprint has fallen by 38% since 1990, when coal accounted for 67% of its energy mix; it is now just 5%, says research firm Carbon Brief.

According to official government figures, the UK's total carbon footprint was 600m tonnes of CO₂ (MtCO₂) in 1990, but had fallen to 367MtCO₂ in 2017. Without the dramatic growth in renewable power in recent years, Carbon Brief claims overall carbon emissions would be double what they were in 1990 and emissions from electricity generation four times higher than present levels.

School resilience focus of CIBSE investigation

The CIBSE School Design Group is to investigate the impact of longer-term climate change projections on new and existing schools.

It will focus on the resilience of teaching environments to climate change scenarios, and the performance of passive design approaches to providing comfort.

The design group will review the latest developments in thermal modelling and feedback from post-occupancy evaluations.

The work will be informed by UKCP18 climate change projections, government policy for climate change adaptation and other industry guidance. For more, visit bit.ly/CJMar19NewsCSG

SES ENGINEERING SERVICES WINS CAMPUS CONTRACT

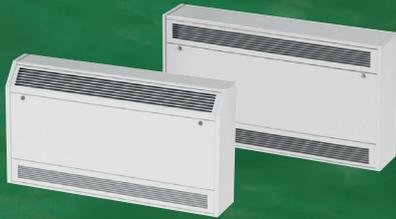


SES Engineering Services is to deliver the design and build M&E package for a £17.9m shared campus and community scheme for two schools in Airdrie. The project is part of North Lanarkshire Council's £100m school estate programme and the main contractor is Morgan Sindall Construction & Infrastructure. St Edwards and Tollbrae Primary schools are currently run from adjacent buildings close to the new campus, which is being built on their playing fields. The new building will have two classroom wings connected by a gym, dining hall and multipurpose rooms.

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Landlords may fall foul of network regulations

Industry experts warn that heat networks could pose new legal risks for landlords and developers

Heat is now more regularly offered as part of a package of services to tenants, but to comply with the Heat Network (Metering and Billing) Regulations 2014, suppliers have to install heat meters and issue bills based on actual consumption. Bundling heat costs within service charges runs the risk of civil and criminal proceedings, according to speakers at an event hosted by heat network data supplier Guru Systems.

'Heat networks are seen as a major part of the government's plans to decarbonise the UK economy,' said Guru Systems' managing director Casey Cole. 'They are a common planning requirement for developers in most cities and many new housing schemes in London must be on a heat network. That means more developers are adding the role of energy provider to their services. The Competition and Markets Authority and the government feel the sector now needs to be regulated to ensure sufficiently high technical standards and a quality experience for end users.'

Some landlords claim charging for heat based on metered consumption is not allowed for in their existing leases - but, says Sandy Abrahams, partner at energy law firm Lux Nova, this would not be enough to avoid compliance with the regulations. 'It can be a criminal or civil offence not to comply... so the safe approach is to assume the regulations will apply, and that will mean making preparations for amending those leases.'



Inaccurate EPCs putting illegal homes on the market

Landlords may be renting out as many as 35,000 properties illegally because of inaccurate Energy Performance Certificates (EPCs), according to a new report. *Impacts of inaccurate area measurement on EPC grades*, published by property technology firm Spec, claims that up to 2.5 million EPCs are probably inaccurate and, so, an estimated 35,000 E-rated properties should not be on the market.

Discrepancies are emerging because the measurement techniques used by domestic energy assessors can lead to errors in floor-space calculations of as much as 27m². The report states that a 1% difference in the area of a property could be turning E-rated homes into F-rated ones in some cases.

Spec's senior adviser, Antony Browne, said: 'Inaccurate EPCs present serious challenges and risks not only to property professionals, consumers and estate agents - but also the environment.'

No-deal Brexit alarm hits construction project starts

Sharp drop in construction activity since end of 2018 reflects fears over EU exit

Market surveys have shown January to have had the slowest growth rate in new construction projects for 10 months, which may reflect rising alarm about the possibility of a no-deal Brexit.

IHS Markit and the Chartered Institute of Procurement and Supply said there had been a sharp drop in activity since the end of 2018, with purchasing managers blaming 'Brexit anxieties'.

The Markit/Cips UK construction purchasing managers' index of business activity dropped to 50.6, from 52.8 in December, which was well below the forecasts of City economists. According to the index, anything below 50 indicates that a market is shrinking.

London is reported to be at most risk if there is a no-deal Brexit, while relatively buoyant regional cities would not be able to compensate for the shortfall in the capital, according to commentators.



The research also revealed that construction firms are hiring at the slowest pace since the EU Referendum in July 2016, as market optimism fell and clients adopted a 'wait and see' approach before finalising investment decisions.

The surveys showed that commercial building was the poorest performing sector and homebuilding the strongest.

'Perfect storm' for engineering services

Building engineering contractors are facing a perfect storm of falling growth alongside rising material and labour costs. This is according to the latest quarterly Building Engineering Business Survey, carried out by the ECA, BESA, Scotland's electrical trade association, (Select) and the Scottish and Northern Ireland Plumbing Employers' Federation.

While a quarter of the businesses surveyed reported increased turnover, another 25% said turnover had fallen in the final quarter of 2018. Outlook for the first quarter of this year was also subdued, with three in four respondents saying they expected their turnover to stay the same or fall.

At the end of last year, 61% reported rising material prices and almost half said labour costs were also up, which was leading to a squeeze on margins, according to ECA chief executive Steve Bratt. 'The current business climate is challenging, with firms facing the knock-on effects of Brexit uncertainty, more challenging contractual conditions, and ongoing payment issues,' said Bratt.

His counterpart at BESA, David Frise, added: 'The challenge for contractors across the sector is maintaining cash flow in a climate where payment issues still reign.'

Industry facing radical change



Dame Judith Hackitt

CIBSE technical director Hywel Davies believes the UK building services industry is facing an unprecedented combination of drivers that will lead to 'radical change'. During his annual policy update for members of the CIBSE Patrons, Davies said the Independent Review of Building Regulations, Brexit and the UK Climate Change Act represented 'three significant pressures'.

'Dame Judith [Hackitt] stated that the current system for ensuring safety in buildings was broken - that is not a phrase to use lightly,' he said. 'Reform is inevitable because history shows that every other sector to have experienced a major disaster has been subject to significant regulatory changes. Building safety is the highest legislative priority for England after Brexit.'

Davies said more than 100 civil servants were working full time on the building safety programme and the Communities Secretary, James Brokenshire, had committed to bringing

forward legislation 'at the earliest opportunity'. A full technical review of Part B of the Building Regulations (covering fire safety) is also under way. Parts L and F will also be reviewed this year, including the problem of overheating in buildings, and the Department for Business, Energy and Industrial Strategy is developing a strategy for decarbonising heat that may include replacing natural gas with hydrogen.

Hackitt has challenged the industry to come up with a more rigorous system of oversight for professional competence, and Davies thinks it could lead to the creation of a body for construction similar to the General Medical Council, which oversees doctors' competence.

'The key message is that business as usual is simply not an option,' said Davies. 'Construction managed to remain impervious to major change initiatives in the past - such as those spearheaded by Sir Michael Latham and Sir John Egan - but this time will be different. The legacy of Grenfell will be that construction has no alternative but to embrace reform.'

While leaving the EU will have some impact on UK environmental legislation, Davies believes most EU measures will remain in place because they are essential to the success of the Climate Change Act.



Past SLL president Lou Bedocs dies

Past president of the Society of Light and Lighting (formerly the Lighting Division) Lou Bedocs has died. His career in lighting spanned more than 60 years, most of which were spent at Thorn where he began as an electrical industries indentured apprentice. Bedocs committed much of his time to lighting education, research and the development of standards. He was also a previous CIBSE vice-president and received the SLL President's Medal, SLL Lighting Award and was Honorary President of the Lighting Industry Federation.

IN BRIEF**Hurley Palmer Flatt buys digital consultant**

Engineering consultant Hurley Palmer Flatt (HPF) has bought the digital information and BIM management business Concentre Consulting for an undisclosed sum.

Concentre will operate as an independent subsidiary of the HPF Group to offer 'standalone or combined services'.

'Our investment... is another step forward to support buildings becoming a digital asset,' said HPF Group chair and CEO Paul Flatt. 'This will give our clients the ability to accelerate their own digital transformations, to adopt proven processes, drive new digital tools and understand the cultural organisational changes required to deliver in a digital environment.'

Troubled Interserve secures rescue plan

Interserve will reduce its debt from £600m to around £275m as part of a rescue package that involves issuing new shares.

Existing lenders will supply another £75m of liquidity and the giant firm – which was thought to be on the brink of financial collapse – will issue around £480m in new shares.

CEO Debbie White said: 'The board believes this agreement will secure a strong future for Interserve. This proposal has been achieved after a long period of intensive negotiation, and has the support of our financial stakeholders and the government.'

Domestic energy efficiency slows down

Energy efficiency levels in English homes has not increased since 2015, according to a new edition of the English Housing Survey.

The average SAP rating has been steady at 62 points for three years. While this is a major improvement on the 45-point average in 1996, there was no change in the average rating of homes between 2016 and 2017. The survey also reported that 25% of privately rented homes do not meet the Decent Homes Standard, which requires tenants to experience a 'reasonable degree of thermal comfort'. That figure falls to 19% for owner-occupied homes and 13% for social housing.

However, the overall proportion of 'non-decent' homes has fallen from 35% in 2007 to 19% in 2017.

Warning of fire-break failures two years before Grenfell

**BRE studies highlighted danger of fire spreading in concealed cavities**

Studies commissioned by the government, and carried out by BRE, two years before the Grenfell Tower tragedy, highlighted the danger of fire spreading through concealed cavities and called for a change to the Building Regulations.

BRE experts analysed 20 fires between 2003 and 2013, and explained to officials at the then Department for Communities and Local Government that some fire barriers were 'found to be missing or incomplete, or incorrectly positioned'. The Ministry of

Housing, Communities and Local Government (MHCLG) said the reports – which were received in 2015 – were now being made public as part of its review of fire regulations in the wake of Dame Judith Hackitt's review.

Grenfell Tower was being refurbished at the time, but the reports were treated as confidential, although BRE also said it transmitted its findings to the industry.

'Poor workmanship with inappropriate materials are the main reasons for the inadequate protection of concealed spaces,' one of the BRE studies reported. It added that these concerns were not disputed by manufacturers, but that 'there are no drivers to encourage more effective solutions to be developed'.

Melbourne tower had combustible cladding

An apartment complex in Melbourne, Australia, which was engulfed in fire last month, had the same combustible cladding as that used on London's Grenfell Tower, according to local firefighters.

Nobody was seriously injured in the fire, which spread up the exterior of the building to the 27th floor, but was brought under control within an hour. Sprinklers were activated on four floors and 150 residents evacuated.

Developers 'ignoring' sprinkler advice

The London Fire Brigade (LFB) says housing developers are 'consistently ignoring' its advice to fit sprinklers in new residential buildings.

The LFB carried out spot checks on 15 new or refurbished blocks and found that just two had sprinklers fitted. It wants Part B of the Building Regulations to include sprinklers as a mandatory measure in all 'purpose-built blocks of flats' or in all blocks more than six storeys high 'at the very least'. It also advises their use in all buildings housing 'vulnerable residents', including care homes and sheltered accommodation, and wants sprinklers to be retrofitted in older residential blocks.

'To ignore brigade fire-safety advice is reckless and the government needs to act now,' said LFB Commissioner Dany Cotton, who added that the LFB's spot checks had proved that the construction industry was not able to self-regulate. 'Although we are telling people that sprinklers will save lives, we can't force developers to fit them.'

The regulations already state that sprinklers should be installed in new tower blocks above 30m, but Simon Rooks, of the British Automatic Fire Sprinkler Association, believes their use should not depend on building height or whether a building is old or new. 'We urgently need a solution that ensures sprinkler systems become an integral component in fire safety systems across the country,' he said.





UK productivity could rise by 8% – equivalent to an extra £20bn in GDP – if workplaces are created using **human-centred design**.*

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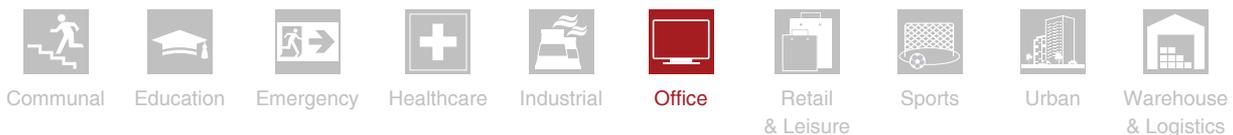
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Students should pull out all the stops for the President's Prize

Entries are now open for the CIBSE Undergraduate Award, sponsored by Hays Building Services. The award is open to all CIBSE student members in their final year of BSc, BEng and MEng study, and is designed to encourage undergraduates to develop their potential and aim for excellence.

Entrants must submit a 2,000-word synopsis of their final-year project, plus a completed application form. A judging panel will look for evidence of excellent understanding and knowledge in building services engineering, science and design, as well as originality and high-quality visual information.

The winner will receive a £500 cheque and trophy, presented at the President's Award dinner in October. Two runners-up will each receive £100. For more information and to enter, visit www.cibse.org/awards. Entries must be received by 19 July.

Recognition for regional volunteer

Kevin Barrett, an outstanding volunteer for the Home Counties North West Region for seven years, has been presented with the Region's Medal and his CIBSE Certificate of Commendation. An elected committee member, Barrett contributed to events on disaster recovery and the HCNW panel discussion on improving building performance, reported in the *Journal* (April 2017) and in Stuart Huggins' dissertation posted on the CIBSE website.



Kevin Barrett, with his wife Irene, receiving the Region's Medal and his CIBSE Certificate of Commendation

Young engineers' unique opportunity to learn

Ken Dale Bursary offers chance to gain a new perspective through travel

CIBSE members in the developmental stage of their career, who would like to spend three to four weeks abroad researching topics connected to their field of work, should put themselves forward for the Ken Dale Travel Bursary 2019.

Now open for entries, the award offers between £1,500 and £4,000 to young building services engineers who would like to experience technical, economic, environmental, social and political

conditions in another country, and examine how these affect the practice of building services engineering.

The application process involves an initial written application, followed by a presentation to a CIBSE panel. Applicants must demonstrate the benefits of their trip to CIBSE, their company, clients and their own development.

Last year, for the first time, there were two winners – Lucy Pemble and Antoni Sapina-Grau. Pemble travelled to Zambia, South Africa, America and Wales to research her report *Demand management: photovoltaics, electric vehicles and the strive for decarbonisation*. Sapina-Grau's paper, *Resilience and adaptive capacity for upcoming climate challenges*, took him to China, Hong Kong, Australia and America.

'It's not every day you get funded to travel the world and research a topic of your choice,' said Pemble. 'The experience has been a positive one. I have been challenged and, as a result, have grown in knowledge and confidence in my practice.'

Sapina-Grau said: 'Winning the bursary means gaining a new perception by visiting different countries, meeting engineers around the world, and experiencing new ways of working. It's a unique opportunity to discover, learn and develop things that are not written in textbooks.'

Entries must be received by 12 April. Visit www.cibse.org/kendale



Lucy Pemble (far right) in Zambia

Switch-on for lighting award

The 25th Society of Light and Lighting (SLL) Young Lighter of the Year competition is now open for entries.

Some outstanding winners and incredible projects over the years have helped cement this award as an invaluable stepping stone for lighting professionals in the early stages of their career. It is open to anyone with an interest in light and lighting, and entries can be on any light-related topic – from design, events, products or art installation, to name but a few examples.

Last year's winner, Emma Beadle – a lighting engineer at WSP – won for her paper *Children's utopian vision of the city: co-designing lighting masterplans through play and exploration*. This described how she engaged with young children on lighting design using co-design methods of working around observation, interviews and workshops. You can watch her video presentation, and those of the other three 2018 finalists, at bit.ly/2to1toS

Entries must be received by 10 May, and this year's winner will receive a cash prize of £1,000. For further information and details of how to enter, visit www.cibse.org/sll





Helping hand with your membership

Planning your CPD for 2019? Is professional membership one of your goals? Join our half-day CIBSE Membership Application Workshop on 19 March to prepare yourself for the 1 August deadline. We will help you get started on your MCIBSE or ACIBSE application.

Spaces are limited so you can benefit from the expertise of our two CIBSE interviewers who run the session.

We also offer support leading up to the application deadline. The workshop price includes a detailed review of your draft ACIBSE or MCIBSE report and a feedback call with a CIBSE interviewer before final submission. Details and booking information are available at www.cibse.org/workshops

If you need further information, email membership@cibse.org

Save the date: SoPHE northern dinner

The Society of Public Health Engineers' northern branch dinner will take place on Friday 10 May. A drinks reception will kick-start the evening of celebration at the Midland Hotel in Manchester. This will be followed by a three-course dinner and guest speaker Graham Poll, former Premiership football referee. To book your place, email m.atherton@cundall.com

Don't miss SLL's Ready Steady Light

This is your final chance to get your team together for this year's Ready Steady Light competition.

The Society of Light and Lighting (SLL) annual competition, run in partnership with Rose Bruford College, is taking place on 26 March. Teams of up to six people – with at least one SLL member – can apply for the competition, in which teams are challenged to design and set up temporary exterior installations with a limited range of equipment across the Rose Bruford College site.

Enter your team by 19 March. For details, visit www.cibse.org/sll

**CIBSE
President
Stephen
Lisk FCIBSE
FSL**

Statement by CIBSE President Stephen Lisk

Prior to the 2016 AGM, a ballot was held to elect Trustees and Officers to the Board of the Institution.

Along with candidates nominated by the Board, five candidates nominated by members, namely Eric Roberts, Derek King, Gay Lawrence Race, Chris Jones, and Catherine Simpson, also stood for election. The member-nominated candidates expressed concerns over certain aspects of the election process, which have been discussed at length since the election.

In particular, all candidates were asked to bear in mind that a Governance Review had recommended that canvassing be discouraged. The member-nominated candidates confirmed that they did not canvass during the election and raised a complaint. The Institution's Regulations governing elections however, had never contained rules in respect of canvassing.

New provisions introduced at the May 2018 EGM clarify the position on canvassing in CIBSE's Regulations as follows: 'Direct canvassing by candidates or by others on behalf of a candidate is not permitted. For the avoidance of doubt this does not prohibit

private communications between individuals already known to each other for the purposes of obtaining nominations or otherwise in connection with the election process.'

The Board would also like to confirm that all candidate statements submitted for the 2016 ballot were presented in good faith.

As President, I would like to thank the five membership nominated candidates for standing for election. We make the most progress by including and respecting different opinions. Experience guides the work of our Institution and provides an opportunity to learn, grow and change, in a spirit of fellowship and mutual respect.

With this in mind, I am pleased that, with the agreement of the member nominated candidates listed below and the Trustee Board, in the best interests of the Institution, this statement brings these matters to a close.

**■ Stephen Lisk FCIBSE FSL President
CIBSE Trustee Board, Eric Roberts
FCIBSE, Derek King MCIBSE, Gay
Lawrence Race FCIBSE, Chris Jones
MCIBSE, Catherine Simpson FCIBSE**

Trailblazers update: Institution to assess more apprentices

CIBSE has been accepted as an End Point Assessor for three more trailblazer apprentice schemes. After being approved for the Register of End Point Assessor organisations for the ST0063 - Building Services Design Technician trailblazer in October 2018, the Institution has now been approved for the following additional schemes:

- Building services design engineer - degree level apprenticeship
- Building services engineering site management - degree level
- Building services engineering technician - EngTech level.

CIBSE will assess candidates and confirm that they have been successful in completing their apprenticeship. It will also assess candidates for either EngTech or IEng registration depending on the apprenticeship standard.

Trailblazers have been introduced to allow employers to design apprenticeships that meet their needs and encourage the development of relevant knowledge and skills.

New members, fellows and associates

FELLOWS

Gidney, Graeme

Edinburgh, United Kingdom

Selvey, Adam Peter

Birmingham, United Kingdom

Chan, Steward Chi Sing

Lantau, Hong Kong

Reynolds, Stephen

London, United Kingdom

MEMBER

Chapman, Stephen

Sutton, United Kingdom

Crosbie, Stephen

Bangor, United Kingdom

Proctor, Nigel John

Banbridge, United Kingdom

Carr, Quincy Lee Jackson

St Albans, United Kingdom

Cooper, Andrew

Farnham, United Kingdom

Thompson, Brian

Chelmsford, United Kingdom

Richardson, Ben

Basingstoke, United Kingdom

Matheson, Graeme

Tyne and Wear, United Kingdom

Maclean, Calum

Bracknell, United Kingdom

Jones, Rhys

Exeter, United Kingdom

Tetlow, Richard

Chippenham, United Kingdom

Toolan, Shane

London, United Kingdom

Baxter, Martin Eric

Caterham, United Kingdom

Allison, Kristina

Abbotts Langley, United Kingdom

Huggett, Elinor

London, United Kingdom

Howden, Steve

Bexleyheath, United Kingdom

Carter, Steven Philip Brian

Truro, United Kingdom

Gallagher, Alison

London, United Kingdom

Garcia, Jaime

Bracknell, United Kingdom

Houghton, Paul James

North Elmham, United Kingdom

Brookes, Jared

London, United Kingdom

Roberson, Peter Jonathan

Maldon, United Kingdom

Menzies, Matthew

Manchester, United Kingdom

Ioannidou, Koula

London, United Kingdom

Verniers, John

London, United Kingdom

Elnahas, Youssef

London, United Kingdom

Beddoe, Alastair

Birmingham, United Kingdom

Huband, Nick

Welshpool, United Kingdom

Bhardwaj, Vikram

Bracknell, United Kingdom

Mousley, Sam Richard

Nottingham, United Kingdom

Ruiz Bolivar, Andrea Alexandra

Ashford, United Kingdom

Masood, Sana

Reading, United Kingdom

Baines, Neil

Prenton, United Kingdom

Evans, Erik

Edinburgh, United Kingdom

Kennah, Steven

Chester, United Kingdom

Blackhurst, Jonathan

Stockport, United Kingdom

Acheson, William

Enniskillen, United Kingdom

Bryce, Leigh

Fareham, United Kingdom

Alwan, Zaid

Newcastle Upon Tyne, United Kingdom

Di Maggio, Maria Sara

Terrasini (PA), Italy

Pratviel, Stanislas

London, United Kingdom

Miriana, Simone

London, United Kingdom

Papantoniou, Georgios

Bristol, United Kingdom

Gkanis, Nektarios

London, United Kingdom

Tsang, Yuen Chong Ivy

Kowloon, Hong Kong

Chan, Ka Shing

Yau Tong, Hong Kong

Chung, Wai Sang

Shatin, Hong Kong

Lui, Chun Tim, Geoffrey

Sheung Shui, Hong Kong

Yu, Kai Yin

Fanling, Hong Kong

Liebenberg Meyer, Timothy

London, United Kingdom

Caldwell, David

Glasgow, United Kingdom

Finch, Will

London, United Kingdom

Drysdale, Ian

Doncaster, United Kingdom

Croucher, Tom

Woolston, United Kingdom

Walton, Thomas Daniel

St Albans, United Kingdom

Brown, Nick

Bristol, United Kingdom

Gledhill, David

Bradford, United Kingdom

Lowe, David

Birmingham, United Kingdom

Baillie, Matthew

Newbury, United Kingdom

Day, James

Watford, United Kingdom

Nally, Stephen

Roscommon, Ireland

So, Gladys Kam Ling

Northbridge, Hong Kong

Fitzgerald, Rebecca

Botany, Australia

Pope, Ian

Berkhamsted, United Kingdom

Gheidi, Sepideh

St Albans, United Kingdom

Qiu, Feng

London, United Kingdom

Shaw, Rachel

Rotherham, United Kingdom

Harital, Grisha

Bristol, United Kingdom

Sadr, Faramarz

Maidenhead, United Kingdom

Burman, Esfandiari Fetcham

Leatherhead, United Kingdom

Dehkal, Redouane Samir

London, United Kingdom

Treglia, Marco

London, United Kingdom

Weglarz, Roman Piotr

Maidenhead, United Kingdom

Cooper, Nathan

London, United Kingdom

Stevenson, Ross

Edinburgh, United Kingdom

Kapenis, Georgios

Manchester, United Kingdom

Hamblin, Adam Richard John

London, United Kingdom

McHugh, Christina Elizabeth

Stanford-le-Hope, United Kingdom

Xia, Qian

London, United Kingdom

Bisson, Marta

Mitcham, United Kingdom

Heede, Benjamin Alexander

Bournemouth, United Kingdom

Bhalerao, Ranjeet Vivek

London, United Kingdom

Barrett, Mark

Edinburgh, United Kingdom

Ewing, Katie Jane

London, United Kingdom

Yang, Jing

London, United Kingdom

Riggs, Samuel

London, United Kingdom

Ricchetti, Antonio

Bedford, United Kingdom

Howlett, Ruth

Sidcup, United Kingdom

Pastuszek, Michal

Birmingham, United Kingdom

Suen, Wun Wun

Lai Chi Kok, Hong Kong

Chau, Ho Yung

Kowloon, Hong Kong

Ali, Nimco

Harrow, United Kingdom

Rodriguez, Jaime

Bromley, United Kingdom

Paluszynski, Przemyslaw

Lewk6w, Poland

Naldzhiev, Dzhordzhio

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Watt, Neil Stuart

London, United Kingdom

Swobodzian, Marta Agnieszka

Leeds, United Kingdom

Stevens, Alexander Charle

London, United Kingdom

Man Wai Jazz, Tse

Tuen Mun, Hong Kong

Chan, Mei Kuen

Lantau Island, Hong Kong

Papapostolou, Emmanouil

London, United Kingdom

Blundy, Tom

Southwater, United Kingdom

McNaughton, Daniel

Farringdon, United Kingdom

Wong, Kin Yan

Kowloon, Hong Kong

So, Ming Chung William

Kennedy Town, Hong Kong

Bemister, Adam Nicholas

London, United Kingdom

Ward, Neil Christopher

Crowborough, United Kingdom

Buica, Adrian

London, United Kingdom

Arif, Muhammad

London, United Kingdom

Koronaos, Georgios

Harrow, United Kingdom

Smith, Jocelyn

Bristol, United Kingdom

Mather, David George

Reading, United Kingdom

Brooks, Ben

London, United Kingdom

Llasera, Tomas

Cardiff, United Kingdom

Elliot, Mark
London, United Kingdom

Darbha, Harshita
Romford, United Kingdom

Zhu, Junji
London, United Kingdom

Axelrod, Jolyon
Hampton, United Kingdom

Watabiki, David Shiro
Wolverhampton, United Kingdom

Tiemann, Isabel
London, United Kingdom

Sykes, Joshua Stephen
Sheffield, United Kingdom

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Cambridge, United Kingdom

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Abela, Clyde
London, United Kingdom

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Chan, Hei Henry
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Leung, Chiu Kit Kevin
Kowloon, Hong Kong

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Toulouse, France

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Sutton, United Kingdom

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Redditch, United Kingdom

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Chan, Chun Keung
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Langdon Hills, United Kingdom

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New Grove, Mauritius

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Brighton, United Kingdom

Chan, Wai Kit
Tsuen Wan, Hong Kong

Jankowski, Slawomir
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Mavridis, Lazaros
London, United Kingdom

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Shanghai, China

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Honiton, United Kingdom

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Lau, Alfred Wui Chun
Hong Kong, Hong Kong

Marchisotta, Antonio
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Brentwood, United Kingdom

Bowman, Geoffrey David
Rochester, United Kingdom

Alo, Babafunsho
Milton Keynes, United Kingdom

Rabadia, Raj
London, United Kingdom

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Mold, United Kingdom

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Leeds, United Kingdom

Muralidharan, Vishnu
Haywards Heath, United Kingdom

Coldrey, Tom
Exeter, United Kingdom

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London, United Kingdom

Keen, George
Welling, United Kingdom

Ogunlade, Daniel
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Wilkinson, Ross Alan
Welwyn Garden City, United Kingdom

Headley, Luke
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Ruiz Blanco, David Felix
Manchester, United Kingdom

LICENTIATE

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London, United Kingdom

Reilly, Ronan
London, United Kingdom

Sanjeev, Jayatharsine
Cheshunt, United Kingdom

Wheeler, Chris
Manchester, United Kingdom

Pool, James
Bristol, United Kingdom

Coyle, Kieron William
Cardiff, United Kingdom

Jayes, Lauryn
Nottingham, United Kingdom

Mulvanny, Sara
Manchester, United Kingdom

Natarajan Theyagarajan, Nitharshan
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Global reform

Following reviews of construction in high-rise residential buildings, the construction sector is facing major change with calls for a significant update of regulations. Hywel Davies reports

In response to the outcry over failings in tall buildings, government is set to introduce a Building Commissioner with responsibility for auditing workers in the industry. There will be greater protection for homeowners and owners' organisations, to help them obtain compensation if builders or engineers have been negligent. The response has been described as the 'biggest shake-up in building and construction laws in our... history.'

An independent report found that the 'nature and extent of the problems [in the industry] are significant and concerning', and 'likely to undermine public trust in the health and safety of buildings if they are not addressed in a comprehensive manner'.

It calls for registration schemes for builders, surveyors, architects, engineers, designers, and building inspectors – and new mechanisms for training and licensing. The government proposals are intended to ensure that 'people who work in the building and construction industry' will have 'to take responsibility for their work.'

The proposals are likely to mean 'requiring designers to sign off on their designs, and builders to build their buildings in line with those designs.' The proposed commissioner would have responsibility for enforcing the licensing scheme.

Other measures will give builders less control over the certifiers responsible for approving their work, and a bond defects scheme will make it easier for homeowners to remedy defective work.

The proposals are part of the state government of New South Wales' response to a major review commissioned in August 2017 – and published in April 2018 – by the Building Ministers' Forum, a collective of Australian state and territory ministers. Its report was the culmination of six months' investigation by the chancellor of Western Sydney University, Peter Shergold, and lawyer Bronwyn Weir, who has many years' experience of building regulations. Further responses will be delivered across Australia in the coming weeks.

The report was commissioned in reaction to a series of problems with tall residential buildings in Australia, including a fire in the Lacrosse Building in Melbourne. Since it was published, there have been highly publicised structural failures in the 36-storey Opal Tower, at Sydney



“Issues facing engineers and their associations across the world are very similar”

Olympic Park. Significant cracks that developed in December 2018 have been attributed to design and construction failures. In early February, there was another high-rise fire in Melbourne, in a block of flats in Spencer Street.

Six days later, NSW fair trading minister Matt Kean released his response to the Shergold Weir report into compliance and enforcement in the Australian building industry. 'When you buy a property in NSW, you have every right to expect that [it] is safe, structurally sound, and free from major defects. And, unfortunately, that is not always the case,' said Kean.

He announced the state government would accept the 'vast majority' of the 24 recommendations in the Shergold Weir report, published just three weeks before *Building a Safer Future*, Dame Judith Hackitt's review of building regulations and fire safety in England.

The two reports review building regulations in their respective countries and recommend reform. They are quite different, reflecting their respective terms of reference and context, and considerable

differences between building regulations in the eight Australian jurisdictions and in England. However, the reports' observations on building practices, culture and regulatory oversight are remarkably similar, and there is scope to learn from each other. Similarities include:



Support for performance/outcomes-based building standards. Both reports conclude that standards for building construction must allow innovation and use of new and emerging products and building methods. They also acknowledge that a performance- or outcomes-based model requires high levels of competency and transparency, which are lacking in current practices.

Architects and designers should be obliged to produce designs that show a proposed building will meet required safety standards. They should supply full evidence that relevant safety considerations have been addressed and managed, and that the building will comply with all relevant legislative requirements.

The role of building surveyors or control officers in both jurisdictions, and the need to avoid conflicts of interest and clients choosing their enforcement officials. Australia has four models across its eight jurisdictions but, where owners or builders can engage a private surveyor or local government to issue approvals, the process to be followed is essentially the same. There are similarities between Dame Judith's model and those in Western Australia, South Australia and, to some extent, Tasmania.

Greater control over changes to approved designs. In particular, over changes to design in 'design and construction' models and during 'value engineering', with tighter control and full records of changes, which need to be enforced effectively. Linked to this is the need for:

Record keeping using digital records, to deliver and maintain key building design and safety information using new and emerging technologies (such as BIM) to give owners and safety managers access to all relevant information for the life of the building.

Competency of building practitioners, with both reports recommending improved competency of key practitioners so that performance/outcomes-based design and construction is delivered by those who demonstrate and evidence adequate qualifications and skills. The Shergold Weir report recommends a harmonised registration scheme for all eight Australian jurisdictions and compulsory professional development.

Comprehensive regulatory enforcement powers supported by meaningful penalties, to reward a compliance-based culture, with high-level coordination of relevant regulators – the 'joint competent authority' in Dame Judith's scheme.

Both reports also address the role of fire authorities, maintenance of fire-safety systems during occupation, and building product safety and quality assurance.

The issues facing governments across the world, as well as professional engineers, are very similar as they strive to rebuild trust and confidence in their building and construction sectors. CIBSE is a global engineering body with members in the UK and Australia, so there is plenty of scope to work together to respond to the challenges our sector faces. While the exact destination may vary from state to state, the direction of travel is clear: regulatory change is coming, and we need to embrace it.

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Shaping a low carbon future, together

Work by the government on Building Regulations and the future of heat offers many opportunities to be involved with CIBSE activities, says the Institution's Julie Godefroy

In the past 10 years, the UK has achieved significant carbon savings through the decarbonisation of the electricity grid. Decarbonising heat is now acknowledged as one of the biggest challenges if the UK is to continue on its trajectory and meet its carbon-reduction targets.

The Department for Business, Energy and Industrial Strategy (BEIS) is exploring how this may happen, and has published its analysis of technology and policy options.

Much aligns with recommendations by CIBSE and others: there is currently no clear, single contender to replace the wide coverage and convenience of gas heating, and a low carbon heating future is likely to require a mix of options. These include electric heating (with a large role for heat pumps); hydrogen, whether used in fuel cells or for decarbonising the gas grid; and heat networks, particularly in dense and mixed-use areas, where they can take advantage of alternative fuel sources and heat rejection from cooling systems, the Tube or other processes.

BEIS also seems to have acknowledged that the market alone cannot deliver such substantial changes, capital investments



“Buildings that are not connected to the gas grid are likely to be the early test beds of future low carbon heat options”

and infrastructure upgrades, while still keeping energy affordable and protecting consumers: a mix of policy requirements and incentives will be required. The department also stresses the importance of increasing consumer awareness. While this is true, there are probably other key drivers that have more of an influence on the heating choices made by consumers. These include convenience, affordability, advice from suppliers and overcoming the caution of installers towards new products. New regulations will be needed to provide the catalyst.

Buildings that are not connected to the gas grid are likely to be the early test beds of future low carbon heat options – an approach CIBSE has long advocated.

The Institution will continue to develop guidance in this area, in particular for future heat networks (4th and 5th generation and ambient loops), electric heating, and demand management. Get in touch if you are interested in taking part.

Beyond questions of how to meet demand, CIBSE has repeatedly stressed that we must consider energy efficiency, both to deliver carbon savings and to increase the feasibility of low-carbon

The Trent Basin housing development in Nottingham has communal battery storage



JULIE GODEFROY
is technical manager
at CIBSE

supply options. Simply put, without demand reduction it is unlikely we will have enough capacity to supply heat entirely from low carbon sources, particularly when huge increases in electricity demand are expected in the transport sector from electric vehicles.

Collaboration on Building Regulations – CIBSE and the UK Green Building Council

After our detailed position paper on recommendations for changes to Building Regulations Part L and F, CIBSE has worked with the UK Green Building Council to produce a common summary statement. The aim of this is to send a consistent message to government and influence the upcoming review of these parts of the Building Regulations. Key elements include:

- Establishing a clear trajectory to 'zero carbon', so the industry can start adopting stretching targets and developing cost-effective solutions
 - Exploring how to gradually introduce requirements on operational energy and carbon, rather than design and as-built requirements alone. As a very first step, this should start with gathering data on operational performance
 - Better addressing indoor air quality and overheating.
- Both papers can be found at bit.ly/CJMar19pos

Environmental regulations

CIBSE has responded to consultations on environmental regulations – an area likely to be most affected by Brexit:

- Department for Environment, Food and Rural Affairs consultation on monitoring of environmental indicators: we broadly support this, and have advocated a more robust framework, including a better culture of assessing policy effectiveness, and reporting against science-based objectives (for example World Health Organization air quality guidelines), not just against the government's own targets
- Parliamentary inquiry on the Environment Bill, which sets the framework for environmental regulations and enforcement post-Brexit: we support a number of proposals; however, we also have serious concerns, including the independence of the future body that will hold government to account.

Current consultations:

- **Air pollution control** programme: respond to CIBSE by 4 March
- We are working with the Royal Academy of Engineering to inform the UK's post-Brexit **immigration strategy**. Let us know if you would like to inform our work – for example, if you have assessed how skills and/or salary criteria may affect your business.
- All can be found at cibse.org/news-and-policy/consultations



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Fossil-fuel energy sources are required when renewable energy is unable to meet demand



The issues of polluting neighbours and carbon factor calculations

A different approach

I read the opinion article by Mike Hefford ('Other factors', *CIBSE Journal*, February 2019) with interest, and certainly agree with his call for wider decentralisation of power generation using CHP integrated with other low carbon technologies.

However, I cannot agree with his endorsement of the use of averages for grid carbon value, be it over a month, year or any other period. This is because focusing on average carbon content disguises the high carbon content of the dispatchable power being used every day to 'top up' low carbon sources, such as wind and solar.

To clarify, dispatchable sources of electricity are those that can be dispatched at the request of power-grid operators and used on demand when renewable energy sources are unable to meet demand. Dispatchable power also provides our 'insurance' against the lights going out when the wind isn't blowing and the sun is obscured by cloud.

The fact that so much of our renewable capacity is at the mercy of the vagaries of the weather means we will always need this dispatchable capacity, irrespective of the installed renewable capacity. In fact, increased use of electrical/electronic technologies, electric cars, heat pumps and so on will increase the UK's power demands in coming years, which increases the backup capacity requirement.

The energy source of this dispatchable power is known as the marginal energy source. Even with the significant increases we've seen in renewable capacity over the past few years, that marginal energy source is still predominantly inefficient, gas-fired power stations, with a little coal thrown in when demand is high. So I believe it is this marginal carbon factor that we should be focusing on, rather than an average carbon factor from all power sources (wind, solar, nuclear, gas, coal).

Moreover, I would argue that focusing on the dispatchable marginal carbon factor, rather than the average carbon factor, is the only way we can effectively resolve the UK's energy trilemma - namely, the need to simultaneously reduce carbon emissions, cut energy costs and ensure security of supply.

Focusing on the marginal energy source reinforces our continued dependence on gas and, crucially, the imperative to use that gas more wisely and efficiently. Such a focus naturally leads us to wider use of 'prosumer' buildings that produce and consume energy. Typically, these would use decentralised CHP combined with heat pumps and electric boilers, in a smart system that can avail itself of green grid electricity when appropriate.

As well as taking pressure off the grid and making more efficient use of fossil-fuel energy sources, decentralising a higher proportion of our dispatchable power meets all of the requirements of the energy trilemma. This approach also has implications for the proposed SAP 10, in terms of using a more realistic carbon factor based on marginal energy sources. In parallel, there is a need to enhance the functionality of SAP software to facilitate the use of the mixed hybrid systems described above, which are not supported in the current version of SAP.

The fact that the Department for Business, Energy and Industrial Strategy is now reconsidering the lower carbon factor proposed in the draft SAP 10 is clearly to be welcomed.

Lars Fabricius

Managing director, SAV Systems

Hard to breathe

I was very interested in the article regarding wood burning. I suffer first hand from a neighbour's chimney that manages to engulf our house in smoke that eventually enters through window and underfloor vents. Apart from the disgusting smell, I am now wondering if we are breathing in any 'nasties'.

I appreciate there is nothing we can do to stop the burning, but I am enquiring of your readers to see if they have had similar experiences - and would welcome any advice.

Colin Smith, ACIBSE

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

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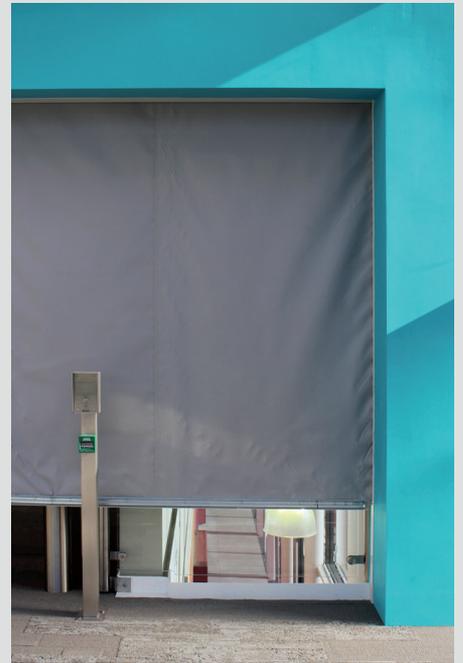


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A FORCE FOR GOOD

The CIBSE Building Performance Awards celebrate the projects, products and companies driving best practice and innovation in the industry. We honour the 2019 winners

BuroHappold Engineering and Cundall were among the big winners at the CIBSE Building Performance Awards, hosted by comedian Jo Caulfield at Grosvenor House hotel in London last month.

They each scooped two awards, with BuroHappold judged the best Building Performance Consultancy (over 1,000 employees) and winning Project of the Year – Public Use for the Urban Sciences Building, Newcastle University. Cundall picked up the trophy for best Building Performance Consultancy (101-1,000 employees), and won the Learning and Development award for the Cundall Diploma.

Australian developer Mirvac was crowned

Building Performance Champion 2019, having won Project of the Year – International with the EY Centre, Sydney, Australia. The judges, chaired by CIBSE technical director Hywel Davies, described the 37-storey office tower as an 'exemplary project' and praised Mirvac's 'truly holistic approach to building performance and wellbeing'.

Elementa Consulting senior engineer Clara Bagenal George won the inaugural Building Performance Engineer of the Year award after launching the influential London Energy Transformation Initiative (Leti).

Many recommendations from the cross-industry group were adopted in the draft London Plan, and the group is now creating a roadmap towards zero carbon homes, which Bagenal George details on page 40.

CIBSE President Stephen Lisk opened the event by telling the audience that the CIBSE awards were the only ones that judged buildings on actual measured performance outcomes. He said everyone in the supply chain could influence building performance for the good of society and the planet.

By volunteering or participating in CIBSE activities, people could contribute to the Institution's standing as a globally recognised force for good, added Lisk. 'It is clear that construction in the UK must change and, as a charitable body that exists for the public benefit, we are committed to being at the forefront of delivering that change.'

BuroHappold Engineering's Dr Sarah Prichard also gave a presentation at the ceremony (see pages 3 and 6 for details). **C** **>>**

BUILDING PERFORMANCE AWARDS 2019



Building Performance Champion

Winner: EY Centre, Sydney, Australia - Mirvac

EY's new office showcases what can be done when a building is treated and delivered as a system. The judges praised the truly holistic approach to building performance and wellbeing, and - in being crowned overall champion - it has demonstrated that the work of performance is more than just engineering.

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Building Performance Consultancy (up to 100 employees)

Winner: WARM: Low Energy Building Practice

Practising what it preaches, building performance consultancy WARM refurbished its offices to the Passivhaus standard. WARM wants to make this level of building performance and quality the standard in the UK, and the judges acknowledged how the consultancy is seeking to develop Passivhaus with the supply chain in an innovative way that is more likely to deliver longer-term impact.

Sponsored by Panasonic



Building Performance Consultancy (101-1,000 employees)

Winner: Cundall

The judges described Cundall's submission as comprehensive and convincing, with the consultancy having its own sustainability roadmap and a stated intention to go beyond the 'business as usual' agenda. Importantly, the consultancy also encourages its clients to exceed standard practice on sustainability.

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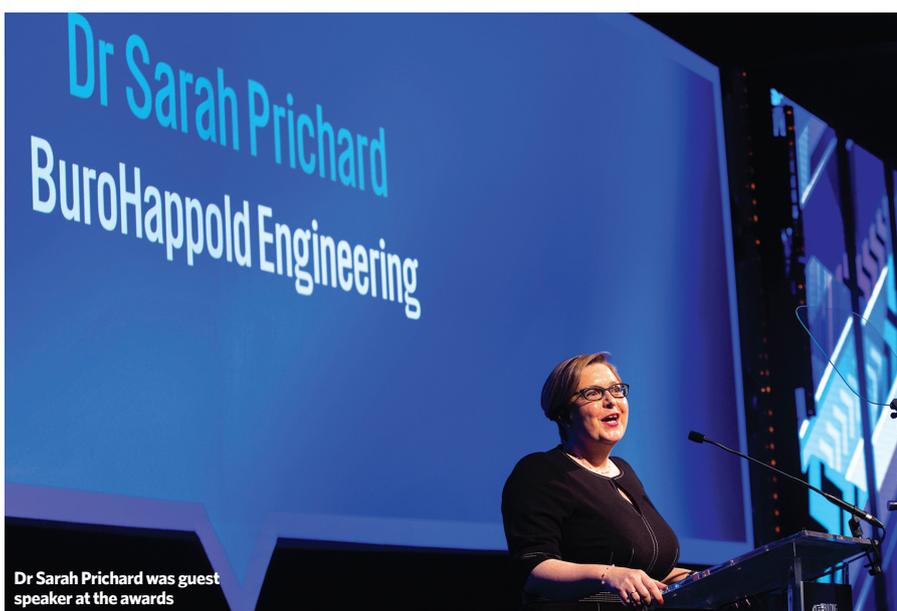


Building Performance Consultancy (over 1,000 employees)

Winner: BuroHappold Engineering

The judges commended the group's commitment to addressing building performance and ensuring that understanding is reflected in what is delivered on site. They acknowledged how BuroHappold is engaging with the key topics of healthy, safe buildings, and delivering ones that are resilient to a changing climate and that have less negative impact on the environment in the future.

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Dr Sarah Prichard was guest speaker at the awards



Collaborative Working Partnership

Winner: Broadway Chambers - Woodford Heating and Energy

This entry stood out for the judges because of the very clear and considered thought process behind the collaboration. The contractor team was chosen to match the client team in terms of personality and seniority. The judges said the project showed the success of considering personality traits and management styles to create the best team possible.

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Learning and Development

Winner: The Cundall Diploma - Cundall

The Cundall Diploma was developed to give staff an in-depth understanding of sustainable design, offering them the knowledge, tools and confidence to offer sustainable design solutions on their projects. The judges particularly liked the depth of the scheme and the inclusive way in which the initiative has been rolled out across the company. They commended its feedback mechanism, and were impressed by the investment of time and effort in the programme.



Energy Management Initiative

Winner: 2 Kingdom Street Demand-driven Strategy - Cavendish Engineers

Cavendish Engineers identified energy-reduction opportunities in this building - which received a Breeam Excellent rating on completion in 2010 - through the modernisation of the three core systems on site. The judges said that the entry demonstrated the importance and potential benefits of active, ongoing building management, and that Cavendish's approach was helping to close the performance gap.

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Facilities Management Team

Winner: TfL Head Offices FM Portfolio - Transport for London

The judges highlighted TfL's excellent behavioural change programme, which has invested heavily in communication and embraced user feedback through social media, building user surveys, questionnaires and post-occupancy evaluations. They also identified good collaboration between opex and capex teams, and commended its Destination Green engagement campaign.

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TfL's Palestra offices



Energy Efficient Product or Innovation

Winner: Armstrong Tango parallel pumping solution - Armstrong Fluid Technology

Armstrong Tango's parallel pumping solution reduces pump energy consumption by about 30%, and can be used in many situations. The judges commended the firm for its significant commitment to reducing carbon emissions in its own manufacturing locations. They were also impressed by the firm donating the proceeds from recycling aged pumps to charitable causes via its Planet Proposition sustainability initiative.





CIBSE BUILDING PERFORMANCE AWARDS 2019

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CONGRATULATIONS TO OUR #BPAWINNERS

Building Performance Champion
EY Centre, Sydney, Australia – Mirvac

Building Performance Consultancy (up to 100 employees)
WARM: Low Energy Building Practice

Building Performance Consultancy (101 - 1000 employees)
Cundall

Building Performance Consultancy (over 1000 employees)
BuroHappold Engineering

Collaborative Working Partnership
Broadway Chambers – Woodford Heating and Energy

Learning and Development
The Cundall Diploma – Cundall

Energy Management Initiative
2 Kingdom Street Demand Driven Strategy – Cavendish Engineers

Facilities Management Team
TfL Head Offices FM Portfolio – Transport for London

Energy Efficient Product or Innovation
Armstrong Tango parallel pumping solution – Armstrong Fluid Technology

Energy Saving Product or Innovation
The Encore Cistern – The Green Futures Initiative

Project of the Year – Commercial/Industrial
One Angel Square, Northampton – BDP

Project of the Year – Public Use
Urban Sciences Building, Newcastle University – BuroHappold Engineering

Project of the Year – Residential
Lark Rise – bere:architects

Highly Commended
Cameron Close – WARM: Low Energy Building Practice

Project of the Year – International
EY Centre, Sydney, Australia – Mirvac

Highly Commended –
Aorangi House Revitalisation and Optimisation, Wellington, New Zealand – Beca

Building Performance Engineer of the Year
Clara Bagenal George, Senior Engineer – Elementa Consulting

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Energy-saving Product or Innovation

Winner: The Encore Cistern - The Green Futures Initiative

Described by the judges as 'a really innovative solution', the Encore is the only concealed cistern that directly uses waste condensate from air conditioning units to flush its toilets. The judges liked the range of potential applications it offers, being suitable for retrofit and new build, and were impressed by the thought that clearly went into its development.

Sponsored by CIBSE Patrons



Project of the Year – Residential

Winner: Lark Rise - bere:architects

Lark Rise, an ultra-low energy, all-electric, two-bedroom detached property, is the UK's first certified Passivhaus Plus home. The judges acknowledged the attention to detail in the design of a 'groundbreaking development', and how it was used to understand and demonstrate how building homes to this specification could be adopted more widely – challenging the need to fulfil energy demand through additional grid capacity.



Project of the Year – Commercial/Industrial

Winner: One Angel Square, Northampton - BDP

The judges thought that a good-quality design had been delivered within a limited budget for the One Angel Square project. They commended the use of TM54 modelling to develop robust operational cost estimates and the maintenance of value as a key principle throughout a tight design and build project, defending engineering options in the design that would lead to better outcomes.



Project of the Year – Public Use

Winner: Urban Sciences Building, Newcastle University - BuroHappold Engineering

The judges were impressed by the huge amount of stakeholder involvement and the strong focus on post-completion and estate-wide post-occupancy evaluation. They also commented on the numerous innovative elements. It was, they said, a complex project that had been well delivered – a year ahead of schedule and on budget – by running procurement and design concurrently, and engaging with the supply chain.



Building Performance Engineer of the Year

Winner: Clara Bagenal George, senior engineer - Elementa Consulting

The inaugural award winner is a senior Chartered engineer working across sustainability and mechanical teams, leading mechanical, environmental analysis and sustainability consulting projects. She was nominated for her above-and-beyond attitude and her true passion for sustainable building performance.

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Project of the Year – International

Winner: EY Centre, Sydney, Australia - Mirvac

The EY Centre is an exemplary project that should be the benchmark for all buildings, according to the award judges. Independent commissioning and the commitment to truecare reinforced the true desire for a whole-life approach, they said. In addition, evidence was provided of high social corporate responsibility, with real-life working examples presented in the award submission.

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How will the energy performance directive impact building design in 2019?

The next update to Part L, due to be released for consultation this spring, looks set to move the goalposts for building compliance and create a shift of focus from carbon emissions to primary energy in line with the Energy Performance of Buildings Directive. **Matthew Maskell**, applications design engineer at Glen Dimplex Heating & Ventilation (GDHV), considers how primary energy's introduction must be targeted correctly to continue our path towards a sustainable future

2019 is going to be a big year for building designers as they work to understand the implications of the planned overhaul to Building Regulations.

Energy use under Part L (alongside its devolved-power equivalents) currently drives HVAC strategy in new buildings, focusing building designers on reducing carbon emissions.

While reducing carbon emissions remains an important part of building design, government policy and the achievement of the fourth and fifth carbon budgets set in the Climate Change Act, it is no longer the only measure with which building designers are going to have to contend.

From 31 December 2020, all new buildings will have to demonstrate that they are “nearly zero energy buildings” (NZEB) in order for the UK to comply with Article 9 of the Energy Performance of Buildings Directive, and this must be measured in primary energy.

This move will see a new target put into place for all new developments. These targets define the maximum kWh/m² allowed in buildings for all energy use, combining appliances, heating, cooling and hot water.

The UK has yet to state what this target may be and whether build types that use less energy, such as apartments, will have a lower target than more energy intensive dwellings such as houses. Other European countries, such as France and Poland, have implemented a maximum permissible value of between 50 and 65 kWh/m², depending on build type.

When set, this new primary energy target will add an interesting dimension to building design as it seeks to address the wider issue of reducing energy consumption in our buildings rather than simply enforcing the lowest carbon technology.

What is primary energy and what impact will it have on HVAC specification?

Primary energy is a reflection of how

much raw fuel, also known as primary energy, is used to generate a unit of final energy. This includes the energy used to create, transform and transport the fuel from its raw form to where it is used.

The proposed UK factors for gas and electricity were included in the recently revised SAP10 methodology, but they have not received as much attention as the more radical changes in the carbon emission factor for electricity.

This is because, with this change, a gas boiler at 90% efficiency will consume 1.1 kWh per kWh of heat delivered, equivalent to 0.231kg of carbon under the new proposed values. As electric heating is 100% efficient at the point of use, 1kWh of electricity will be consumed when producing 1kWh of heat, equivalent to 0.233kg of carbon under the new proposed values.

As a result, if you consider carbon in isolation, a 90% efficient gas boiler is now equivalent to an electric heating system, which in a carbon-focused method of compliance could create a

Proposed SAP10 Values		
Fuel	Carbon	Primary Energy
Mains Gas	0.210 kgco ₂ per kWh	1.122 per kWh
Electricity	0.233 kgco ₂ per kWh	1.738 per kWh

surge in electric heating specification.

When applying the focus of primary energy to this scenario, we see a different story. Using the primary energy values published in SAP10, the same boiler will consume 1.234 kWh/m² per kWh of heat delivered and the electrical heater 1.738 kWh/m² per kWh of heat.

This means that, despite the carbon impacts having become almost identical, the added perspective of primary energy has the potential to change the direction of the future of HVAC system specification, as designers work to meet this new compliance criteria.

What does this mean?

Assuming that primary energy does become the focus for future building compliance, it appears that in many scenarios gas-based solutions will still be preferred, especially when paired with a renewable technology such as photovoltaics (PV).

Where these traditional systems cannot be applied viably, either because of regional requirements, restrictions in infrastructure or air quality limits, designers will need to look for an alternative solution.

Ground source and air source heat pumps are already used widely in these instances because of their high efficiencies and ability to make use of low-grade heat. However, heat pump technology has evolved from the externally situated plant solution that often springs to mind. Internal heat pumps have found their place in the market and show potential to not only step into areas where gas-based solutions cannot be used, but also to support a gas-based solution where traditional renewable pairings are not viable.

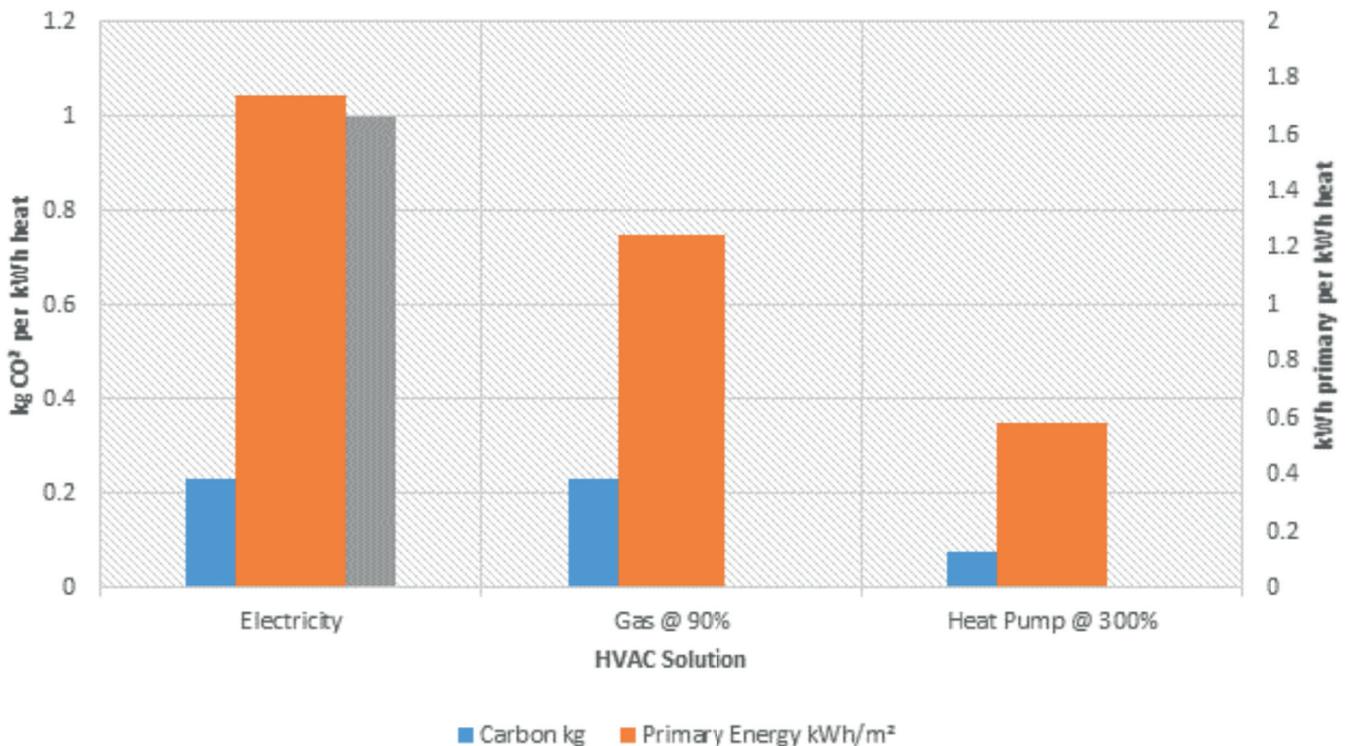
One such example of this technology is a hot water heat pump, consisting of a ducted system providing fresh air to a small refrigeration circuit mounted on top of a water cylinder, which supplies hot water to a dwelling. As previously outlined, producing hot water in an efficient way is going to be a priority as it becomes the dominant load, and a significant amount of energy can be saved in the production of hot water through renewable sources. Units such as the Dimplex Edel, listed in SAP Appendix Q with a COP of up to 3.24, are already being used alongside electric heating where gas-based solutions cannot be specified.

The introduction of primary energy and the targets used to control it could well be the catalyst for more widespread adoption of heat pump technologies in residential dwelling design. However, the extent to which this is the case will not be fully understood until the UK primary energy targets are proposed this spring. We plan to host discussions on the potential impact these could have on the industry when the information is released, and would welcome anyone who would like to be involved in these.

■ For more information on these sessions or the contents of this article call 0344 879 3587 (option 3) or email pre-sales@glendimplex.com.



Primary Energy vs Carbon per kWh of heat



MIRVAC'S GOLD STANDARD

Mirvac's 37-storey building towered over its rivals to win CIBSE's coveted Building Performance Champion Award. **Andy Pearson** examines the holistic approach to design to deliver both occupant comfort and energy outcomes

The walls of the 37-storey office building at 200 George Street in Sydney, Australia, look as if they are made from gold. Their appearance, however, comes from the hundreds of timber blinds comprising the building's state-of-the-art façade system.

Known as the EY Centre, after its anchor tenant, the tower contrasts starkly with the grey, metallic, aluminium-and-glass façades of its neighbours. While its timber aesthetic sets it apart, however, what really differentiates the EY Centre is that it has established a new standard for how workplaces should be created.

The 39,000m² tower was developed and constructed by Mirvac, to an architectural design by Francis-Jones Morehen Thorp and an MEP scheme devised by Arup. At the time of the scheme's development, in 2014, Mirvac had just launched its sustainability strategy, *This Changes Everything*.

'The development at 200 George Street was an awesome opportunity to walk the talk,' says David Palin, Mirvac's sustainability manager, office and industrial.

'We set a target to be net positive in terms of carbon by 2030. For the first five years of the plan, we said we'd reduce our carbon intensity by 20% and we wanted this project to achieve that as a minimum.'

It was a walk that was all the more significant after Mirvac decided to relocate its head office to six floors in the new building. The environmental performance benchmark for office buildings in Australia is the National Australian Built Environment Rating System (Nabers). Mirvac's sustainability targets were a 5-star Nabers energy rating and a 4-star Nabers water rating.

It also set out to achieve a 6-star design rating and 6-star as-built rating under the Green Building Council of Australia's (GBCA) Green Star scheme. 'The GBCA tools are a little more holistic, but they do use Nabers for their energy and water components,' explains Palin.

In developing the low-energy design, Mirvac took a whole-life approach by incorporating lessons it had learned from recent projects with the early involvement of its operations team in the design process. It was an exercise that resulted in the removal of a proposed tri-generation system and the blackwater (sewage) recycling plant, reducing development costs by approximately AUS\$3m (£1.66m).

'We view tri-gen as a liability, because – if it goes offline – your

PROJECT TEAM

Developer: Mirvac
MEP engineer: Arup
Architect: Francis-Jones Morehen Thorp
Façade system: Permasteelisa Group



Nabers rating will go with it,' Palin says. Instead, the team placed an increased focus on operational efficiency. 'We removed the eco-bling to focus on good engineering,' Palin adds.

Mirvac spent the money it had assigned to tri-generation on additional metering and controls. 'We wanted to understand how the building and its systems were performing so we could optimise their operation during a two-year, soft landings tuning process, to learn from the experience,' says Palin.

In addition to a comprehensive control strategy, the developer also invested in the façade. The tower's structure is relatively conventional, comprising a reinforced-concrete core and post-tensioned concrete floor plates. By contrast, its 16,000m² closed-cavity, double-skinned façade system is exceptional. It comprises an outer glazed skin

"The floors Mirvac occupies have the kudos of being the first in Australia to be certified under the Well Building Standard, achieving a gold rating"



VENTILATION

Fresh air to the office floors is provided by a hybrid HVAC system developed by Arup. This comprises a VAV system with heating and cooling, serving the central office area and a zone of active chilled beams at the perimeter. Chillers and boilers are located in a plantroom next to the tower, but the air handling units are housed in the main building.

The air handling units deliver high volumes of fresh air to the offices at a rate of 18.75 L·s⁻¹ per person, in line with the requirements of the GBCA's Green Star Design rating document; this is well above the minimum fresh air requirements. 'We do have CO₂ sensors fitted, so - if the occupancy levels are lower on a particular floor - we can lower the fresh air supply rates to save energy,' says Mirvac's David Palin.

Mirvac is using the project to learn about the impact of measures such as the increased fresh air rate on the building's occupants. It turned one of the floors it was occupying (Level 30) into 'a living lab'. 'We've got lots of environmental monitors and other sensors, in addition to extensive energy and water metering,' Palin explains.

and an internal double-glazed unit for insulation. The glass is low-iron to maximise transparency, and a wooden blind is located in the cavity between the two skins. To prevent moisture and dust entering the cavity, it is kept lightly pressurised with dehumidified, air.

Double-skinned façade

Manufacturer Permasteelisa Group claims the façade system can achieve a similar performance to a traditional, double-skin façade. 'The quality of the façade makes a big difference in helping to manage heat loads and such like,' says Palin.

With floor-to-ceiling glazing, the timber blinds are key to maintaining comfort conditions on the office floors. They are fully automated to deliver what the architect describes as 'a kinetic façade' - which, in reality, means each blind's horizontal louvres can tilt to control glare and heat gains in





The scheme has achieved 5.5 Nabers stars for indoor environment

the offices while maintaining views out.

Somfy manufactured the blind motors, producing a 365-day sun-tracker model, with integrated web-based controls.

This controls precisely the louvre angle, depending on where the sun is incident on a façade at a particular time, on a particular day of the year.

The shadow-management software also predicts the areas of the building's façade that will be shaded by the surrounding buildings at any time, and then opens the louvres in those areas to allow in more light.

This may be a useful feature given that 75% of Mirvac's workstations are located within 7.5m of a window, giving employees access to natural light. The system also allows administrators to log on to the system to close the blinds further, should they wish.

The system is based on an open-protocol KNX system; the blind motors are linked to controllers, which are connected to a LAN backbone and a central processing system based on a Tridium Niagara network. Sensors on the roof detect light levels relative to a threshold and the blind-management system will adjust the blind angle accordingly.

This system manages 34 line masters, 754 motor controllers, 2,879 venetian blinds and motors across 351 zones, with each zone containing between four and 18 blinds.

LED lighting

Lighting on the office floors is programmed for the varying levels of brightness throughout the day. The EY Centre is Australia's first fully LED-lit buildings. At the time the scheme was being developed, LED lighting systems for open-plan office floors were still in their infancy.

'We trialled between 20 and 30 systems in the offices in which we were working, and in the site offices, to find the best solution,' Palin says. The extra effort was worth it: according to the scheme's lighting designers, Arup, the solution offers energy-consumption savings of 25% over T5 fluorescent lighting,

and reduces waste to landfill significantly because of the increased life of LED fittings.

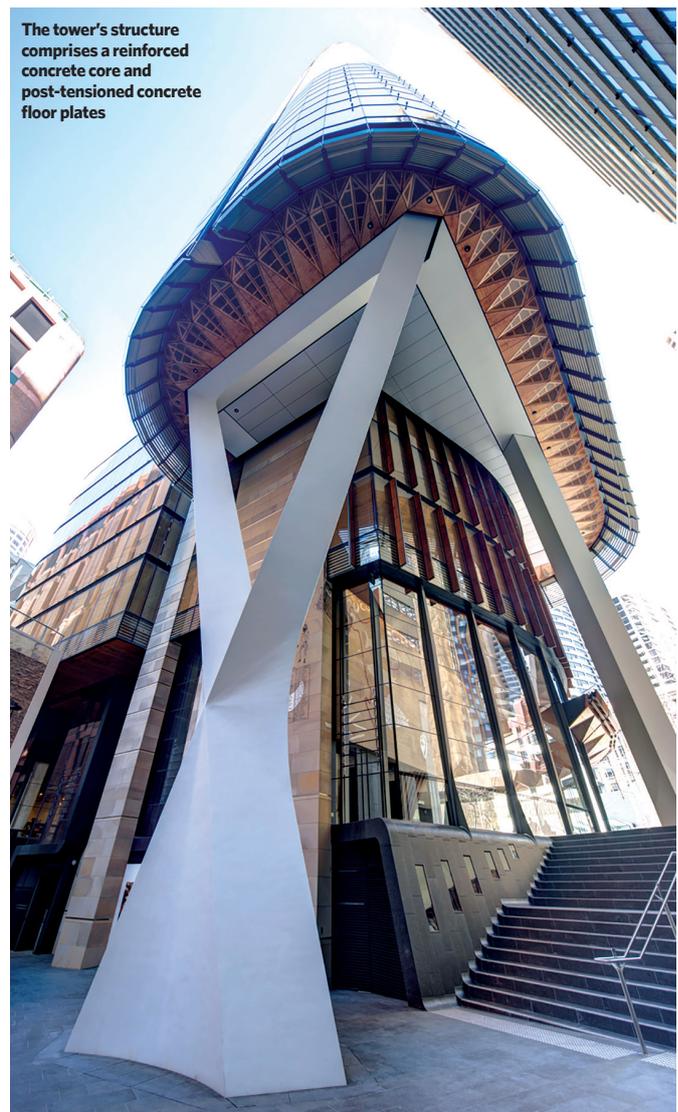
Lighting control within office and back-of-house areas is via a range of motion (PIR and microphonic) and light (photoelectric) sensors. Lighting-control zones are smaller than 100m² in area, and all lighting control interfaces with the building management system (BMS).

Soft landings

Palin says a key element in achieving the 5.5-star Nabers for Offices energy performance was the commissioning, tuning and handover phase. 'We put a fair bit of resource into having a 24-month tuning process under soft landings,' he adds. Again, operational input was critical at an early stage to ensure a focused approach to tuning and to the allocation of resources to support that process.

In conjunction with Mirvac's operational team, an independent commissioning agent (ICA) was appointed before commissioning, to review the design and give feedback. The commissioning team comprised Mirvac Development, Construction and Operational representatives, design consultants and contractors, and the ICA. This team was in place for two years to optimise the building performance and to learn from the initial operational phase of the building.

To aid the tuning process, a SkySpark fault-detection and diagnosis package was used to monitor and interrogate building operations, and to detect control-system anomalies. This system was hosted and managed by Bueno, while the installed BMS is a Metasys Building Automation System. Regular meetings between BMS and mechanical contractors, facility management and sustainability teams are held to



The tower's structure comprises a reinforced concrete core and post-tensioned concrete floor plates



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Judges praised the project's 'truly holistic approach to building performance and wellbeing'

"We removed the eco-bling to focus on good engineering" – David Palin

maximise the impact of these systems, and to identify anomalies and opportunities.

To assist the tuning process and build knowledge of indoor environment quality, several Samba monitoring systems were embedded within the Mirvac tenancy. The units offer a rich insight into indoor environmental quality (IEQ) parameters and help optimise plant operating periods.

In addition to the Samba IEQ data, Mirvac did post-occupancy evaluation surveys using the Building Occupants Survey System Australia (Boss), developed at the University of Sydney's IEQ lab, headed by Professor Richard de Dear. A survey was conducted on employees in Mirvac's ageing offices before their relocation. After a six-month honeymoon period

in their new 200 George Street accommodation, a second survey was undertaken.

Mirvac found a significant improvement in employee perception of IEQ. Scores for overall performance, health and productivity improved by 35%; noise distraction and privacy scores improved 50%; and spatial comfort scores also increased by 50%. In fact, the EY Centre outscored Mirvac's former head office across all categories.

The 5.5-star Nabers for Offices energy rating is a significant achievement in a premium-grade office tower without tri-generation or renewables, and an improvement on Mirvac's 5-star target. 'How did we get the scheme from 5 to 5.5? The quality of the façade makes a big difference in managing heat loads,' says Palin.

The improved rating represents a 26% reduction in carbon emissions over a 5-star performance, representing a reduction of approximately 733tCO₂e. 'With 200 George, we save about A\$200,000 in energy a year by having a 5.5-star – rather than a 5-star – Nabers energy rating. That reduction in building operational costs represents a significant potential valuation increase of A\$3.78m (using a 5% cap rate) for the building owners,' says Palin. The building's energy-use intensity is 84kWh-m².

The scheme has subsequently achieved 5.5 star Nabers for Offices Indoor Environment rating – and the six floors that Mirvac occupies for its new HQ have the kudos of being the first in Australia to be certified under the Well Building Standard, for which they achieved a gold rating. The building has also achieved the 6 star Green Star Design, As-built and Performance ratings that Mirvac was targeting.

'We didn't target Well for the whole building because Well came to our attention after the project was under way. But we wanted to learn about it, so we targeted Well for our tenancy space,' says Palin.

Not every target has been met, however. The development target of a 4-star Nabers water rating was missed during the first year of operation, with the building managing 3.5 stars. A reduction of 38 L-m² would have been required to achieve this result. The operational team is working on reducing water consumption and optimising rainwater capture and reuse to deliver on design objectives. 'We're only 3.5 stars on the water, but we'll get there; it shows that you can be water efficient, energy efficient and have a beautiful building,' Palin says.

With credentials such as these, it will come as no surprise to hear that the building won the Project of the Year – International category, and walked away with the best-of-the-best award, at this year's CIBSE Building Performance Awards. The judges described it as 'an exemplary project' and praised the 'truly holistic approach to building performance and wellbeing'. **CJ**

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THINK LOCAL

ASHRAE President **Sheila Hayter** says renewables are putting engineers at the forefront of energy developments. **Tim Dwyer** reports on the keynotes at the ASHRAE Winter Conference and AHR Expo, and shares his highlights from Atlanta



ASHRAE CEO Jeff Littleton announced a new HQ for the society, while President Sheila Hayter (top) spoke about the opportunities with renewable energy networks

The worldwide growth in renewable energy networks is giving the building services industry the opportunity to drive future energy developments, according to ASHRAE President Sheila Hayter.

Speaking at the Winter Conference and AHR Expo, Hayter said ASHRAE was preparing buildings professionals for the challenges of designing efficient and grid-responsive buildings within the changing energy sector. She described the global changes in the energy markets that are increasingly based around distributed energy resources, such as solar and wind systems integrated with improved and less-expensive battery storage and microgrids.

'As we explore ways to incorporate renewable energy technologies into integrated building concepts, ASHRAE will take an even greater leadership role in defining the relationship between buildings and the power sector,' she said.

The Winter Conference, with 300-plus technical presentations, attracted more than 2,700 people, while the Expo – running alongside it – had 65,000 attendees. The conference featured a new seminar stream, *Renewable and natural systems*, which explored renewable energy sources and the future of the smart grid.

Hayter said the bi-directional flow of energy will mean buildings and the grid will have to get smarter, and those buildings will play a dynamic role on a smart grid. She reminded the audience of the free resource *Building our new energy future* – which marked the start of her presidential year – and announced the release of a presidential webinar, *Efficient buildings, the future and a more intelligent grid*.

ASHRAE CEO Jeff Littleton, meanwhile, spoke about the release of the 2018 International Green Construction Code. This has been developed in conjunction with North American organisations including the American National Standards Institute and the US Green Building Council, and is aimed at domestic and global markets. Littleton said the code aims to offer effective green building strategies, designed to work with local energy codes and environmental assessment tools.

Hot off the press was Littleton's announcement that ASHRAE has bought a new HQ building at 180 Technology Parkway, Atlanta – 10 miles north of the current location, which has been sold to make way for a hospital development. The building will be renovated to serve as the society's headquarters from October 2020, and the aim is to reduce annual energy use (EUI) to below 69.4kWh·m⁻², with a limit of maximum daytime plug load at 5.4W·m⁻². ASHRAE pledged not to use members' annual subscriptions to pay for the HQ and has mounted a fundraising campaign to finance the works – see ashrae.org/newhq for details.

Positive change

CIBSE President Stephen Lisk presented at the *Adapting to thrive – shaping resilient future urban performance through historical*





insight seminar, in which he developed his presidential theme. He declared that CIBSE and ASHRAE members have the power to deliver positive impacts on people's lives, 'whether through the products we make, the projects we design, the buildings we manage, operate, maintain and refurbish, the codes and guidance we write, or the standards and regulations we contribute to and improve'.

Lisk was not just talking about landmark developments, but also everyday projects, such as housing schemes, and smaller ones that have a significant local impact and the potential to improve people's daily lives.

He stressed that construction must change and added that pan-industry collaboration – including between professional organisations

“CIBSE and ASHRAE members have the power to deliver positive impacts on people's lives”

– could offer the chance for shared innovation and incremental value across the sector.

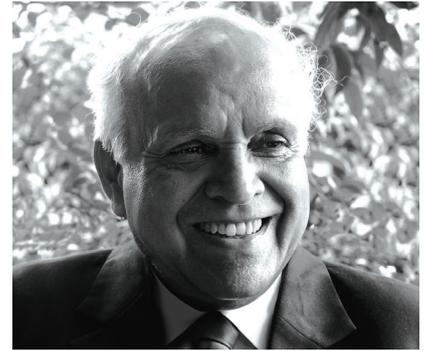
At the same seminar, Dru Crawley, fellow and director at Bentley Systems, spoke about how changes in the external climate – and in the expectations of building owners and occupants – are 'a game changer for designers and operators'. His stunning presentation, which included computer-generated, street-level fly throughs of Paris and Philadelphia, showed that success in engineering the future built environment can be powered by the knowledge and experience amassed from previous projects, research and operation.

Crawley explained that it is possible to quickly model a city using 3D technologies such as photogrammetry, LiDAR, and BIM, and this could be done for older buildings for which documentation is lost. Using federated data from these sources, and merged building-performance data, it is possible to evaluate the resilience of a city under different scenarios, he said. With the advent of mechanical conditioning, Crawley added, much of the knowledge of how we can keep buildings comfortable without conditioning had been lost. He suggested such techniques allow us to learn from older buildings that used building mass, daylighting, and natural ventilation.

Completing the seminar, Loughborough University's Dennis Loveday spoke about applying the principles of *pankhās* and ceiling fans to low-energy cooling and ventilation in Indian homes. He explored delivering thermal comfort by optimising natural ventilation in combination with mechanical cooling systems (including ceiling fans) to form mixed-mode strategies that cut energy demand by avoiding unnecessary air conditioning.

More details of Loveday's seminar will be featured in a future issue of *CIBSE Journal*. [C](#)

OBITUARY: DR PREM JAIN



ASHRAE Distinguished Fellow Dr Prem Jain did more than anybody to promote sustainable building in India. Through his MEP consultancy Spectral, he built dozens of platinum- and gold-rated buildings, and as chair of the Indian Green Building Council (IGBC), he helped make the country aware of sustainability. His dream was for India to be a world leader in sustainability and he was revered there as the father of green buildings.

Jain graduated from Banaras Hindu University in 1957 and obtained a double PhD in mechanical and electrical engineering from the University of Minnesota, USA, in 1965. He established building services consultancy Spectral in 1980, and it now has 700 partners in nine locations across India.

During his career, Jain designed services for Vigyan Bhawan, the All India Institute of Medical Science, Bahá'í Temple extension, Siddhi Vinayak Temple, and Osho Ashram Pune. He was the honorary adviser to the President of India, for the air conditioning of the Durbar Hall, Rashtrapati Bhawan, New Delhi, and was personal technical adviser to the prime minister from 1984 to 1990.

Spectral designed Godrej Green Business Centre in Hyderabad, which was awarded Leed Platinum Rating in 2003 and became the world's greenest building in March 2004. In 2011, Spectral merged with Aecom and Jain took over as chairman emeritus for Aecom India. He achieved 60 platinum and 40 gold awards from the IGBC and USGBC for the design of green buildings in India. He was given a lifetime Achievement Award from Marquis' *Who's Who in the World*.

Jain founded ISHRAE, which now has more than 12,000 members and 8,000 student members, and was presented with a lifetime achievement award by both ISHRAE and ASHRAE. He became chairman of the IGBC in 2007, and worked relentlessly to create 23 chapters across India. He was also instrumental in launching more than 150 IGBC student chapters in various colleges.

Under Jain's guidance, IGBC launched 25 green building rating systems, one for each specialised application. As of November 2018, more than 4,900 projects are adopting IGBC standards. Today, India has the second highest level of registered green footprint in the world.

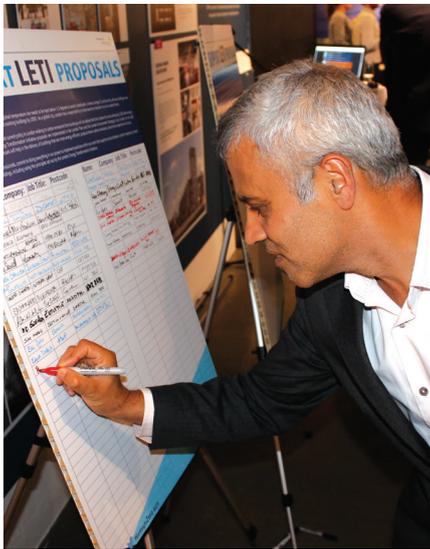
The Prem Jain Memorial Trust, founded in his memory, will promote sustainability and identify future leaders who can be a catalyst for global development of sustainability.





The London Energy Transformation Initiative aims to support the construction of zero carbon buildings by 2030. It is creating a roadmap describing how this can be achieved, and newly crowned CIBSE Building Performance Engineer of the Year Clara Bagenal George says anyone in the industry can get involved

COUNTDOWN TO ZERO



Signing up to support Leti's zero carbon 2030 proposals

The latest Intergovernmental Panel on Climate Change (IPCC) report, from October 2018, makes abundantly clear the need for urgent action to reduce carbon emissions, warning that we have just 12 years to limit the impact of climate change by keeping global warming to a maximum of 1.5°C.

The London Energy Transformation Initiative (Leti), along with the World Green Building Council (WorldGBC), Architecture 2030 and others, believe all new buildings need to achieve net zero carbon in operation by 2030. This might feel like a long way off, but considering projects are often completed and occupied up to five years after they are designed, this deadline appears much closer.

By 2025, 100% of the buildings we design need to be able to achieve net zero in operation. As an industry, we need to be certain that we can deliver this – not just for pioneer projects, but for all projects.

Currently, the industry is not even sure how to define zero carbon and what this means for our projects. Should the target depend on location, height or building typologies – and does it include embodied carbon or unregulated loads?

Although much progress is being made in the data-disclosure movement, the industry often does not make the connection between performance in use and what is deemed to be a sustainable building design. To understand the extent to which we have to reduce emissions, we need to get to grips with how our buildings are performing.

Definition

Leti believes that, by 2020, we need to have developed a definition of 'operating at net zero', with defined measurable targets and a design approach. This will give us five years to sense check, refine and validate the approach – as well as allow time for market uptake – so we can be sure that, by 2025, all the buildings we design operate at net zero.

To that end, Leti aims to develop a comprehensive roadmap during 2019 setting out the approach, targets and benchmarks that developments in London need to achieve to reach net zero in operation. This means that, by 2020, developers, consultants and policy officers in London – and the rest of the UK – will be able to understand what their developments must achieve to ensure our climate change targets are met.

Leti working groups

The roadmap includes seven Leti working groups focusing on the following areas:



Leti is aiming to develop a comprehensive zero carbon roadmap during 2019



“By 2025, 100% of the buildings we design need to be able to achieve net zero in operation”

Net zero carbon

This group is feeding into work, led by the UK Green Building Council (UKGBC), on a definition for net zero carbon. It is also collaborating with the Greater London Authority (GLA) on a policy roadmap to achieve net zero carbon in new buildings by 2030 and existing buildings by 2050.

Leti will develop tools to make net zero carbon more tangible, coherent and achievable for the industry. It will confront issues such as cost and feasibility, setting out what net zero carbon buildings could look like by working up examples for typical London typologies. This will include developing a technical tool for designing and delivering net zero carbon buildings, using the Leti Declaration as a starting point.

Embodied and whole-life carbon

Working with UK and international bodies – such as UKBGC/WGBC, the World Business Council for Sustainable Development, Climate-KIC and the Children’s Investment Fund Foundation – this group aims to develop guidance relevant to planners

and built environment professionals on conducting embodied carbon assessments. This will include where to source data on embodied carbon in materials and building services, and where to draw the boundaries of an embodied or life-cycle carbon assessment. It is also raising awareness of embodied carbon.

Calculation methodologies – Part L of the Building Regulations:

This group is developing recommendations on the role of energy modelling in the design process, both for compliance and performance modelling. It will put together detailed recommendations for the energy assessment methodology in Part L of the Building Regulations, and explore questions such as the effectiveness of an approach based on the notional building, and other alternative methods.

Be seen – data disclosure

This will offer recommendations on the in-use energy and contextual data that should be reported, and advice on the practicalities of setting up metering, monitoring and reporting systems. The group will demonstrate some of the uses of the data and the opportunities these bring.

The future of heating

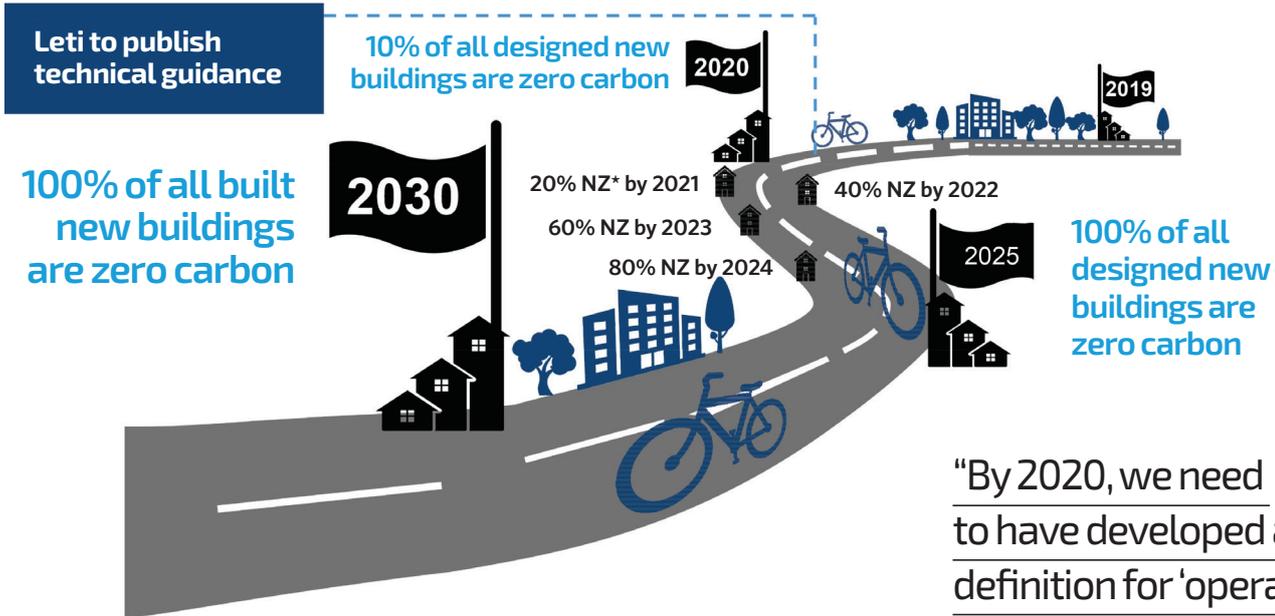
The aim of this group is to develop clear guidance for industry on this rapidly changing area. Fluctuating carbon factors between high- and low-demand periods >>



Leti workshops over the past year have helped to engage the industry on zero carbon targets



Launch of the Getting to zero report



Leti's pathway to zero carbon in 100% of all new buildings by 2030

*nearly zero (NZ)

» are a challenge to developing low carbon and low-cost heating and hot water systems. So this group will explore whether the focus should be on reducing heat demand rather than improving supply efficiency, and how close we are to satisfactory building fabric for individual buildings, or clusters of buildings, to run on internally generated heat gains.

Demand response and energy storage (DRES)

This will establish whether flexibility in when buildings and occupants use energy

“By 2020, we need to have developed a definition for ‘operating at net zero’, with defined, measurable targets”

can reduce carbon emissions. The focus will be on developing guidance on how DRES can reduce the carbon footprint of buildings, and how local authorities can assess whether a building has been designed to maximise energy-use flexibility.

The group will also explore how DRES in a development could reduce or delay the need for grid upgrades, and its wider impact on renewables.

Leti Declaration

To achieve the Leti goals, it is crucial that industry leads by example and builds upon the changes in the draft London Plan to deliver operational net zero carbon buildings. The Leti Declaration tool has been developed to help achieve this, with a strong focus on nudging design teams to think about how their design proposals would perform in operation.

The focus is now to refine, develop and test the Leti Declaration to disclose energy data at the design stage and compare this with measured in-use performance data, by developing functionality to link to post-occupancy monitoring data.

To avert disastrous, irreversible climate change, we only have one year to develop our first version of a roadmap for achieving operational net zero carbon buildings. For this roadmap to be robust, we need as many people as possible to become involved. Sign up at www.Leti.london/2019-workstreams **CJ**

CLARA BAGENAL GEORGE is a senior engineer at Elementa Consulting

LETI AND ITS IMPACT

Leti was established to support the transition of London’s buildings to net zero carbon. Its focus was initially to influence energy policy in London, including the draft London Plan and the London Environment Strategy. Although still working with the GLA, Leti’s focus has shifted to offering solutions and approaches to support the zero carbon transition. Many of its recommendations have been included in emerging London policy and energy assessment guidance:

Energy-use disclosure: A ‘be seen’ stage has been added to the energy hierarchy that cements monitoring, verifying and reporting into the London Plan.

Carbon factors: The draft London Plan recognises that Building Regulations use outdated carbon-emission factors. The GLA energy assessment guidance recommends that SAP10 carbon factors (for example, 233gCO₂/kWh for electricity) are used from January 2019.

Whole life-cycle carbon: Referable schemes to calculate whole life-cycle carbon emissions through a nationally recognised assessment, and to demonstrate actions taken to reduce life-cycle carbon.

Enhanced fabric and systems: A 10% reduction in carbon emissions for residential development, and a 15% reduction for non-residential, to be achieved by using efficient building fabric and systems.

Increased transparency of design: Reporting on total energy demand and glazing ratio. Fabric Energy Efficiency Standard (FEES) to be reported for residential.

Overheating: CIBSE TM52 or TM59 criteria are met using the DSY1 (2020’s 50th percentile) weather file, and that sensitivity analysis is carried out for DSY2 and DSY3 (2020’s 50th percentile). An overheating checklist must be completed for residential developments.

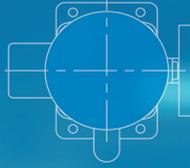
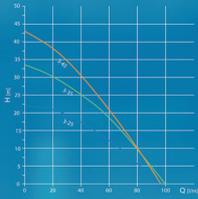
Future-proofed to achieve zero carbon onsite: All developments and district heating systems to be future-proofed to achieve zero carbon onsite by 2050.

Calculation of unregulated energy consumption: Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations.

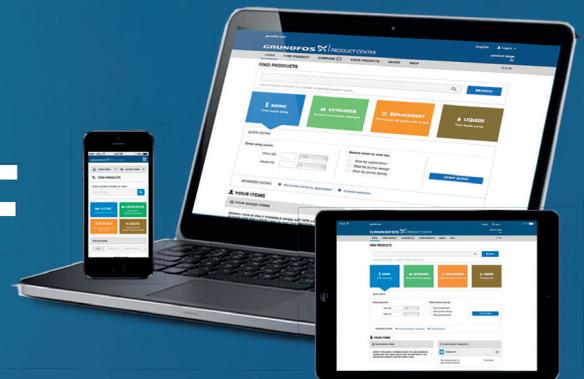
Cost to occupant: To be reported if heating and hot water are to be provided by heat pumps.

Onsite renewable: To be maximised, regardless of whether 35% carbon-emission reduction has been met.

Demand-side response: Plans for demand-side response and investigations into energy storage are required.



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Battery storage

Advances in battery technology and steep falls in prices for PVs and storage is making smart energy grids an attractive commercial proposition. Aecom's first cost model of the year assesses the viability of batteries across a number of scenarios

The advance in battery storage technology means the role it can play in developing a smarter energy system is becoming a commercial reality. Lithium-ion batteries have fallen in price, so storage has become an increasingly attractive method of reducing energy bills and dependence on the National Grid. Coupled with a dramatic fall in the price of solar photovoltaic (PV) cells, there is a promising business case to be made for the large-scale employment of both technologies in the domestic and commercial market.

State of the market

Since 2010, there have been more than 700,000 domestic solar PV installations in the UK, resulting in a solar PV capacity of 9GW – representing a huge opportunity for battery storage to harness this energy. In the



same period, there has been a significant fall in the price of lithium-ion battery storage, from £770/kWh to £180/kWh. This is plateauing, however, and Tesla and Panasonic have recently revised their prices upwards by 12% for their domestic and small business Powerwall product. Despite this, when the relative warranties and efficiency degradation rates are taken into account, products such as Tesla's offer a cost-effective solution to a consumer with sufficient load demands.

While the rest of the domestic battery-storage market catches up with the demand created, the market is not necessarily moving in the right direction. If battery storage is to be employed effectively in communities – which contain a mix of residential, retail and commercial space with varying loads – it needs to be done in partnership with the distribution network operator (DNO).

A great example is Project SCENE's Trent Basin development, which is home to Europe's largest community battery-storage system, with a capacity of 2.1MWh. Sized to be future-proof, this system aggregates demand and supply, thereby offering a far more efficient use of energy while generating a revenue stream through a firm frequency response (FFR) contract signed with the National Grid.

This concept of community energy storage gets particularly exciting when combined, potentially, with electric vehicles (EVs). Researchers and the industry are now grappling with the challenge of integrating EVs into community battery-storage systems with two-way charging points, which would allow energy to be pooled between building demands and the connected vehicles (naturally, stationary for 95% of the time). In the near future, we could see EV owners being paid when they connect to the Grid and agree to controlled charging.

The business case

Electricity consumption can be a significant cost to a commercial or industrial consumer. Battery storage represents an opportunity to not only reduce this, but also generate a return on the investment. Judging the business case for investing in battery-storage systems requires an



understanding of the relevant agreements in place with the Grid that ensure revenue streams back to the operator.

The initial capital investment made in a battery-storage system includes not only the battery, but the connection costs associated with the DNO, the necessary inverter, transformer, switchgear and contract formation. While there is sizeable initial capital expenditure (capex), the operator has to consider the coinciding operating



Cost data: battery storage. three scenarios: TNUoS/DUoS income and FFR and Econ 7	Base position				Base position + five years FFR				Base position + five years FFR + Economy 7			
	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
	2019	2020-28	2029-38	2039-48	2019	2020-28	2029-38	2039-48	2019	2020-28	2029-38	2039-48
	1	2-10	11-20	21-30	1	2-10	11-20	21-30	1	2-10	11-20	21-30
Capital expenditure (capex)												
Estimated installation of 1.8MW system	900,000				900,000				900,000			
DNO network connection costs	45,000				45,000				45,000			
LV inverter/transformer/switchgear	60,000				60,000				60,000			
Contract formation	40,000				40,000				40,000			
Operational expenditure (opex)												
Annual maintenance		27,300	44,000	65,200		27,300	44,000	65,200		28,600	46,200	68,300
Replacement cycle			1,320,900	684,900			1,320,900	684,900			1,320,900	684,900
Additional insurance premiums		86,100	110,200	127,900		86,100	110,200	127,900		109,519	110,200	127,900
Physical maintenance		500	5,800	7,400		4,000	6,200	7,900		7,500	10,500	13,500
Net cash outflows	1,045,000	113,900	1,480,900	885,400	1,045,000	117,400	1,481,300	885,900	1,045,000	122,200	1,487,800	894,600
Income												
TNUoS		618,100	1,144,700	1,955,300		618,100	1,144,700	1,955,300		618,100	1,144,700	1,955,300
DUoS		240,100	444,600	759,300		240,100	444,600	759,300		240,100	444,600	759,300
FFR						282,900	0	0		282,900	0	0
Capacity market levy		49,000	68,800	88,000		49,000	68,800	88,000		49,000	68,800	88,000
Economy 7 opportunity										145,900	271,400	463,500
		907,200	1,658,000	2,802,600		1,190,100	1,658,100	2,802,600		1,336,000	1,929,500	3,266,100
Assumed average efficiency (fluctuates due to replacement cycle)		89%	81%	72%		89%	81%	72%		89%	81%	72%
Net cash inflows (after efficiency is accounted for)	0	795,800	1,342,100	1,999,500	0	1,065,800	1,342,100	1,999,500	0	1,179,900	1,560,600	2,330,100
Net cash flows	-1,045,000	681,900	-138,800	1,114,100	-1,045,000	948,400	-139,200	1,113,600	-1,045,000	1,057,700	73,000	1,435,700
Present value of income	834,885				1,058,502				1,378,918			
Initial capital cost	-1,045,000				-1,045,000				-1,045,000			
Net present value	-210,115				13,502				333,918			
Percentage value of return on investment	-20%				1%				32%			

Figure 1: Inflows and outflows calculated against an initial investment in three scenarios, and the final return generated



“In the near future, we could see electric vehicle owners being paid when they connect to the Grid and agree to controlled charging”

on the transmission network during ‘triad’ periods – the three, half-hour periods with the highest system demand between November and February, which National Grid uses to determine TNUoS charges to business customers. This higher cost band can be avoided with a battery-storage system, so represents a cash inflow to an operator. The DUoS charge is added to all business electricity bills, is set by your DNO, and is time-banded to encourage levelled demand. It can be mitigated through use of a battery-storage system.

Battery storage can also be used in conjunction with a time-of-use tariff, such as Economy 7, for arbitrage and load shifting to cheaper periods. A battery-storage operator can also draw revenue from the savings made in reducing its Capacity Market Levy charges – a government levy to improve supply security.

The final cash inflow an operator will see in the current market is from providing a FFR to the Grid. Once negotiated, this can be a good source of revenue, but it is set to be phased out over the coming years.

In Table 1, these inflows and outflows are calculated against an initial investment in three scenarios, and the final return generated. The analysis does not take into account the benefit of a solar PV generation system paired with the storage system. The storage system is assumed to be a 1.8MW, lithium-ion battery system, with a two-hour supply time.

The data shows that significant returns can be recognised, even without a solar PV system, only when all incentives are taken advantage of in the current market conditions. These are benchmarked figures, but clearly show that there is a strong commercial case to be made for battery-storage systems. [C](#)

» expenditure (opex) over the period of planned operation. This includes annual maintenance to ensure battery health; physical maintenance from 10 years onwards; additional insurance premiums; and – the largest opex – the replacement cost once the lifetime of the battery has expired (every 13 years in this example). These are significant cash outflows, but can be outweighed when the correct inflows are planned and agreed.

The main inflows to an operator are the savings generated via arbitrage (peak shaving), and the avoidance of the Transmission Network Use of System (TNUoS) and Distribution Use of System (DUoS) charges. The TNUoS charge is for using the electricity transmission network and applies solely to business users and generators. It is based on the share of demand

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UK to keep EU refrigerant restrictions after Brexit

Existing F-Gas requirements to be transferred into British law

Refcom, the UK's fluorinated gases (F-Gas) register, has published guidance on how the country will continue to manage F-Gases after its departure from the EU. The Department for Environment, Food and Rural Affairs (Defra) has also confirmed that quotas established as part of the EU's F-Gas regulations will remain in place for the UK whether or not there is a Brexit deal.

Refcom explained that existing F-Gas requirements will be transferred into UK law from 30 March, so that ozone-depleting substances and F-Gases will continue to be restricted in line with existing EU-wide commitments. This includes: preventing the intentional and unintentional release of F-Gases during production and use; leak checking, with records kept up to date; and gas recovered for recycling, reclamation or destruction when equipment is repaired or decommissioned.

Refcom will continue to operate the UK register after Brexit and existing qualifications will remain valid, and still be required by engineers and technicians



working with F-Gases, such as HFC refrigerants. Defra said restrictions on higher global warming potential refrigerants will remain at 63% of the initial baseline for 2019 and 2020, with the quota cut to 45% in 2021. In the event of a no-deal Brexit, however, businesses putting HFC products equivalent to 100 tonnes or more of CO₂ a year onto the market will need to apply for a new quota (see article below).

Defra launches 'no deal' register for firms trading HFC products

The Department for Environment, Food and Rural Affairs (Defra) has launched a mandatory register for companies trading and importing products that contain HFC refrigerant gases. It will come into force in the event of a no-deal Brexit.

The online register has been created to make sure the UK continues to impose EU restrictions on fluorinated gases (F-Gases) and ozone-depleting substances (ODS), whatever the outcome of the Brexit negotiations. In the event of a no deal, it will replace the current system used by all EU member states.

'Delivering a negotiated deal with the EU remains the government's top priority, but it is the job of a responsible government to ensure we are prepared for all scenarios, including no deal,' said Environment Minister Thérèse Coffey. 'The new system is part of the government's commitment to maintain environmental standards once we leave the EU.'

'The continued phase-out of harmful greenhouse gases is critical to the global fight against climate change.'

Registered firms will receive an email and any that register before 29 March - the date the UK is set to leave the EU - will be able to continue operating as normal. After that date, firms will have to wait for their registration and gas quota to be approved. Anyone registering after 12 April will not get a quota for this year.

African air con market speeding up

The African air conditioning market grew by 4% in volume last year, according to BSRIA. It is forecast to grow at around 5.5% between 2017 and 2023 - faster than the 4.9% forecast for the total global market over the same period.

Ghana, Kenya, Nigeria and Tanzania are leading the way because of population growth, better performing economies, more stable governments, new construction, urbanisation and rising disposable incomes.

There are still myriad challenges faced by countries in the region, however, including a recovering economy in Egypt and economic stagnation in South Africa.

'In spite of its political uncertainty and economic challenges, the continent continues to attract investors' attention, especially from China,' said BSRIA research manager Saziye Dickson.

Chinese manufacturers accounted for a significant market share in Africa last year, with South Korean companies in second place, Dickson added.

According to Oxford Economics, gross domestic product growth for Africa is set to outstrip that of any other global region from 2012 to 2030, driven by rapid economic and population expansion, resulting in faster urbanisation than on any other continent.

Flammable refrigerant safety guide released

The Australian Institute of Refrigeration, Air conditioning and Heating (AIRAH) has released an online, updated version of its Flammable Refrigerants Safety Guide. Developed with support from the Australian Department of the Environment and Energy, it is aimed at refrigeration technicians, apprentices and other stakeholders.

In January 2018, Australia began a phase-down of hydrofluorocarbons, which has resulted in a shift to flammable, low global warming potential synthetic and natural refrigerants. AIRAH CEO Tony Gleeson said: 'We need to ensure, as the use of alternative refrigerants picks up, that our industry is equipped to work safely, efficiently and professionally with any refrigerant it encounters.'

The revised guide refers to standards AS/NZS ISO 817 and AS/NZS 5149 series, which have superseded AS/NZS 1677.

To download the updated guide, visit bit.ly/2GUuQr8



Hunt on for innovative lower GWP technology

ASHRAE and UN jointly promoting international award

Entries are open for an ASHRAE and UN Environment international award programme to promote innovative designs, research and practices of low global warming potential (GWP) refrigerants and related technologies.

The jointly established Lower GWP Refrigeration and Air Conditioning Innovation Award recognises people who have developed or implemented technological concepts applied in developing countries to minimise global warming potential through refrigerant management.

First place and honorable citation awards will be made in two categories – residential applications and commercial/industrial facilities. The winners will be selected based on innovative solutions

for designs, practice or research using lower GWP technologies.

The selection will take into account the following criteria: extent of need; innovative aspects in transforming conventional practices; technical replicability to developing countries; and the economic feasibility to developing countries.

Entries will be accepted until 15 May. Winning projects will be publicised by both organisations, and first-place recipients will get a stipend to receive their award at a UN Environment event.

ASHRAE President Sheila J Hayter PE said: 'We look forward to seeing entries from innovators who are committed to sustainability through the development and implementation of a new generation of low GWP efficient solutions.'

For more information on how to enter, visit ashrae.org/lowergwp



Mitsubishi Electric to create net zero energy building test facility

Mitsubishi Electric is to build a new test facility for its portfolio of technologies for net zero energy buildings (ZEB) at its information technology research and development centre in Kamakura, Japan.

The aim is to accelerate the company's development, evaluation and demonstration of ZEB technologies.

The four-storey, steel-frame facility, which will cost approximately ¥3.6bn (£25.4m) to build, is scheduled to start operating in June 2020 and will provide 6,000m² of floor area. It will be used to test applications and innovations in advanced heat insulation, solar shading, high-efficiency equipment, and onsite energy generation systems.

Japan's Ministry of Economy, Trade and Industry defines ZEBs as buildings with considerably reduced annual energy consumption by saving as much energy as possible via better heat insulation, solar shading, natural energy and high-efficiency equipment. They also create energy – for example, with photovoltaic power generation – while maintaining comfortable environments.



Carrier chiller lands at Gatwick Airport

Spie has installed a Carrier AquaForce 30XAV chiller at Gatwick Airport's Jubilee House administrative offices, as a replacement for an ageing, air-cooled screw unit.

The chiller uses Carrier's PUREtec HFO R-1234ze refrigerant with a global warming potential (GWP) rating of less than 1. Using a fine-control inverter, it matches cooling output with the load, which – Carrier says – optimises efficiency, particularly at part-load conditions.

Gatwick Airport is aiming to reduce its carbon emissions by 50% and energy consumption by 20%. The move away from refrigerants with high GWP is part of an environmental policy set out in Decade of Change vision and Cooling Strategy beyond 2020.

Trane expands XStream portfolio

Trane has added new small capacity water-cooled chillers and water-to-water heat pumps to its XStream product portfolio. The new XStream RTWF solutions cover lower capacities between 340kW and 920kW and include models designed with low global warming potential (GWP) refrigerants R-513A and R-1234ze.

According to Trane, the use of the less than 1 GWP R-1234ze refrigerant makes the XStream RTWF unit capable of delivering heating capacity up to 80°C delivering, the company claims, a safe, efficient and sustainable cooling and heating solution.

Trane claims the design features of the XStream products make them suitable for critical indoor environments such as data centres, hospitals, large office building or industrial process applications.

For more details, visit trane.eu

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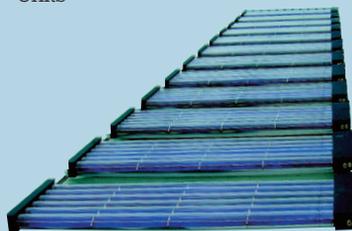


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GOING TO ANY LENGTH

Limited space and the need for flexibility helped drive the specification of chilled beams at Lambeth Civic Centre. Frenger's **Michael Ainley** explains

The need to supply fresh air over a large open-plan office with limited space and locations for the service risers and bulkheads led to the specification of 778 multi-service chilled beam (MSCB) sections, and 39 ceiling-integrated chilled beam (CICB) units, at Lambeth Council's new £45m civic centre.

Frenger's prefabricated MSCBs, which incorporate cooling, heating, lighting and ventilation, were connected in a series across the 11,000m² of office space over six storeys.

The civic centre building has an energy centre on the roof and district heating and cooling networks that serve the site. It features an open-plan office, central atrium, meeting rooms and cellular offices.

Limited space and locations for the service risers meant that, to achieve adequate distribution of fresh air over the floor space, the design team and Frenger used long runs of MSCBs, with the fresh air connected in series. The air chambers effectively became the distribution ductwork, eliminating the need for ventilation ducts.

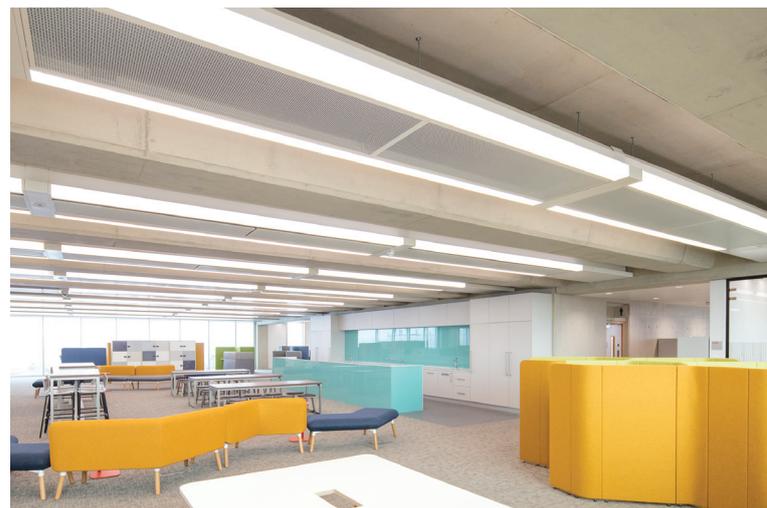
The ability to partition office space and maximise ceiling heights were two of the key benefits of the specification of MSCBs.

Low-temperature hot water (LTHW) and chilled water (CHW) circuits from the energy centre – as well as tempered fresh air – is distributed around the building via dedicated risers, and routed to chilled beams using high-level distribution bulkheads on each floor.

The MSCBs use Frenger's patent-protected burst-nozzle design – a multi-layered nozzle strip that enables a highly accurate and evenly distributed supply air volume at a given pressure at any point along

the length of the active chilled beam air discharge. This means each unit is able to deliver correct fresh air volumes for each specific control zone, based on the upstream static pressure. With the burst nozzles factory set to the exact air volume and pressure (also allowing for pressure drop from one MSCB section to another), this eliminated the need for dampers to site set each beam to the design air volume, apart from one damper to the first beam in the run.

The large open-plan areas meant the chilled beams had to be designed to accommodate higher-than-normal fresh air volumes of up to 150L·s⁻¹ per MSCB run of five separate units in series (totalling 15m each) – a rate of 10L·s⁻¹·m⁻¹. This was requested at the early design stage to future-proof the system for maximum occupancy of one person every 3.5m² – each person with 12L·s⁻¹ and the required design static pressure for that air volume being >>



The chilled beams distribute lighting, chilled and hot water and fresh air

» 100Pa to the first beam in the total run. The static pressure when ‘turned down’ yields the current occupancy of one person every 10m² with 12L·s⁻¹ per person –around 55L·s⁻¹ for the 15m run.

To ensure each MSCB section delivered the correct air volumes, the manufacturer physically tested the proposed series of MSCBs in one of its BSRIA-calibrated microclimate laboratories. The completed testing confirmed the relationships between air supply volumes and static pressure loss, thus ensuring the MSCBs connected in series would ‘self balance’ and each deliver the correct fresh air volumes.

Given these high air volumes, noise-level testing was carried out within a hemi-anechoic acoustic testing laboratory, to ensure the MSCBs did not generate excessive noise.

One challenge was to ensure the fresh air supplied by dedicated air handling units (AHUs) did not present a risk of condensation when used in conjunction with the chilled beam system. Frenger, ChapmanBDSP and AHS, the AHU manufacturer, formed a



LED lighting limited lighting-system heat gains to 8W·m⁻²

PROJECT TEAM

Architect: Cartwright Pickard
Consulting engineers: ChapmanBDSP
Contractors: Morgan Sindall and NG Bailey
Multi-service chilled beam supplier: Frenger
AHU supplier: AHS

coordinated design to ensure that the risk was negated by supplying air at 18°C and 45% relative humidity. LED lighting was specified for the chilled beams to reduce energy demand as well as limiting the lighting system heat gains to 8W·m⁻².

To further simplify the installation, the chilled beams’ cooling and heating circuits were designed to be self balancing, which meant MSCBs in each control zone had cooling and heating circuits connected in parallel.

This meant no individual commissioning valves were required to regulate flowrates. To achieve this, several specifically designed heat exchanger coil manifolds were used to control the waterside hydraulic pressure at the given design mass flowrates.

Their design, scheduling and manufacture was more difficult because of the combined permutations of the airside connections in series and waterside circuit connections in parallel.

However, the scheme offered financial savings for a reduction in ductwork, dampers, controls and commissioning valves, and saved considerable site labour time associated with the installation and commissioning.

With fewer controls, life-cycle costs also fall, as less routine maintenance is required. **CJ**

MICHAEL AINLEY is managing director at Frenger

FLEXIBLE WORKING

Future flexibility of office space is a key consideration for developers, so it is important that services can adapt to the changing requirements of building owners and occupants.

The MSCBs at Lambeth Civic Centre were 2.8m-long units, each with a 200mm-long removable joining infill dummy section to create 3m partition breaks on the typical five-unit, 15m runs. This also allowed flexibility for shorter runs, enabling partitions to dissect the run of MSCB units.

Typically, the British Council for Offices (BCO) calls for structural grids of 6, 7.5, 9 and 12m as this works well with its preferred standard planning grid of 1.5m increments and perimeter room widths of 3m, 4.5m and 6m (with a work space density of 8-13m² per person).

The above BCO best-practice requirements can be met with MSCB runs on a 3m pitch, perpendicular to the façade. Each run consists of a nominal 3m and nominal 1.5m-long MSCB unit section, or two nominal 3m-long plus two nominal 1.5m-long MSCB unit sections in a 4.5m or 9m overall run length consisting of two- or four-unit sections respectively.

In between each unit section there are removable short-length joining infill panels that conceal any plug and play interconnections, which are fed from a central bulkhead (for exposed roof soffits) or notional corridor (for suspended ceilings). Lighting can also be fitted into the infills if the aesthetics of a continuous light source are desired.

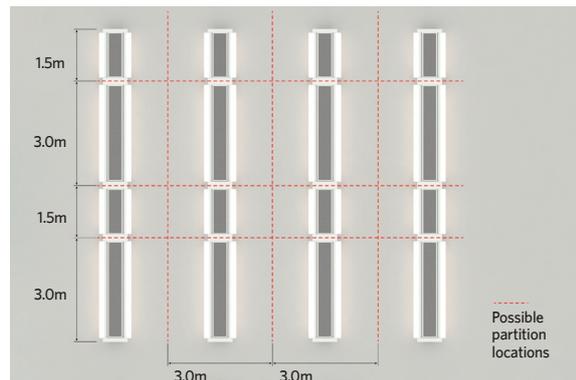
The removal of these short lengths of joining infill panel allow for office partitions to be built along predetermined office planning grid lines (agreed at early design stage). See image, right.

Flexibility for increased fresh air volumes can be achieved by factory setting all chilled beam units to deliver the design volumes at a lower static pressure than the central plant could deliver (all chilled beams factory set to 60Pa, for example). If static pressure is increased to 100Pa, this would

enable a boost function for demand control of 29% or 41% if static pressure is increased to 120Pa. The turn-down facility from the 60Pa initial design parameters for system static pressure could be as much as 50% (see ‘Easing the pressure’, *CIBSE Journal*, March 2018).

Frenger has supplied MSCB projects with LED lighting with 500 lux on the working plane, with drivers factory set at as little as 230 milliamperes per linear metre and 4.8W·m⁻² energy consumption. So it is possible to dim to 300 lux or increase the milliamperes to exceed 500 lux, although consideration should be given to uniform glare-rating indices.

Frenger has also supplied MSCB projects with two-part heat exchanger coils (spilt coil) so sprinkler heads and other services, such as PIR sensors, can be located anywhere along the length of the MSCB unit sections.



Multi-Service Chilled Beams

The Future of Space Conditioning



Active MSCB's or Passive MSCB's

Based on Active Chilled Beam technology, Active Multi-Service Chilled Beams (MSCB's) are connected to both the ventilation **supply air** ductwork and the **chilled water** supply. **Low temperature hot water** (LTHW) can be used as a separate supply (4 pipe) in this system for heating.

A main air handling unit supplies fresh air into the various room areas through the chilled beams, which uses the primary air supply to induce room air into the beams heat exchanger. The induced air is then re-circulated into the room, along with the fresh air supplied by patent protected burst nozzle slots along the beam.

Active and Passive MSCB Design Options

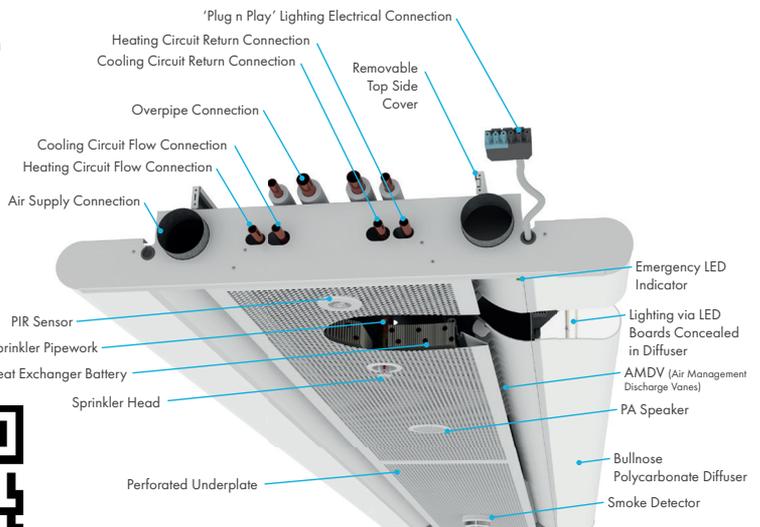
- Cooling
- Heating (Active)
- Electrical Compartmentation
- Up-lighting
- Direct lighting
- Emergency Lighting
- Control valves
- Sprinklers
- Acoustic insulation
- Smoke detectors
- Lighting sensors
- Distribution Ductwork
- Fresh Air (Active)
- PA / VA Speakers
- Distribution water pipes

Key Benefits of MSCB's

- Ideal where floor-to slab height is minimal
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- Beam aesthetic can be customised to client requirements
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The ability to cool by radiation means that passive MSCB's can provide 40% more cooling at the same air movement velocities when compared to traditional finned coiled batteries. They are ideal where there is a requirement to provide the **best possible occupancy comfort levels** and **excellent energy efficiency**.



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DIGITAL ENGINEERING AT THE TECHNICAL SYMPOSIUM

The 9th CIBSE Technical Symposium will be held in Sheffield next month, offering the opportunity to hear about the latest building services research, including on digital engineering. Below are four papers being considered for inclusion

Obstacles facing BIM implementation

Sara Ibrahim, Mirage Architectural and Engineering Consultant

This review considers obstacles to BIM implementation and explains how owners, clients and non-technical managers can help to overcome some of these.

It addresses concerns about the cost and effectiveness of BIM, illustrating how it shifts the balance of overall life-cycle costs to the design and construction stages, significantly reducing a building's post-construction operation, maintenance and other running costs – which can account for 80% of total life-cycle costs.

There is still some resistance to BIM from business owners and managers who may not fully understand or appreciate the complete project life-cycle benefits – and cost savings – it can achieve. This review explains the benefits BIM can bring to all in the industry.

Fault detection and localisation using IFC: a case study of BIM-based visualisation of BAS-related faults

Fatin Abdoul-Wali, University of Sheffield

This paper explores issues around fault detection and localisation, using cross-referencing of data between BIM systems and building automation systems (BAS).

BIM integration with BAS still has limitations associated with fault-detection strategies related to building services systems such as HVAC. As different components within a complex HVAC system may manifest similar symptoms for a reported problem, the fault-detection process may be aided by accurate visualisation information.

This paper develops an ontology-enriched IFC for fault detection and localisation, enabling BIM-based visualisation and assessment of BAS components in terms of forward and backward fault propagation. It presents a building case study by exploiting the BIM model semantics in developing a computational method for data retrieval and visualisation on the basis of IFC content and knowledge-based diagnostic rules.

Digital engineering, data analytics and model calibration – the future of building operation?

Darragh Gleeson, IES

This paper investigates the role operational building



The symposium is an opportunity to hear about the latest research

data can play alongside advanced analytic and 3D energy modelling traditionally only used in the design stage. It considers whether digital engineering concepts and existing design models can be applied in operation to improve performance.

Building energy modelling calibration is a complex task requiring expert knowledge. However, a calibrated operational model of a building can be used to identify control issues, test which improvement or retrofit strategies will yield the best results, and measure/verify results. In practice, and for a number of reasons, model calibration is rarely done. When it is, the level of data available dictates the level of accuracy that can be achieved.

This paper explores the challenges, considerations, potential results and possible applications of the latest building services digital technology and data analytics to improve performance.

When is a building smart?

Dan Cash, University of the West of England

This opinion paper discusses the current status of artificial intelligence (AI) and the opportunities and challenges digital technology and machine learning bring to building services design.

Human behaviour within buildings is responsible for a significant amount of the energy use. This leads to a drive for controls to be intuitive and users to be taught how to use them.

An alternative approach would be to remove control from humans and allow AI to operate the building. Machine learning would optimise operation, to maximise comfort and productivity while minimising energy consumption. This requires a fundamental rethink about how buildings are designed, particularly with regard to data-based systems – such as building management, security and lighting controls – and the integration of control and data monitoring systems. **CJ**

■ The 2019 CIBSE Technical Symposium takes place at the University of Sheffield from 25-26 April

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DATA WITH DESTINY

Building data offers valuable insights into performance, so it is essential protocols are in place to ensure digital information imported from the building management system is robust and relevant, says BuroHappold Engineering's **Tom Hopton** FCIBSE

Too often, HVAC plant fails to operate at optimal efficiency because equipment has been poorly integrated and controls have not been programmed properly. Better understanding of controls and building management systems (BMS) won't just improve the energy performance of buildings, but also other operational outcomes, such as daylighting and ventilation. Health, wellbeing and productivity need to be considered alongside energy performance in controls strategies (see below).

Unfortunately, controls and BMS engineers in the UK are in short supply, and there isn't always the knowledge in the consultancy sector to advise clients and embed outcome-driven solutions into BMS design specifications. The Building Controls Industry Association (BCIA) is working to address the lack of engineers through its new BEMS apprenticeship scheme, among other initiatives. Consultant engineers must understand the discipline, and be able to communicate

opportunities to clients effectively. They must be competent enough to understand the system integration, and include programming and software in design specifications. If these are not robust, the design will be put under cost pressure at the tendering stage and key outcomes may not be realised.

Procurement through a contractor design has its pros and cons. Clearly, there is an advantage in using the contractor's specialist knowledge of manufacturers' hardware and integration capabilities to drive the most cost-effective solution – not least because the technology is evolving at such a fast pace.

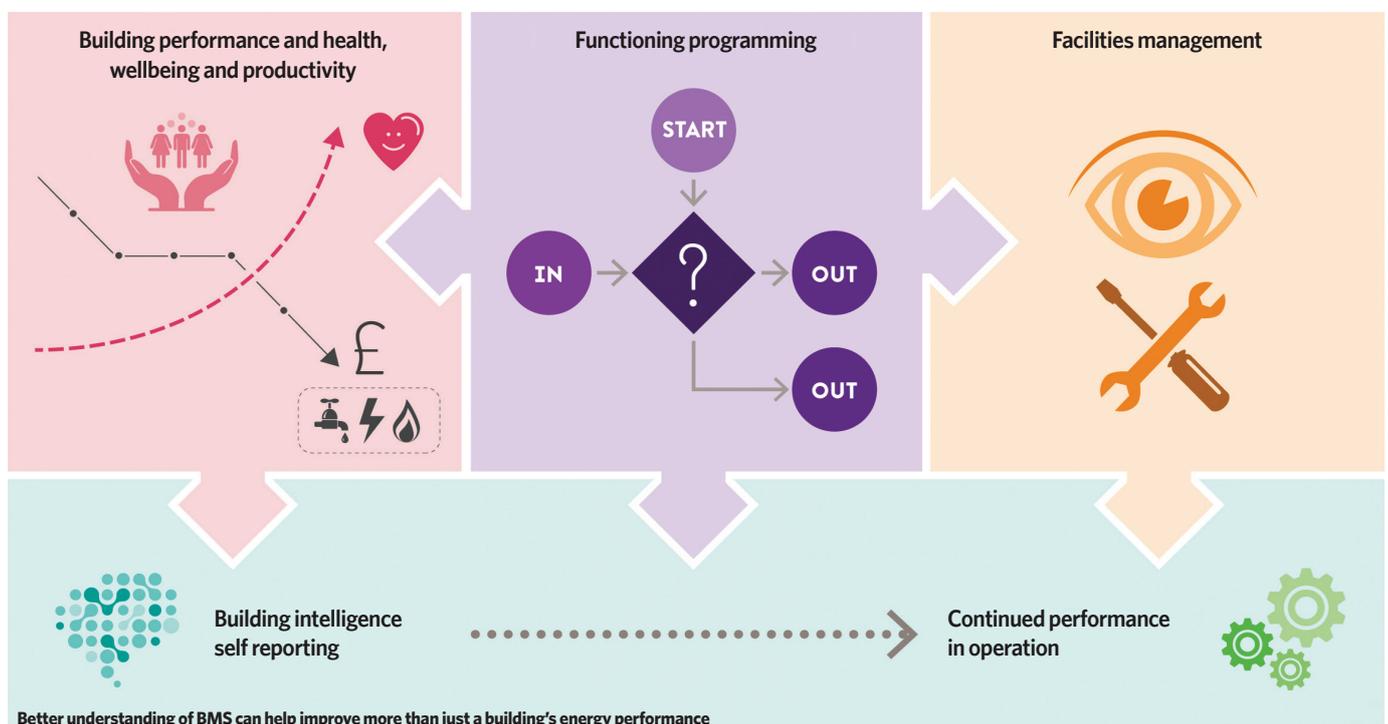
On the flip side, outline performance specifications are in danger of becoming too vague, leaving too much to interpretation. Competitive tenders and squeezed commissioning programmes mean short cuts are often made; this, coupled with a knowledge gap in witnessing engineers, leaves the industry with underperforming buildings.

The digitalisation of buildings

For some time, our buildings have operated under a digital platform of controls, networked together in a BMS. Over the past decade, these have become more sophisticated, with higher levels of cross-discipline integration.

Buildings collect data continually, often as a byproduct of the core functional needs of the controls system. This presents a fantastic opportunity for the industry to gain insights >>

Smart building management system



Better understanding of BMS can help improve more than just a building's energy performance

» – but only 20% of buildings use up to 80% of the building data available. For more data to be usable, there needs to be greater rigour in the way it is structured and named. BACnet and similar protocols have succeeded in opening up what used to be ‘black box’ technology, but we now need to leverage this beyond the needs of the core control function, towards the needs of data management.

In BACnet, we can recognise a data field for its content (protocol) but, all too often, the ‘naming conventions’ programmed during commissioning leave buildings with data that is poorly structured and named inappropriately. This is not just about naming energy meters correctly, but about deploying a common standard for occupancy monitoring data, pump and fan speed data, and any other metrics useful in the building performance assessment.

Each controls vendor seems to have a different approach, while some have no standard approach at all to naming data. Greater awareness is needed around the value of this data and how it can be more easily released with adoption of a naming convention such as Haystack (see project-haystack.org). Wider adoption of this will ease commissioning, witnessing, and the often laborious process of post-occupancy reviews.

Our industry has to make data more accessible to stakeholders, who can gain value from the insights it can reveal. We are now firmly in the digital age. Data science and automated data-management techniques, including machine learning, will accelerate our ability to gain insights from building data and turn this into performance improvements.

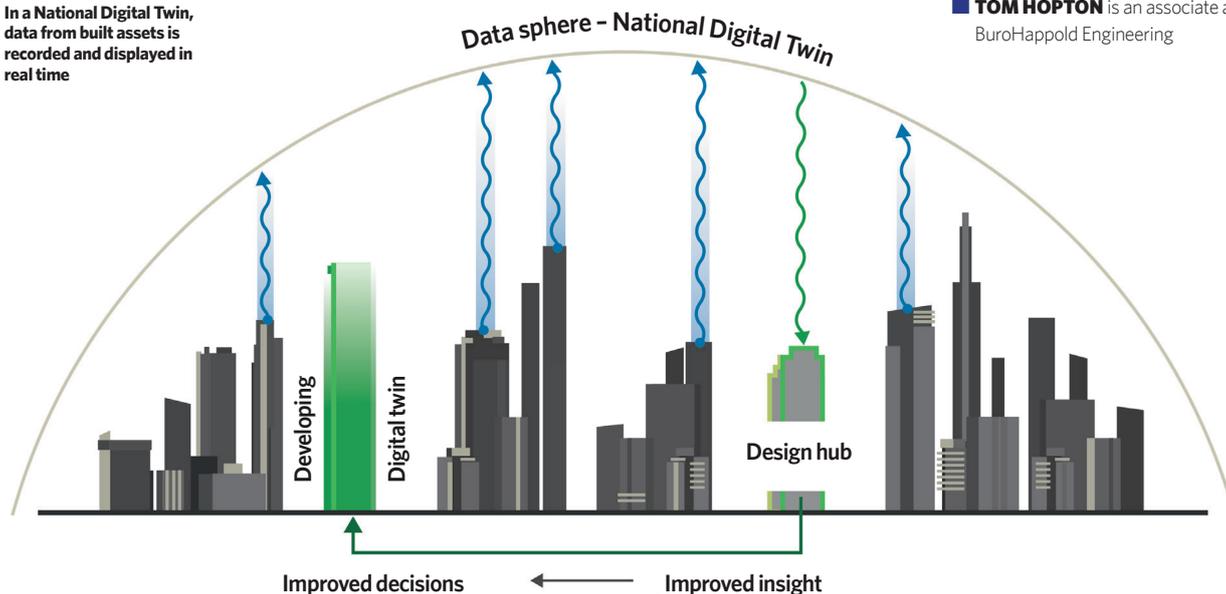
These data sets are frequently too large for traditional tools and a human-led approach. The relationship between building systems and user operations are also often too complex to map manually. Data science and machine-learning techniques can make sense of this – but to reap the benefits, we must start with good-quality data.

Closing the gap

An industry-wide naming standard for building data will give more insight into the building performance gap. If we can collect data from multiple sites, regardless of design consultant or BMS vendor, we can create a valuable database. There will be challenges, however; data will need to be secure and anonymous, but also accessible by third parties. Other questions are how building data submission can be financed or incentivised, and who is responsible for curating and analysing it.

The government has set out a vision to transform the way buildings are designed and operated by harnessing digital technology to capture and analyse data. This is being delivered via the Industrial Strategy

In a National Digital Twin, data from built assets is recorded and displayed in real time



DESIGN GUIDANCE AND STANDARDS

Existing industry guidance in the discipline is sparse. *BS EN 15232-1-2017 Energy Performance of Buildings. Impact of Building Automation, Controls and Building Management* provides a welcome standard to justify capital investment against a return in energy costs. The standard is summarised in BRE's *Energy management and building controls* at bit.ly/MarCJBMS1

The BCIA has recently published (October 2018) a Performance Specification for BEMS. This is a key industry benchmark, helping to quantify a standard baseline of BMS provision in our buildings.

Aside from these publications, there are other pockets of design guidance, but very little in the past decade, and no standard of control programming since the *BSRIA Library of System Control Strategies* in 1998. This year, there will be further control guidance from BCIA bcia.co.uk, and an update of the 2009 CIBSE Guide H: *Building control systems*.

DE6.1: *Cyber security in building services design* considers the need for secure design when dealing with complex information systems. See bit.ly/CJMar19DE6

Transforming Construction programme and the creation of the Centre for Digital Built Britain (CDBB), at the University of Cambridge. A recent CDBB¹ publication sets out the principles guiding the development of a National Digital Twin, where data from built assets is recorded and displayed in real time. The information management framework that will enable this is at bit.ly/CJMar19BMS

Access to this data would allow designers to benchmark design solutions with the data of recently completed building performance metrics and their data insights. The benefits could be huge. Greater data sharing is predicted to release an additional £7bn per year of benefits across the UK infrastructure sectors,² equivalent to 25% of total spend.³ 

References:

- 1 Centre for Digital Built Britain, *The Gemini Principles*, 2018
- 2 Deloitte Confidential: Public Sector, *New technologies case study: Data sharing in infrastructure – a final report for the National Infrastructure Commission*, November 2017
- 3 Office for National Statistics, *Developing new statistics of infrastructure*: August 2018.

 **TOM HOPTON** is an associate at BuroHappold Engineering



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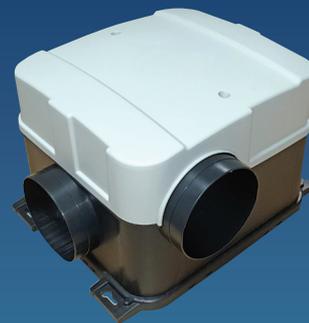
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The ubiquity of carbon dioxide in building services engineering

This module explores how carbon dioxide is ever-present in building services engineering and how this should be considered in a variety of applications

Carbon dioxide (CO₂) is omnipresent in the world of the building services engineer. Aside from atmospheric CO₂, the gas is used in refrigeration and, commonly, for the assessment and control of indoor air quality (IAQ) to provide healthy and productive internal environments.

A carbon atom forms four bonds with neighbouring oxygen to form CO₂ molecules, as shown in Figure 1. With each carbon-oxygen bond in CO₂ consisting of a double bond, with two pairs of shared electrons, CO₂ is very stable. It exists as a gas at standard atmospheric pressure and temperature, as it has a very low triple point of -57°C at a pressure of 5.2bar (where solid, liquid and vapour phases of a particular substance coexist). 'Dry ice' – solidified CO₂ at below -78.5°C – readily sublimates from a solid to a gas when exposed to standard pressure and temperature. At standard pressure and temperature, it is a colourless, odourless and non-flammable gas that accumulates near the ground (CO₂ is 60% heavier than air). Carbon dioxide is often misunderstood as being toxic because it is frequently associated with asphyxiation and even loss of life. CO₂ can be toxic at extremely high concentrations and cause asphyxiation; however, such issues are more likely to happen because enclosed environments are vulnerable to CO₂ accumulation that displaces the oxygen from the area, so causing hypoxia (low oxygen levels in body tissues). When present at relatively high concentrations – typically quoted in references related to building occupants as being above 10,000ppm – it is commonly thought to cause drowsiness.

Atmospheric CO₂

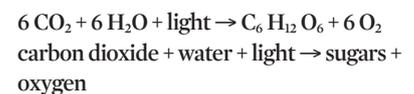
CO₂ is released from the Earth's core through openings such as springs and volcanoes, and produced from acidic water on carbonated material such as limestone. Naturally occurring CO₂ emissions – through respiration, fermentation and plant decay – are roughly balanced by the photosynthesis in plants (which also produces oxygen – see Equation 1) and absorption at the surface of the world's water masses.



Figure 1: The carbon dioxide molecule

Atmospheric CO₂ is thought to have risen by about 45% since the start of the Industrial Revolution. The current atmospheric CO₂ level¹ is reaching beyond 410ppm (Figure 2) on an apparently steadily rising trajectory.

Elevated atmospheric CO₂ has been reported as increasing the rate of plant growth, but also² adversely affecting the nutritional value of crops, as it reduces the ability of plants to convert nitrate into protein. Recent research³ has indicated that, when coupled with the predicted higher ambient temperatures, the nutritional value of the plant will be maintained.



Equation 1: Photosynthesis converting CO₂ to plant growth and oxygen



» And, of course, the key concern of rising atmospheric CO₂ – and the many other more significant gases – is its impact on the global climate.

CO₂ is produced by the combustion of fossil fuels, such as coal, oil or natural gas, as well as ‘renewables’, such as wood, biomass and biogas. Coal is the most CO₂-intensive fossil fuel, with approximately twice⁴ the equivalent emissions per kWh of natural gas when it is burned. The combustion of wood emits a similar amount of CO₂ as coal.

The term ‘CO₂ equivalent’ – or CO₂e – gives an interpretation of the amount of CO₂ that would have the equivalent ‘global warming’ impact (typically over 100 years) for a particular greenhouse gas. The principal other gases noted in the recent Department for Business, Energy and Industrial Strategy (BEIS) report⁵ for UK emissions are methane, nitrous oxide and hydrofluorocarbons (HFCs). However, for the residential/business and related energy supply that may be considered as being most influenced by the activities of the building services sector, CO₂ emissions provide by far the greatest contribution. The estimated current CO₂ emissions for the UK are broken down by sector in Figure 3.

CO₂ as a contemporary refrigerant

Despite its notoriety as the measure of global warming impact, CO₂ is considered as a low global-warming potential and cheap refrigerant (R744). With the Kigali amendment to the Montreal Protocol (to cut the production and consumption of HFCs) and the European F-Gas Regulations, there has been renewed interest in the use of CO₂ as a refrigerant, as it has a global-warming potential of 1.

The ‘critical point’ for CO₂ – at which the temperature and pressure are such that it is in a state of equilibrium between solid, liquid and vapour – occurs at 31°C, much lower than other common refrigerants (for example, the critical point for R134a is at 101.1°C). Above the critical point, the CO₂ is a supercritical fluid (considered a gas) and in the CO₂ ‘transcritical’ refrigeration cycle, gas cooling takes place instead of the more standard condensation process. Such CO₂ systems operate at much higher pressures than commonly used refrigerants in building services applications – the *CIBSE Journal CPD* from December 2012 offers some further explanation. In recent years, CO₂ has increasingly been applied in smaller-scale – as well as the more traditional, larger – commercial refrigeration and heat-pump applications.

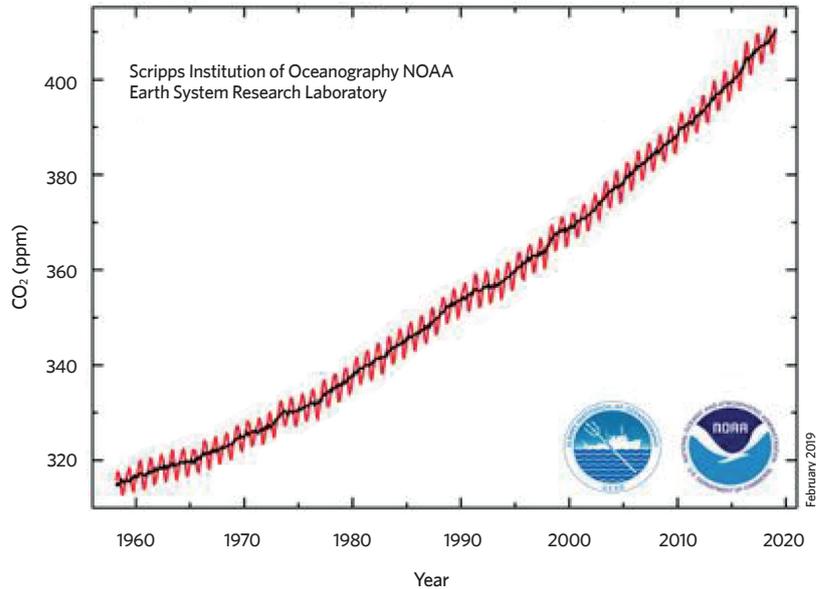


Figure 2: Atmospheric CO₂ measured at the Mauna Loa Observatory in Hawaii

CO₂ in internal environments

As summarised in CIBSE KSI7,⁶ the CO₂ emitted by occupants and/or appliances can give an indication of the ventilation rate in a space. In a sedentary occupied zone, a concentration of 800 to 1,000ppm typically represents a ventilation rate of about 10L·s⁻¹ per person. CIBSE Guide A⁷ notes that, as a general rule, the fresh air supply rate should not fall below between 5L·s⁻¹ and 8L·s⁻¹ per occupant, but this will depend on various other factors, including floor area per occupant, processes carried out, equipment used, and whether the work is strenuous. As a rule of thumb, 8L·s⁻¹ fresh air is equivalent to an elevation of 600ppm of CO₂ that, when added to the normal outdoor CO₂, gives an internal CO₂ concentration of approximately 1,000ppm; 5L·s⁻¹ would be equivalent to 1,350ppm internally. However, CIBSE recommends higher values of 10L·s⁻¹ for comfort – which includes consideration of other aspects of IAQ, such as other emissions from occupants known as ‘bioeffluents’. The UK statutory average exposure limit over an eight-hour reference period is a CO₂ concentration of 5,000ppm in working conditions, with a 15-minute short-term exposure limit of 15,000ppm.⁸

CO₂ concentration in indoor environments has long been used as an indicator of ventilation requirements and as a proxy for indoor air quality. The study⁹ undertaken by Allen, published in 2016, cited the increasingly airtight and energy efficient buildings as key in the increase in levels of internal CO₂ and volatile organic compounds (VOCs). Referring to US homes, he noted that infiltration rates had typically reduced from a ‘traditional’ house with one air change per hour to 0.1-0.2 air changes per hour for modern homes. This decrease in the (normally) diluting ventilating action of the outdoor air can lead to increased concentration of CO₂ and indoor pollutants that contribute to the resulting challenges of ‘sick building syndrome’.

In an example of the many UK investigations carried out in recent years, the

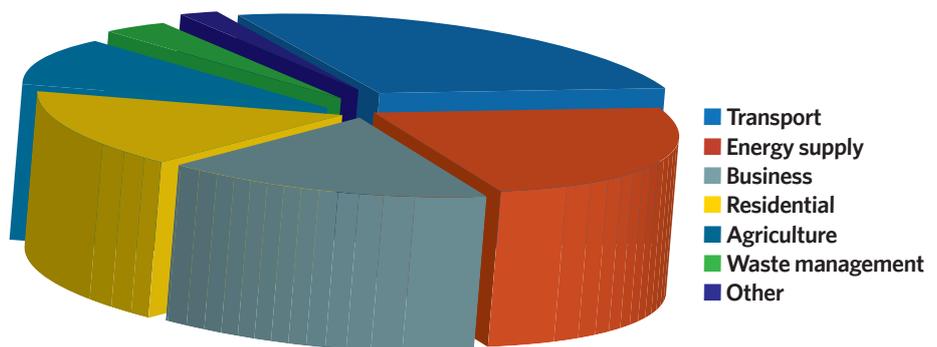


Figure 3: CO₂ production in UK 2017⁵

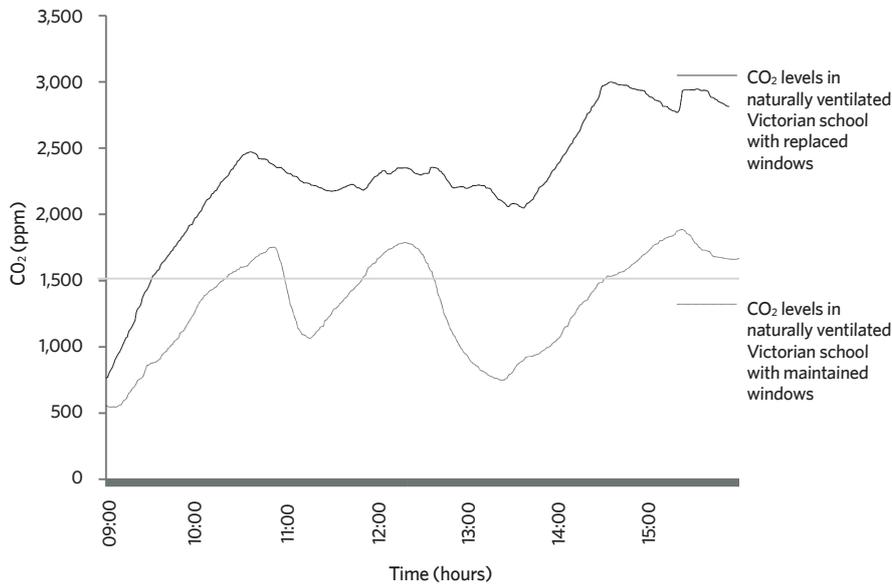


Figure 4: CO₂ concentrations during a typical day in two similar occupied Victorian schools

work¹⁰ undertaken by Chatzidiakou contributes to the evidence that airtightness in buildings is clearly associated with the internal CO₂ concentration. Two similar occupied Victorian school buildings were monitored in 2011. The defining difference between the buildings was that the one featuring recently installed, well-fitting windows had approximately half the infiltration rate of the other, which had older 'heritage' windows. The measured internal CO₂ concentrations, as shown in Figure 4, appear to reflect the influence of the building airtightness on the measured levels.

Many studies have attempted to determine the impact of IAQ on building occupants. Recently, Allen's experimental work⁹ in a test that ran over six days considered the impact of the indoor environment on higher-order cognitive function – a driver of real-world productivity – in office workers exposed for the whole working day. The study included varying levels of VOCs and CO₂. Compared with a low-CO₂ environment of 550ppm, cognitive function scores were 15% lower for the moderate CO₂ day at approximately 945ppm, and 50% lower on the day with CO₂ concentrations around 1,400ppm. The paper acknowledges the traditional use of CO₂ as a proxy for IAQ. However, it notes that 'this conventional thinking is being challenged as the evidence mounts for CO₂ as a direct pollutant, not just a marker for other pollutants', and that the statistically significant reduction in cognitive function measured in this work were at CO₂ concentrations that are commonly experienced in indoor spaces.

An extensive review¹¹ of numerous older studies by the US National Research Council indicates that, specifically in relation to the needs of submariners, the long-term limit values for CO₂ concentration should be 8,000ppm, with maximum 24-hour values at 25,000ppm. This is, apparently, significantly higher than those values recommended in many studies relating to the built environment.

In a recent interview,¹² Pawel Wargocki, of the Technical University of Denmark – an experienced researcher in indoor environmental quality – spoke of his initial surprise at a study in which humans were exposed to 1,000ppm CO₂, which was then increased to 5,000ppm, where there were no observable effects on their performance or their subjective responses. However, when the CO₂ exposure was combined with bioeffluents, this caused responses that were particularly strong at 3,000ppm. He notes that further work is needed to examine this in detail, but considers that CO₂ is merely an index (or proxy) for IAQ.

Human CO₂ generation

CO₂ is a convenient marker in internal spaces to determine the number of occupants, particularly for use with demand-controlled ventilation systems. In a recent paper,¹³ Persily reported new methods of estimating CO₂ generation rates from people, based on concepts from the fields of human metabolism and exercise physiology, as well as more recent data used in ventilation and IAQ. This new approach characterises body size using body mass rather than surface area, as is used in the current methods

that underpin the CIBSE and ASHRAE estimations of human CO₂ emissions. Body mass is easily measured and data on body mass distributions are readily available. The approach also explicitly accounts for the sex and age of the individuals being considered, which is not the case with currently employed methods. The new method was compared with laboratory-measured CO₂ generation and was found to overestimate by 2% for male subjects and 8% for females. In similar tests, the existing methods were found to overestimate by 20% for males and 33% for females. The paper notes that there is very little published data on measured CO₂ generation rates from people and that additional data will be helpful in assessing the new estimation method. The new method is explicitly applicable to groups of people, and not for single individuals.

CO₂ measurement in buildings

To enable CO₂ control in a building – whether it is considered a direct pollutant or a proxy – requires appropriate measurement. Typically, non-dispersive infrared (NDIR) techniques are employed that make use of selective light absorption of CO₂ (a wavelength of 4.26µm is commonly¹⁴ used). The NDIR devices have long-term stability, reasonable accuracy (for building services applications) and relatively low power consumption, while also being relatively low cost; sensors are currently available at less than £20. However, the increasing demand for internal spaces that are comfortable, healthy and productive, as well as being environmentally and financially responsible, is prompting the research and development of new distributed, wireless-connected sensors, to allow CO₂ monitoring that is simpler to integrate into building systems. An example is a current US\$1.5m project¹⁵ at Purdue University, which is aiming to develop a new occupancy sensor that has the explicit purpose of saving a substantial part of energy consumption in buildings. This combines a sensor that will detect the presence of CO₂ then switch on another, newly developed sensor that will perform precise measurements to determine how many people are in the room; this method is designed to save operational power. The sensor will be slightly larger than a postage stamp, cost less than £0.50 per m² of building space, and last longer than three years. This is an example of micro-electromechanical systems that contain micro-scale mechanical components employing plates coated with a film that absorbs CO₂, changing their vibration frequency.

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■ Turn to page 66 for references.



Module 142

March 2019

» **1. Approximately how much heavier is CO₂ compared to air?**

- A 20% heavier
- B 40% heavier
- C 60% heavier
- D 80% heavier
- E 100% heavier

2. What is the recently measured atmospheric CO₂ level at the Mauna Loa Observatory in Hawaii?

- A Less than 350ppm
- B 351ppm – 375ppm
- C 376ppm – 400ppm
- D 401ppm – 425ppm
- E More than 425ppm

3. What is the critical point temperature for CO₂?

- A -78.5°C
- B -57°C
- C 31°C
- D 45°C
- E 101.1°C

4. In work reported by Allen, what CO₂ level (on its own) reduced cognitive function scores by 15%?

- A This was not observed at all
- B Approximately 600ppm
- C Approximately 945ppm
- D Approximately 1,400ppm
- E Approximately 5,000ppm

5. In the interview with Wargocki, what was the level of CO₂ (on its own) that he associated with observable effects on test subjects' performance?

- A This was not observed at all
- B Approximately 600ppm
- C Approximately 945ppm
- D Approximately 1,400ppm
- E Approximately 5,000ppm

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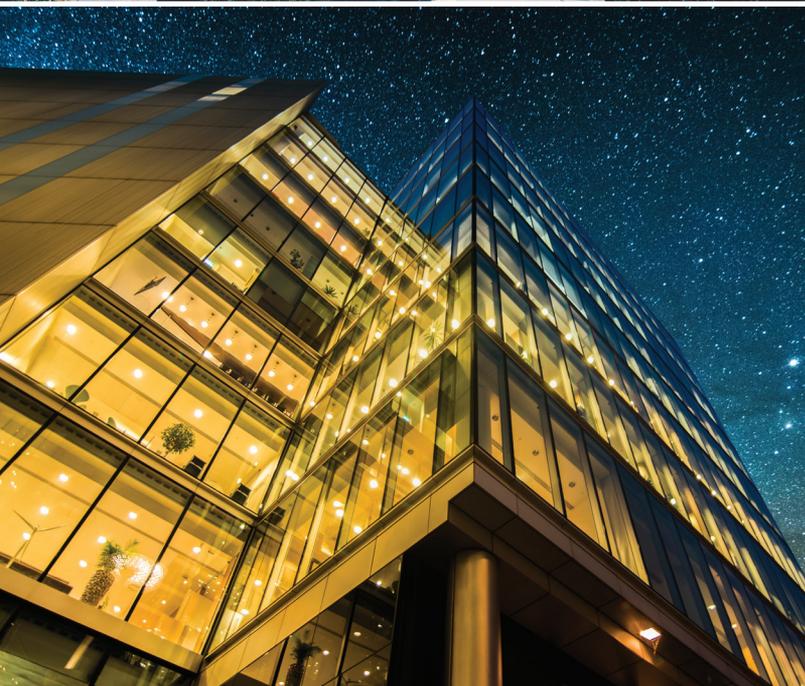
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Weather data is an essential component of virtually every new building design and major refurbishment.

CIBSE supplies the industry's standard weather data files used in building performance analysis and simulation. The new data files have been created to better represent our current climate and weather pattern.

Data set packages* are available across 14 UK sites for the following:

- Test Reference Year (TRY) Hourly Data
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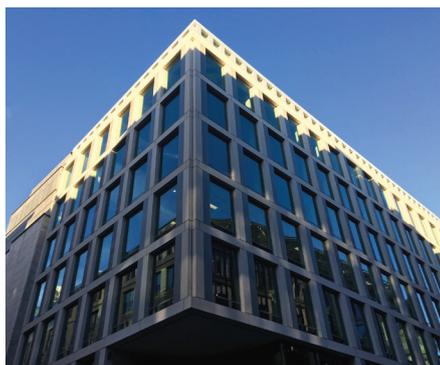
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PRODUCTS & SERVICES

Underfloor services for new terrace at 55 Gresham Street



AET Flexible Space has completed the supply and commissioning of underfloor air conditioning equipment for the new ninth-floor terrace at 55 Gresham Street, situated near the Guildhall in the City of London.

The redevelopment included the creation of a level-access corner entrance and reception at Wood Street and Gresham Street, with remodelled cores, extensions of the floorplates at ground to sixth-floor levels, and replacement seventh and new eighth and ninth floors, created through the removal of the existing ninth-floor plant.

Underfloor air conditioning was specified for the new ninth-floor terrace to maintain the architectural

vision. By placing services within the floor void, the remaining available space and floor-to-ceiling heights were maximised by eliminating the need for ceiling-based pipe and ductwork. The two-zone system on the terrace is served by two CAM-C25 downflow units with direct expansion coils and 30 standard TU4 fan tiles with EC fans for enhanced energy performance.

■ Call 01342 310 400 or email aet@flexiblespace.com

The consultant's new best friend: Domus Ventilation launches specification guide

As part of its strategy to return to the specification sector, Domus Ventilation has launched an in-depth Specification Guide for its range of award-winning, energy-efficient ventilation products. The 108-page guide has been developed by the company's in-house technical department to support consultants' specifications and text data. It is accompanied by free technical and design services, a dedicated national specification sales manager, a free BIM library for all products and, soon, CIBSE CPD accreditation.

■ Visit www.domusventilation.co.uk



Evinox Energy supplies interface units to new Wood Wharf district

Evinox Energy is supplying heating and cooling interface units for 1,330 apartments in the first phase of a new urban district being created in London's Canary Wharf. When it is completed in 2023, the Wood Wharf development will feature up to 3,600 new homes, a GP surgery, a primary school for 420 children, 149,352m² of retail space and eight acres of public space in the form of squares and parks.

The scheme was approved in 2014, with Tower Hamlets Council describing its design as 'innovative'. In the same year, Wood Wharf won the Tall Buildings category of the MIPIM Architectural Review Future Project Awards.

Evinox Energy has been working with the developer, Canary Wharf Group (CWG), and with SES Engineering Services, Emico and Haydon Mechanical & Electrical contractors.

Homes in Wood Wharf are all connected to a district heating network, and each apartment will feature a ModuSat XR-ECO twin plate heat interface unit, for the supply of heating and hot water, and a ModuSat single plate interface unit, to provide cooling.

As a requirement of this project, the interface units were tested by BSRIA - and Evinox was confident its first-class product manufacturing and performance would exceed the required results. In addition to the ModuSat units' efficient performance, Evinox equipment was chosen because of the flexibility of manufacturing and short delivery timescales. 'On time' delivery was critical for this project, because some equipment was built into prefabricated pods by a third party before delivery to site.

■ Call + 44 (0)1372 722277 or visit www.evinoxenergy.co.uk or www.evinoxresidential.co.uk



Condair at Data Centre World 2019

Condair is appearing at the Data Centre World exhibition, on stand D921, at the ExCel Centre, London, from 12-13 March. The company will display the latest in adiabatic and steam-humidifier technology, which supplies in-duct evaporative cooling and humidification to data centres.

Products on display will include the Condair ME evaporative humidifier, which offers 0.68kW of adiabatic cooling to an air handling system for every 1kg of moisture evaporated into the air stream.

■ Call 01903 850200, email uk.sales@condair.com or visit www.condair.co.uk



Never run out of hot water with Rinnai's 11i multipoint continuous flow water heaters

Rinnai's multipoint, continuous flow, Energy-related Products (ErP) A-rated, gas-fired 11i water heater units are the perfect antidote to more traditional storage systems. The high-performance 11i ensures user comfort and safety with 100% accurate water-temperature control.

These energy efficient, low-NO_x units are neat and compact, with not a tank in sight. Internally wall-mounted, the multipoint Rinnai 11i model measures 675 x 370 x 134mm and weighs just 16kg, with a gas consumption range between 6.10kW and 21.60kW.

■ Visit www.rinnaiuk.com



Former racehorses in the spotlight thanks to Luceco Ceres

Luceco has lit a special arena for horse charity Heros. Located at North Farm Stud in Oxfordshire, the charity aims to rehome racehorses when they retire, giving them an opportunity to enjoy a new life.

An indoor arena and education hub has recently been added to the charity's complex, and it now benefits from LED lighting supplied by Luceco. Ceres is a compact LED high bay, rated IP65, which has die-cast aluminium housing with vortex cooling for maximum LED chip performance. It supplies 50,000 hours of operational life and has a luminaire efficacy of up to 130 lm/cw.

The lighting was designed and supplied by Ben Dewey, lighting division manager for R&M Electrical Group, and the electrical installation was completed by Mark Bradburne, of Bradburne Electrical.

Heros has successfully rehomed hundreds of former racehorses - LED lighting from Luceco ensures these amazing animals are very much in the spotlight at North Farm Stud.

Call 01952 238100, email uk_sales@luceco.com or visit www.luceco.com



Claim Breeam points with RHeco

Reznor, part of Nortek Global HVAC (UK), continues its tradition of manufacturing high-efficiency warm air heating equipment with the introduction of the RHeco series of energy-saving, condensing gas-fired unit heaters. The ErP-compliant RHeco range offers substantially reduced CO₂ and NO_x emissions (less than 25ppm). Units exceed the requirements of Building Regulations L2, with thermal efficiencies up to 109% to give exceptional levels of seasonal efficiency. The extremely low-NO_x modulating pre-mix burner also allows Breeam points to be claimed when applicable.

Visit www.nortek-erp.com or email erp@nortek.com



Largest Jung Pumpen stocks in the UK



Jung Pumpen has been working with its largest UK stockist, Aldermaston-based Pump Technology, to expand its already extensive pump stocks. This will ensure immediate supply from its centrally located warehouse should Brexit delay future deliveries.

Pump Technology's business development manager, David Johnson, regularly visits London to demonstrate the latest pumps and systems - such as Compli, DrainMinor, DrainMajor and DrainKing - to public health engineers.

Call 0118 9821 555 or visit www.pumptechnology.co.uk

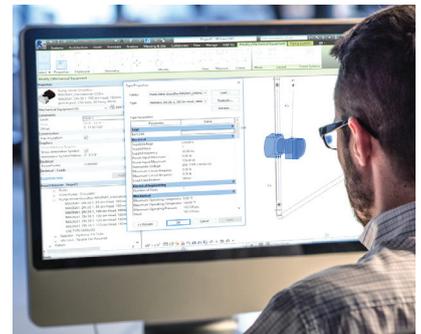
Grundfos helps to share the load

Statistics show that more people are now finding the information they require when they visit the Grundfos Pumps website, with a 40% year-on-year increase in file downloads.

After logging on, you get immediate access to a wide range of information sources, many of which can be downloaded. These give you a window into news and case stories, as well as products, campaigns, training platforms, white papers and technical information.

The Grundfos Product Centre is ready to assist those who want to select or specify a pump using a range of criteria. It continues to be a very popular point of online contact, offering a range of downloadable materials in a one handy location. This intuitive hub helps you find the answers you need - for example, to find the correct new or replacement pump, regardless of the application or demand. You can also retrieve supporting documentation, drawings, spare parts, and instructional videos.

Call 01525 850000, email grundfos-uk@sales.grundfos.com or visit www.grundfos.co.uk



Lochinvar upgrades hot water sizing software

It is important for engineers to match equipment output to demand accurately, so boiler and water heater manufacturer Lochinvar has upgraded its Select digital hot-water sizing programme.

While the Select programme has been available for almost 20 years, the 2019 version includes a number of new features, as well as the company's high-efficiency, gas-fired water heater products. It can be quickly and easily downloaded from the Lochinvar website.

The programme covers 20 building types, including educational facilities, hotels and industrial plant. Data is entered via a 'virtual walkthrough' process and default settings are included where appropriate. Select helps designers of hot-water systems calculate the most suitable product(s) to meet peak-demand periods and the volume of hot water needed for the building in question.

Most traditional hot-water sizing methods are based on indirect systems, with an emphasis on hot-water storage. The advantage of direct gas-fired water heaters is that they work on low storage with fast recovery rates, and Select 2019 prioritises continuous output. The programme enables the user to choose from a single water heater up to a maximum of four units, but Lochinvar has noted significant growth in the number of large commercial projects requiring multiple heaters.

Visit www.lochinvar.ltd.uk



^ 'Enhanced peace of mind' with Ideal Commercial warranty

Ideal Commercial Boilers has introduced a five-year heat exchanger warranty across its Imax Xtra, Imax Xtra EL and Evomod ranges of floor-standing condensing commercial boilers.

The boilers need to be registered within 30 days of installation and commissioned by Ideal Commercial within three months of installation. Commissioning is made easy because all boiler ranges qualify for Ideal Commercial's market-leading Free Commissioning offer.

The company's national sales manager, Andy Forrest, said: 'Customers will benefit from enhanced peace of mind, alongside the great quality, efficiency and flexibility that they've come to expect from Ideal Commercial floor-standing boilers.'

Available for three product ranges, the new warranty is applicable across outputs from 80kW to 1,240kW and includes boilers with aluminium or stainless-steel heat exchangers, including a modular boiler option in Evomod.

All applicable boilers registered since 1 January 2019 will be eligible for the warranty as long as the terms and conditions are met.

■ Visit www.idealcommercialboilers.com

Hamworthy Heating finalises sales team line-up

Hamworthy Heating has completed its sales team with the appointments of Barrie Welsh (left), Terry Simmonds (centre) and Simon Dobson (right).

Welsh is Hamworthy's new technical sales manager, and has worked on a vast array of machinery - from steam equipment, high-pressure water heating and large space heating. He has been managing district heating schemes, as well as supervising and training engineers.

Simmonds joins the company from contractor Invicta Building Services, where he was business development manager. With nearly 30 years of experience in the heating sector, he has worked for plumbers' merchants and many other well-known names in the industry. For Hamworthy, he will be looking after customers in Kent, East London and Essex.

Dobson, who will be the East Midlands area sales manager, has been in the industry for 20 years, in a variety of roles, from heating engineer with hands-on installation experience to technical services manager.

■ Call 01202 662500, email sales@hamworthy-heating.com or visit www.hamworthy-heating.com



^ Vent-Axia's Standard range to be discontinued after six decades

Launched in 1958, Vent-Axia's Standard range of wall fans has spanned the decades and can be found in numerous locations. These include many high-profile and listed buildings, such as the Houses of Parliament.

Now, at the age of 60, it has earned its retirement and is set to be discontinued over the next two years. To help minimise disruption for customers, Vent-Axia has ensured it has enough components to secure production of this faithful fan for another 12-24 months.

■ Call 0844 856 0590 or visit www.vent-axia.comcom/+makitauk



^ Hadley Group makes corrugated curver investment

Hadley Group has improved its UK production capabilities with a new corrugated curver at its Oldbury facility. The curver has bolstered the group's ability to shape metal and is helping it expand into new markets.

The curver bends sinusoidal metal sheets using a series of rolls housed within the machine. It can produce a more comprehensive assortment of shapes, including L-shape units, circles or rounded squares. The investment underlines Hadley Group's ability to deliver innovative solutions to complex challenges.

■ Visit www.hadleygroup.com

Viessmann to reward installers with free security products to fight tool theft

Viessmann has launched a 'Security and Style' sales promotion to help installers fight the threat of tool thefts from vans. Throughout 2019, installers buying Viessmann Vitodens boilers and Vitocell cylinders will be rewarded with points, which can be used to obtain selected items from Birchwood Price Tools. These include van-security products and a range of professional workwear, safety footwear, and lighting.

The rewards scheme pays out: 100 points for every Vitodens 050-W and 100-W boiler purchased; 200 points for the Vitodens 111-W and 200-W models below 60kW; 300 points for the Vitodens 200-W (80 to 150kW); and 100 points for Vitocell cylinders.

For as little as 100 points, rewards can be claimed for items such as polo shirts and fleeces. The most valuable products available under the scheme are a Defender light cannon, worth £569, and a Van Vault slim slider drawer system, worth £488. Van-security items include the Van Vault 2 high-security steel storage box, and a Van Vault roof-tube, for the secure transportation and storage of copper, waste and other pipes.

■ Visit www.viessmann.co.uk

Fleming appointed to develop Condair's operations in key European markets

Condair has appointed Tony Fleming as head of sales cluster Northern Europe. He takes on responsibility for the operations of Condair's two sales and manufacturing facilities based in the UK and Denmark, as well as the Condair sales offices in Ireland and Sweden. Fleming said: 'I am delighted to take on this new role of developing Condair's operations in the key markets of the UK, Ireland and Scandinavia.'

■ Call 01903 850200, email uk.sales@condair.com or visit www.condair.co.uk



Rinnai LPG hot-water heater is low-NO_x and great for off-grid

Rinnai condensing hot-water heater units using LPG deliver lower carbon emission figures and greater energy efficiencies, and are more economic to run than other sources - making them perfect for off-grid installations and sites.

Tests show that a Rinnai Infinity condensing water heater emits 35.18mg/kwh NO_x compared with a typical oil boiler, which emits approximately 364mg/kwh NO_x. By choosing an LPG continuous flow water heater instead of a standard electric one, end users can also reduce energy costs by up to 50% and cut greenhouse gas emissions by up to 61%.

■ Visit www.rinnaiuk.com



128 Robur chillers solve power shortage at Embassy Gardens, London

Faced with a shortage of electrical power, 128 Robur gas-powered chillers have been installed to supply comfort cooling to six residential apartment buildings at Embassy Gardens, the landmark development in Nine Elms, London.

The Robur chillers, supplied by UK distributor ESS, are mounted on factory-assembled skids, pre-wired and pre-piped, each of which has a 90kW output but requires just a 30 Amp single phase power supply. The integrated controls automatically 'cascade' the chiller modules and share the load evenly between each of them.

■ Call 020 8641 2346, email info@roburheatpumps.co.uk or visit www.roburheatpumps.co.uk

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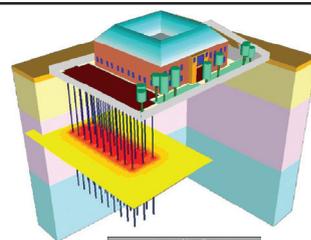
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Senior Electrical Building Services Engineer

London, £45k - £55k + bens

This is an exceptional opportunity for an engineer to join a consultancy with a reputation for their dynamic and innovative approach and project delivery. Their work has been noted with an impressive list of industry awards, with some of the most highly regarded MEP engineers working in their London office. Their success is underpinned by the passion and appetite for innovation, and the ideal candidate will share this thirst and enthusiasm to push the engineering envelope. Ref: 4829

Senior Mechanical Engineer

London, £40p/h

This is a fantastic opportunity to work with a leading London based consultancy that has been established for over 20 years. Their London office work on a variety of projects including commercial, hotels, and listed buildings. They require an experienced Mechanical Engineer to assist their busy team for a contract of six to nine months. Ref: 5363

Public Health Design Engineer

City of London, £40k - £55k + bens

Would you be interested working in partnership with the world's leading architects designing the most iconic and complex buildings in London and Overseas? If so this is an opportunity to join an established public health team who's ethos is to design buildings that will tread more lightly on the planet and continuously push the boundaries of sustainability in engineering. Ref: 5360

Intermediate/Senior Mechanical Engineer

Hertfordshire, £35k - £50k + bens

Seeking an engineer to run their own projects, across multiple sectors carrying out full detailed design for a practice established over 30 years ago. Much of their success comes from longstanding client relationships and repeat business. The company is large enough to manage medium to large sized projects, and small enough to provide a high level of service. Excellent benefits and progression. Ref: 5355

Senior Mechanical Engineer

Croydon, £45k - £60k + bens

This is a key role within a medium sized well-established consultancy who are looking for a driven and dynamic Mechanical Engineer equally comfortable in mentoring and inspiring junior and intermediate engineers, liaising with internal and external stakeholders, managing projects, and liaising with clients. All of these skills will be recognised internally to map out a clearly defined and achievable career progression plan within this highly regarding and forward thinking, privately owned practice. Ref: 5330

Senior Electrical Engineer

Berkshire, £40p/h

An Electrical Engineer is required to work on a long-term contract in Berkshire. You will provide designs for low voltage, lighting, electrical power distribution, and alarm system designs on a large education masterplan in London. You must be proficient using Revit, Amtech and Dialux software as well as being client facing. Immediate start. Ref: 5354

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We welcome applicants for the following roles:

Grade 9 Principle Engineer (Energy Management)

Ref: UOS021521

Grade 8 Specialist Services Manager

Ref: UOS021522

Grade 7 Mechanical Engineering Manager

Ref: UOS021520 (2 Roles)

Grade 7 Electrical Engineering Manager

Ref: UOS021525 (2 Roles)

Grade 5 Energy Officer

Ref: UOS021523

If you would like to have an informal discussion about any of the above roles, please call Geoff Badger, Interim Head of Engineering and Maintenance, on 0114 222 9113.

Visit <https://www.sheffield.ac.uk/jobs> for further information and to apply.

Closing date: 22 March 2019.

Pursue the extraordinary



Clara Bagenal George with her award

Driving change

CIBSE's 2019 Building Performance Engineer of the Year, Clara Bagenal George, talks about her passion for sustainability

The inaugural winner of the CIBSE Building Performance Engineer of the Year Award – Clara Bagenal George – leads mechanical, environmental analysis and sustainability consulting projects at Elementa Consulting. She has worked on many low-energy schemes, including Hackbridge Primary in Surrey – a net-zero energy and Passivhaus school – and a fossil-free residential development in Brighton. In May 2017, Bagenal George launched the London Energy Transformation Initiative (Leti), which has brought together more than 250 built environment professionals to put London on the path to a zero carbon future. She also champions diversity and equality in the industry, and has established a Women in Engineering group at Elementa. Read more about Leti on page 40.

What inspired you to start Leti?

I and others at Elementa Consulting were frustrated that the energy policy in London wasn't driving design solutions to encourage long-term reductions in carbon emissions. The outcome of this was to establish Leti, with the aim of putting together evidence-based recommendations for the London Environment Strategy and the London Plan. Leti has had a massive influence on Elementa's projects, enabling us to work with other engineers and across disciplines. We bring this peer-group learning and collaborative attitude to our projects, to consider decisions in a more holistic way.

What work do you do outside of the office?

I am a Mayor's Design Advocate for Good Growth, supporting the Greater London Authority (GLA) and Transport for London (TfL) by reviewing projects and working towards a circular economy. I am an advocate of STEM, visiting schools and tutoring at the Bartlett School of Architecture, UCL. A neglected area of building services engineers' work is our collective understanding of the whole-life carbon impact of the decisions we take. To this end, I have completed a research paper, *Understanding the importance of whole-life carbon in the selection of heat-generation equipment*, which will be published as part of the CIBSE Technical Symposium in April.

How do you balance your volunteer work with professional duties?

Elementa Consulting is supportive of personal research and development, so I have been able to split my time on Leti between working hours and my own time. I have always been passionate about sustainability, so working for a company that is so

driven in this mission is fantastic. Previously, I have worked on voluntary projects – such as building a wind turbine in Peru – with campaign groups such as Greenpeace and Citizens UK. It is normal for people to spend their own time on things about which they are passionate – for me, this is reducing our impact and influence on climate change. Leti gives me the chance to merge my professional life, campaigning and advocacy work.

What can the industry do to inspire more women into engineering?

Like the schoolchildren who have been taking part in climate change strikes recently, I went to demonstrations with my school and learned that everyone has the capacity to make change – and, more importantly, has the responsibility. This type of thinking needs to be promoted, with the understanding that engineering is a way to create positive change. Young people should be encouraged to pursue their passions when considering a career, and practising professionals should create inclusive and nurturing environments.

What are the benefits to chartership?

You gain instant trust and credibility when you tell clients you are a chartered engineer. I found the process of working towards chartership with my CIBSE mentor, Simon Ebbatson, very rewarding – it gave me a framework and enabled me to focus on areas I needed to develop. Chartership also gives you confidence in yourself as an engineer.

Can the industry achieve net zero carbon buildings?

I am optimistic that we can; the timeframe in which we achieve this depends on the definition of net zero carbon. My optimism is based on necessity of action – we must make huge changes in this industry to meet our targets. As engineers, we all have a responsibility to act. If you share this sentiment, get involved in Leti by visiting leti.london/get-involved

What does it mean to win the CIBSE award?

To be recognised by an institution such as CIBSE is a great honour and I hope this award offers a platform for Leti to continue having an impact. Leti would not have been so successful without the enthusiasm and dedication of numerous industry professionals and, for that, I am extremely thankful.

■ CLARA BAGENAL GEORGE is a senior engineer at Elementa Consulting

NATIONAL EVENTS AND CONFERENCES

CIBSE Technical Symposium 2019

25-26 April, Sheffield

Peer-reviewed presentations and papers outlining funding, policy and local contexts, with practical outputs.

www.cibse.org/technicalsymposium

SLL LightBytes

28 March, Bristol
25 April, Edinburgh

In collaboration with the CIBSE FM Group.

www.cibse.org/sll

CIBSE TRAINING

For details, visit

www.cibse.org/training
or call 020 8772 3640

Mechanical service explained

6-8 March, London

The importance of energy efficient buildings

6 March, London

Low carbon consultant design training

7-8 March, London

Energy strategy reports

11 March, London

Fire-risk assessment to PAS 79

12 March, London

Building services explained

12-14 March, Birmingham

Successful design management

13 March, London

Low carbon consultant En/MS/ISO 50001:2018

13-15 March, London

Design of heating and chilled water pipe systems

18 March, London

Low carbon consultant building operations

19-21 March, Manchester

Overview of IET wiring regulations

20 March, London

Fire safety in the design, management and use of buildings: BS 9999

22 March, London

Gas safety regulations (designing for compliance)

22 March, London

High voltage (11kV) distribution and protection

25 March, London

Electrical services explained

26-28 March, Manchester

Above-ground building drainage

27 March, London

Energy monitoring and targeting

27 March, London

Low carbon buildings for local authorities

28 March, London

Earthing and bonding

1 April, London

Lighting design: principles and application

2 April, London

Electrical services explained

2-4 April, London

Mechanical services explained

2-4 April, Manchester

ESOS – Energy Savings Opportunity Scheme

3 April, Manchester

The New London Plan: half day

3 April, London

Sanitary and rainwater design

5 April, London

Energy efficiency building regulations: Part L

5 April, London

Above ground building drainage

25 April, London

Practical controls for HVAC systems

29 April, London

Low carbon consultant design

29-30 April, London

Introduction to combined heat and power

30 April, London

CIBSE GROUPS, SOCIETIES AND REGIONS

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

SLL and CIBSE Scotland: spring seminar

6 March, Glasgow

Richard Caple, SLL immediate past president, on emergency lighting requirements in relation to SLL Lighting Guide 12, and Alistair Murray, director of Arup's fire engineering team, on developing and delivering fire strategies.

East Midlands: annual dinner

8 March, Nottingham

With guest speaker, comedian and writer Paul Boardman.

North East – expert witness

12 March, Newcastle upon Tyne

Gerry Brannigan, of HKA, will present on the topic of expert witness work within building services engineering.

ANZ: Resolving construction disputes

12 March, West Perth

With speaker John Fisher, chartered engineer who operates his own practice, specialising in project recovery and dispute resolution.

CIBSE Scotland Conference – evolving building technology

13 March, Glasgow

The application of innovation and creativity to improve how we design and construct buildings and their surrounding infrastructure.

SLL and CIBSE Southern: technical seminar

14 March, Eastleigh

The latest research on bats and lighting, and lighting outside

the borders of standards, in association with the Institution of Lighting Professionals.

SLL and CIBSE North West: history of light and health

19 March, Manchester

Presentation by Henrik Clausen, director of Fagerhult's Lighting Academy, Copenhagen.

CIBSE application workshop

19 March, London

Help with the Engineering Practice Report for Associate and Member applications.

YEN South West: optimised internal environments

19 March, Bristol

Exploring how design teams approach optimisation of internal environments during early design stages. With Ben Richardson, BuroHappold Engineering.

ANZ and CIOB: piecing it all together – prefabrication and modular construction

21 March, Sydney

First in a series of joint technical seminars, looking at prefabrication and modular construction from a construction and building services perspective.

Merseyside and North Wales: annual luncheon

22 March, Liverpool

At Anfield Stadium, with comedian Darren Farley.

HCNE: LG14 control of electric light

26 March, London

With speaker Sophie Parry, key account manager for specified projects, ZG Lighting (UK).

SLL Ready Steady Light

26 March, Sidcup

Teams compete to design and set up temporary exterior light installations.

Society of Façade Engineering AGM

2 April, London

AGM followed by a technical presentation.

Western Australia: lighting design and performance in 2019

2 April, Perth

With guest speaker Ben Conick, co-founder of Lighting Options Australia.

North East: health and wellbeing

2 April, Newcastle upon Tyne

Presentation by Julie Godefroy, technical manager, CIBSE.

HIGHLIGHTS



Richard Caple will speak in Glasgow on 6 March



Ben Richardson will speak at the YEN South West event on 19 March

Futurebuild

5-7 March, ExCeL, London

Over three days, Futurebuild – previously EcoBuild – will explore and tackle the biggest challenges affecting the built environment and beyond, championing innovation and sustainability. The overarching theme of this year's conference is 'time for action', which will be reflected across the 11 seminar streams.

Visitors will also be able to hear about the latest industry developments from leading suppliers in the six themed exhibition hubs. Visit the CIBSE stand (B137) within the Knowledge Forum, where we will be running a workshop on 'Digital Tools? What does the future of knowledge look like?', at 12.40pm on 7 March.

Register for your free ticket to Futurebuild at www.futurebuild.co.uk



Technical Symposium 2019

Technical Symposium 2019

25-26 April 2019, University of Sheffield

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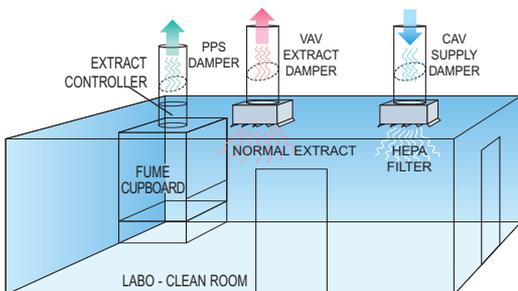


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