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Housing's ground zero

The likelihood of the UK meeting its 2050 target of cutting greenhouse gases by 80%, relative to1990 levels, will be determined, in part, by housebuilders' ability to deliver new zero energy homes and slash emissions from existing stock. Around 200,000 new homes a year are expected to be built over the next 30 years, so it is imperative that design professionals use all the tools at their disposal to produce high-quality homes.

With this aim in mind, CIBSE has launched TM60 *Good Practice in the Design of Homes*, offering best-practice guidance for building services engineers. It emphasises the importance of integrated design teams and, at the launch event last month, it was encouraging to see representatives from a contractor, housing provider and building services engineer.

TM60 particularly stresses the importance of building service engineers' continual involvement in the design process. 'As the ability to influence certain decisions decreases as the design progresses, it is important they are consulted when changes that may impact on building services are made by other design-team members,' says lead author Tom Lelyveld (page 30).

Two examples of housing good practice were recent winners of CIBSE awards and are featured in case studies, starting on page 32. Killynure Green won Project of the Year – Residential at the CIBSE Building Performance Awards, while Little Kelham was judged the CIBSE Yorkshire Commercial and Industrial Project of the Year. They are the stars, but – at Ecobuild – there was a stark reminder of how dysfunctional the industry can still be. In a frank discussion on Grenfell Tower, past RIBA president Jane Duncan said designers needed 'to demonstrate competency and the skills to deliver high-quality buildings.' She said the industry mindset had to change from being 'lowest cost first' and said professionals have a social responsibility to focus on quality.

Lendlease head of residential Richard Cook said the culture around quality would have to improve in the same way that on-site safety had in the past 20-30 years. He lamented that the industry tended to change for the better through legislation, rather than its own means. HomeOwners Alliance CEO Paula Higgins said the success of housebuilding was not judged on the quality of the end product or customer care. 'There's no data on new homes – nothing to help consumers make the right decision in choosing one developer over another. All we have data on is things like share price.'

Grenfell has come as a terrible wake-up call. The industry must now change, and by driving best practice in housebuilding, services engineers can play an important part in the transformation of this troubled sector.

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CONTRIBUTORS

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Matthew Rhodes
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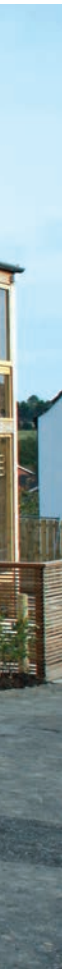

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UCL HEADS EAST AS BUILT AND ENGINEERING FACULTIES COLLABORATE IN HI-TECH LABS

University College London (UCL) has completed a new site at the Queen Elizabeth Olympic Park, which includes a 2,000m² robotics and advanced prototyping space, and an area for the new UCL Bartlett Real Estate Institute.

UCL Here East is located in the former London Olympic Media Centre and was redeveloped by architect Hawkins\Brown and consultant BuroHappold Engineering.

The manufacturing-focused space will be shared by UCL Bartlett, Faculty of the Built Environment, Engineering Sciences Faculty – and UCL is keen to foster collaboration in its new facility.

The university has created a new undergraduate degree focusing on engineering and architectural design, based at Here East, which also features a 300-seat auditorium.

Cladding claimants could sue government

130 apartment blocks have already failed similar safety tests

Leaseholders ordered to pay more than £2m to replace flammable cladding on their apartment block have been advised to consider legal action against the government, because the Building Regulations could be deemed 'not fit for purpose'. Private residents of the 95-apartment Citiscape complex in Croydon, South London, are facing financial ruin after a ruling by an independent tribunal that they – and not the building's management company – must pay for the cladding to be replaced.

It was deemed unsafe after an inspection prompted by last June's Grenfell Tower fire. The residents argued that the cost of replacement work should not be added to their service charge as it was not standard wear and tear. However, chair of the local property tribunal Angus Andrew ruled that 'if the manager is obliged to do work... tenants are obliged to contribute to the cost'.

This ruling could have significant implications, because a further 130 apartment blocks have failed similar safety tests since the Grenfell fire.

Andrew said the residents could have warranty claims against the cladding manufacturer and the builder 'if they were found to be negligent as to the selection and installation'. They could also sue the local authority 'if there were errors in the certification process', but may also have a case against central government 'if the Building Regulations were not fit for purpose'. However, no claims could go ahead until the public inquiry into the causes of the Grenfell fire completed its work next year.

Andrew also warned that tenants could 'find themselves mired in litigation for many years' and that their flats would be unsaleable as a result.

Residents of Croydon's Citiscape complex, clad in similar flammable panels to Grenfell Tower, are facing a bill of £2m

Grenfell fire door failures 'not systemic'

The risk to members of the public posed by poorly performing fire doors remains low, according to Housing Minister Sajid Javid.

While he admitted that the results of tests carried out on doors used in Grenfell Tower were 'troubling', Javid told the House of Commons that the problem was not 'systemic'. The fire doors fitted to the flats in Grenfell Tower between 2011 and 2012 were specified to resist fire for 30 minutes, but only lasted 15 minutes in tests carried out as part of the ongoing Metropolitan Police investigation into the fire, which killed 72 people last June.

Shadow housing minister Tony Lloyd said he was 'astounded' by Javid's claim: 'If this isn't systemic, what assessment has been made of how many buildings are potentially affected by this – how many individual flats, how many people who have fire doors that simply don't do the job?'

Grenfell survivors also condemned the government for failing to improve regulations after previous tower-block fires.

The doors tested were manufactured by Manse Masterdor – now operated by Synseal – and installed between 2011 and 2012. Synseal issued a statement saying it 'never had any involvement with Grenfell Tower' and that the doors used there were no longer being sold. However, it said it was cooperating with the police investigation.

BEIS opens 'future of heat' consultation

The Department for Business, Energy and Industrial Strategy (BEIS) has called for evidence to prepare for the decarbonisation of heating.

The consultation will explore what the government could do over the next decade to drive the rollout of low-carbon heating systems – including setting out the long-term plan for phasing out high-carbon fossil-fuel heating – while reducing reliance on subsidies. It will also consider technologies that can be used as alternatives to oil and coal heating systems.

The government will use the evidence it receives to design and implement a framework that will follow on from the Renewable Heat Incentive.

Ship rescue in pipeline

Sanha has donated 24 metres of 28mm NiroSan stainless steel tubing to the Dunkirk Little Ships Restoration Trust, to help with its work on *Dorian* – one of the ships that helped to rescue 338,000 allied troops from the French beaches during World War II.

Dorian was a 41ft harbour launch, originally built in 1915 by the Royal Navy before being sold, in 1937, and converted into a cruising yacht. She was severely damaged in a fire and finally bought by the Trust for £1.

Trust volunteers are restoring *Dorian* at Southampton docks.

OFF-SITE MANUFACTURING FIRM AIMS TO SOLVE HOUSING CRISIS

British modular homes business Ilke Homes, which specialises in off-site manufacturing techniques, is opening its first factory in Harrogate, Yorkshire. It plans to deliver up to 2,000 modular homes a year, in an effort to help solve the UK's housing shortage.

Nigel Banks, the company's product and marketing director, said that, within the next two years, the company plans to deliver 2,000 modular homes, which can be installed on site at a rate of six homes per day. Assembling these on a factory production line does not rely on hard-to-find construction skills and, according to the firm, will bring more manufacturing roles back to the UK's jobs market.

The factory is scheduled to open this spring and will create 150 jobs, and 800 roles within the next two to three years.

RHI has been a 'waste of money'

Scheme saved 4.5 million tonnes of CO_2 equivalent in 2017, but at a cost of £1.4bn to claimants

The National Audit Office (NAO) has condemned the government's Renewable Heat Incentive (RHI) scheme for failing to deliver value for money to the taxpayer.

Launched in 2011 to offer incentives for commercial and residential building owners to switch from fossil-fuel heating systems to renewables, it has only achieved around 20% of its target number of installations. The NAO calculated that fewer than 80,000 new installations had been completed by the end of last year and estimated that just 111,000 new installations will be delivered through the scheme by March 2021. The original target was 513,000 projects by 2020.

Research showed that the RHI saved about 4.5 million tonnes of CO_2 equivalent last year, but at a cost of £1.4bn so far to claimants. Total payments through the scheme are expected to rise to £23bn by 2040-41. Regulator Ofgem said that about £3m was paid to 'non-compliant' systems last year.

The Department for Business, Energy and Industrial Strategy (BEIS) defended the scheme as 'playing a crucial role in reducing carbon emissions from heat', and added that it had 'taken major steps to prevent people from cheating the system'.

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Courts blamed for failure to enforce Building Regulations

Perpetrators' gain by ignoring the rules estimated to be more than £12,000

Local authority building control officers say the legal system is undermining their efforts to enforce the Building Regulations.

Prosecutions for breaches of the regulations have fallen by 75% in the past 10 years, according to the Local Authority Building Control (LABC) trade body, which called for courts to 'get tough' with companies that flout the rules. The number of prosecutions continues to fall because courts do not fine perpetrators enough to deter them, and fail to award sufficient costs to the prosecuting bodies, claim LABC.

A survey of its members showed that it cost an average £10,750 to bring a Building Regulations prosecution to court, while the average award for costs was just £670. Similarly, average fines were around £5,100, while perpetrators – by ignoring the regulations – were estimated to gain financially by more than £12,000, even after any fine is taken into account.

LABC's director of technical policy Barry Turner said: 'Effective enforcement has become more and more difficult. It's time for the government to make clear to the courts they should get tough with the tiny minority in the industry who don't comply with the regulations and standards.'

Philips Li-Fi broadband arrives

Philips Lighting has launched Light Fidelity (Li-Fi), which delivers a broadband internet connection via light waves.

Li-Fi is a two-way, high-speed wireless technology similar to Wi-Fi, but uses light waves instead of radio waves to transmit data. The company says its office luminaires, enabled with Li-Fi technology, provide broadband speeds of up to 30Mb per second 'without compromising lighting quality'.

'While radio frequencies are becoming congested, the visible light spectrum is an untapped resource with a large bandwidth suitable for the stable, simultaneous connection of a vast array of Internet of Things devices,' said Olivia Qiu, chief innovation officer for Philips.

French real estate investment company Icade is piloting the technology in its offices in La Defense, Paris.

Hunt launches BIM outsourcing firm

Liverpool-based M&E consultant Steven Hunt & Associates has formed a sister business, Digital Engineering Studio, offering outsourced building information modelling (BIM) services.

Managing director Dominic Sibbring said his team would work behind the scenes with clients to transform drawings and early designs into fully functional 3D models, which can then be populated with data requirements.

'We often deal with companies who want to take the leap into BIM, but don't have the capability,' Sibbring said. 'The upskilling of existing staff and the financial outlay on new hardware and software often means it is a non-starter for many businesses.'

Skanska UK reorganises

Skanska UK is consolidating its construction-related businesses into two organisations, in a bid to simplify its structure. One will focus on construction and the other on building services engineering, a company statement said.

The firm's two building operations had been separated on a geographical basis, but will now come together under managing director Steve Holbrook. Its facilities services and M&E engineering business will be combined into one building services organisation, under managing director Adam McDonald.

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MPs criticise 'tick box' response to air quality

Pollution should be treated as national health emergency, committee says

Four parliamentary committees have slated the government's approach to air pollution and called for a new Clean Air Act. A joint report by the Environment, Food and Rural Affairs, Environmental Audit, Health and Social Care, and Transport committees has dismissed the government's Air Quality Plan as 'box ticking', and says the pollution problem should be treated as a national health emergency.

The report follows a third successful legal action by environmental law firm ClientEarth against the government. It secured a ruling in the High Court that UK air quality policy continues to be 'unlawful' because it fails to require 40 English local authorities to take action, despite breaching EU pollution limits.

The committees' report claims that the £3bn Air Quality Plan, launched by the government last year, fails to address the fact that, in 44 UK towns and cities, the air quality breaches World Health Organization guidelines. This costs the country £20bn a year because it contributes to an estimated 40,000 early deaths, the MPs said.

Poor air quality contributes to 40,000 early deaths per year in the UK

They accused the government of opting for a compliance-led response and a series of 'box-ticking' exercises. The Environmental Audit Committee's chair, Mary Creagh, said the country needed a new Clean Air Act to hold the government 'accountable for failures to achieve air quality commitments after the UK leaves the EU'.

20% carbon factor drop will prompt 'massive change'

A recalculation of the carbon content of electricity will lead to dramatic changes for heating systems installed in new projects, visitors at last month's Ecobuild were told.

Proposed changes to the SAP methodology includes a shift downwards of the carbon factor from 0.519 to 0.398 kg/CO_2/kWh – close to a 20% drop. This comes after the use of coal also fell by 52% in 2016.

Last year, renewable energy sources generated more power than coal for 90% of the time, and wind farms produced more electricity than coal on more than 75% of days. The UK also experienced its first 24-hour period without coal being used to create power since the Industrial Revolution. As a result, the carbon content of our electricity is dropping, which will create a 'big shift in the way the performance of heating technologies is calculated', according to Matthew Turner of Aecom.

He told an Ecobuild seminar, supported by CIBSE, that a 'massive change' was coming, with electric systems likely to increase their share of the heating market. However, a simultaneous surge in the use of electric vehicles could put 'significant pressure on local infrastructure' and drive up the cost of electricity.

There will, therefore, be strong incentives to improve design and technology choices to enable 'more effective use of electricity'. This will also incentivise on-site generation and storage of electricity, he added.

Turner pointed out the new carbon factors could be a disincentive for gas CHP and boost the use of heat pumps in heat networks.

More from Ecobuild on page 26.

Contractors finished 2017 in good shape

The vast majority (80%) of building engineering services contractors enjoyed increased or steady demand in the final quarter of last year, according to the latest sector survey carried out by BESA, the ECA, Select and SNIPEF.

Also, 85% of respondents said they expected turnover to increase or remain the same in the first quarter of 2018. But many said operational costs had risen and that the full impact of Carillion's collapse had not yet been felt.

Almost two-thirds said the price of materials had increased, and 50% admitted to labour-cost rises. More than half said they were still being paid late for commercial and public sector work.

'These figures show that, overall, the sector is in confident mood, even against a backdrop of commercial and political uncertainty and rising operational costs,' a joint statement said. 'However, the true effect of Carillion's insolvency on the supply chain is yet to come through.'

Arid cities must rethink planning and design

Arup is calling on arid cities to move on from an era of 1950s planning and design, or face becoming increasingly less habitable as they become drier. Its report, *Cities alive: Rethinking cities in arid environments*, urges them to learn from innovative developments around the world, to implement such things as industrial-scale fog- and dew-harvesting and cooling pavements.

The report outlines three key principles in shaping city-building in arid regions: to learn from the past and make use of locally adapted, climate-specific design solutions; to invest in green and blue infrastructure; and to design intelligent buildings and public spaces that respond to the climate. It gives examples of initiatives that are making arid cities more sustainable, including: the Sustainability Pavilion at the Dubai Expo 2020, which will use hybrid structures to generate renewable solar energy and capture water from humidity in the air and the City of Los Angeles, which is coating its streets with CoolSeal paint, reducing ambient temperatures by 6.6°C.

CIBSE's *Buildings for Extreme Environments – Arid* is available at **www.cibse.org/knowledge**

BESA appoints Frise

David Frise has been appointed as the new chief executive officer of the Building Engineering Services Association (BESA).

He has been combining the roles of head of sustainability at BESA and chief executive of the construction fit-out body FIS for seven years. He takes over as CEO of BESA with immediate effect, but will continue in his role at the FIS for a short period, to help manage the transition to his successor.

A former nuclear submariner, Frise left the Royal Navy to become managing director of a building engineering services contractor, which he described as a 'logical step'.

'Submarines and buildings might look like two different worlds, but, in the end, it's all plumbing,' he said.

Frise said his key priorities would include: stepping up the association's technical standards and guidance; working in collaboration with other sector bodies; and increasing the delivery of training.

Historic building services survey

Dr Henrik Schoenefeldt has created an online survey for CIBSE members, to gain insight into what today's building services engineers think about the industry's history and their role in modern education and practice.

Dr Schoenefeldt, senior lecturer in sustainable architecture at the University of Kent, is the principal investigator on the project 'Between heritage and sustainability: restoring the Palace of Westminster's historic ventilation system'. In addition to the survey, he will carry out a series of in-depth interviews with individuals, to explore some of the emerging themes.

The research is being carried out in preparation for the Technical Symposium (see page 28), where the results will be presented at a plenary session and form the beginning of a chaired discussion.

The survey, 'Historic perspectives in the practice and education of building services engineers', can be accessed at **www.surveymonkey.co.uk/r/WN66H3T**

THE EYES HAVE IT AS EPR ARCHITECTS' THE IRIS MAKES SHORTLIST

EPR Architects' The Iris is one of four design ideas shortlisted by Islington Council for the transformation of London's Old Street roundabout.

Described as a 'piece of metropolitan land art... a reflective lens facilitating interaction, inclusive gatherings, performances, play and relaxation', The Iris was selected from 39 entries that were showcased in a three-week public exhibition.

Also shortlisted by the judges were: Gpad London's 'Old Street Digital Garden' – a 'forest of lights that generate electricity enveloping a new pavilion, a water feature, and a "digital totem"'; Dar Group's 'Old Street Circus 2050'; and Nicholas Hare Architects' 'Old Street Park'.

The council wants to create an 'iconic gateway' and public space at Old Street when the 1960s roundabout is removed by Transport for London next year.

AC industry alerted to risk of flammable gas retrofits

R410A and R32 are not interchangeable as drop-in replacements and could result in serious injury, warns Refcom

The manufacturers' trade body FETA and the refrigerant handling register Refcom have issued warnings about the growing practice of retrofitting air conditioning systems with mildly flammable gases. Both organisations have sounded the alarm bell after the revelation that some users are removing R410A – a gas that is being phased out as part of the European F-Gas Regulation – and replacing it with R32.

FETA warned that A2L class refrigerants (mildly flammable) such as R32 are not suitable for retrofit projects. 'A system that was originally designed for non-flammable R410A will not have taken into account the safety factors required when using an A2L refrigerant,' it said. 'Systems designed for use with R32 have different pressure-switch regimes, altered inverter profiles, and specially designed heat exchangers.'

Charging an existing system with R32 would breach the refrigerant safety standard EN378, create a potentially hazardous situation, and breach manufacturers' warranty conditions, FETA continued. This could also invalidate the user's insurance policy.

Refcom pointed out that R32 has a higher compressor discharge temperature than R410A, so would increase wear on the compressor and significantly shorten its operating life.

It added that unsafe retrofit work was becoming more common because of dramatic rises in the price of certain refrigerants as a result of the phase-down process under the F-Gas Regulation.

Although the operating characteristics of R32 are similar to those of R410A, Refcom pointed out that 'these refrigerants are not interchangeable as drop-in replacements and serious injury could be the result of improper use'.

Architects Sheppard Robson ID:DR had a challenging vision. To create two huge lighting rings for this internal garden court area.

The specification agreed with engineers Troup, Bywater + Anders required 15,000 LEDs to produce 390,000 lumens from only 2,750W. The savings in power consumption achieved are impressive.

With the world's biggest bank job, the devil is in the detail.

Needless to say, it was an 'inside job'. Installing a one-of-a-kind, circular, 12 metre diameter LED-powered luminaire at the Bank's head offices in busy central London was never going to be a job for the faint-hearted.

The main structure was built off-site in sections small enough to be relatively easily transported and erected with the minimum of disruption to day to day Bank business.

The sheer scale is best seen in this trial assembly photograph taken at the factory.

This installation achieved the recognition of Guinness World Records on 22 March 2017 as the largest hanging lamp/light, at 12.1 metres.

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IN BRIEF

Stephen Lisk

AGM date

The CIBSE AGM will be held on 8 May 2018, at The Royal Society, 6-9 Carlton House Terrace, London SW1Y 5AG. It will be followed by incoming President Stephen Lisk's address. Members will receive a calling notice this month, and further details are available at **www.cibse.org/agm**

The AGM will be preceded by an extraordinary general meeting (EGM) to consider proposed changes to the governing documents of the institution. The EGM will start at 4.30pm, with the AGM due to start immediately afterwards, at 5pm.

Receive the information you want

The new General Data Protection Regulation (GDPR) comes into effect on 25 May.

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It will only take a couple of minutes and, then, you won't receive any further email reminders from CIBSE about GDPR.

For more information visit **www.cibse.org/gdpr**

SoPHE backs plumbing centre of excellence

First-year students with Society of Public Health Engineers (SoPHE) competition

CIBSE SoPHe chair Steve Vaughan, and Sanjay Modasia, chair of the SoPHE Contractors Working Group, attended London South East College's Bexley campus recently, to present prizes to the winners of an NVQ Level 1 plumbing competition.

The contestants had to complete a multiple-choice test, before moving into the workshop for the practical assessment – a static task board, which included technical challenges associated with the use of copper, black iron and plastic pipework materials, as well as working to specific dimensions and connection details. Philip Clarke took first prize, William Brooke second, and Danny Williams third, and were presented with plumbing tool sets and personal protection equipment.

SoPHE plumbing competition entrants

The prizes were sponsored by the SoPHE Industrial Associates, and the materials for the competition task boards were donated by JA Brooks Mechanical Services.

At the SoPHE annual dinner in London in November, Vaughan had outlined how SoPHE – with its Industrial Associates and Contractors Working Group – planned to collaborate with London South East College as part of its Construction Advisory Board (CAB) initiative.

Working with Bob Noseda, sector skills executive at the college, and the Chartered Institute of Plumbing Engineers, the aim is to develop a Centre of Excellence. This will enhance the NVQ Level 1 to 3 syllabus for plumbing trainees, offering skills and knowledge aligned to commercial plumbing installations and public health engineering consultancy. The Society hopes such engagement will inspire those who want to progress within the sector.

SoPHE also plans to promote technical CPDs to the students and lecturers at London South East College, to align with the training syllabus, and develop installation bays to represent commercial plumbing arrangements. It believes early engagement with students and further education providers will significantly benefit both the trainees and potential employers.

North West dinner relaunches

Patrick Nicholls and Colin Lehane

The CIBSE North West (NW) annual dinner relaunched on 26 January, at the Midland Hotel, Manchester, with more than 130 guests.

The NW region, CIBSE's oldest outside London, hosted the first such event in the region for more than seven years in conjunction with celebrating its 90th anniversary.

NW chair Colin Lehane addressed the audience and presented previous chair, Patrick Nicholls, with the chair's medal and a certificate of commendation in recognition of his service. Nicholls held officer roles within the Young Engineers Network (YEN) and the regional committee for many years, so the committee felt the award was greatly deserved.

After dinner, special guest speaker Eddie 'The Eagle' Edwards delighted the audience with his intriguing life story, going from plasterer to Olympic ski jumper, and even showed some of his original training footage.

The NW region would like to thank the sponsors, including Lindab, Remeha, Crane Valves, Schneider, Johnson Controls, WSP Group, Mitsubishi Electric, IDOM Merebrook, Tozer Associates, EECO2 and SI Sealy.

Special mention goes to: Lehane; Malcolm Atherton, SoPHE Northern representative; Jemma Halliwell, honorary secretary; Katerina Konsta, SLL representative; Matthew Lowe, social secretary; and Joe Timms, membership coordinator, CIBSE, for helping to organise the event. The dinner will take place again in 2019 – dates and details to follow.

Winning entry creates buzz with bike sheds

Green Roof Shelters wins Green Infrastructure Design Challenge

A company that transforms bus stops and bike sheds into thriving ecosystems has been named the winner of the third annual Green Infrastructure Design Challenge.

Green Roof Shelters was awarded the prize at Ecobuild last month, by competition organisers CIBSE and the Adaptation and Resilience in a Changing Climate network (ARCC), part of the UK Climate Impacts Programme (UKCIP).

Teams had to submit designs of buildings – existing or in planning – that demonstrated how indoor and outdoor green infrastructure can contribute to the health and wellbeing of occupants, while also improving the building's energy efficiency and climatic resilience.

The four finalists each gave a summary of their designs at Ecobuild. Winning team Green Roof Shelters takes functional structures – such as bus stops, bin-storage units and bike sheds – and turns them into individual ecosystems.

Vertical surfaces offer habitats for insects and small mammals, while horizontal surfaces provide pollen and nectar. The green roofs can also be designed to trap water, which can irrigate mini-wetlands.

John Little, of Green Roof Shelters, said: 'Communities need cycle and bus shelters. If you're going to have such structures, why not use them for more than one purpose?'

Architects Hawkins/Brown was awarded second prize for its design for the Urban Sciences Building at Newcastle University – an integration of parkland and building, that blurred the distinction between interior and exterior, and maximised the use of vegetation.

The other finalists were low energy building designers RCZM, and building engineers XCO2.

Submitted designs and challenge details can be viewed at **bit.ly/2FAF14B**

UKCIP, funded by the Engineering and Physical Sciences Research Council, offers a UK-wide network to develop knowledge and evidence to inform policy and practice.

Double crown for Rose Bruford College at Ready Steady Light

A team from Rose Bruford College celebrated two victories at the annual Ready Steady Light event, organised by the Society of Light and Lighting (SLL). The competition took place at Rose Bruford College, Sidcup, in March, where nine teams designed and set up temporary exterior installations, with a range of equipment, in only 180 minutes.

Rose Bruford College won the Technical and Artistic Awards, with Arup being highly commended in both categories. The team from DPA won the Peer Award.

Each team was allocated, at random, a site around the campus. Focusing on a return to basic engineering and design, they lit each site in its natural state with designated equipment, having to overcome challenges without a budget and within time constraints. Each team was led by an SLL member, with newcomers encouraged to take part.

Ready Steady Light is held in partnership with Rose Bruford College and supported by the International Association of Lighting Designers and Philips, Lee Filters, Whitelight, SGM and Erco.

CIBSE offers soft skills training

CIBSE has recently launched the first of its series of online Soft Skills modules – Business & Management Skills.

The modules are intended to help members of the building sector community to act as effective leaders and problem-solvers in different situations.

CIBSE is offering this training because it believes that strengthening these skills will have a positive impact on their members' career progression. It is also in recognition of the importance of skills outside of technical capabilities.

Each module is priced at £40 and CIBSE members will get a 10% discount when they are logged into their MyCIBSE area.

For more information visit **www.cibse.org/softskills**

Hurry to hit travel bursary deadline

Entries for the Ken Dale Travel Bursary must be received by 13 April. The award offers £1,500-£4,000 to CIBSE members, in the developmental stage of their career, who would like to spend three to four weeks abroad, researching aspects connected to their field of work.

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

Last year's winner was St John Townshend (pictured, below). For more information and to enter visit **www.cibse.org/awards**

St John Townshend

FEEDBACK

Andrew Geens: Landlords must exercise due diligence to ensure EPC ratings are current

CIBSE LinkedIn Group discusses the importance of accurate EPC ratings

Colin Lilllicrap
With the introduction of the Mees legislation, it is important that landlords and their advisers check the accuracy of EPC ratings for their rented properties. It is reported that many EPC ratings are wrong and, when recalculated using the current version of the national calculation method, many are downgraded, putting buildings currently rated as E at risk.

Using approved dynamic simulation software, instead of SBEM, allows more accurate modelling of a building and, in the case of cooling-dominated buildings, can lead to improved EPC ratings. In some instances, using dynamic simulation software can result in a building previously rated as F or G achieving an E rating, avoiding the need to invest in improvements.

Peter Chisnall
Totally agree; however, SBEM is the national calculation methodology. Dynamic simulation has to be used on Level 5 buildings though, but still SBEM.

Dan Lash
SBEM is not the national calculation methodology (NCM). The NCM is the calculation procedure. 'The NCM allows the actual calculation to be carried out either by an approved simulation software or by a simplified tool based on a set of CEN standards.' SBEM is the simplified tool; IES and TAS are examples of approved software. SBEM is, by definition, not dynamic simulation. What the opening post demonstrates is differences in the calculation methods of SBEM versus dynamic simulation software. In my experience, they give different emphasis on different end-use energy demand, and (dynamic simulation models) DSMs tend to predict less energy in absolute terms. You can use a dynamic simulation (if you are a Level 5 assessor) to produce an EPC, even for a simple building.

Andrew Geens
A different rating today does not mean the rating produced five years ago was wrong. An EPC produced today may no longer be accurate next week if, for example, a lighting upgrade happened the day after the EPC was produced. It is about exercising due diligence to ensure the EPC rating for a building is current.

Steve Dale
Mees needs to take into account the requirement for retail units, unheated and without lighting, where the 'worst case' has to be assumed for the M&E services. There is a danger that perfectly suitable buildings could get an F and, therefore, become unlettable.

Stewart Thompson
We've been working with private landlords to combine Domestic Renewable Heat Incentive and Energy Company Obligation to give them a healthy return on investment, improve their EPC, and save tenants money.

Paul Vassallo
I come from Malta, a predominately cooling country, and we use a revised version of SBEMmt.4.2 developed by BRE in around 2012. It is rather crude when assessing the building services because it lacks aspects on design and circuits, and the energy transfers mechanisms are very different in cooling than in heating. I have checked it with a complex building and the SBEM results were nearly double. I understand you developed SBEM for simple or complex buildings, and registered assessors have different grades – even up to level 5. It looks like we have adapted it and stopped there, which is giving us pessimistic EPCs.

Neil Dady
A DSM created to produce an accurate EPC holds greater value for the client in many other areas, including energy management and investment decisions.

Darren Coppins
There's also a lot of EPCs out there that were undertaken by the cheapest bidder, using a lot of defaults which will impact the rating. Many I see are inappropriate for the building type, with the wrong national occupational standards (NOS) level for the building complexity.

Andrew Fletcher
Interesting that the discussion focuses on improving EPC via choice of methodology, as opposed to actually improving energy performance! Darren makes a valid point that, as a profession, we have allowed a race to the bottom, with value stripped out of process in favour of minimising cost. There is a disconnect from reality for many EPCs, when clients' energy performance bears no resemblance to what their EPC predicted.

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Variable Refrigerant Temperature

A new way of thinking about energy

Soon, millions of electric vehicles could be on Britain's roads, offering a huge, flexible storage capacity for the built environment. To take advantage, the government must focus on upgrading infrastructure, says Matthew Rhodes

The latest Tesla electric vehicles run off 85kWh battery packs – enough energy to drive a car 265 miles or to run an average house for a week. But, what are the likely implications of these simple facts for the way we think about energy and, in particular, the way we manage energy in buildings?

Electric vehicles (EVs) are already here and, while projections about take-up vary, they will probably number in the millions within a relatively short time. From an energy perspective, large numbers of electric vehicles mean vastly more flexibility and fluidity in the system. That's not all; it also means a completely new infrastructure and additional demand for electricity, all of which needs to be managed. But it is the flexibility and fluidity that we'll all probably notice most.

"Every million new EVs on our roads represents up to 50GWh of storage"

Increased demand for electricity

National Grid estimates that the UK will need between 6GW and 18GW of additional generation capacity by 2050 to cope with the increased numbers of EVs[1]. Interestingly, the 6GW estimate relates to it most radical 'two degrees' scenario, while the 18GW reflects its more conservative 'consumer power' projection. The difference is an assumption, in the more radical scenario, that we will also adopt much more varied business and charging models, such as less vehicle ownership and more optimised charging and use of vehicles, often offered to us on a shared and autonomous model with centralised managed charging.

In context, 6GW is two to three large, traditional or nuclear power stations, or about 10% of current national peak power demand – so not as challenging, perhaps, as some observers might have first suggested, especially if we have until 2050 to build these stations and can already see the need. But something tells me it's unlikely to be so simple.

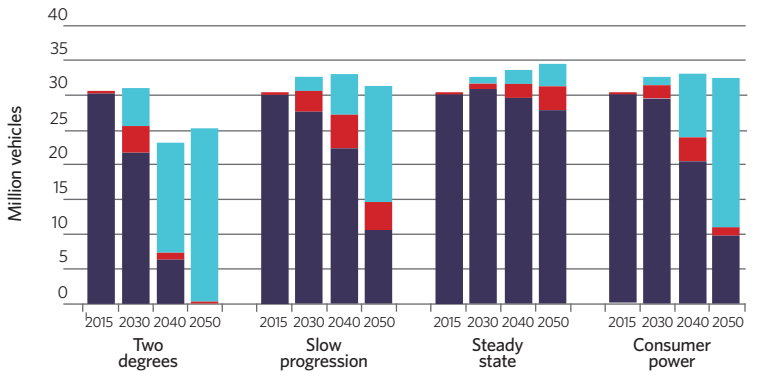
Novel infrastructure

The kind of radical reduction in peak power requirement from 18GW to 6GW suggested by National Grid requires sensible, planned energy-infrastructure investment in the right locations – for example, 'super-hubs', where autonomous EVs can return for charging, or travellers can switch from fossil- or hydrogen-fuelled, long-distance transport systems to regional and local EVs. It also needs effective charge-management algorithms and business models to emerge relatively quickly.

The omens for such outcomes aren't great. At the recent Ecobuild conference in London, a government spokesman blithely announced they are planning simply to prohibit charging at certain times of day to reduce the risk of excess demand. This seems a draconian and short-sighted measure, which will simply inhibit innovation and alienate customers. Much more effective approaches – for example, using time-varying tariffs as incentives – would be more effective in encouraging electric vehicle take-up and use of all this additional storage capacity in a way that benefits the national system.

On the other hand, there are innovations being developed and trialled nationally. In Milton Keynes, induction charging is used at bus stops to keep electric buses charged during the day, to reduce demand when they return to base at night[2]. At Ecobuild, Western Power Distribution (WPD) presented on its Electric Nation project. This has more than 700 EV drivers trialling smart-charging systems, allowing WPD to control when vehicles charge at night (subject to a customer opt-in) to optimise use of the distribution network[3].

Projected take-up of electric vehicles in the UK to 2050



Source: National Grid, future energy scenarios 2017

Flexibility and fluidity

It's the flexibility and fluidity that EVs offer the national system that excites me the most, though. Even with an average battery pack of 50kWh per vehicle, every million new cars on our roads represents up to 50GWh of additional storage capacity in our energy system – equivalent to virtually the whole generation capacity of the country running for an hour.

This capacity will move around, but not necessarily in an unpredictable way or, indeed, for most of the time. According to the RAC, the average UK car spends 96.5% of its time parked[4] – outside a person's home or place of work. Either way, the vehicle is following the main source of energy demand and demand volatility: the driver.

Battery charging and management is becoming increasingly slick and sophisticated – as the Milton Keynes example illustrates – and includes vehicle to grid options, as well as the traditional grid to vehicle.[5] So we suddenly have a world in which the average home or office has a whole new energy-management tool at its disposal – especially businesses that pay quite complex electricity bills, reflecting usage patterns and total demand, which might have hundreds of parked cars outside every day.

Current thinking about the opportunities this creates tend to focus on the value to the national system: 'What if the system had a (free) 50GWh storage asset as part of its portfolio? Do we really need that extra power station for peak demand, or could we design incentives to smooth out the national demand profile and use our new storage asset efficiently?' But there's probably quite a lot of virtue in thinking through the potential for individual homeowners, communities and businesses. What about taking my house (or business) off grid for a couple of days while the electricity price is particularly high? Or selling use of my storage asset to an aggregator to offer balancing services to the grid for a suitable fee? Or installing a solar system to do my own charging and minimise grid costs?

People relate to cars and mobility in a different way to how they relate to buildings and energy, so look out for a whole new world of customer engagement in the energy system – coming our way very soon.

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1 National Grid, *Future Energy Scenarios*, July 2017, ngrid.com/2HVSgcH

2 Maq Alibhai, Wirelessly charged electric buses in Milton Keynes, www.eurotransportmagazine.com 12:2 (2014), bit.ly/2G11jZb

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4 RAC Foundation, Spaced out: perspectives on parking policy, 17 July 2012, bit.ly/2GSmU7H (Most studies put the figure at about 95%).

5 Jonathan Susser, Not just a car: The possibilities of vehicle to grid technologies, www.advancedenergy.org, 4 October 2017, bit.ly/2G4AbZl

MATTHEW RHODES is an independent consultant. He chairs the Energy Capital initiative in the West Midlands. **https://www.energycapital.org.uk/**.

Testing time will follow review

More robust regime should result from Grenfell inquiry, says Andrew Collard

The building services industry must be prepared for a far more rigorous approach to fire-safety testing in the wake of the Grenfell tragedy. As Dame Judith Hackitt prepares to publish her final report this month, the system of product testing is to be made a priority. Clear goals for improved fire safety will also be set through the long-awaited revisions to Part B of the Building Regulations.

Earlier in the review process, the Hackitt committee said it was alarmed by the fact that many products were marketed 'with specification data presented in ways which can easily be misinterpreted'. It also pointed out that the widespread use of desktop studies to determine product suitability was undermining the quality of the specification process. The committee called for test results – and the details of those who produce them – to be made public, and for testing to simulate 'real life' operating conditions.

Another key concern for the Hackitt committee was who takes responsibility for design and installation decisions. BCOs will have to ensure adequate information is given by project teams, which will depend on them having comprehensive testing data. This also seeks to address the problem that contractors are often expected to work with only partially developed designs that have crucial technical details missing. Together with budget constraints, this can seriously compromise the original design intent.

Testing via computer models has become more sophisticated in recent years, but there is still no substitute for using physical test facilities. You can recreate actual conditions and then show the engineer or client just how their equipment will respond. Product test facilities are already seeing a marked shift in demand, and manufacturers are receiving record numbers of requests for technical assistance with installation.

As Dame Judith has pointed out, a robust physical test regime will be needed to offer the vital technical evidence to the industry as it seeks to improve its competence, knowledge and skills around life-safety systems. The changes called for by her review are creating a significant shift towards comprehensive testing and a more thorough design process, to support the rigorous professional standards that will emerge from the final report.

Swegon Air Management

ANDREW COLLARD is Actionair product manager at Swegon Air Management. **www.swegonair.co.uk**

The future of heat

The government has issued a call for evidence on a framework for heat in buildings. Hywel Davies looks at what it offers

In reviewing the Clean Growth Strategy, the Committee on Climate Change wanted more detail on several issues. As well as plans to phase out sales of petrol and diesel cars and vans by 2040, it focused on how we phase out the most polluting fossil-fuel heating in homes and businesses off the gas grid, and generate 85% of UK electricity from low-carbon sources by 2032.

The committee also wanted more detail on how we will increase energy efficiency in homes by 2035 – and for UK businesses and industry by 2030 – along with proposals to improve energy efficiency standards of new buildings.

When it comes to heat, the committee would like to see a clear, combined strategy for energy efficiency and low carbon. It also wants a significant increase in energy efficiency measures, as well as greater uptake of heat pumps and heat networks where appropriate.

In addition, it would like to see a proper evaluation of the potential for low carbon hydrogen to meet heat demand. The committee views low carbon heating and improved energy efficiency as ways to close the current shortfall in meeting the target of the fourth carbon budget.

On energy efficiency, there is scope to do much more. Some measures are obvious – and even free.

The recent cold snap in the UK highlighted the mindless policy of some UK retailers keeping shop doors open whatever the weather. They do this to attract potential customers, even if those customers are cold and ask to shut the doors – and regardless of the comfort of the shop staff.

If every retailer shut their doors, it would be a win for everyone: warmer customers and staff; reduced energy bills – which feed directly into increased profits (in a sector that faces huge pressure on margins and profits); and reduced UK emissions. And at zero cost, save that of the regulation!

No retailer will voluntarily go first, for fear of a drop in footfall, but if regulation required closed doors – as it does in New York – they would just do it. In the meantime, we forego emissions reductions and we all pay for wasted energy, as retailers defy the laws of thermodynamics and simple good engineering, and try to heat the world.

The government has already committed to reviewing Part L once the independent review of Building Regulations and fire safety is published, giving us the opportunity to propose further improvements to energy efficiency in our building stock. While we do not yet know the timescales, CIBSE members will be busy thinking about how we improve the efficiency of our homes and commercial buildings – as well as hospitals, schools and other public buildings – ready for the inevitable consultation.

"We face radical reconfiguration of the energy system, and not just the energy supply system"

Meanwhile, we must also think about how we heat buildings in future. The demise of internal combustion engines may be a way off, but switching to electric vehicles will have a profound effect on demand for, and distribution of, electricity, in the UK and all major economies.

With growth in distributed electricity generation from PV, wind and other renewables – and the move from fossil to electric heating – we face the most radical reconfiguration of the energy system in a century, and not just the energy supply system. It will have major implications for the systems we design and install in buildings.

Conventional fossil-fuel heating systems may no longer be the obvious choice for new buildings. As renewables deliver an increasing share of total capacity, assumptions about off-peak supply may need to change to match the improved output from PV systems in daylight hours. There is a lot of talk about battery storage, but what might that mean for individual buildings? How long will we continue to generate electricity through a PV array, transform it from DC to AC, move it a few metres, then transform it back to DC to power a handheld or mobile device? Why do we tolerate such inefficient processes? Perhaps we should revisit Edison's DC supply system.

Against this backdrop, the government is calling for evidence about how we set about the long-term decarbonisation of heat. In particular, it wants information to support actions to move off-gas-grid buildings away from high-carbon fuels, but this is part of a much wider picture.

As an institution, we will be responding to this consultation and would welcome contributions from our members – and, indeed, other readers. While it is a UK exercise, it will be relevant to readers elsewhere, because many of the issues are not unique to this country.

Decarbonising the heating of our buildings poses questions about the way we design and service them. It will change the way we all work and the systems we design, install and manufacture, as well as the way we operate them. We have the chance to contribute to designing this change. Like closing the doors, we should just do it!

- The consultation is available at **bit.ly/CJApr18HD**
- For more information on the CIBSE response to the consultation, visit **bit.ly/CJApr18HD2**

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

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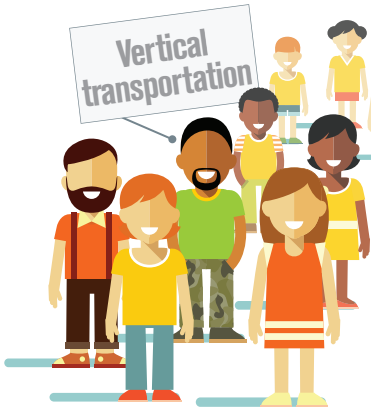


HIDDEN IN PLAIN SIGHT

A solution to the UK's engineering skills gap has been staring us in the face for decades – women and people from minority ethnic backgrounds. So what is CIBSE doing to encourage more diversity in the profession?

Our society faces major challenges when it comes to climate change, urbanisation and environmental pollution, so our profession must keep looking for innovative solutions to these problems. Our vital work will be harder to deliver, however, unless something is done to address the skills gap, which is continuing to grow. It is estimated that an additional 87,000 graduate-level engineers per year are needed in the UK between now and 2020, but the higher education system is producing only 46,000 engineering graduates annually.

The good news, however, is that the potential resource to fill the gap is right under our noses. We can start using it simply by attracting talented people who, traditionally, have not considered taking up careers in our industry. This is the goal of diversity and inclusion (D&I) initiatives, where diversity represents the mix and inclusion refers to getting the mix to work well together.

The case for action

Consider that the UK has the lowest proportion of female professional engineers in Europe, at just 8%, despite women making up 51% of the working population. Only 6% of professional engineers are from black, Asian or minority ethnic (BAME) backgrounds, whereas changing demographics mean this group now comprises 25% of the UK's secondary school population. And 60% of women surveyed reported encountering barriers when returning to work after a maternity break.

The message is clear; there is abundant untapped potential – and attracting underrepresented segments of the population to science, technology, engineering and maths (STEM) careers is the obvious first step to boosting the number of engineering professionals in the UK.

'There is no doubt that addressing diversity and inclusion is vital to the continued success of our industry,' says Jo Edwards, co-vice-chair of CIBSE's Inclusivity Panel. 'I am very pleased to be associated with organisations – including CIBSE – that are embracing the issue so comprehensively that they are incorporating D&I into their overarching strategic aims.'

Researchers are increasingly and consistently finding that companies and organisations with higher rates of diversity are more successful. Companies in the top quartile for gender diversity are 15% more likely

to have financial returns above their national industry median. That number becomes 35% for companies in the top quartile for racial/ethnic diversity. Success doesn't have to be considered only in terms of financial performance, however. Studies show that companies with more women in senior management functions report significantly higher levels of employee satisfaction, too.

Regardless of the business case, there are also strong ethical and legal dimensions to consider. Engineering organisations are united by a desire to improve society. Setting goals and treating all people fairly, proactively to include them and to make their organisations more representative of the communities they serve is not just the right thing to do – it ultimately contributes to the betterment of society. From a legal perspective, the Equality Act 2010 prohibits discrimination and unfair treatment of people on the grounds of their demographic characteristics, so we must address biases in the workplace.

Despite the convincing evidence, and legal and ethical imperatives, human nature, societal norms and cultural baggage continue to stand in the way of the industry reaching its full potential. Even at primary school age, girls have less positive perceptions of engineering than boys (32% compared with 61% of boys). Graduates from BAME backgrounds are less likely to be hired than their white peers, and can expect to be paid less than them, on average, should they manage to secure full-time employment. It's even estimated that the industry is losing a potential £11.2bn per year in productivity because of lesbian, gay, bisexual and transgender (LGBT) engineers feeling forced to hide their sexuality at work out of fear.

Given the current situation in the sector, how can we ensure we have the talent to deliver creative solutions to the challenges society faces? As an industry, we have to be more proactive in changing ourselves – who we are and how we work. This is where diversity and inclusion initiatives come in.

'Diversity and inclusion go hand in hand – recruiting people from under-represented demographics is not enough; the industry also has to engage with what minority employees bring to the table if we want to leverage innovation and new approaches. This means cultural shift, not just cosmetic changes,' says co-vice-chair Mikal Ahmed.

> "Setting goals to treat all people fairly and to make their organisations more representative of the communities they serve ultimately contributes to the betterment of society"

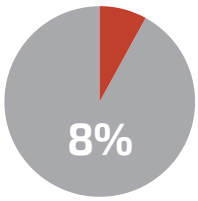
Taking action

The Royal Academy of Engineering (RAEng) recognises the vital importance of this topic and, with UK government support, has been running a programme since 2010 to increase diversity and inclusion across the engineering professions. A strategy spanning four years to 2020 was published in 2016; its aim is to understand and address the extent to which engineering and its organisations are inclusive and nurture diversity.

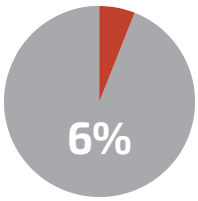
CIBSE has taken this opportunity to relaunch its diversity committee – now the Inclusivity Panel – to engage with the RAEng's initiative, and to do more to fulfil CIBSE's obligations under the Diversity in Engineering Concordat.

'It's immensely reassuring to me that CIBSE's commitment to addressing inclusion issues pre-dates the noticeable increase in public debate and media coverage we've seen over the past year,' says panel chair Atif Rashid. »

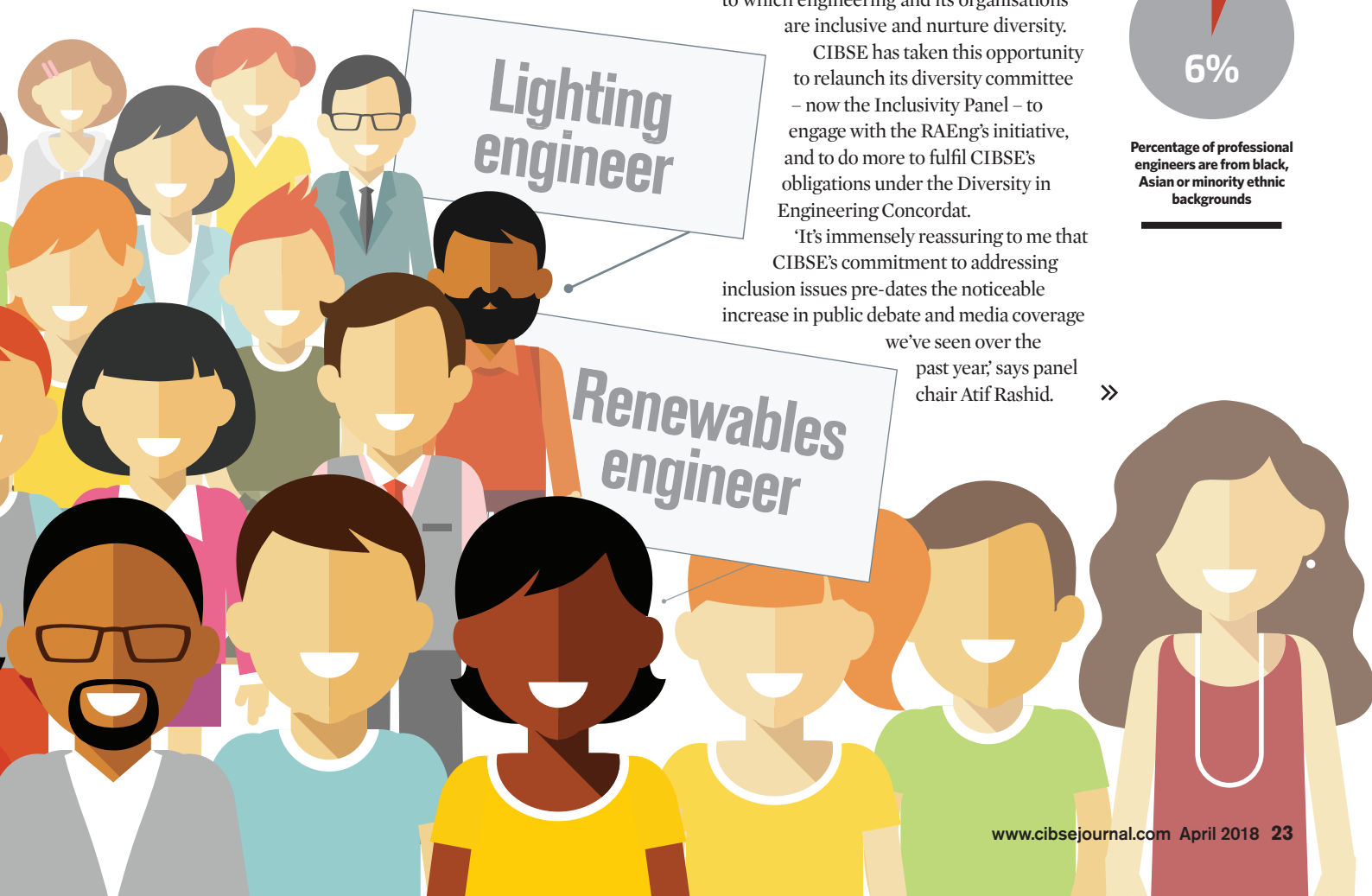
Diversity statistics



Percentage of female professional engineers in the UK – the lowest proportion in Europe



Percentage of professional engineers are from black, Asian or minority ethnic backgrounds



» 'These efforts are not reactionary, but stem from a genuine conviction that doing well on inclusion is central to the future health of our institution and our industry.'

Formed last summer, CIBSE's Inclusivity Panel comprises 10 volunteers from across the membership, including from the institution's board and the executive.

It participated in a benchmarking exercise organised by the Royal Academy. This came out of a joint project between the RAEng and the Science Council to develop a bespoke Progression Framework to help improve diversity and inclusion among scientific and engineering professional bodies.

Institutions were asked to self-assess their performance across eight departmental areas against a range of diversity and inclusion maturity indicators. The results put CIBSE on a par with the other institutions that took part, but indicated that – as an industry – we are just starting to get to grips with a complex issue. The exercise did, however, give the panel a base from which to consider what it wants to achieve and where to start.

40,000

The annual shortfall in the number of engineering graduates in the UK

CIBSE's next steps

After analysis of the results of the benchmarking exercise, the Inclusivity Panel developed three key aims for 2018:

- Improve awareness and understanding of inclusivity and diversity across CIBSE, and embed these concepts within the institution's strategic aims
- Improve the breadth and quality of data captured (anonymously) about the diversity of staff and members
- Increase the proportion of female members and registrants.

The first aim ensures CIBSE's stance on these issues is clear, well communicated and identified as a key component of the industry's future success. The second enables CIBSE to understand the current situation among its staff and membership, and to begin tracking progress over time. The final aim addresses a particularly acute issue unearthed during the RAEng benchmarking exercise – the poor representation of women among our numbers.

These aims were put to the board and approved in January 2018. As the year goes on, CIBSE members can expect updates on the panel's progress and, perhaps, requests for help. After all, cultural change in any organisation can only come about with the buy-in of all its stakeholders.

The Inclusivity Panel is currently working with the executive on the first set of actions to achieve its aims. It looks forward to the support of our peers and colleagues towards nurturing a more diverse CIBSE that is representative of us all – and a more inclusive CIBSE for every one of us. The future of our industry – and, therefore, wider society – depends on it. CJ

- Statistics sources: **bit.ly/2G8D7HJ** and **bit.ly/2DJu7DM**

FRANCES WINCH – A BUILDING SERVICES PIONEER

Frances Winch MCIBSE, who died last month aged 92, proved that it was possible for women to have a richly rewarding career in building services – but it wasn't always easy. Frances, also known as Frankie, joined the industry after World War I, during which she served as an air mechanic (electrical) and petty officer in the Women's Royal Navy Service.

After the war, she became one of the first female graduates of the newly formed National College of Heating, Ventilation and Fan Engineering, which eventually became part of London South Bank University (LSBU). Frances then worked as a heating and air conditioning engineer before becoming a librarian at the National College and a lecturer at Salford College of Technology. She ended her varied career at Manchester City Council, as a senior officer in the fuel-efficiency unit, where her work involved monitoring control systems.

Women's work

Challenging times ahead...

Highlighting opinions

The challenges facing a woman in the industry were revealed in two letters Frances wrote – one when applying for a development officer position at CIBSE in 1987, and one to the *Building Services Journal* (forerunner to *CIBSE Journal*), 10 years later.

In her letter to CIBSE, Frances said it was hard to return to the industry after having a family, because of the lack of retraining courses available. In the *BSJ* letter, she called for a change in attitude towards women in the industry, and lamented that only 2% of services engineers were female. She called for more incentives for women to return to work, more flexible working and intensive refresher courses. 'More flexibility in career structure would be welcomed by many men as well as women,' she wrote.

The percentage of women working in the industry is still only 8%. Frances' son-in-law, and CIBSE past president, Andy Ford – who is now director of enterprise and innovation at the LSBU's School of Environment and Architecture – says there is plenty more to be done. 'I made significant efforts to promote the profession to women while president, and I continue to do so at LSBU – but, after reading her letter, I am depressed to realise most barriers she mentions still remain,' he says.

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A packed main auditorium at Ecobuild and a well-attended side session (right)

GRENFELL SETS THE TONE AT ECOBUILD

After the devastating fire at Grenfell Tower, the focus at Ecobuild was on the quality of every element in design, construction and operation, not just sustainability. **Alex Smith** and **Ewen Rose** sense a different mood at this year's event

London's annual Ecobuild is no longer just a show about sustainable building. After the Grenfell Tower disaster, how could it be? The tower was refurbished to help improve energy efficiency and reduce fuel poverty among residents – but, for reasons that will become clearer in the coming months, it ended up contributing to the deaths of 72 people.

The tragedy has brought into question the collective ability of the construction industry to design, construct and operate buildings that are not only sustainable, but also safe and fit for human habitation.

Grenfell was tackled head on, in a packed auditorium, by past RIBA president Jane Duncan, who said the world was watching the industry to see if it was capable of building homes that were fit for purpose. 'We need to demonstrate competency in our roles and skills to deliver high-quality buildings,' she said. 'The industry needs to respond with speed and integrity to improve standards and quality in design, delivery, compliance, enforcement and accountability.'

Richard Cook, head of residential at LendLease, said developers 'should be focusing on customers and people living in our buildings.' He said that what the industry has achieved on site safety over the past 20 years needed to be applied to building quality, and that legislation may be required to force industry to improve.

In the same debate, Lynne Sullivan, partner at Sustainable By Design, called Grenfell 'a national scandal and a huge wake-up call for our industry'. She added: 'The issues that caused it are symptomatic of systemic failure in our industry.' Sullivan said government reforms of the National Planning Policy Framework focused too much on housing numbers, rather than needs. Post-Grenfell, she said, there needed to be a focus on verification and drew attention to outcome-focused initiatives, such as the Australian energy disclosure scheme Nabers.

Good Nabers

Verco technical director Robert Cohen bought delegates up to speed on the latest developments in the Design for Performance (DfP) initiative, which aims to replicate Nabers in the UK. He reminded the audience how far the UK is lagging behind Australia, stating that offices in London were using 80-160kWh·m^{-2} per year of energy compared with 40-70kWh·m^{-2} per year in Melbourne.

Without the measurement and disclosure of operational energy, Cohen added, 'the UK was completely blind to the performance of new commercial buildings in the UK'. He listed some of the main areas of failure in British commercial buildings, including problems with specification and operation of controls, building managers lacking the skills to operate buildings properly, and the failure of metering.

Six buildings at various stages of construction are piloting DfP, and the aim is to introduce a fully fledged scheme by March 2019. Cohen says the BCO Guide 2019 could mandate DfP for large new offices.

The initiative is backed by many cross-industry organisations, including CIBSE, but Cohen and Sarah Ratcliffe, programme director, Better Buildings Partnership, called for more 'pioneers' to get involved. 'We know there is a world-leading solution to that problem, but do we have the will to replicate the solution in the UK?' asked Cohen.

Catherine Staniland, director of New London Architecture

Passivhaus performance

One performance initiative that is proving itself is Passivhaus. Two of the projects at this year's CIBSE Building Performance Awards were Passivhaus certified. Architype designed one of them – The Enterprise Centre – and its managing director, Jonathan Hines, revealed the results of monitoring at its recent Passivhaus schools.

Working with a researcher at Coventry University, Architype looked at the performance of schools, including three of its Passivhaus facilities. 'We have monitored our project for many years, because we think it's crazy that the industry never learns from one building to the next,' said Hines. By monitoring, Architype learned that it could reduce solar gain in its designs by having less glazing and not taking it to the floor.

Jon Bootland, chief executive of Passivhaus Trust, said nearly 1,000 buildings in the UK had now been certified Passivhaus, and Gwyn Jones, city growth and development manager at Norwich City Council, said it is aiming to deliver more than 200 Passivhaus homes on two sites in the city. He explained how the council had first carried out a 10-home pilot to understand how occupants coped with Passivhaus controls and technology. 'People don't have an understanding yet of how Passivhaus works and the benefit it brings,' added Jones, who remarked that some occupants instinctively want to turn off the mechanical ventilation. 'All of our tenants were given a user guide, but some still had difficulties. For our next scheme, we will show in picture form everything residents need to do to operate the property.'

Heat networks

The future of heat networks was a major theme of Ecobuild, with several speakers concerned about a lack of regulation leaving consumers unprotected as the market grows.

Currently, networks account for 2% of UK heat demand, but the government wants that to increase to 18% by 2050, to help it meet its low carbon commitments. Speakers discussed the move away from gas boilers and towards biomass CHP, heat pumps, and energy from waste that could be used to feed networks. However, they pointed out that a rapid increase in generating heating and hot water in this way presented hazards – not least the lack of consumer protection in a lightly regulated market.

District heat has 'a history of poor performance' and a 'weak supply chain', said Bob Lowe, of the UCL Energy Institute, who chaired a CIBSE-supported session. He said networks do not play a role in decarbonisation, but allowed 'significant economies of scale in heat production and storage'. Lowe proposed repurposing the existing gas grid to deliver the decarbonisation that the government wanted.

However, it was the impact on the consumer that concerned Bindi Patel, of Heat Trust. 'Getting heat and hot water from a network is a big change for a consumer,' she said. 'There is a lack of support for customers, no regulation, and networks are set up to be monopolies, so you can't even switch supplier.'

Heat networks are long-term infrastructure projects, and suppliers are keen to receive a return on their investment, raising the spectre of an unregulated 'wild west' market, with consumers left vulnerable to uncertain pricing strategies and poor performance, delegates were told.

Patel, along with other speakers, called for greater consistency between what is reported on a property's Energy Performance Certificate (EPC) and the actual performance of the network.

In response, several delegates urged suppliers to refer to the Code of Practice developed by CIBSE and the Association for Decentralised Energy (ADE), to establish best-practice principles in design and operation. This would also form the basis of a technical compliance scheme, which the government should push network suppliers to adopt, they said. The UK was urged to follow Sweden, where heat networks are not regarded as a carbon-saving option, but as a highly efficient way of using waste heat. This prompted a debate about the fact that much of the energy from waste generators in the UK is not connected to heat networks because there is no financial incentive for it to be so. Several speakers called on the Heat Network Delivery Body to tackle this and pointed out that it was a 'planning issue'.

There will be papers presented on heat networks at the Technical Symposium, held at London South Bank University from April 12-13 (see over for a preview). CJ

Beyond business as usual

Industry experts will present more than 70 papers at the 8th CIBSE Technical Symposium, which is being held at London South Bank University on 12-13 April

The theme for the 2018 CIBSE Technical Symposium is 'stretching the envelope'. The challenges of climate change – and the uncertainties around resources and security – mean that a business-as-usual approach will not be enough to guarantee habitable buildings in the future.

Expert papers presented by more than 70 practitioners and academics will give delegates an opportunity to learn about the latest techniques, applications and technologies that create healthy and productive environments.

'It's time to stretch the envelope,' says organiser Tim Dwyer. 'We are heading for more than two degrees of warming by 2050. We need to get our heads around comfort and system efficiency outside buildings, as well as inside buildings.'

As part of the two-day event at London South Bank University (LSBU) on 12-13 April, Andy Ford, past CIBSE President and professor of building systems engineering at LSBU, will chair a debate for the motion: 'The linear economy wreaks planetary havoc – stretching new ideas are vital for sustainable future cities.'

Professionals, as represented by CIBSE, think about comfort and the human need like no-one else and we need to shift our buildings and cities so they are not only a pleasure to live in, but still livable when our climate is dramatically different, says Ford. 'If successful, could our future cities help the natural world survive what our profligate waste has achieved?' The debate will consider the state of the planet 50 to 100 years from now.

High-profile failures in engineered systems, including Grenfell Tower and the Florida bridge collapse have focused attention not only on the design of systems, but also on the proper delivery and maintenance of buildings.

Technical Symposium participants can safely explore the potential implications of their design and operation decisions, says Dwyer. 'It is a forum for unfettered and convivial discussions between practitioners and leaders, which will help develop and deepen knowledge and understanding of the potential consequences of their professional and technical activity.'

■ To book at place at the Technical Symposium visit **www.cibse.org/symposium**

SUBJECTS OF INTEREST

Key themes to be covered by the peer-reviewed papers

- **Assessing, assuring and improving occupant health, comfort and wellbeing**
- **Developing and applying leading edge products and systems**
- **Moving towards net zero energy and net zero water-built environments**
- **Reuse and refurbishment for future benefit**
- **Enhancing constructed engineering solutions through modelling and prediction**
- **Fusing passive and active building systems**
- **Creative technologies and systems for an ageing population**
- **Employing big data and IoT to enhance building systems**
- **Leading edge technology to survey, assess and monitor building systems**
- **Building automation**
- **Defining and maintaining safety and security**
- **Benchmarking, standards and regulations for assuring building performance**
- **Metering, intelligent monitoring and control techniques to manage energy use**
- **Improved building development and operation using BIM**
- **Design and operation of future and, potentially, smart cities**
- **Maintaining integrity and enhancing the practical longevity of historic buildings**

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FIT FOR THE FUTURE

CIBSE's new guidance promotes integration of building services engineers in the design, construction and operation of high-quality homes, as Aecom's **Tom Lelyveld** highlights

The energy used in homes accounts for nearly 30% of the UK's total energy use and carbon dioxide (CO_2) emissions. It has been estimated that the construction sector can influence around 55% of the country's carbon emissions, with energy use in domestic buildings accounting for half of this.

The CIBSE Homes for the Future group identified an imbalance in guidance available to service engineers working in the residential sector, compared with the commercial/non-domestic sector.

Technical Memorandum 60 (TM60) *Good practice in the design of homes* has been written to bridge this knowledge gap. It is the first overarching housing guidance document from CIBSE and, in time, will be supported by more detailed, discipline-specific good-practice guidance. CIBSE awarded Aecom the contract to develop this TM, and recognises the considerable additional 'in kind' contribution of time to support the development of the guidance.

The aim of the TM is to help building services engineers and other professionals working on the planning, design and construction of homes to:

- Understand and demonstrate good practice
- Understand the relevant guidance, tools and other resources available
- Contribute to delivering good practice as part of a wider design team.

It was decided that good practice be defined as 'the design and delivery of homes that are safe, fit for purpose, resource-efficient, low carbon, comfortable, healthy, and easy to operate and maintain.' We then specified that 'where possible, good practice should deliver lower capital and life-cycle costs. As well as the current needs of occupants, potential future needs should be taken into account when designing homes.'

The UK government has a stated target to build 200,000 new homes per year in England, which represents less than 0.01% of England's total housing stock of 23 million. Furthermore, the UK has committed to achieving an 80% cut in CO_2 emissions by 2050, compared with a 1990 baseline. Achieving this legal obligation will not only require the delivery of zero carbon – and zero net energy – new homes, but also, more challengingly, the wholesale refurbishment and retrofit of our existing housing stock to reduce our demand for heat and power.

It is critical that the homes we build and refurbish are well designed and constructed/refurbished, so that we are not revisiting our new-build or refurbished homes in years to come, to fix issues arising from poor quality. Delivering such homes offers many benefits, including:

- Helping to reduce energy bills and maintenance costs
- Providing healthy homes that are comfortable throughout the year, well lit – with good access to daylight – water efficient, and well ventilated, to maintain good indoor air quality
- Providing homes that are relatively simple to understand and operate
- Reputational and marketing benefits to professionals involved in their design
- Helping to reduce greenhouse gas emissions and mitigate climate change.

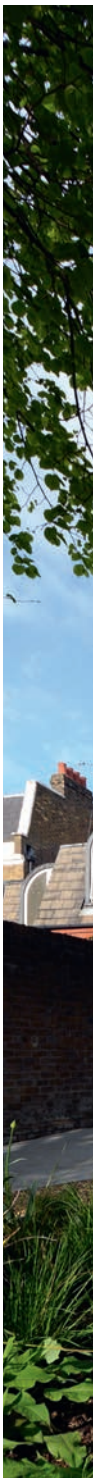
This is the agenda that TM60 has been developed to support. The format of the guidance loosely follows the construction process. First, it

INDUSTRY SUPPORT FOR TM60

"At Willmott Dixon, we understand that achieving best practice in services design and installation is a key aspect of the long-term performance of our residential projects. By underlining what best practice looks like and highlighting key focus areas, such as ducted ventilation services and apartment overheating risk minimisation, TM60 will help deliver better-performing residential projects for developers, contractors and customers alike"
Alasdair Donn, principal SD manager, Willmott Dixon Re-Thinking

"Integrated design will require greater collaboration and understanding of the impacts of system selection and various decisions through the design, construction and subsequent occupation and operation of homes"
Ashley Bateson, Hoare Lea, chair, CIBSE Homes for the Futures Group

"How we design and construct our new homes – and getting this process right for our residents, as well as for our business – is of prime importance. TM60 is an important step forward because it points the design team towards integrated design, with the building services developed in conjunction with the approach to building fabric and the design of other services"
Susan May, head of design and quality, Clarion Housing Group



sets the context and introduces key themes that run through the more detailed service-by-service subsections in Section 6. It then moves on to the construction and commissioning process and closes with the provision of informative guidance to future occupants, to enable the effective use of their good-practice home.

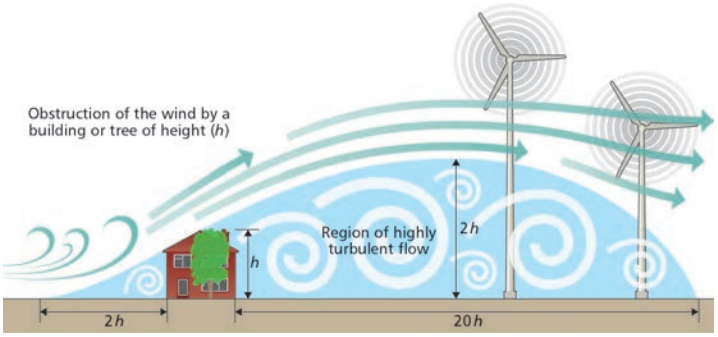
Each section of the TM is concluded with key messages, which will be useful aides-mémoire when looking to draw salient points into briefs.

Below are a few of the key themes highlighted in TM60.

Early appointment and retention of the building services engineer

One repeat theme that was fed back from our internal team and members of the steering group was the importance of the early and ongoing engagement of building services engineers. The earlier they are involved in a project, the greater the positive impact they are likely to have.

Quoting from TM60: 'It is good practice for the expert skills and knowledge of building services engineers to be used to inform, clarify, and, where appropriate, challenge the brief and client requirements. This is likely to be an iterative process, ideally starting with the initial statement of need and strategic brief, and moving on to the project brief, concept design and further design development stages.'



How airflow can be affected by obstacles

Integrated design

Coordination across the design team, collaboration, and the integration of design decisions across the full life of a project – from concept through to post-occupancy evaluation – are essential to deliver good practice in the design of homes.

Examples of some of the key integration issues for building services include ensuring that sufficient space is provided for future accessibility and maintenance, and that services do not compromise the insulation or the air barrier.

Poor coordination and poor integration are contributing factors to the performance gap often experienced when homes are occupied. The TM highlights the importance of the ongoing involvement of the building services engineer through to handover and post-occupancy evaluation (POE). It is good practice for engineers to then take lessons from the POE and to feed them back into concept and later stages of design.

As the ability to influence certain decisions decreases as the design progresses, it is important that building services engineers have regular input. They need to be well integrated into the design team and consulted when changes that may impact on building services are made by other design-team members.

Some issues, such as product substitution, occur later in the design process, so it is important that building services engineers continue to be involved in the later stages of design and delivery, and that any handovers between stages are well planned and clear design drawings provided.

The development of this TM has been a collaborative process with Aecom, CIBSE, the steering group and the CIBSE Homes for the Futures Group. All the contributors were focused on the desired outcome – an improvement to the quality of our design and to the quality of the new and refurbished homes that will be delivered in the UK in the years to come.

I would encourage CIBSE members and their clients to draw on the content of the guidance when setting briefs, responding to briefs and then delivering residential projects. CJ

CIBSE's new TM60 aims to help building services engineers to deliver good practice as part of a wider design team

TM60 can be download for free by CIBSE members and as a hard copy for £7.50. For non-members, both pdf and hard copies are available for £15 at **www.cibse.org/knowledge**

TOM LELYVELD is a regional director at Aecom

A low energy housing scheme in Northern Ireland impressed at the CIBSE Building Performance Awards, where it won Project of the Year – Residential. **Andy Pearson** finds out why it deserved the trophy

SPOILED FOR CHOICE

Choice Housing Ireland (CHI) wanted its 39 homes in Killynure Green, Carryduff, south-east Belfast, to show developers it was possible to build low energy housing without a radical approach to construction or an over-reliance on renewable technologies. So it built Northern Ireland's first Code for Sustainable Homes Level 5 (CSH Level 5) scheme.

The £7m development was completed in October 2015. Two years on, this innovative scheme is living up to expectations, with residents saving up to 42% on the cost of energy, compared with a similar-sized dwelling, and with CO_2 emissions 60% less than the Building Regulations minimum.

The scheme's pragmatic approach to low energy housing impressed at this year's CIBSE Building Performance Awards, where it won Project of the Year – Residential. The judges said: 'Killynure Green was a really commendable approach to a social housing scheme', and praised the fact that it incorporated 'lots of references to lessons learned from previous projects that they had reviewed and improved on'.

To design the CSH Level 5 scheme, CHI worked with PDP Architects and engineers Caldwell Consulting. 'We developed the first Code Levels 3 and 4 schemes – and the first certified Passivhaus social housing – in Ireland. This scheme demonstrates our appetite to try to deliver the best service and homes for tenants that we can,' says Brian Rankin, energy manager at CHI.

As well as meeting CSH Level 5 criteria, the designers had to ensure the scheme met

£7m

Cost of Killynure Green development, which was finished in October 2015

Key dates for 2019 Awards

- **Entries open May 2018**
- **Entries deadline: 14 September 2018**
- **Shortlist announced: 15 November 2018**
- **Awards dinner: 12 February 2019**

The scheme's CSH Level 5 homes are built from Kingspan's Ultima timber frame system

The roof-mounted solar PV array (right) is 4kWp

the requirements of Lifetime Homes and Secured by Design, and the space parameters set by the Department for Communities (DfC).

The design

Killynure Green is built on a sloping site. The architect's design exploits this gradient by arranging the two-, three- and four-bedroom homes in terraces along its contours. Homes are orientated to face north-south.

Their northern elevation incorporates a big feature window, allowing large amounts of daylight to enter the homes without the need to control solar gains. By contrast, the southern elevation incorporates a double-height, single-glazed wintergarden. This is designed to collect solar gains in winter, with air warmed by the sun drawn into the homes through opening doors and windows. The wintergarden is intended to reduce the home's heating load. In summer, shading elements and opening vents allow occupants to purge unwanted heat from the space.

The CSH Level 5 homes are built using a proprietary Ultima Timber Frame System – a prefabricated structural system, selected by contractor GEDA Construction to achieve high levels of thermal insulation and airtightness. This off-site solution ensured fabric U-values could be kept between 0.11-0.16 $W \cdot m^{-2} \cdot K^{-1}$.

In addition, enhanced accredited construction details were used to achieve Y values (the proxy for the heat loss through the non-repeating thermal bridging areas of a building) of 0.04 $W \cdot m^{-2} \cdot K^{-1}$ by minimising thermal bridges. Where details differed from standard enhanced details, thermal modelling was carried out to test junctions. All windows are triple-glazed.

Airtightness tests were carried out once the building envelope had been completed, but before the internal linings were finished. This approach proved effective, with the homes having a permeability of between 2-3$m^3/m^2 \cdot h$ at 50Pa on completion. »

"The southern elevation incorporates a double-height, single-glazed wintergarden to collect solar gains in winter, with air warmed by the sun drawn into the homes through opening doors and windows"

» Although the homes are highly insulated, they are not designed to Passivhaus standard. One reason for this was the experience CHI had when developing the first certified Passivhaus social housing scheme in Ireland. Rankin says it found that monitored energy consumption for the scheme was 'higher than expected because of unrealistic expectations around air permeability due to occupants having the freedom to open windows'. In addition, he says, 'the design team felt that attempting to achieve Passivhaus standard on this project would involve additional cost'.

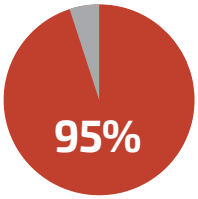
The homes do, however, include a mechanical ventilation with heat recovery (MVHR) system to remove stale air and provide fresh, filtered and warmed air. The system is fitted with a summer bypass to supply cooling in warmer weather.

The original design proposed solar thermal panels to heat a thermal store that, in turn, would supply domestic hot water and heat for an underfloor heating system. The system would also have included an air-to-water heat pump for top-up heat. This proposal was abandoned, however, to be replaced by a condensing combination, natural gas boiler-based solution, which was expected to have lower capital and maintenance costs.

'This switch is one of the main reasons the scheme has performed so well,' says Rankin. 'There were no objections from the design teams; they were happy to consider an alternative approach and review its benefits in light of various changes to market conditions and financial incentives for renewables.' Using gas-fired combi boilers also supported the idea that the scheme could be easily replicated by others.

The impact of the change was a capital cost saving of more than £50k, reduced CO_2 emissions and energy costs, and a simpler system to design, install and maintain. Without the solar thermal panel, the size of the roof-mounted solar PV array could be increased to 4kWp, significantly raising the amount of renewable electricity generated. This, in turn, increased the value of the Renewable Obligation Certificate (ROC) payments that could be claimed by CHI over the scheme's 20-year life, along with payment for exported electricity. Payback for the PVs is expected to be about six years.

Satisfaction levels



Proportion of respondents who said their electricity costs were lower than in their previous home

Proportion of respondents who said their heating costs were lower than in their previous home

Happy handover

Its experience from earlier projects meant that CHI understood the importance of commissioning systems appropriately, and the critical nature of the handover process – from contractor to housing association and housing association to tenants – so everybody understood how to benefit from the homes.

A pre-handover visit took place with the design team, contractor and housing association, to highlight the technologies within each home and to explain how these should be used. Potential tenants were also invited to information sessions, to give them more detail about the scheme and help them decide whether to accept the offer of a home.

Groups of those who decided to move in were then invited to visit the development for a 30-minute presentation in one of the properties, before the keys were handed over.

After the presentation, each tenant was taken to their home so the heating controls, for example, could be set up appropriately for each household. A home user guide was also produced, containing information on the development, plus explanations of the different »

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All of Killynure Green's 39 homes have an EPC A rating

» features, including the wintergarden, MVHR and PV systems. The main contractor and subcontractors were available to help support the handover process.

CHI's involvement in the detailed monitoring of its passive house development highlighted the cost implications and technical challenges of this approach. For Killynure Green, it opted simply to collect twice-yearly meter readings for the solar PV systems, and annual electricity and natural gas consumption readings. During these visits, tenants are able to raise questions or ask for further support.

Consumption and cost

All the Killynure Green homes achieved an Energy Performance Certificate (EPC) A rating. This indicates that average energy consumption is expected to be 35kWh/m², with average CO_2 emissions of 6kg/m². The average annual energy running cost for each home is predicted to be £409. The EPCs exclude unregulated energy, such as that used for cooking and by appliances and electronic equipment.

After one year of occupation, in October 2016, meter readings were taken for every home. They showed the overall energy used within the properties was less than the national average for Northern Ireland. For the two- and three-bedroom properties, the average annual total energy costs were £564, compared with the Northern Ireland average for similar-sized properties of around £877 (based on National Energy Efficiency Data in June 2015). This represents a reduction of around 36% for occupants.

For the four-bedroom properties, the average annual energy costs were £682, compared with an average of £1,169 for a similar-sized property – a difference of 42%. Of these total energy costs, each home is paying about £250 per year for heat and hot water.

The solar PV system was expected to generate around 3,108kWh of electricity each year for each home. However, the first year's analysis showed the PV systems generated an average of 3,318kWh at each property – 7% more than expected – with 28% being used within each home.

The electricity generated by the PV is available free for residents to use, with unused electricity exported to the grid. 'Tenants can use as much of the generated electricity as they want,' says Rankin. At the moment, however, they are only using, on average, 28%. If they were to use 60%, tenants would benefit from an additional saving of £160 on their electricity bills. 'If a number of residents are out working during the day, they may not want to leave equipment running and may not be available to use the solar-generated electricity,' Rankin explains.

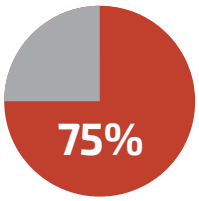
There is a difference between the EPCs' predicted energy costs and actual energy costs of around £200-250 in each home. Two factors account for this: the proportion of renewable electricity from the solar PV used in each home, and unregulated energy use.

CHI is able to claim Renewable Obligation Certificates (ROC) payments for the PVs, along with payments for exported electricity. In the first 12 months of occupation, Choice received approximately £580 per property in relation to the solar PV systems. According to Rankin, this highlights the benefit of this approach to building new homes. 'In a private development, if the ROCs and payments for exporting solar PV were made to the homeowners, the average overall annual cost of energy for these homes would be - £90 for each property, so tenants would actually make £90 a year in relation to energy,' he says.

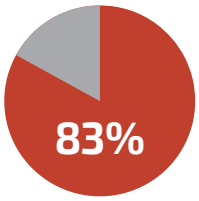
Even without ROC payments, responses to surveys indicate that tenants' satisfaction levels are high, with 95% of respondents stating that their electricity costs are lower than in their previous home, and 100% saying their heating costs are lower. In addition, 75% of respondents reported that their monthly electricity costs are less than £30 per month, while 83% said their monthly natural gas costs were also less than £30 per month.

Design for the second phase of homes is now under way, and these properties will also be on social housing tenures. As the Code for Sustainable Homes no longer exists, CHI's intention is to pilot this second phase to a new, optional, energy efficiency standard outlined by the DfC. These new homes are expected to be some of the first developed in this way in Northern Ireland. CJ

Energy savings



Proportion of respondents who said their monthly electricity costs are less than £30 per month



Proportion of respondents who said their monthly natural gas costs were less than £30 per month

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‘MAT’ FINISH

LEDA had to come up with an innovative solution when it was asked to design the heating, hot-water and ventilation systems for a part-built housing scheme in Sheffield, as **Andy Pearson** discovered

CIBSE Yorkshire Award-winning project Little Kelham is a mixed-use development, built on the site of a former steelworks in Sheffield. The masterplanner was Sturgeon North Architects, with detail designed by Bauman Lyons Architects. The residential element of the scheme comprises 151 – predominantly two-, three- and four-bedroom – apartments and houses.

These are built from structural insulated panels (SIPs) and have been fitted with triple-glazed windows to deliver homes with a SAP A rating and heat losses lower than the minimum required under current Building Regulations – see box, ‘Typical fabric U values for Little Kelham homes’. The SIP system delivered an airtight solution with an air-leakage rate of less than $1.0 m^3 \cdot h^{-1} \cdot m^{-2}$ for all the properties.

Leeds Environmental Design Associates (LEDA) was appointed in 2015 to design the heating, hot-water and ventilation systems for the homes. ‘We’ve done lots of housing work, so we understand how to heat a low energy house,’ says Matthew Hill, director of energy consultancy and building services engineering.

The developer, CITU, wanted the homes to be all electric and the heating system to be hidden from view. It should have been a fairly straightforward assignment for a new development of highly insulated homes; however, some of the properties had already been built, while others were under construction. ‘We became involved after the first terrace of houses had been completed and construction of the second terrace was under way,’ says Hill, who adds that it was already ‘too late to pursue a large-scale community heating solution’. Instead, the consultant opted to heat the homes on an individual basis.

‘Because the floors had already been installed in the houses, we went for the innovative solution of putting electric heating mats, embedded into the internal walls, in some of the rooms,’ says Hill. The mats, he adds, are ‘the sort of thing you’d expect to find under the floor of a bathroom’ – and they work because the dwellings are so well insulated. The total heat demand for a three-bed terrace house is no more than 2kW. The mats are installed in the living and dining rooms, kitchen and bedrooms, each of which has a maximum heat requirement of less than 400W. According to Hill, ‘a few square metres’ of mats is sufficient to meet the heating demand.

Because heating mats are not often fitted to walls, LEDA had to work with the product suppliers and the contractor to ensure they were installed correctly. This involved glueing the mats to the plasterboard inner lining of the SIP panel, using tile adhesive. The mats were then covered with a layer of tile adhesive before a second layer of plasterboard was attached on top of the mat.

‘The key to the installation was to ensure there were no air pockets, to maximise the mat’s radiant heat output,’ explains Hill.

Interestingly, tests showed that convection from heat mats in the walls was greater than from the ones installed in the floor, so a smaller area of heat mat could be used. The location of the mats within a room was important, though.

Roofs are PV-ready

TYPICAL FABRIC U-VALUES FOR LITTLE KELHAM HOMES

External walls: 0.11 $W \cdot m^{-2} \cdot K^{-1}$
Ground floor: 0.10 $W \cdot m^{-2} \cdot K^{-1}$
Roof: 0.11 $W \cdot m^{-2} \cdot K^{-1}$
Windows and doors: 0.8 $W \cdot m^{-2} \cdot K^{-1}$

PROJECT TEAM

Client/developer/main contractor: CITU
MEP and sustainability: LEDA
Architect: Sturgeon North Architects/ Bauman Lyons Architects
SIPS/timber frame: Innovaré Systems
Civil engineer: Cundall

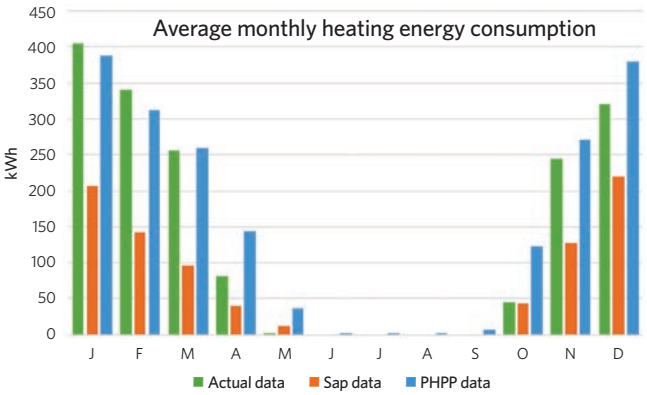
Air-leakage rates for homes are less than 1.0m³·h⁻¹·m⁻²

'With airtight houses you don't have to worry about where you put the heating in a room, because there is very little temperature differential across it,' says Hill. 'However, we had to try to avoid installing mats where they were likely to be covered by a wardrobe or other large piece of furniture.'

Residents are given documentation to tell them where the heating mats are installed, so they can keep the walls clear. This also prevents mats from being damaged by occupants fitting picture hooks, for example.

An advantage of the heating-mat solution is that it allows occupants to control temperatures on a room-by-room basis. The electric heaters also work independently of the property's mechanical ventilation system with heat recovery (MVHR).

The consultants did consider using electric heat pumps to deliver heat to the project. However, energy consumption for hot-water provision in these houses is typically 53% of the total energy consumed for both heating and hot water, so most of the heat pump's output would be needed to meet hot-water demand.



Energy use v Sap and Passive House Planning Package (PHPP) predictions

"The developer is looking at encouraging residents to charge electric cars at peak output"

'Air-source heat pumps are OK for low-temperature heat applications, but their coefficient of performance is not good when heating hot water to more than 55°C,' explains Hill, who adds that the same argument is true for ground-source heat pumps. These also have a high capital cost for housing schemes because there are no piles in which to install the heat-collection coils.

The Little Kelham scheme will have an extensive roof-mounted PV installation, which will generate electricity for the development. The building services consultant has supplied detailed modelling of PV panel locations on site, as well as anticipated usage profiles and PV output, so that CITU can optimise the array sizes.

According to Hill, if PVs are fitted to all suitable roof areas, the potential peak output could be as much as 720kW. 'We worked out that the development would be able to use the vast majority of this,' Hill says. The PV-generated electricity will feed into a substation commissioned by CITU, from where it can be sent to the grid or used to supply the homes through what Hill calls 'a private electricity network'.

Unusually, the developer has set up Little Kelham Utilities to buy electricity and water collectively for the community. It is owned by the Little Kelham Community Interest Company (CIC) and residents become members of the CIC automatically, through home ownership, as do the site's commercial tenants with long-term leases.

The scheme includes a community data infrastructure – which delivers fibre optic directly to the homes – plus a controls network for monitoring. This system makes it easy to meter and manage energy consumption. 'Because the scheme is so well metered, they can have real-time information on the operation of every heater and immersion heater, so will be able to set up the electric immersion heaters to operate at off-peak times to smooth out demand, or when the PV output is high,' says Hill.

The developer has also created a smartphone app to enable occupants to control their home and monitor their energy use. It will be further developed to notify residents to turn on their washing machines, for example, when the PV output is high, and to allow them to turn off lights and appliances remotely when they are out of the house.

In addition, the developer is looking to encourage residents to charge electric cars at peak output. 'Our modelling of the PV showed that demand management is a much better option than trying to put in a lot of battery storage,' Hill says. CJ

SCRATCH THE SERVICE

Robust technical advice given by an M&E engineer can benefit property landlords, investors and occupants – so, asks Tuffin Ferraby Taylor's **Marc Hill**, why do so few consultants offer expert transactional services?

Technical due diligence (TDD) enables those involved with the acquisition, occupancy and disposal of commercial property to understand and manage risk, make informed decisions, and future-proof their investments.

Building services installations are more dynamic – and their associated issues often result in greater disruption and cost – than the building fabric elements, so M&E technical expertise and advice is a fundamental part of the TDD process. The role of the M&E engineer is to assess the services installations, gain an understanding of their design and condition, and give a professional opinion of them. This is done by carrying out a visual inspection, reviewing the level of planned preventative maintenance that has been implemented, identifying defects and outstanding repairs, and assessing future replacement requirements, including technical obsolescence.

The M&E engineer must consider the suitability of the services for their intended use and understand associated risks. As well as identifying potential future costs and other liabilities, they must assess whether these are the responsibility of the landlord, can be apportioned to the tenant, or are service-charge recoverable. Current and potential opportunities for the services installations must be investigated and areas of non-compliance – including statutory, life safety, health and safety, legislative, design and so on – reported.

All of these factors can affect the short-, medium- and long-term performance of an investment or a building's use. Robust technical advice can bring many benefits and offer a level of protection for the occupier, landlord or investor/funder. Strong guidance and advice on matters that affect value provide a basis for price negotiation, allows risk to be allocated, and can satisfy lending requirements.

M&E engineer shortage

Despite the M&E engineer's clear role in TDD, not all building services consultants offer transactional services as an area of expertise. Where it is offered, reporting methodology, commercial awareness, and suitability of the advice given varies widely, for a number of reasons. The TDD team is usually led by a building surveyor, whose methodology and reporting requirements are structured and documented, generally in line with the Royal Institution of Chartered Surveyors' TDD Guidance Note. With the exception of guidance on condition surveys, there are few recognised industry publications on TDD for building services engineers.

There remains a perception that TDD surveys are 'high risk', with a threat of litigation if something is missed, or incorrect/

poor advice is given. TDD instructions do not give the continuous, stable workload that projects or monitoring roles can offer; they are often very reactive, with quick timescales for doing site inspections, and reports being produced and issued to tight deadlines.

Experience and a combination of skills are vital. The M&E engineer must have a broad knowledge of mechanical and electrical building services systems – how they are designed and function, how they fail, and the repair and rectification works required. This must be coupled with an ability to understand design criteria, maintenance and servicing obligations, lease arrangements, allocation of responsibilities and apportionment of costs. Most critically, they must appreciate, identify and assess the commercial factors that will affect their client's investment. This goes beyond having good technical understanding of how systems are designed and operate, to include knowledge of lease structures, ownership and lease-investment strategy.

Good practice

Numerous case studies show the importance of good M&E TDD. The following are based on actual instructions, but the names and selected information have been redacted.

Inadequate energy supply

A property was bought for investment purposes. A single tenant occupied the whole building under a long-term, full repairing and insuring (FRI) lease arrangement that was about to expire, and had confirmed they did not intend to renew the lease. The buyer planned to refurbish the building and install new/enhanced services to provide comfort-cooled office space for multiple tenants.

As part of the TDD survey, we found that: the property did not have an independent gas supply (the existing supply was sub-metered and derived from an adjacent building); the incoming electrical supply capacity was insufficient to install comfort cooling; and the existing single-passenger lift was inadequate for the proposed occupancy. This could have undermined the appraisal on which the investment was based, and it enabled the investor to negotiate a reduction on the price.

Poor water quality

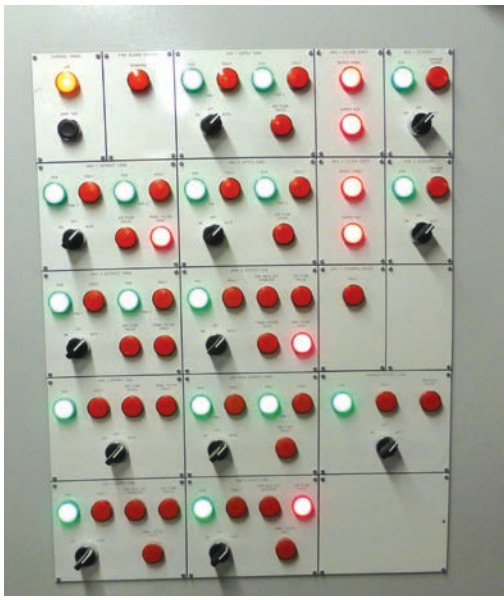
A review of a site logbook helped identify a problem with water quality at a 10-year-old regional headquarters with complex services. Reports in the logbook for closed water systems identified poor water quality for three years up until the TDD survey.

The visual inspection of the distribution pipework systems and associated plant confirmed deterioration had occurred. Signs of corrosion could be seen in pumps, some of which were leaking at the impellor base, while others had historical leaks. There was also premature replacement/refurbishment of various pump motors, corrosion to pipework within a plantroom, and the water that had leaked from pipework, local to a fan coil unit, was in a poor condition.

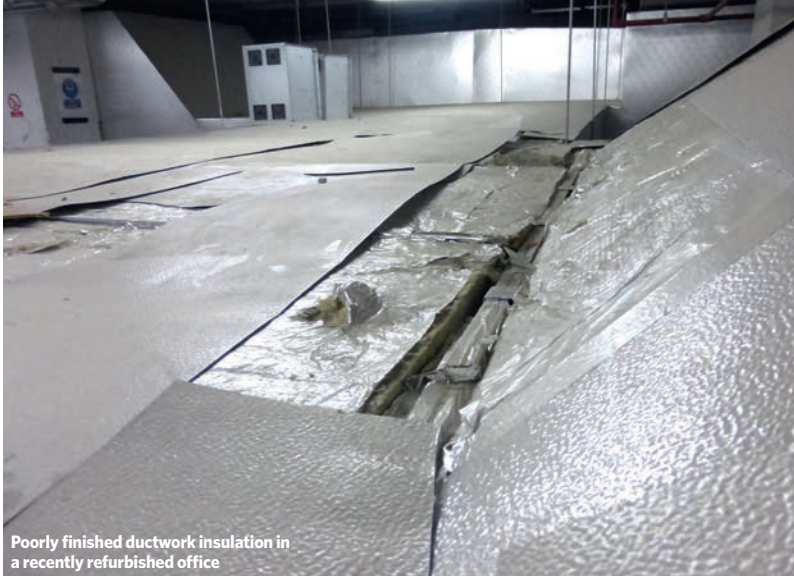
The TDD report stated that immediate work was needed to ensure acceptable water quality. It also said intrusive investigations to determine the exact condition of the retained distribution systems and associated plant were necessary. These inspections would help identify the potential for future failure of critical plant and components.

The TDD highlighted that the tenant was not meeting the repair and maintenance obligations of their FRI lease agreement. Substantial discussions were needed between the new landlord and the tenant, to agree a scope of disruptive and expensive works, to mitigate further »

> "The M&E engineer must appreciate the commercial factors that will affect their client's investment. This goes beyond having good technical understanding of systems, to include knowledge of lease structures, ownership and lease-investment strategy"



From left: Leak next to a fan coil unit, showing poor water quality; insufficient electrical supply for comfort cooling; and fault lamps illuminated on control panel in refurbished building


Poorly finished ductwork insulation in a recently refurbished office

» deterioration and premature failure. Talks with specialist lift advisers ascertained that the lift controls were poorly designed and difficult to maintain. Similar installations had been replaced before their usual life expectancy because of design issues.

Snagging

A mid-1980s office building had wholesale refurbishment works completed to Grade A specification, approximately two years before the TDD inspection. There were a number of outstanding defects and areas of substandard workmanship that had not been addressed as part of the de-snagging process.

A review of site documentation identified several maintenance repairs and installation defects that were not evident from the visual inspection. Operation and maintenance manuals were incomplete and there were no records to confirm various landlords' systems had been commissioned correctly. Where systems had been commissioned, the results were outside acceptable tolerances.

Site records also showed a shortfall in planned preventative maintenance. The TDD inspection found that this – in conjunction with the time taken to rectify outstanding defects – could have a detrimental effect on the condition and future expected service life of the plant and equipment, as well as affect manufacturers' warranties.

Ventilation installed by the tenant penetrates through the roof, in front of the landlord's plantroom

In agreeing various licences for alteration, the vendor had not fully considered good installation practices and access requirements. A tenant's ductwork, for example, prohibited access to a landlord's plantroom housing life-safety system equipment. The TDD report said there were outstanding defects and items of disrepair, installation standards were not as expected, and there was a legacy of poor building management practices. These would have to be rectified immediately, it stated – which meant the purchaser could negotiate a price reduction and an agreed schedule of works that the vendor would do.

The evolution of TDD

Advances in technology are continuous, while bespoke and complex design solutions are commonplace for newly constructed or refurbished properties. The way in which M&E TDD is done must evolve to reflect this. Those carrying out TDDs must be aware of changes in legislation, standards and certification schemes, to ensure buildings are fit for the future. These include Energy Performance Certificates (EPCs), Breeam, minimum energy efficiency standards (MEES), the Well Building Standard, green leasing, and investors' and occupiers' environmental and corporate social responsibilities. If buildings don't meet future environmental requirements, they may become unlettable.

Buildings services installation is rarely free from defects or deficiencies. In today's risk-averse environment, it is no longer sufficient to report purely on condition alone. The examples above show how TDD can highlight significant services issues that can have implications for value, price negotiation, risk allocation and lending requirements. CJ

MARC Hill is technical partner at Tuffin Ferraby Taylor

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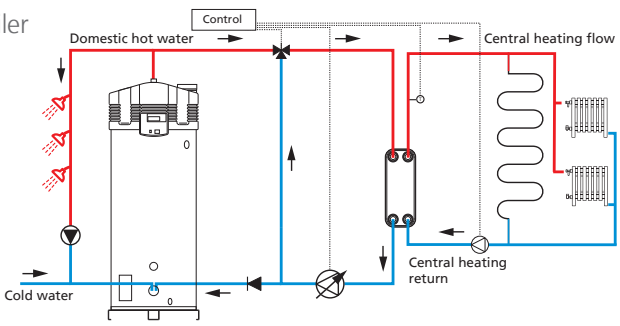

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PLAYING THE LONG GAME

A life-cycle approach is required to improve data centre sustainability, says **Robert Tozer**, **Sophia Flucker** and **Beth Whitehead** of Operational Intelligence

There is a need to consider the environmental impact of data centres more holistically

Data centres are energy intensive buildings and much progress has been made in addressing their energy efficiency. However, energy use is only one part of environmental impact[1]. Life-cycle assessment (LCA) looks at environmental impact throughout the life of a product, service or process, including the production and end-of-life phases (embodied impacts), and may be applied to understand the full environmental impact of data centres.

Life-cycle assessment

LCA is a framework that can be used to analyse environmental impacts from cradle to grave. The environmental impacts from pre- and post-operation (embodied impacts) include those associated with material extraction, manufacturing, transportation, and end-of-life treatment (recycling/landfill/remanufacturing/reuse).

The range of environmental impacts considered is broad – in the hundreds – and includes not only carbon dioxide (CO_2) emissions, but also other emissions to air, water and soil, and their associated impacts on the environment. These are grouped into damage categories: human health (includes climate change), ecosystem quality, and resources.

As well as analysing the specific emissions with different products/processes, it can be useful to summarise the overall impact using a single score, allowing for different impacts to be compared. This can be achieved using the Eco-indicator 99 method, by which impacts are quantified and weighted as eco-points, where 1,000 points (Pt) equate to the environmental impact of an average European person per year.

Previous LCAs of data centres have found that the operational and embodied impacts are of the same order of magnitude. The embodied impacts are not commonly measured, however, so where improvements are made to reduce operational impact – for example, by improving energy efficiency – there is a risk of burden shift (such as an increased embodied impact) and the overall impact may not result in a net benefit.

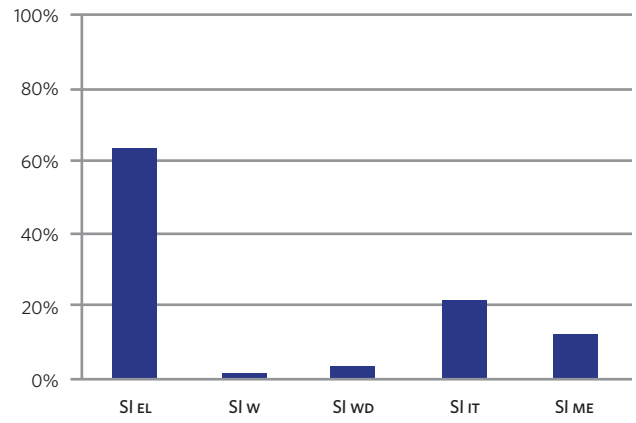

Figure 1: Environmental impacts in data centres by percentage (see key on page 46)

Embodied and operational impacts

Data centre LCA studies have found that operational energy use is significant, as is the embodied impact of ICT and mechanical and electrical (M&E) equipment, and the source energy mix. The embodied impact of the building (fabric and so on) was found to be relatively less significant – two to three orders of magnitude less than the sum of ICT and M&E – so is excluded from the model below. By focusing only on operational energy consumption, there is a risk of »

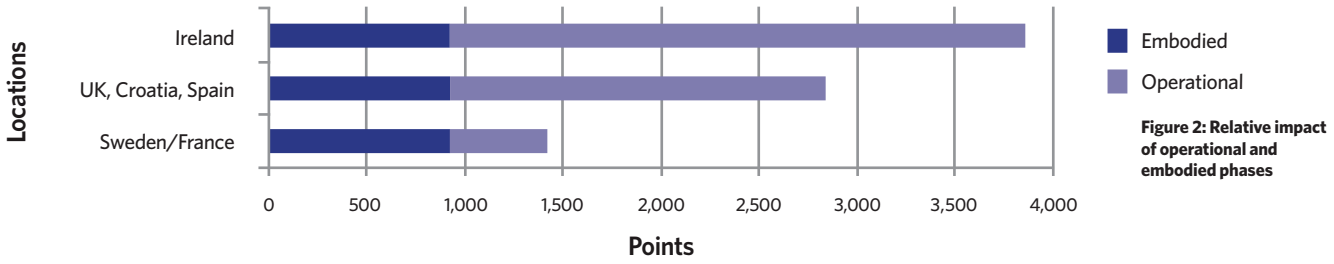

Figure 2: Relative impact of operational and embodied phases

» burden shift going unnoticed. For example, components may be replaced by more energy efficient ones, but the embodied impact will have increased.

Without analysis, it is not possible to assess whether the improvement in energy performance offsets sufficiently the increased embodied impact. A sustainability index (SI) is proposed to better understand these impacts without the need for a full LCA[2].

> "By focusing only on operational energy consumption, there is a risk of burden shift going unnoticed… components may be replaced by more energy efficient ones, but the embodied impact will have increased"

Sustainability index

The annualised data centre sustainability index may be defined as follows:

$$SI = \frac{operational\ impact_{elec\&water} + Embodied\ Impact_{IT\&ME}}{Useful\ work}$$

$$SI = SI_{EL} + SI_{W} + SI_{WD} + SI_{IT} + SI_{ME}$$

SI	(Pt/b)	Sustainability index
SI EL	(Pt/b)	Operational electricity index
SI IT	(Pt/b)	Embodied ICT index
SI ME	(Pt/b)	Embodied M&E index
SI W	(Pt/b)	Operational water index
SI WD	(Pt/b)	Operational water discharged index

Pt = points
b = bits

Note, bits out are used as a simplified proxy for data centre workload. This is a complex area – as shown by The Green Grid's papers on productivity proxies[3].

Figures 1 and 2 illustrate results from application of the metric. For the locations analysed – where there is a relatively high fossil-fuel content in the electricity grid – the operational phase dominates because of the relatively high impact of electricity use. The embodied impact of ICT equipment is the next most significant element. However, in countries with a high renewable grid mix, the embodied impacts are larger than the operational ones.

The SI equation can also be used to analyse the trade-offs between design decisions – for example, between increased electricity with air-cooled chillers compared with more efficient water-cooled chillers, and the environmental impact of their associated water use and discharge.

Water discharge

The index includes the environmental impact of water during the use phase of a data centre. Discharged water has a far higher environmental impact than tap water because it requires processing – including dilution – to be converted from grey water back to clean water. As water stress increases, the impact in this area is likely to grow.

Conclusions

There is a need to consider the environmental impact of data centres more holistically, but the use of detailed LCA is complex and time consuming. Applying this metric can be used to simplify the process and better inform the industry on its impact.

Initial findings from applying SI suggest the following improvements to be significant:

- Increasing use of ICT (consolidation and virtualisation)
- Using a renewable energy source
- Minimising power usage effectiveness (PUE) (optimising cooling systems, scalability at part loads)
- Reducing the embodied impact of ICT equipment (product design, manufacturing and end of life)
- Assessing when an ICT equipment refresh results in a reduced impact
- Considering overall resilience, and removing excessive levels across ICT and M&E systems (for example, virtualisation)

A number of best-practice recommendations can be found in the *EU Code of Conduct for Data Centre Energy Efficiency*[4] and EN50600 Technical Report 99-1. But most of these relate to PUE improvements; analysis suggests that more prominence should be given to those affecting ICT energy consumption. More awareness of improvements relating to embodied impacts and water discharge is also required.

EN50600 Technical Report 99-2 will incorporate further recommendations associated with the embodied – rather than operational – impacts, and encourage practices to reduce environmental impact without the need for users to conduct their own LCA. However, more research is required in this area for continued refinement of the industry's approach. **CJ**

- This article was based on a Technical Symposium paper

- **ROBERT TOZER** and **SOPHIA FLUCKER** are directors at data centre specialist Operational Intelligence; **BETH WHITEHEAD** is an associate sustainability engineer

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EkkoSense launches IoT-enabled thermal sensor

Model shows temperature profiles of last hour, 24 hours or week for immediate thermal assessment

EkkoSense launched a wireless temperature and humidity sensor at Data Centre World 2018 last month.

According to the firm, the new sensor 'disrupts the traditional data centre sensor cost model', enabling it to be deployed in such vast numbers that true real-time thermal management of critical facilities – such as data centres – is now realistic.

The sensor features a local display of the measured temperature and relative humidity values, with additional screens that can show temperature profiles over the past hour, 24 hours and seven days, for quick thermal assessment on site.

'Organisations are spending far more than they need to on expensive cooling hardware – so there's a pressing requirement for thermal performance optimisation. To achieve this, it's essential for data centre managers to have access to much more granular levels of data,' said Paul Milburn, head of product management at EkkoSense.

EkkoSense CEO Dean Boyle added that the firm's technology accurately captures temperatures, energy use, heat outputs and airflows.

JCA showcases Kao Data London One data centre project

One of the UK's most advanced data centres was unveiled at Data Centre World 2018 by engineering services-led principal contractor JCA.

Opened last month, Kao Data London One is the first of four planned data centres that will make up the Kao Data Centre Campus on the 36-acre Kao Park development, in Harlow.

Each building on the £200m campus will be split into four halls, with around 150,000ft^2 of total net technical space. In addition, each technology suite will be able to support a 2,200kW IT load, representing a technical load of 8.8MW per data centre.

Rack densities of 20kW and beyond can be accommodated within the data hall, which is designed around the principle of hot aisle/rack exhaust air stream segregation, with flooded-style supply air distribution.

Breeam Excellent Kao Data London One offers the latest indirect evaporative cooling systems, which need no mechanical cooling.

Beyond the metrics

Clients must be encouraged to consider the whole life-cycle of a data centre if hidden costs of energy-saving measures are to be avoided, argues Keysource's Richard Clifford

Data centres are inherently energy intensive, accounting for as much as half of a company's energy consumption. As financial, regulatory and corporate social responsibility (CSR) pressures have increased, energy efficiency has been pushed to the top of the agenda for data centre design.

However, myriad options in the market – exacerbated by different consultants championing their own approach or solutions – has led to confusion and, in some cases, a lack of understanding for the end user. In the race to specify efficient data-centre estates, options and outcomes are not being fully explored, which can lead to increased costs and compromise CO_2 reductions.

Part of the problem is that the industry's go-to metrics can be misleading or easily manipulated to appear more attractive. Specifiers often focus on metrics because they offer an easy reference point that can be used to evaluate the efficiency of different options. Yet measures that bring the best results on paper may not be the most efficient or cost-effective option – and can, in extreme cases, lead to long-term operational faults.

"The industry's go-to metrics can be easily manipulated to appear more attractive"

Most of these measures also work on an assumption that the facility is operating with a full IT load, which rarely happens. Energy efficiency decreases at lower IT loads and suggested levels can take longer to come into play – if they ever do. Investing in a design solely because it offers a good efficiency metric can leave a business open to higher operational costs than expected down the line.

For example, power usage effectiveness (PUE) – a ratio of how efficiently energy is used by a data centre's computing equipment compared to cooling and other overheads – can be improved by raising rack temperatures. This has very little effect on savings, as any energy saved by turning down cooling systems is shifted to server fans.

Metrics such as PUE don't paint a full picture of efficiency and, as consultants, we should be working with our stakeholders to ensure they understand the true implications of how different solutions and routes will affect their facilities in the long term.

Hidden costs

Many of the energy efficiency measures available are key examples of this and their long-term implications need to be thoroughly understood. Without proper consideration, some can create hidden costs and cancel out any potential saving. In the worst-case scenario, they can have a negative impact on a facility's resilience, increasing the risk of downtime.

Fresh air cooling – often considered one of the most eco-friendly cooling methods – is a textbook example. On paper, it has almost no carbon footprint and can be particularly cost-effective for facilities in colder climates. Such alluring benefits are causing many customers to specify these systems without considering suitability or being aware that operating them can be more complicated than first anticipated.

Fresh air cooling is highly dependent on location; it is easily contaminated by pollution or seawater, which can damage hardware and result in high replacement costs. Preventing this damage means investing in additional cleaning and maintenance, which brings more overheads and, ultimately, a larger CO_2 footprint if replacement parts are needed. Fresh air cooling also needs more complex control systems, such as fire detection and suppression, which all add to the capital and operational costs.

Recent changes to F-Gas legislation are also having an impact on efficiency, having prompted price rises relating to the management of stalwart gases such as R404A and R410A. This could have a large impact on pumped refrigerant direct expansion (DX) systems, and lead to maintenance issues, despite their lower capital costs.

Collaboration is key

It may be an attractive option to choose methods that appear to represent a lower upfront investment, but without full consideration of the operational life-cycle, any financial or carbon savings may be eliminated in the long term.

Many clients are stung because they don't take a wide enough view of their data centre's management, agreeing to efficiency measures without consulting the teams responsible for the day-to-day running of the facility. Early consultancy and collaboration at the design stages is vital to prevent this occurring.

Efficiency will always be a concern for the industry, but it needs to go beyond just meeting metrics. By considering a facility's life-cycle, rather than just initial costs, environments can be created that save money and energy throughout their use. As consultants, we need to be driving this shift in focus, to ensure data centres are built with long-term operation in mind.

RICHARD CLIFFORD
is head of innovation at critical environment specialist Keysource

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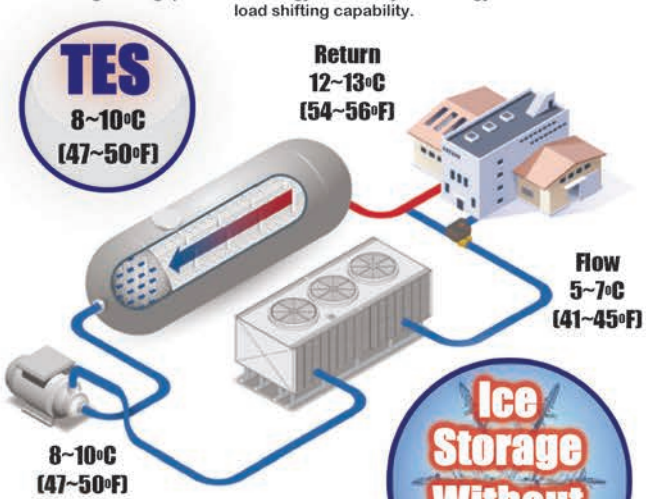

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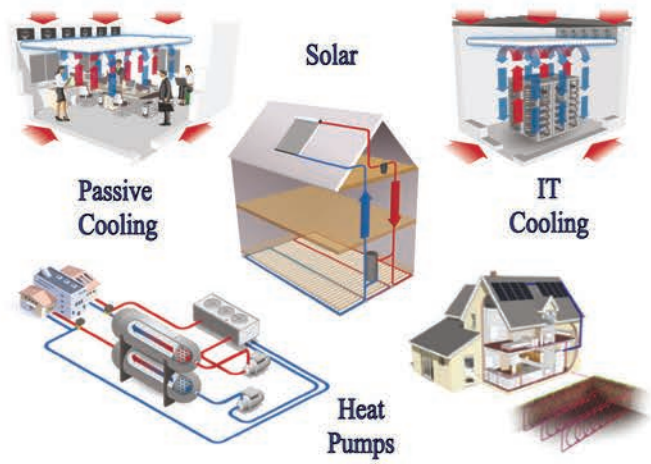

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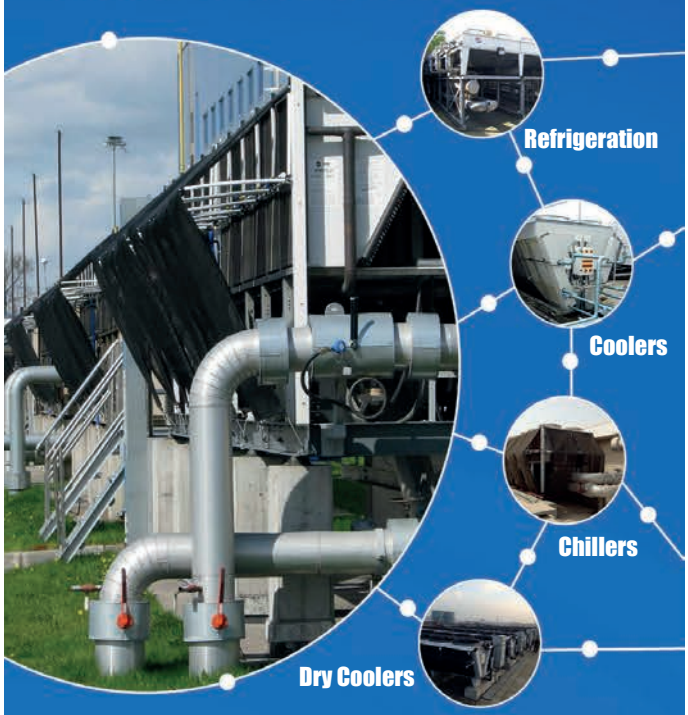

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WINDS OF CHANGE

The 'Beast from the East' and the campaign to reduce air pollution are an unlikely combination when it comes to market drivers, but both could influence the UK's water-heating market, says **David Pepper**

Non-domestic gas consumption is responsible for 33% of NO_x emissions in central London

The UK's carbon emissions are now 38% below where they were in 1990. In 2017, CO_2 emissions from fossil fuels fell by 2.6%, which followed on from 2016's record-breaking 52% drop in the use of coal.

Last year was also the 'greenest' on record for UK electricity generation, with the country experiencing its first 24-hour period without coal-powered generation since the industrial revolution. Overall, renewable energy sources created more power than coal for 90% of last year, and wind farms produced more electricity than coal on more than 75% of days.

The country may appear to be turning a renewable corner, but recent weather events were a timely reminder that we still have a fair distance to travel.

The week-long 'cold snap' that gripped the country just as spring was supposed to be starting pushed our gas supplies close to breaking point. A dramatic dip in the temperature forced the National Grid to raise the alarm about a 'gas deficit' for the first time since 2010.

There was a shortfall of around 50 million cubic metres of gas and the Grid considered limiting 'non-essential industrial use' – showing just how vulnerable we remain to extreme events.

Reliance on imports

Our gas infrastructure is struggling. Declining supplies from North Sea fields and higher reliance on gas for power generation, as coal-fired power stations are decommissioned, are stretching our resources and making us heavily dependent on imports. As the whole of Europe was in the grip of the 'Beast from the East', there was a limit to how much could be piped over to us, and wholesale prices rose significantly midway through the crisis.

38%
Amount by which the UK's carbon emissions have been cut since 1990

2.6%
Reduction in CO_2 emissions from fossil fuels in 2017

52%
2016's record-breaking drop in the use of coal

90%
Proportion of time renewable energy sources generated more power than coal in 2017

75%
Share of the time in 2017 that wind farms made more electricity than coal

While it was a deeply unpleasant experience for large parts of the country, the unseasonal weather was a timely reminder that the UK's heating industry cannot take its eye off the ball when it comes to the energy efficiency of gas-fired technologies. We may be transitioning to a renewable future, but improving the performance of conventional technologies in existing buildings remains essential for the short to medium term.

We need to step up our efforts around integrated and hybrid systems, in which conventional and renewable processes work together. This keeps capital outlay relatively low when compared with renewable-only solutions and means some end clients – who might have considered renewables to be beyond their budget – can afford a renewable element. This helps them satisfy planning requirements and meet their corporate social responsibility (CSR) obligations.

Gas-fired water heaters installed in combination with renewable technologies can help to conserve our increasingly valuable gas supplies, with the renewable source designed to satisfy most of the hot-water demand.

Heat pumps have enjoyed a surge in popularity in homes in recent years, but most – if not all – are installed with back-up from immersion heaters to ensure they are able to deliver hot water in the coldest conditions and when demand is high.

This approach is not always practical in commercial buildings, where hot-water demand is much higher and where the requirement is usually to store water at 65°C. As a result, specifiers often revert to providing heating and hot water by using traditional gas-fired methods. However, by installing heat pumps or solar thermal systems, and using gas-fired systems as back-up, we can reduce our dependency on gas.

Multivalent systems, where energy is gathered from a number of separate sources – including solar thermal, heat pumps and condensing gas-fired boilers and/or water heaters – also have great potential. This focus on performance can help us deal with that other pressing

environmental challenge – air pollution. The High Court has again ruled that the government's plans for cleaning up air pollution in our cities are unlawful. This is the third time the environmental law firm ClientEarth has taken legal action over air quality, and the third time that judges have ruled against the government by deciding that current policy does not go far enough. This is despite a £3bn programme being put in place last year to tackle emissions from vehicles and create 'clean air zones' around the UK.

Emotive

Air pollution remains a highly emotive issue – which is not surprising given that health experts link it to 40,000 premature deaths every year in the UK. Most British towns and cities are in breach of World Health Organization (WHO) air quality guidelines.

Emissions from transport tend to take the brunt of negative publicity, and most of the political heat, but concentrations of NO_x – nitric oxide (NO) and nitrogen dioxide (NO_2) – created by heating products are also in the spotlight. According to the City of London Corporation, non-domestic gas consumption is responsible for 33% of NO_x emissions in central London, so our industry does have a significant role to play in improving urban air quality.

NO_x is a by-product of combustion, created by both transport and heating sources. The WHO says there is no safe limit for this type of airborne particulate – which has been linked to a range of respiratory and cardiac conditions – and, for the first time, the next phase of the EU's Energy Related Products (ErP) Directive imposes NO_x emission limits of 56mg/kWh on water heaters.

At the moment, around 50% of storage water heaters sold in the UK are atmospheric models, which do not meet the new NO_x limit coming into force this September. Unlike the non-domestic boiler market, which is now almost entirely condensing, there is still a high demand for replacement atmospheric water heaters.

Most of these replacements are distress purchases, which means the primary – and sometimes only – concern for many end users is to get the building's hot-water supply up and running again. However, the new ErP regulations may mean some building owners or occupiers have to rethink their approach.

All newly manufactured products will have to meet the updated emissions standard after 27 September 2018. It will still be allowable to sell existing stock – which could create some breathing space – but, after that, some end users may find it more difficult to replace an atmospheric water heater than they may currently imagine. »

New ErP rules will impose NO_x emission limits of 56mg/kWh on water heaters

"Emissions from transport tend to take the brunt of negative publicity, but NO_x created by heating products is also in the spotlight"

The WHO says there is no safe limit for NO_x, a by-product of transport and heating combustion

» For owners of restaurants, hotels, leisure centres, care homes and so on, the prospect of having no hot water available is alarming – which is why the quickest fix is often preferred.

From an efficiency and emissions viewpoint, the best solution is to switch from an atmospheric model to a higher efficiency condensing alternative. However, making that change is not always straightforward. For example, a complete new flue system might be needed, which can be practically and technically challenging, as well as adding substantial cost.

Benefits

Some end users are aware of the many benefits of installing modern, high-efficiency water heaters and are in the process of switching over to condensing systems across their estates.

Many are not, however, and a large number of smaller organisations will not have budgeted for this. Many may be unprepared to deal with the fact that they can no longer simply have a like-for-like replacement. While it is important, therefore, that the industry continues to steer people towards higher efficiency systems wherever possible, we have a responsibility to give clients a choice, so their businesses are not undermined in the short term. We should bear in mind the practicalities of any major technological shift, such as the one prompted by the ErP Directive.

There is a persuasive case for continuing to improve existing atmospheric technology so it can meet increasingly demanding energy efficiency and emissions targets. As well as helping the transition to a renewable future, this will also help to make us more resilient in the face of extreme weather events. CJ

DAVID PEPPER is managing director of boiler, water heater and heat pump company Lochinvar

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Meeting variable, uncertain DHW demands with natural gas- and electrically powered DHW generation

This module explores solutions for natural gas and electricity-powered non-residential DHW applications

There is a need for domestic hot water (DHW) in practically all habitable buildings. Many technologies and energy sources are available to deliver this, and this CPD will focus on those that directly consume natural gas and electricity that – although applicable universally – specifically relate to non-residential applications.

The term 'domestic' hot water can be somewhat confusing, as it includes any 'water that has been heated for cooking, food preparation, personal washing or cleaning purposes, and the term used irrespective of the type of building in which the hot-water system is installed'.[1] DHW would normally be 'wholesome'[A] water, so it is equivalent quality to that used in the drinking water services but at a higher temperature. The amount of hot water required, and the pattern of consumption, will depend on many factors including: the application (for example, residential, commercial or institutional); the users (owners, public, visitors or employees); the outlet types (such as combinations of spray basin taps, bath taps, showers, sluice buckets, washing machinery, and so on); the system characteristics (single or multi-point, extent of dead legs, distribution distance and recirculation method); and the degree of automation and control. The range of parameters and their uncertainty makes the prediction of hot-water usage particularly challenging. The guides and tables that have been produced to assist in design are based on historical measurements of actual hot-water consumption in various applications, so will not necessarily reflect the use of any particular building.

Typically, the design profile for hot-water use is established by using loading units (LU) that provide a statistically based prediction of the required flow of water. But, as discussed in Jess Tindall's paper[2], the LUs between the three principal methods employed in the UK – BS EN 806[3]; CIPHE Plumbing Engineering Services Design Guide (IoP)[4]; and BS 8558[5] – differ in their bases. Unlike BS EN 806, the IoP and BS 8558 LUs are not simply linked to flowrate, but also take account of the length of time that the outlet will be in use and the outlet's patterns of usage. All three methods sum the downstream LUs for each pipe

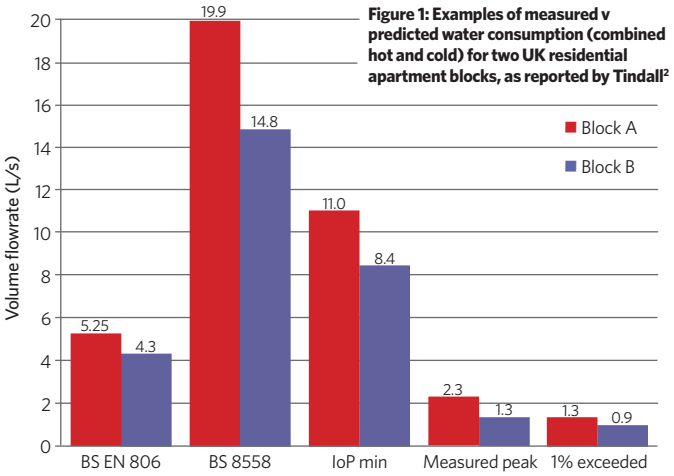

Figure 1: Examples of measured v predicted water consumption (combined hot and cold) for two UK residential apartment blocks, as reported by Tindall[2]

[A] 'WHOLESOME' DISCUSSION... **bit.ly/2G0VN92**

» section, and then employ a conversion chart to determine the design volume flowrate (the charts are based on different levels of diversity). CIBSE Guide G[6] gives a detailed commentary – and employs the IoP LUs – but the potential difference in design sizing is significant, as indicated in the example comparison undertaken by Tindall and reproduced in Figure 1.

This highlights not only the uncertainties in the prediction of required water supply, but also the impact of the diversity factors that are employed by the methods – BS EN 806 applies more significant diversity factors at high values of LU. However, as noted in Guide G, in practice in buildings with large numbers of sanitary fittings, a small increase in demand over the design level is likely to cause a slight reduction in pressure and flow at the fittings in use, which is unlikely to be noticed by the users unless this becomes excessive. Whatever the variability is, the hot water generator and the system must be sufficiently flexible to meet that demand with a safe supply.

Serving the variable DHW needs

The system needs to be able to produce the required volume of (controlled temperature) hot water at the rate required – and at an appropriate pressure – at the point of use. As the UK average electricity cost, for medium size businesses, is currently about five times that of gas[7], and the equivalent CO_2 emissions for grid-supplied electricity are about 1.75 times that of gas[8], the use of gas is the most commonly chosen energy source for hot-water generation systems. (Electricity is also a high-quality form of energy, and in terms of exergy is not most productively used in generating DHW.) Heat pumps, and systems that employ heat rejected from local generation, industrial and commercial processes and environmental systems – when appropriately applied – can often provide a viable and operationally effective electrical alternative to using natural gas.

Where natural gas is not available, or is impractical – and, possibly, where the system is likely to be used for a short period or there is local renewable power generation – direct electricity can offer a flexible cost-effective solution. For example, at its simplest, this could be a point-of-use, non-storage, instantaneous electrical heater serving an individual outlet. However, aside from discrete applications – such as single basins serving, for example, lone WCs in a shop or warehouse that have no other significant hot-water need – the practicality of this system may not be appropriate to being scaled up to multiple installations in a building because of factors such as maintenance, power distribution and loading, aesthetics, and limited hot-water flowrates. The flowrate through a small basin mixer tap is approximately 0.05L·s^{-1} and would require 7.75kWe (32A @ 240V) to supply water directly at 45°C.

To allow water generators (electrically and gas-powered) to benefit from the typically intermittent hot-water demand – as in the example in Figure 2 – it has been the norm to use some form of hot-water storage.

This can either have an integral heater, such as in the multipoint heater of Figure 3, by using a separate hot-water storage vessel or a calorifier that – as well as

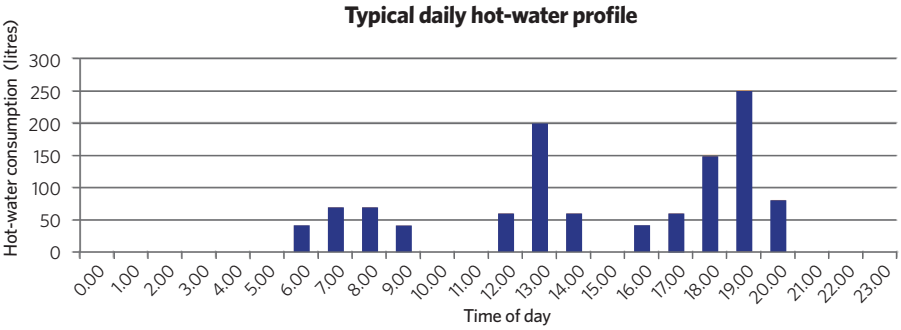

Figure 2: Example hot-water demand that could be experienced

MOVING ENERGY

Natural gas pipework is able to distribute large amounts of energy using a relatively small space. For example, a 25m length of 2in nominal diameter (60mm outside diameter) steel gas pipe – weighing 5.5kg per metre – could supply approximately 310kW.

To meet the same load, single-phase electricity would theoretically need two conductors, each in 120mm diameter cables (and each weighing about 20kg per metre), plus earthing.

POWERING WATER HEATING

Energy to heat one litre of water – To heat 1L (1kg) water from 8°C to 60°C the energy required = 1kg x 4.2kJ·kg^{-1}·K^{-1} x (60-8) = 218kJ (0.061kWh).

Power required for a flow – To continuously heat a flow of 1L in one second requires a power of 218kJ·s^{-1} (218kW) to 60°C and 155kJ·s^{-1} (155kW) up to 45°C (direct outlet temperature or mixed, for handwashing). And to heat 1L in n seconds from 8°C to 60°C would require (218kJ ÷ n)kW.

End energy use example – A 100L (100kg) bath would be around 40°C (by mixing 60°C and 8°C water) and so would require 100kg x 4.2kJ·kg^{-1}·K^{-1} x (40-8) = 13,440kJ (3.73kWh) at point of use (that is, no distribution losses included).

Figure 3: Example of multipoint electric water heater with integral storage that could be installed under a worktop or in a cupboard and could, for example, serve one or two washrooms. Efficiency is very high and practically only affected by standing losses of less than 1kWh per day

Figure 4: An indirect storage calorifier that includes coils to heat the stored water using primary, higher temperature, hot water from a heat source (Source: Andrews Water Heaters)

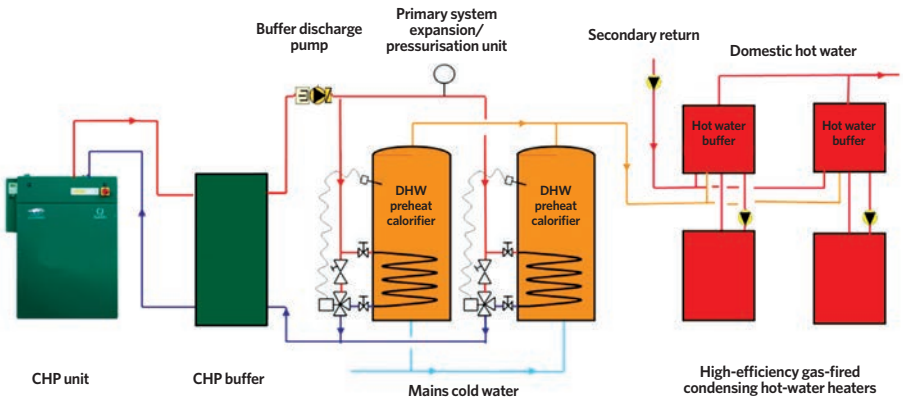

Figure 5: Employing storage to maximise the operating time of a CHP plant through preheating the DHW that is subsequently heated by high-efficiency direct gas-fired condensing water heaters (Source: Andrews Water Heaters)

storing hot water – uses a coil carrying hot fluid or an electric element to heat the water (as in Figure 4, but shown without the essential insulation). This allows the stored water to be heated with an indirect power source (typically a boiler) that, when intermittently used, can deliver an adequate volume flow to meet the full demand. However, the DHW would need to be stored at a temperature of at least 60°C, requiring primary water at (typically) 80°C flow and 60°C return – this would not allow a boiler to operate in condensing mode.

Whenever water is stored, due consideration must be given to preventing risks from Legionella (see CIBSE TM13: 2013 *Minimising the risk of Legionnaires' disease*). The recovery time – the time to heat the water up from the inlet temperature – will normally be indicated by manufacturer (accounting for losses), but can also be readily estimated using the calculations illustrated in the 'Powering water heating' panel.

A storage vessel plays a key part in an integrated hot-water system where the water may be heated from multiple sources, including combined heat and power (CHP); a heat pump; or heat recovered from environmental systems – such as variable refrigerant flow (VRF) – and renewable or industrial processes.

Such a vessel can also be used to pre-heat water (below DHW temperatures), so maximising the opportunity of recovering heat from lower temperature sources, and it is subsequently heated to the required supply temperature in a hot-water generator. This not only helps to reduce the total primary power requirement to produce hot water, but can also allow other systems to work more effectively. For example, the CHP in Figure 5 will be able to operate for longer hours (to

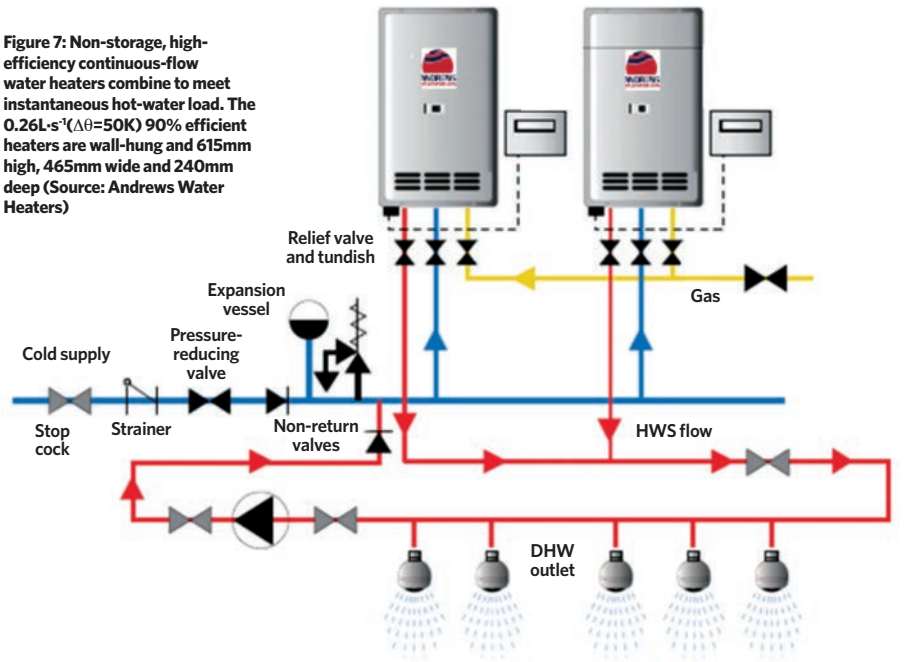

Figure 7: Non-storage, high-efficiency continuous-flow water heaters combine to meet instantaneous hot-water load. The 0.26L·s^{-1}(Δθ=50K) 90% efficient heaters are wall-hung and 615mm high, 465mm wide and 240mm deep (Source: Andrews Water Heaters)

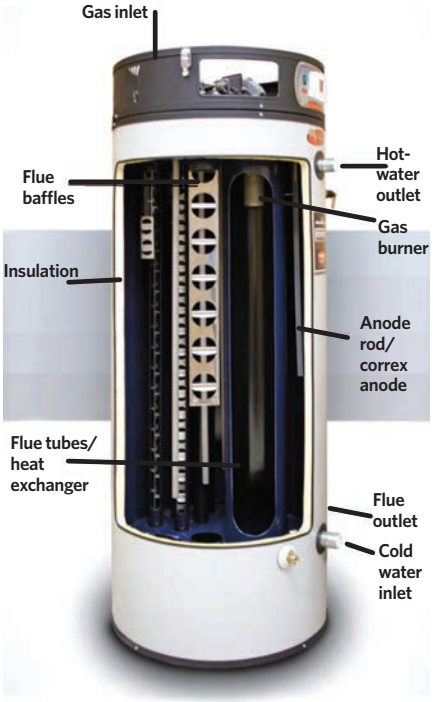

Figure 6: A direct gas-fired storage hot-water heater (Source: Andrews Water Heaters)

generate electricity), so improving its cost and environmental effectiveness, as well as reducing the load on the hot-water generators. The smaller buffer vessel is provided as part of the CHP unit to reduce cycling and provide primary control feedback to ensure safe and efficient operation. The thermal storage is provided by two preheat calorifiers that then supply the water to the condensing high-efficiency water heaters.

A direct gas-fired storage hot-water heater – as in Figure 6 – provides hot water at high generating efficiencies, and the relatively low storage capacities enable very short recovery times. However, as it is a storage vessel, it can be selected to meet intermittent peak DHW demands while having a modest input power. There are similar electrically heated cylinders available, but they, typically, will have lower power inputs and so longer recovery times.

Gas-distribution systems – and so gas-fired systems – are able to deliver large amounts of energy in small spaces (see 'Moving energy' panel). The non-storage, high-efficiency continuous-flow water heaters in Figure 7 heat incoming mains water directly by using multiple parallel connected units. These can supply hot water continuously at their maximum design flowrate – as well as modulate to part-load – to provide a compact hot-water generator with no requirement for storage, with its associated losses and maintenance requirements.

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Turn to page 58 for references.

SPONSOR

ANDREWS WATER HEATERS

Module 124

April 2018

1. **In the work undertaken by Tindall, which of the following indicated the highest volume flowrate for building Block B?**

☐ A 1% exceeded

☐ B BS 8558

☐ C BS EN 806

☐ D IoP min

☐ E Measured peak

2. **How much power would be required to heat 10 litres of water from 8°C to 60°C every 10 seconds (with a 100% efficient heater)?**

☐ A 0.22kW

☐ B 2.18kW

☐ C 21.8kW

☐ D 218kW

☐ E 2180kW

3. **Which CIBSE TM provides guidance on minimising the risk of Legionnaires' disease?**

☐ A TM13

☐ B TM14

☐ C TM21

☐ D TM22

☐ E TM23

4. **Which of the following is not noted as an attribute of the direct gas-fired storage hot-water heater (as illustrated in Figure 6)?**

☐ A Always includes large volumes of stored hot water

☐ B Can be selected to meet intermittent peak DHW demands

☐ C Operates with high generating efficiencies

☐ D Requires modest input power

☐ E Very short recovery times

5. **What is the height of each of the non-storage, high-efficiency continuous-flow water heaters shown in Figure 7?**

☐ A 415mm

☐ B 515mm

☐ C 615mm

☐ D 715mm

☐ E 815mm

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References:

1 England Building Regulation Approved Document Part G *Sanitation, hot-water safety and water efficiency*, 2015, amended 2016.

2 Tindall, J et al, A comparison of UK domestic water services sizing methods with each other and with empirical data, *Building Services Engineering Research & Technology* 2017, Vol 38(6) 635–649.

3 BS EN 806 *Specifications for installations inside buildings conveying water for human consumption*, BSI 2006.

4 *Plumbing engineering services design guide*, CIPHE 2002.

5 BS 8558:2015 *Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages – Complementary guidance to BS EN 806*, BSI 2015.

6 CIBSE Guide G *Public health and plumbing engineering* Chapter 2, CIBSE 2014.

7 *Prices of fuels purchased by non-domestic consumers in the UK*, UK Government BEIS, December 2017.

8 *UK Government GHG Conversion Factors for Company Reporting*, UK Government BEIS, 2017.

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PRODUCTS & SERVICES

Energy efficient dry cooling with Jaeggi

Efficient re-cooling is an economic success factor in the industry, particularly in air-conditioning applications and data centres. In addition to the overall size, low investment, low operating costs and low noise emissions are all important criteria for choosing equipment. The hybrid blue ADC is an advanced dry cooler variant, where its simplicity is particularly convincing. When the outdoor temperature is high, the ambient air can also be pre-cooled to ensure low coolant outlet temperatures. Adiabatic pre-cooling is achieved via humidification pads in an angular arrangement in front of the dry cooler. The pads are used to pre-cool the ambient air at the air inlet area. Innovative, technological details show Jaeggi is consistently developing its intelligent technologies. As an expert in hybrid dry coolers with a high level of system competence, Jaeggi delivers premium quality and outstanding service.

Call 01788 869000 or visit www.jaeggi-hybrid.eu

Sprayed concrete by Saint-Gobain Weber delivers essential repair to retaining wall

High performance webercem spray DSF by Saint-Gobain Weber has been specified by BAM Ritchies for the repair of a concrete retaining wall on the approach to Blair's Bridge.

The spray was applied to the structure, incorporating A252 steel reinforcing mesh, to the full 69mm thickness and hand trowelled for a flat profile. A final flash coat was applied to give a uniform texture to the wall. Around 40 tonnes of the economical spray was used. This is a polymer-modified, cement-based concrete mix that contains inert limestone.

Call 08703 330 070, visit www.netweber.co.uk or follow @SGWeberUK on Twitter

Belfast film industry is at the cutting edge

Northern Ireland has established itself as a major location for the film industry, with such colossus as HBO's *Games of Thrones* being filmed there. To keep up with the increasing demand, a major investment was recently made in a state-of-the-art 120,000 ft^2 studio space that has been built on a former landfill site in Belfast.

Taking up eight acres, the North Foreshore Studios today offers a range of both indoor and outdoor facilities, which will make this a very attractive proposition that is bound to build on the country's film success and give it even more of a global focus.

Working behind the scenes to maintain the ambient temperature are well-known players from the Grundfos pump family. These include members of the energy efficient Magna3 circulator range as well as a booster set that is a great performer and will ensure there is sufficient water where it is needed, when it is needed.

Call 01525 850000 or email grundfos-uk@sales.grundfos.com

ESAB welding consumables selected for new Forth Road Bridge, the Queensferry crossing

ESAB has supplied flux-cored wires and welding electrodes to the Forth Crossing Bridge Constructors consortium that designed and built the new Queensferry Crossing for Transport Scotland.

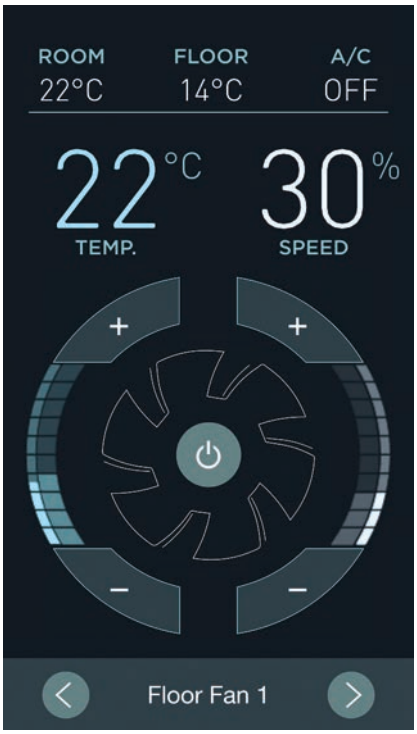
For most welded joints on the bridge decking, across the Firth of Forth, a single flux-cored wire was specified, namely ESAB OK Tubrod 15.14. This is a versatile wire that is highly suitable for all-positional welding on the S355 grade structural steel used in this exposed application.

Call 0800 389 3152 or visit www.esab.com

Mikrofill at Goodyers End Primary School

The existing boilers and associated ancillaries at Goodyers End Primary School were removed and replaced with new Mikrofill equipment by Warwickshire term contractor Dodd Group. These included three Ethos 90kW stainless steel condensing boilers, each with an integral shunt pump providing a total modulation of 30>1 (270>9kW). The new LPHW installation was complemented with a Mikrofill 400 pre-commissioned pressurisation package. A new Extreme 500-litre loading cylinder was also installed.

Call 03452 606020 or visit http://mikrofill.com/



New mobile app for user control of underfloor air conditioning systems

AET Flexible Space, provider of underfloor air conditioning (UFAC) systems, can now offer even more personal user control with the newly launched FlexApp.

The app will offer workers remote adjustment of temperature and fan speed settings on Fantiles via their Android or iOS device, eliminating the need to physically adjust the settings on the controller via the hatch.

The app displays current room temperature and under floor temperature, and users can power individual Fantiles on or off.

Call 01342 310 400 or email aet@flexiblespace.com

Historic housing uses modern technology

Oventrop UK was employed by H&V Service Plan to deliver solar thermal hot water systems to seven apartments on Southern Housing Group's Lisgar Terrace, as part of a £50m redevelopment of the area. The remit of OVUK was the full design supply and installation of suitable systems. The seven systems used two OKF CS22 solar thermal collectors mounted on 'A-frame' mounting systems, using a ballast system. The systems were all connected using pre-insulated, stainless steel pipe installed in single lengths.

Call 01256 330441, email info@oventrop.co.uk or visit www.oventrop.co.uk

SPC announces exciting plans for the future under new ownership

British HVAC manufacturer SPC has announced new ownership as of February 2018. The company's product portfolio includes heating and cooling coils, fan convectors, trench heaters, radiant panels, air curtains and heat pipes.

SPC's new managing director Steve Gage has been SPC's sales director for the last three years, building a solid sales force.

Jeremy Davies has become sales director, having spent three years as SPC's southern regional manager, and Jeremy Allen has become chair, having previously worked as an equity analyst.

Call 0116 249 0044 or visit www.spc-hvac.co.uk

Cambridge delves deeper with new research centre

Kingspan Kooltherm's FM Pipe Insulation has been installed on a University of Cambridge building.

The £26m Maxwell Centre, a centrepiece for the university industrial partnership with the physical sciences and engineering, opened in 2016. It achieved credits towards a BREEAM Excellent rating thanks in part to the pipe insulation specified for the project.

The building has had 10,000m^2 of Kingspan Kooltherm FM pipe insulation installed – offering superior thermal performance, and comprises a fibre-free phenolic insulation core.

Call 01544 387 384, email info@kingspaninsulation.co.uk or visit www.kingspaninsulation.co.uk

Swep wins contract for 51MW heat transfer unit at DTU, Copenhagen

Swep has been awarded its largest contract for a single heat transfer unit. Vestforbraending I/S, Denmark's largest waste management company, handles around 1 million tonnes of waste each year and focuses on producing energy from waste incineration.

The new project will involve distributing 51 MW from Lundtofte Vekslerstation, the Danish Technology University (DTU), to serve the district heating network that supplies residential and commercial properties in the surrounding western area of Copenhagen.

Swep will deliver eight fully loaded B649 units with the maximum number of plates. The total value of the contract is €119,000. Following on from detailed logistics, project planning, delivery and installation will take place in several phases over the next three months.

Of the energy produced from waste incineration at Vestforbrænding, 80% is turned into district heating and 20% becomes power. District heating generated through incineration of waste causes much lower CO_2 emissions than most other heating forms.

Christer Frennfelt responsible for project business, said: 'Our success in winning this major order is due to our ability to meet the required heat load with minimum weights and footprints.

'We are delighted to be working with Vestforbraending and hope it will be a successful and long-term relationship.'

Visit https://www.swep.net/

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Nortek's ErP-compliant range includes the highly efficient Nor-Ray-Vac – a gas-fired continuous radiant tube heating system designed specifically for the building it is required to heat.

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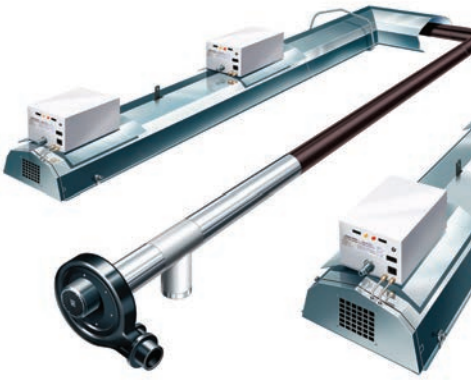

Weber spray concrete defends Nothe Fort at Weymouth Harbour

High performance spray repair concrete by Saint-Gobain Weber has been used to fortify a sea wall that acts as coastal defence to Nothe Fort at Weymouth Harbour. Webercem spray DS and RS were used.

Webercem spray RS ready-to-use, dry-sprayed concrete is able to achieve rapid repairs to structures within tidal zones, dock walls, jetties and sea walls.

It achieves a permanent repair where time constraints demand the earliest possible strength gain. It can be applied up to 100mm thickness.

Call 08703 330 070 or visit www.netweber.co.uk @SGWeberUK

Contour from Luceco lights the way in Valencia

Contour from Luceco has been installed at the Valencia-Cabañal railway station in Valencia, Spain.

It is the ideal linear fluorescent luminaire replacement where continuous runs of illumination are required in many commercial and service environments.

The LED lighting system consists of connectable modules offered in 600mm, 1,200mm, 1,500mm and 1,800mm lengths that can be surface mounted, suspended or recessed. Seamless lines of cost effective LED lighting can be created with interconnecting power and module connectors including corners, T-junction and cross pieces. Other options include direct and indirect lighting distribution as well as DALI and emergency self-test variants.

Current railway facilities owner Adif is now benefiting from more than 50,000 hours operational life offered by Contour, as well as no maintenance over the lifetime of the luminaire. This is an important factor when considering applications such as railway stations where 24-hours operation may be required.

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

Big Foot offers big support for prestigious infrastructure project

Big Foot Systems has supplied HD cubes, HD beams, bespoke frames and custom HD frames to support large amounts of ventilation equipment being used during the construction of a prestigious infrastructure project. Big Foot's products support ventilation equipment and ductwork which was needed during the construction of a new railway line.

The chosen solution was to fit air handling units (AHUs) at either side of the central section, requiring custom heavy duty frames supported by two 100m³/s AHUs.

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Visit www.rinnaiuk.com

Dunham-Bush trench heating meets English heritage criteria at ancient tower

Built in 1494 during the reign of Henry VII, the historic Square Tower in Portsmouth has undergone many changes of use during its 524-year life. Following a major refurbishment, including a new heating system, the tower, which is owned by Portsmouth City Council, has become a popular venue for weddings, family celebrations and corporate gatherings.

During the refurbishment Dunham-Bush worked closely with the council, who undertook the design of the heating system. All work had to comply with English Heritage requirements and consideration had to be given to protecting the tower's structure without damage or alteration to its appearance.

An appropriate aesthetic integration of the heat emitters was also an important criterion for product selection.

Dunham-Bush Hydrocourse trench heating offered the ideal solution. The system designer, Lu Zhou, Portsmouth City Council, selected 63 metres of bespoke HTA-2s trench heating, with heavy duty I-bar grilles for extended life.

Call 023 9247 7700, email info@dunham-bush.co.uk or visit www.dunham-bush.co.uk

Adveco's Totem achieving energy savings and carbon reductions

The Adveco Totem is the first in the latest generation of micro-CHP, featuring cogeneration efficiencies of up to 107.4% and the lowest NO_x and CO emissions for any CHP within its class at <12 mg/kWh. A recently commissioned Adveco T50 system at a large boarding school is achieving run hours averaging more than 20 hours per day. This correlates to a design of more than 7,400 hours per year, and anticipated annual savings in excess of £21,500. A school sports complex fitted with an Adveco T20 in 2016 has since achieved peak run hours of 23 hours a day in a demand pattern that is expected to continue year round.

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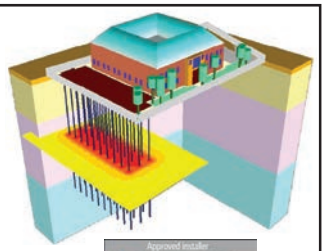

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The Building Services Research and Information Association (BSRIA) is a knowledge based consultancy, research, test and instrumentation organisation. It provides specialist services in construction and building services with the mission is to 'make buildings better'.

To achieve this it enables the building services and construction industries and their clients to enhance the value of the built environment. It does this by improving the quality of their products and services, the efficiency of their provision and the effectiveness of their operations.

As part of BSRIA's succession plan, they are appointing a Technical Director. It is intendedthat the remit of this role will broaden in due course to include other aspects of the engineering responsibilities. The Technical Director will attend the BSRIA board. The Technical Director will:

- Lead and direct the technical direction and focus of BSRIA both as the role stands at the moment and the shaping of it for the future
- Provide top level technical, engineering and professional decision making that affects all aspects of Company operation and performance
- Have strategic budget responsibility for one or more business units and support teams
- Manage BSRIA technical input to regulatory, legislative and parliamentary activity, including energy policies, Building Regulations and other related initiatives
- Promote BSRIA's technical capability and reputation at all opportunities externally.

To be considered, candidates must have an Engineering or relevant degree and evidence of continuing professional education or equivalent. You are likely to be a Chartered Engineer and a background of experience in construction or building operations or services is also likely. Appropriate and broad technical and or engineering experience is a prerequisite as is experience of senior and/or Board level participation. We are looking for an innovative and strategic thinker who has good analytical, investigative and decision making capabilities. In addition, you should be a good networker with excellent oral and written communication and presentation skills. This is an exceptional opportunity to contribute your technical expertise in a role that can influence the industry for the future.

The position is being handled by Signium UK. To apply, please email David Sneesby at Signium UK, providing your CV and covering letter to ADCV@signium.co.uk and quoting reference 1592 – Technical Director in the subject line.

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Queen Mary University of London is one of the UK's leading research-focused higher education institutions. With around 25,000 students, 4,000 staff and an annual turnover of £430m, we are one of the biggest University of London colleges. We teach and research across a wide range of subjects in the humanities, social sciences, law, medicine and dentistry, and science and engineering.

Infrastructure and Maintenance sits within the Estates and Facilities Directorate, and is responsible for carrying out both planned and reactive maintenance across all areas of the University using in-house technical staff and external contractors.

The Asset and Contract Manager is a key position in the development of the Queen Mary University of London's Estate. Under the supervision of the Assistant Director of Estates, Infrastructure and Maintenance, the Asset and Contract Manager will develop and implement a maintenance strategy that ensures compliance with all the latest employment, environmental and health and safety legislation and standards, delivers a first class service to our students, staff and visitors and is financially and environmentally sustainable.

The successful candidate should be educated to HNC or degree level in Building, Building Services Engineering or Facilities Management and hold a membership of appropriate professional body.

The post is full time and permanent. The salary range for this post is £45,577 - £50,881 per annum plus a benefits package which includes 30 days annual leave, a defined benefit pension scheme and also an interest-free season ticket loan after a qualifying period. Candidates must be able to demonstrate their eligibility to work in the UK in accordance with the Immigration, Asylum and Nationality Act 2006. Where required this may include entry clearance or continued leave to remain under the Points Based Immigration Scheme.

To apply for this position or to see full job details including a job description, person specification and application form please visit http://www.jobs.qmul.ac.uk/, and search for reference QMUL12990.

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Intermediate Mechanical Design Engineer
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An opportunity for an ambitious engineer to specialise in healthcare, pharmaceutical, and data centre projects has arisen with a leading D&B contractor. With great prospects to progress to a Senior Design Engineer/Project Manager and support to become Chartered, this would suit someone looking to step up in their career. No previous pharmaceutical/data centre experience is necessary. You must be proficient working in BIM, using Cymap, and other relevant design software. Ref: 4862

Mechanical Project Leader
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A successful, forward thinking M&E Design consultancy that specialise in very high profile projects are seeking an experienced discipline lead to work on major projects. This is a challenging but highly rewarding role for an ambitious and self-motivated technical manager with a strong career history within a firm that has a great culture and values decent engineers and efficacious good quality delivery. Ref: 4812

Electrical Resident Engineer
London, £42p/h

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Ref: 4858

Senior Mechanical Design Engineer
Surrey, £36 - £38 p/h

With continuous success on winning projects the need for a Senior Mechanical Engineer has arisen. You will be part of project team predominantly working on residential, commercial, and educational projects. There is the opportunity to be rewarded with working on a longer term contract as well as leading projects – based on your willingness. Ref: 4805

Senior-Associate Mechanical
London, £50k - £70k + bens

A highly acclaimed multidisciplinary consultancy is expanding their London office due to substantial workload. This is a hugely rewarding role for an ambitious engineer looking to progress to director level whilst delivering large scale complex projects in the UK and the Middle East, including the next Megacity. You must be degree qualified with experience leading projects and managing key clients. Ref: 4865

Senior Mechanical Design Manager
London, £85k - £90k + bens

Exceptional opportunity to work client side for a data centre provider. You will possess excellent understanding of mechanical services and standard practices in the design and delivery of mission critical projects, including ASHRAE guidelines and Uptime Institute TIER ratings, be responsible for concept and detailed design, project budget, project quality management, apply company guidelines and standards across the portfolio of projects, production of project reports. Ref: 4854

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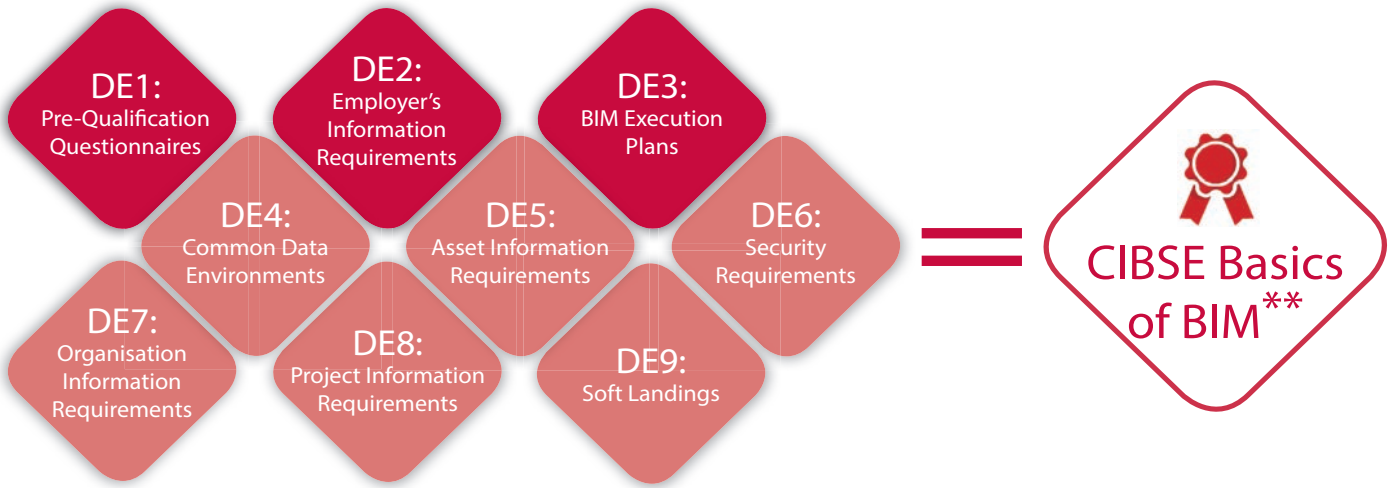

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EVENTS

HIGHLIGHTS

Helen Loomes will speak at SLL's LightBytes on 26 April and 10 May

Julie Futcher will give her city tour on 21 April, in London

NATIONAL EVENTS AND CONFERENCES

CIBSE Technical Symposium 2018 – 'Stretching the envelope'
12-13 April, London South Bank University
The 2018 symposium will enable the sharing and dissemination of knowledge and skills that 'stretch the envelope' by applying forward-looking techniques, applications and technologies to create and maintain healthy and productive environments.
www.cibse.org/technical-symposium

Society of Light and Lighting: LightBytes
26 April, Newcastle
10 May, Glasgow
Continuing the 2017-18 SLL Lighting Knowledge Series 'LightBytes'. The day includes peer-reviewed, bitesize presentations focusing on four key areas: design, build, specify and future. Speakers include Lee Thomas and Nick Van Tromp, from Fagerhult, Steve Shackleton, from Zumtobel Group, Helen Loomes, from Trilux, and Roger Sexton, from Xicato. The series will continue through to June 2018.
www.cibse.org/sll

CIBSE TRAINING

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

Introduction to combined heat and power (CHP)
16 April, London

ISO 50001:2011 Energy Management System
17-19 April, London

Electrical services explained
17-19 April, London

Practical controls for HVAC systems
19 April, London

Energy Savings Opportunity Scheme (ESOS)
20 April, London

Low Carbon Consultant design training
24-25 April

Overview of IET wiring regulations
24 April, London

Mechanical services explained
24-26 April, Birmingham

Heat networks code of practice
26-27 April, London

Earthing and bonding systems
26 April, London

Fire smoke control: Matching the method to the building
27 April, London

Heat networks code of practice
1-2 May, Birmingham

Low carbon consultant building operations and DEC
1-3 May, Sheffield

Fundamentals in digital engineering
3 May, London

Fire risk management system: PAS 7 2013
4 May, London

CIBSE GROUPS, SOCIETIES AND REGIONS

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

South Wales: The growing need for standby generators
9 April, Cardiff
Presentation, to be followed by South Wales region AGM.

North East: Clean growth, carbon emissions and Brexit
10 April, Newcastle
CIBSE technical director Hywel Davies will discuss the twin challenges of Brexit and the Clean Growth Strategy.

West Midlands: Power quality and energy management
11 April, Birmingham
With speaker David Bradley, of Socomec, exploring a series of case studies.

West Midlands: Speed Hillclimb
14 April, Alberbury
Regional social to Speed Hillclimb at Loton Park.

Decarbonising the electricity grid – the impact for district heating
18 April, London
A joint CIBSE CHP-District Heating and Heat Networks group event.

Southern: 2018 AGM
19 April, Chichester
At South Downs Planetarium and Science Centre.

HCNW: CHP, thermal and battery storage, and AGM
19 April, London
With a look at a low carbon energy centre solution for Wirral Metropolitan College, Liverpool.

HCNW: Walking in the big city – 25th anniversary tour
21 April, London
Julie Futcher will share her personal knowledge and views on strategic planning, relationships between buildings and weather, and impacts of green infrastructure.

North West: AGM
23 April, Manchester
The evening AGM will take place at BDP's office, Manchester.

North West: CIBSE Homes for the Future Group – TM60 breakfast briefing event
24 April, Manchester
Joint NW region and Homes for the Future Group event, launching TM60 *Good Practice in the Design of Homes*.

North West: Brexit panel event
23 May, Manchester
Panel discussion at the Co-operative Group.

SLL *Lighting Research & Technology* Symposium

16 May, Darwin Building, UCL

In celebration of the 50th volume of *Lighting Research & Technology (LR&T)*, the Society of Light and Lighting (SLL) will hold a celebratory *LR&T* Symposium on 16 May, the inaugural International Day of Light.

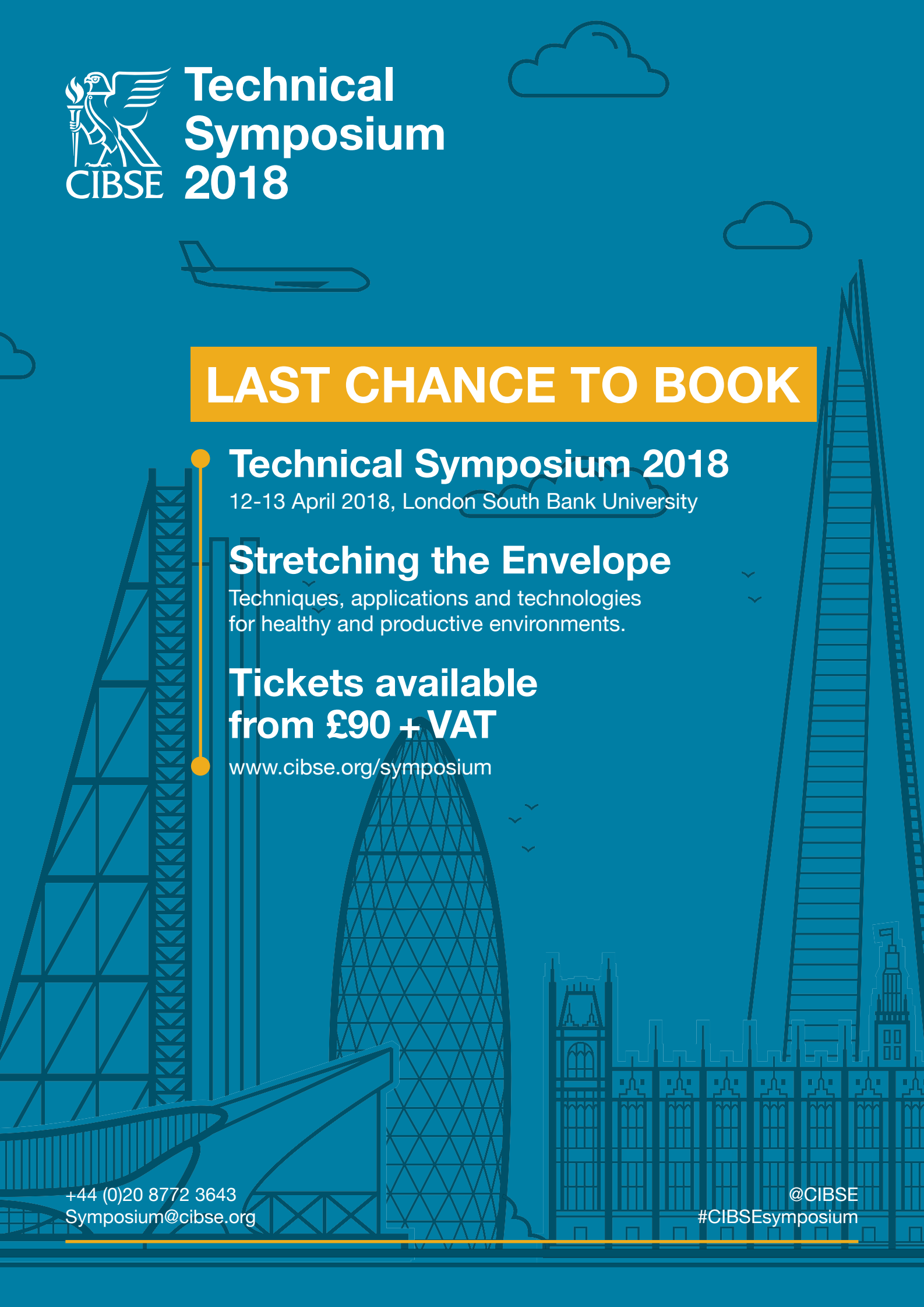
Contributors to the 50th volume will offer unique views on the impact of their specialism on future developments. Among the speakers will be Mike Simpson, of Philips Lighting, and Dr Peter Boyce, Lux Person of the Year 2017. An evening reception will take place after the symposium, at the South Cloisters, University College London.

SLL will acknowledge the publication of the 50th volume of *LR&T* with a series of events throughout 2018. The *LR&T* journal is available to CIBSE members for free at **www.cibse.org** To register for the event, visit **www.cibse.org/sll**

Mike Simpson

Peter Boyce

The Natural History Museum was lit up for SLL's Night of Heritage Light 2017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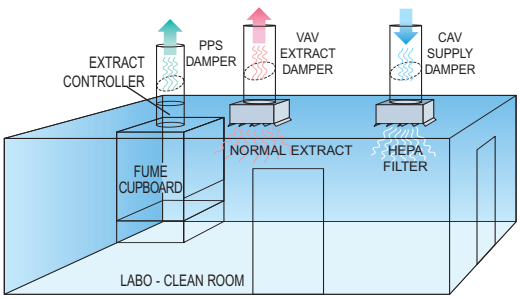

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