

#Build2Perform

January 2023

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OPENING UP ABOUT MENTAL HEALTH IN CONSTRUCTION CUTTING CARBON AT FOSTER + PARTNERS' BATTERSEA HQ NET ZERO AND SAFETY ON THE AGENDA AT BUILDZPERFORM

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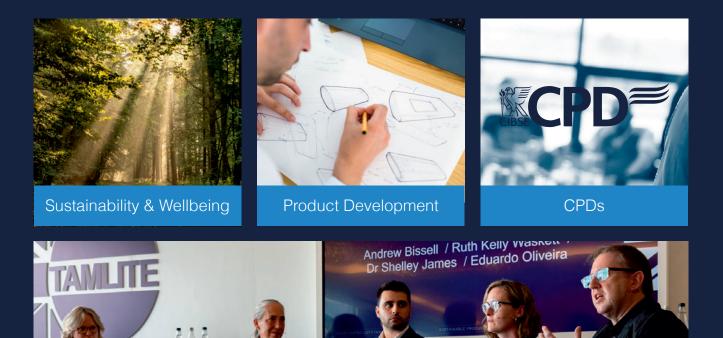
The challenge of connecting to a constrained grid at a large electric housing scheme in West London





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EDITORIAL

Editorial

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January can be a bleak month, and the short winter days are particularly biting this year because of soaring inflation and worries around a looming recession. It's an apt time to launch an initiative that seeks to improve wellbeing and welfare in construction. The Make it Visible project aims to reduce the stigma around mental health and promote the support available. These are points that David Fitzpatrick makes in his open and honest article about his experience of growing anxiety and a stress-related illness (see page 22).

What's striking about David's testimony is that early warning signs are familiar to all of us. Long working days, insomnia, and feelings of inadequacy are par

for the course in many jobs, but they shouldn't be, as they can lead to severe illness. David wishes he had asked for help earlier, and was glad he had the support of friends and family when the pressure became too much. Happily, more firms are now taking steps to ensure the good mental health of employees by training mental health first aiders and encouraging people to voice their concerns and anxieties.

Support networks

The next year will be pivotal for the construction industry. Not only must building services engineers come to terms with the requirements of the Building Safety Act, but they must also ensure their designs minimise operational and embodied energy for buildings, to meet their net zero targets. One of the biggest challenges is the switch to all-electric buildings, which, with the constraints on Grid capacity, means making sure building loads calculated by the engineers translate into reality during operation.

With electrical engineers desperate to reduce loads to minimise the cost of electrical infrastructure, the pressure on engineers to calculate and anticipate loads correctly is growing. Our feature on Convent Way – an all-electric Passivhaus development of nearly 1,000 homes – illustrates some of the challenges of restricting power requirements to meet the limit imposed by the distribution network operator (see page 34). Load management and diversity will play a big role in ensuring targets are met.

Minimising the embodied energy of building services will be a key theme of 2023. On page 30, Stoane Lighting shares its experience of using the TM66 Circular Economy Assessment Method (CEAM) tool. These are measures that can reduce the environmental impact of a component according to product design, materials used, manufacturing and the product's eco-system. With more and more lighting companies assessing their components against the tool, it is hoped the method could be extended to other product sectors such as controls in the new year.

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CONTRIBUTORS



Hywel Davies asks what happened to a government proposal to rate commercial buildings on their actual energy consumption



Alison Crompton addresses the challenges of building low carbon homes following her study on four completed housing projects



Kevin Mitchell

opened Build2Perform Live, which was themed around the challenges of net zero and safety



Tim Dwyer This module explores TM68 and its guidance on measurement, monitoring and data management



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Fire chiefs plea for two staircases in buildings more than 18m

NFCC wants 'unambiguous guidance' for new residential developments

Two staircases must be included in any new residential building that is over 18m high or has seven storeys or more, fire chiefs urge.

In a new policy position statement published in December, the National Fire Chiefs Council (NFCC) says 18m and seven storeys should become the mandatory threshold for more than one staircase in any new development.

This threshold should also be kept under review, it suggests.

The NFCC notes that England is one of the few countries in Europe, Australasia or North America that has no height limit on singlestaircase residential buildings.

Multiple protected staircases make tall

buildings safer by creating more resilience to support evacuation and firefighting operations.

A need for unambiguous guidance, says the NFCC, is 'particularly important' given the clear problem with culture and competency identified across the design and construction industry since the Grenfell Tower fire tragedy.

The NFCC also says it is 'disappointed' that there has been insufficient progress with the full technical review of the Approved Document B guidance five years on from the Grenfell disaster.

Last year, developer Ballymore delayed plans for a new 51-storey residential block after the London Fire Brigade expressed concerns about the building's single fire-escape staircase. Planning permission was eventually approved in March after a second staircase was added to the design.

New regulations define higher-risk buildings in post-Grenfell safety act

The government has unveiled new regulations that will define the types of buildings to be included in its new and more stringent regulatory building safety regime.

The Higher-Risk Buildings (Descriptions and Supplementary Provisions) Regulations, which were laid in parliament just before Christmas, complete the definition of 'higher-risk buildings' – those that will be required to meet the legal requirements of the new regime established under the Building Safety Act 2022.

It means residential buildings, care homes and hospitals that are at least 18m high or have seven storeys, are subject to the new requirements during design and construction.

The new regulatory framework will also apply to residential buildings of the same heights.

'These regulations are the first of a number that we can expect to see made in the first part of 2023 as the Building Safety Act and the new building safety regime is put into operation,' says Hywel Davies, chief technical officer at CIBSE.

'Taken together they will drive the most radical shake up of building regulation since the Second World War, with widespread implications for *CIBSE Journal* readers.'

The regulations will now have to be debated and approved by both Houses of Parliament before they can become law.

The new regime will be enforced by the Building Safety Regulator, which has also been created by the act.

NEWS

IN BRIEF

Building Advisory Committee meets to advise new safety regulator

The committee set up to advise the new Building Safety Regulator held its first meeting just before Christmas.

The Building Advisory Committee (BAC) was established under the 2022 Building Safety Act as part of the government's post-Grenfell fire disaster reforms.

The BAC's remit will be to assist the new regulator to address emerging issues across the built environment, while providing leadership across industry and drive change.

The committee members are: Richard Blyth, Hywel Davies, Andrew Lawrence, Simon Lay, Nick Mellor, Paul Mooney, Andy Mullins, Paul Nash, Suzannah Nichol, Benjamin Ralph, Niall Rowan, Aman Sharma, and Martin Taylor.

Hywel Davies, chief technical officer at CIBSE, said: 'I look forward to serving on the committee to advise and support the new regulator in rebuilding confidence and trust in the sector.

'The establishment of the Building Advisory Committee is the first of many measures to implement the new Building Safety Act and to deliver the regime to raise standards in the industry, across the whole industry and for all buildings.'

The BAC will be joined in 2023 by two other committees established by the Building Safety Act – the Residents' Panel and the Industry Competence Committee.

Construction output rises for fourth consecutive month

Monthly construction output increased in October for the fourth month in a row, hitting a record level of £15.2bn since records began in 2010, according to the Office for National Statistics (ONS).

The ONS' latest monthly snapshot, released on 12 December, says that overall construction output increased by 0.8% with increases in both new work (0.5%) and repair and maintenance (1.3%). Five out of nine sectors saw a rise in October 2022, with the main contributors to the monthly increase seen in private housing, and non-housing repair and maintenance, which were up by 2.9% and 1.7%, respectively.

Mould problems affect 80% of homes on estate

Nearly 80% of homes on the housing estate where two-year-old Awaab Ishak died of a severe respiratory condition are affected by mould, the social housing regulator has found.

A survey showed that hundreds of homes on the Freehold Estate, run by Rochdale Boroughwide Housing (RBH), have signs of damp and mould, said the Regulator of Social Housing. The figures, in a report published by the regulator on 15 December, include a small number of properties that would constitute a category one hazard under the housing health and safety rating system.

A coroner ruled in November that Awaab Ishak died as a result of a severe respiratory condition triggered by prolonged exposure to mould in his home.

Since the finding that RBH had breached its decent homes standard, the landlord's chair has resigned and its interim chief executive has announced the formation of a damp and mould taskforce to accelerate remedial work.

Make ventilation a priority, says chief medical officer

Low energy ventilation a 'critical' challenge, says Professor Whitty

Achieving effective ventilation while minimising energy use is a major engineering challenge that needs to be overcome, according to Professor Sir Chris Whitty.

In his annual report, the UK's chief medical officer (CMO) highlights effective ventilation as a 'priority' for reducing air pollution and respiratory infections while achieving net zero.

Maximising ventilation and minimising energy use, while keeping buildings warm in winter and cool in summer, is also a 'critical' engineering challenge, he said.

Measures to improve energy efficiency, such as insulation and double glazing, can lead to increased pollution concentrations from indoor sources if there is not adequate ventilation for pollutants to leave the building.



The CMO's report also states that ownership of indoor air quality policy within government must be clarified.

The Department for Environment, Food and Rural Affairs has confirmed the government's target to reduce levels of PM2.5 air pollution to $10\mu g$ per cubic metre by 2040. However, the Royal College of Physicians – among others – has called on the government to bring forward this target to 2030.

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Simpler M&E designs are key to better performance

Building for 2050 report says overcomplexity results in performance gaps

Residents in showpiece eco-home projects had increased running costs because of a combination of significant performance gaps and 'overly complex' building services designs, a new government-sponsored report has found.

Building for 2050 – which was carried out by consultants Aecom, commissioned by the Department for Business, Energy and Industrial Strategy in 2017 – was published last month.

The study is based on the detailed analysis, from inception to occupancy, of four small-scale, low carbon housing developments in England.

It found that residents in some of the schemes experienced bills 'significantly higher' than expected, partly because of a 'significant' performance gap between the way the homes were designed and operated. Some 'overly complex' building services designs also contributed to the increased running costs, according to the research team, which says 'simpler' solutions are likely to perform best in terms of carbon reductions and lower costs. Another key contributor to higher running costs, however, was the 'significant difference' in unit costs between gas and electricity, primarily because of the environmental and social levies on the latter. This difference in unit costs was not negated by the improved efficiency of space heating and hot-water generation, the research found.

While the heat pumps analysed in the case studies were three to four and a half times more energy efficient than gas boilers in the provision of space heating, electricity unit prices were between four and five times higher than gas when the analysis was done in 2022. As a result, living in low carbon homes did not translate to low energy bills for residents, the report finds.

Delivering lower energy costs needs to be a 'greater focus' for developers and designers, to ensure the performance gap is closed, the study says. However, performance issues 'should be avoidable' at future developments, it adds.

The case studies included the 42-dwelling Marmalade Lane co-housing scheme in Cambridge and the 47-home Etopia Homes private development in Northamptonshire.

CE marking extended until mid-2025

The EU's construction product safety regime has received a stay of execution in the UK. The Department for Levelling Up, Housing and Communities announced on 9 December that the government will continue to recognise the CE mark on construction products for another two and a half years.

The move gives construction businesses until 30 June 2025 to prepare for the introduction of the UK Conformity Assessed (UKCA) mark, which is due to replace the CE mark.

The Department for Business, Energy and Industrial Strategy had announced in November that CE product marking will continue to be recognised for non-construction products in Britain for a further two years.

Engineering services umbrella body Actuate UK welcomed the extension to the UKCA mark transition and urged the government to work with industry to agree a joined-up plan for the transition to the UKCA mark.

Tom Garrigan, technical director at BSRIA, said the government's announcement was 'necessary' to ensure the continued supply of construction products into the market.

IN BRIEF

Deadline extension for Net Zero Carbon Buildings Standard

The deadline for submitting evidence to inform and guide the development of the UK's first Net Zero Carbon Buildings Standard (NZCBS) has been extended to 11 January. The extension will give interested parties more time to submit their operational energy and embodied carbon data, including in-use consumption data from the best-performing existing buildings and modelled performance data for those in design or construction. Visit www.nzcbuildings.co.uk

Swansea docks site for hydrogen and renewables hub

Engineers HDR and Siemens are among a number of international companies that have formed a consortium to transform Swansea's docks into a renewable energy and hydrogen hub. The first step in the proposed Blue Eden project would be a renewable energy transport hub, the largest facility of its kind in the UK, including electric and hydrogen charging facilities. This hub forms part of a larger scheme to reinvent Swansea's dock area, including a tidal lagoon power plant, green hydrogen production, a floating solar array and a battery storage facility for the renewable energy generated on site.

Construction suicide numbers rise again

The number of suicides in the UK construction industry in 2021 increased by 5%, to 507, according to the Office for National Statistics. Of those who died, 503 were male.

In 2020, there were 483 suicides, an increase of 25 over the previous five-year average.

The Lighthouse Construction Industry Charity, which provides aid and assistance to construction workers, said that suicides were four times higher in construction than the national average.

It has been asked by the Construction Leadership Council to work with the Mates in Mind charity on a project called Make It Visible, to improve welfare and wellbeing in construction.

For more, read 'Mental health matters' on page 22.

Heat pump trader sentenced for fraud

A dishonest trader has been sentenced after conning more than a dozen people into buying unsuitable heat pumps and air conditioners, and taking deposits for work he didn't do.

Adrian Miles, trading as Duchy Eco Heating, pleaded guilty to fraudulent trading after being prosecuted at Truro Crown Court for misselling heat pumps and taking payment for work he did not carry out. He misled customers about the suitability of the systems he installed in their homes and failed to provide remedial work and servicing under warranty. He also falsely claimed his business was properly certified.

Miles was sentenced to 20 months' imprisonment, suspended for 18 months, and ordered to carry out 200 hours' unpaid community work.

The investigation by trading standards found that he had falsely claimed his business was certified under the Fluorinated Greenhouse Gases (F-Gas) Regulations and made fraudulent applications to two certification bodies, including Refcom.

Scotland set to mandate Passivhaus for new homes

New regulations supporting performance standard due in 2024

Scotland looks set to be the first part of the UK where all new homes will have to meet the Passivhaus standard, after the Scottish government agreed to adopt the ultra-low emissions benchmark.

Alex Rowley, a Labour member of the Scottish parliament, submitted a private member's bill during the summer to mandate the Passivhaus standard, or a Scottish equivalent, for all new-build housing in Scotland. The Domestic Building Environmental Standards (Scotland) Bill was in response to a recommendation by the Scottish Climate Assembly.

In a letter to Rowley on 15 December, Scottish zero carbon buildings minister Patrick Harvie confirmed that the government would implement the standards within two years through secondary legislation. Work on developing the new standard will start early this year, with a view to laying the new regulations before parliament in mid-December 2024.

Responding to Harvie's letter, Passivhaus Trust CEO Jon Bootland praised the 'truly forward-thinking approach' taken by the Scottish government. 'They are to be applauded for taking this crucial step towards meeting their net zero/climate emergency goals,' he said. 'Now we must ensure that the bill is well developed and implemented to deliver the greatest impact on the actual performance of new homes in Scotland.'

Rowley said: 'We have the knowledge and technology to build houses fit for the future, with occupant comfort as a priority, at a fraction of the heating costs of a standard-build house now – it simply seems obvious to me that we should be doing this. This will help future-proof housing stock, save people money and tackle our climate emergency.'

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Trevor, Senior Design Engineer



Government calls for hydrogenready boilers from 2026

Consultation paper also proposes higher gas boiler efficiency standards

The government has announced plans to ensure all new domestic gas boilers are capable of running on hydrogen from 2026.

The business, energy and industrial strategy (BEIS) department has published a consultation paper seeking views on the proposals.

Deployment of such boilers from the mid-2020s is expected to deliver significant benefits should hydrogen replace natural gas in the gas grid by reducing the costs associated with scrapping natural gas-only devices before the end of their useful life.

The government says it expects the upfront costs of hydrogen-ready boilers to match those of natural gas devices and that customers will not have to pay a premium to use them.

Other proposals seek to set higher efficiency standards for new gas boilers, including plans to reform boiler controls standards, tackle oversizing of boilers and improve the minimum standards for hot-water tanks.

These policies are expected to improve the in-home performance of the average newly installed natural gas boiler by up to 6%, ensuring they can be delivered as close as possible to lab-tested efficiency levels, saving an estimated 21m tonnes of CO₂ by 2050.

The consultation also says the government hopes that hybrid heat pump and boiler systems may play a 'more substantive' role in the transition to lower-carbon heating.

Energy and Utilities Alliance CEO Mike Foster said: 'Mandating hydrogen-ready boilers is an important step towards decarbonising homes. The government is absolutely right to support this no-regrets option.'

However, Jan Rosenow, director of European Programmes at the Regulatory Assistance Project, tweeted that there was a danger these boilers would be running on 100% natural gas for at least 10 years, when the government predicts there will be enough green hydrogen for heating. He said: 'The danger is that rather than rolling out low carbon heating tech and energy efficiency measures available today, the UK adopts a waitand-see approach, compromising its ability to meet the net zero carbon emission targets.'

The government also announced \pounds 25m of funding for new technologies designed to generate clean hydrogen from biomass and waste, and \pounds 77m to support nuclear fuel production and next-generation advanced nuclear reactors.

IN BRIEF

Baxi tests hydrogen boiler in gas network

Boiler manufacturer Baxi has announced the world's first industrial-scale trial of a carbonneutral solution for heating up gas so it can be piped to homes and businesses.

Gas pressure must be reduced before it can be transported through the distribution network. However, doing so can cause the gas to freeze, meaning it has to be pre-heated so that it can flow.

The heat-in-a-box containerised solution combines electrolysis, H2GO's low-pressure hydrogen storage system and Baxi's Remeha Quinta Ace 45 hydrogen boiler. It is powered by solar PV.

A demonstration of the system is due to take place at Northern Gas Networks' Low Thornley test facility near Gateshead.

• Baxi has appointed Harriet Evans to the new position of renewables director.

RDCP takes 90% stake in Avon

Bristol-based mechanical and electrical engineering firm Avon Combined Electrical Services (ACES) has been bought by RDCP Infrastructure.

ACES' MD Stephen Sage stays in his current role following RDCP's acquisition of a 90% stake in the firm, which has been trading for more than 30 years.

ACES' clients include Galliford Try, the Ministry of Defence, the NHS, Morgan Sindall, Kier, BAM, ISG and Sir Robert McAlpine. RDCP's other acquisitions include mechanical engineering and FM company Macair FMI.

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IN BRIEF

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CIBSE's gold, silver and bronze medals recognise exceptional, outstanding and distinguished service of individuals to CIBSE and the wider industry.

We seek to recognise those whose contribution has been made through long and loyal service to CIBSE and those whose work has inspired us all – and has helped raise the profile of the building services profession.

Proposals for 2023 are now open. Please visit https://bit.ly/ CJJan22CN for more information. The 2023 deadline for proposals is 31 March.

CIBSE Building Simulation Awards

Judges impressed by level of entries at Build2Perform Live event

Winners of the CIBSE Building Simulation and Young Modeller awards were announced at Build2Perform Live in November.

Daniel Sánchez-García, of Universidad Carlos III de Madrid, won the CIBSE Building Simulation Award for 'Adaptive Comfort Control Implemented Model (Accim), Transforms PMV-based into adaptive setpoint temperature EnergyPlus building energy models'. His winning project is a novel energy management application based on the Accim EnergyPlus simulation modules developed to convert fixed



Winners of the Building Simulation and Young Modeller Awards

building mechanical system setpoints to adaptive setpoints that respond to occupant adaptive thermal comfort rules, and take into account outdoor temperature in the system operation. The modelling framework provides flexibility to the system operation and offers significant energysaving potential. The case study building presented around a 30% total energydemand reduction through the application of the adaptive comfort temperature HVAC simulation module alone.

The judges recognised the novelty and robustness of the simulation method in the winning entry. Vasiliki Kourgiozou, CIBSE Building Simulation Group secretary and head judge, highlighted the importance of such efforts to maximise energy demand reduction of buildings, especially in the context of the climate emergency.

Shweta Salvankar, from Cardiff University, was recognised as the CIBSE Young Modeller of the Year. The judges were very impressed with her study, which aimed to optimise embodied and operational carbon using a range of modelling tools.

Overall, the judges and organisers were thrilled to see that industry and academic applications of dynamic building thermal simulation foster the exploration of advanced modelling techniques and are informing integral national and international policy.

Remebering Bryan Franklin

Bryan Franklin was one of the longest-serving members of CIBSE and was in his seventh decade of membership at the time of his death in December.

Bryan joined the industry in the days of the IHVE and worked his way to being a partner at Steensen Varming, The practice was the services engineers for the British Library project in St Pancras, which was the largest public building constructed in the UK in the twentieth century, taking 23 years to complete.

It was not a project without parliamentary controversy over the cost and it attracted an unfavourable comparison by the then Prince of Wales with an academy for secret policemen. But in the quarter of a century since it opened it has become a cultural icon and a fitting legacy to the engineering of Bryan and colleagues.

Bryan was a part of the newly created CIBS meetings committee in the early 1980s and served CIBS and CIBSE in various active volunteer roles for forty years. He was on the Council, the executive committee before the creation of the CIBSE Board, and chaired the policy and consultation committee (now technology committee), for many years. He led the steering group which oversaw revisions to the Commissioning Codes in 2001-3, the creation of Commissioning Management Code M, and the guidance on ductwork cleaning issued in TM26.

Bryan was also an active participant in the work of BSRIA, serving on several of their committees and chairing the BSRIA Board for a time. He was an assiduous and meticulous recorder of any meeting, always taking copious and immaculately written notes. It is doubtful that any opponent would have been able to gainsay him in any dispute about the discussions or outcomes of a meeting.

At an age when many might have looked to retire, in 2006 Bryan took a leading role in CIBSE's development of certification activities, a significant new opportunity for the Institution. He led the development of the Low Carbon Consultants Scheme, then chaired the directors of the newly established CIBSE Certification from 2007. He also chaired the certification steering committee and remained in those roles until relatively recently.

Bryan's exceptional service to the Institution was recognised by the award of the Silver Medal in 2001, followed by the award of Honorary Fellowship in 2007. He was awarded the Gold Medal earlier this year and was very honoured to have been recognised alongside a number of his peers.



Celebrating excellence in digital engineering

Atkins' Decarbonomics initiative named overall champion

The winners of the Society of Digital Engineering (SDE) Awards were unveiled at Build2Perform Live in November.

The awards celebrate excellence in digital engineering across built environment professionals, recognising those who are contributing to digitalisation, including technicians, engineers and designers.

This year's categories celebrated projects and collaboration; processes and application; and the best contractor, consultancy, manufacturer, and digital engineer.

Carl Collins, head of digital engineering at CIBSE, said: 'The judges were very impressed with the quality and breadth of entries this year. We would like to congratulate all our winners and those shortlisted, with a special mention to the Atkins team for their Decarbonomics entry, which won overall Digital Engineering Champion."

All the category winners are judged to find the overall champion – the entry that judges felt best exemplifies what the SDE represents in terms of contribution to the industry.

2022 SDE Award winners:

Best process and its application

1st: Atkins Member of the SNC Lavalin

Group – Decarbonomics • 2nd: Hydrock – Hydrock Digital Toolbar

- Best project and collaboration
- 1st: Buro Happold Museum of the Future
- 2nd: Cundall The Storm Rollercoaster
- Best consultancy
- 1st: Buro Happold
- 2nd: Red Engineering
- Best contractor ● Kane Group

Best manufacturer

- 1st: Schindler Elevator
 2nd: Legrand Electric
- Best digital engineer
- 1st: Mateusz Lukasiewicz KEO International Consultants
- 2nd: Matt Crunden Legrand Electric

Digital champion 2022

 Atkins Member of the SNC Lavalin Group - Decarbonomics

For more about the SDE Awards and the full 2022 shortlist, visit the CIBSE website at: bit.ly/CJJan22CN2

LEV 2023 set for Birmingham

The Institute of Local Exhaust Ventilation Engineers (ILEVE) with the British Occupational Hygiene Society (BOHSO) are holding their eighth joint LEV-focused event on 7 February in Birmingham. The one-day hybrid event is for anyone who has an active involvement in the local exhaust ventilation (LEV) industry.

The conference is aimed at those involved in LEV system design, installation, commissioning, thorough examination and testing, servicing, maintenance work or if you own LEV installations. The event is reaching out to those working specifically in LEV, those working within the broad field of occupational hygiene or even just those interested and wanting to learn more.

The event will feature a series of sessions and workshops on the theme 'Where the future is headed', delivering insight and generating debate on the latest issues affecting the LEV industry, control and its role in the reduction of industrial disease.

For more information and to book visit bit.ly/CJJan23CN1



Catchpole and Carter head to Hong Kong

As part of CIBSE's commitment to strengthening international reach, Adrian Catchpole, CIBSE Presidentelect, and Ruth Carter, CIBSE CEO, visited Hong Kong in November.

The trip was timed to coincide with the City for Future: Journey to Carbon Neutral Building symposium, organised jointly by CIBSE Hong Kong, the Hong Kong Institution of Engineers (HKIE), and ASHRAE Hong Kong.

Delivering the opening keynote speech, Catchpole spoke of the collective and global responsibility to achieve net zero carbon. He referenced CIBSE's work in supporting engineers with the transition to resources such as the embodied carbon calculation methodology, TM65.

Acknowledging innovative thinking in relation to the way buildings are designed, Catchpole also commented on the move towards modular construction techniques and the adoption of process management tools, such as BIM.

His speech focused on the need to lead with action and address the challenges presented by the global engineering skills shortage, and he emphasised the crucial role of engineers in delivering on climate targets.

During their visit, Catchpole and Carter met the CIBSE Hong Kong regional committee to discuss plans and objectives for 2023.

They also met the Hong Kong government's Architectural Services Department, with which they discussed approaches to addressing the global engineering skills shortage and the challenges associated with the transition to net zero carbon.

CIBSE has a long-standing relationship with the HKIE, and this visit provided an opportunity to discuss the structures and aims of both organisations, and how they can better support each other.



Nominations and appointments of Officers and Board and Council Members

New CIBSE Officers, Board Members and Council Members take office each year from the AGM in May. Officers and Board Members serve on the Board, which is the Institution's governing body. It comprises the seven Officers (President, President-Elect, three Vice-Presidents, Honorary Treasurer and Immediate Past President) and five Board Members.

The Institution's By-Laws and Regulations require that all candidates for Officer and Board Member vacancies arising at the AGM be considered by the Institution's Nominations Panel, to which all sections of the Institution are invited to suggest candidates for consideration.

The Panel gives careful thought to its recommendations and seeks to reflect Charity Commission guidance by nominating a range of candidates with the skills and experience required to fulfil the Board's role as the governing body of a significant registered charity.

It also seeks to ensure that the Board includes a balance of representation from different industry sectors. Having considered the advice of the Panel, the Board then nominates candidates for President Elect and Board Member vacancies. The Board's nominated candidates for vacancies arising at the AGM in May 2023 are: **President Elect: Fiona Cousins CEng FCIBSE; Honorary Treasurer: Vince Arnold CEng FCIBSE; Members of the Board: Mike Burton CEng FCIBSE, Mark Walker CEng FCIBSE**

The Board, having considered the Nominations Panel's advice, also appoints three Vice-Presidents to take office at the next AGM. These appointments are normally made from those who serve or have served on the Board, and all those listed below are current or past Officers or Board Members. The Board's appointments to take office in these roles from the AGM in May 2023 are: Vice Presidents: David Cooper CEng FCIBSE, Laura Mansel-Thomas CEng FCIBSE, Les Copeland CEng FCIBSE

The Council is a larger consultative body that advises the Board on Institution policy. It includes representatives of Regions, Societies, Groups, Networks and Standing Committees, and elected members, who serve a three-year term. The Board has agreed to operate a similar procedure for election as that applying to Board members, and two corporate and one non-corporate positions are available for election each year. The Board, having considered the advice of the Nominations Panel, agreed to nominate the following for vacancies arising at the AGM in May 2023: Members of Council: Aleksandra Krstanovic (corp), Peter Anderson (corp), Emeka Osaji (non-corp).

Public health engineers celebrate achievements

Freya Scott named SoPHE Young Engineer of the Year at annual dinner

The Society of Public Health Engineers (SoPHE) rounded off a productive and successful year with its annual dinner in London in November. The event, attended by more than 350 people, was an opportunity to celebrate and award achievements within the public health engineering sector.

Freya Scott, from Arup, was named SoPHE Young Engineer of the Year after her work at the 2022 SoPHE Plumbing Centre of Excellence/YEN plumbing competition.

Rachel Yates, from Arup, and Jess Humphries, from Ramboll, were awarded joint second place. SoPHE would like to thank Pump Technology for its generosity in sponsoring the prizes for the Young Engineers awards.

The Chris Sneath Bursary was presented to Kevin Buchanan for his achievement of Level 2 first prize.

Phil Salmon MCIPHE, SoPHE was made a SoPHE Honorary Fellow for his incredible contribution to the public health industry.

The SoPHE London Dinner is a clear example of how important our volunteers and members are to the running of CIBSE.

CIBSE would like to extend its thanks to those involved in the organisation of the event – the SoPHE Steering Committee and Industry Working Group – and the SoPHE Industrial Associate members for their generous sponsorship of the dinner.

Ministry of Innovation wins Teambuild challenge



The construction industry competition Teambuild UK returned in November, after a three-year break because of the Covid-19 pandemic.

Supported by several industry bodies, including CIBSE, the competition involves teams of new construction sector professionals designing, developing and building a complex project during a weekend of intense activity and training.

Individuals, many of whom have never met before, work together in multidisciplinary teams, and unexpected challenges – such as onsite accidents, burst sewers or collapsing buildings – are

thrown in to see how they react. This year's competition was based on a real current project: the SG1 Stevenage Town Centre regeneration, by Stevenage Borough Council and Mace. 'We chose this project because it has both the scale and complexity we seek to challenge competitors, as well as being relevant to the challenges faced by our sector today,' said Teambuild trustee Marcel Peeperkorn.

Six teams took part in the event, and their performance was evaluated by senior industry figures, each representing a construction institution. The Ministry of Innovation (pictured above), with members from John F Hunt, Atkins, and Weston Williamson and Partners, won the competition and were awarded a cash prize of \pounds 2,000, sponsored by the Worshipful Company of Constructors.

The Procurement Prize of £1,500, sponsored by the Worshipful Company of Chartered Architects, went to Wesconex, from Weston Williamson and Partners, Conisbee and Expedition Engineering. Anna Kelly, of Mace ,and Shivank Kakar, of Conisbee, were jointly awarded the Leadership Prize of £500, which was sponsored by the Commercial Education Trust, in recognition of the services of its former chair, David Coughtrie.

Teambuild chair Patricia Bessey said: 'The winning teams and individuals demonstrated considerable strength in teamwork, communication and innovative ideas.'

New CIBSE Fellows Network aims to inspire

Organisation seeks to give Fellows more opportunities to engage with industry and encourage the next generation of engineers

A CIBSE Fellows Network has been launched in a bid to increase activity, communication and participation among Fellows.

At a launch event at London South Bank University, chair of the network Geoff Prudence FCIBSE said: 'There was a massive opportunity for Fellows to help each other and exchange ideas.' He added that the aim of the network is to engage in wider industry forums and, as a 'proactive lead resource', inspire the next generation as part of CIBSE's 125th anniversary challenges.

CIBSE President Kevin Mitchell FCIBSE said: 'I'm delighted the CIBSE Fellows Network has launched during my presidency. The wise heads have the experience to guide young and new engineers.'

Speaking at the launch, CIBSE CEO Ruth Carter said building safety was an issue that Fellows could lead on. 'There's a juggernaut coming around the corner and the industry doesn't know enough about the Building Safety Act. Fellows can promote competence at a senior level.'

Jon Belfield FCIBSE, managing director of In Tandem Systems, said the network was a great opportunity to engage with young engineers. 'At the start of your career, you don't think your opinion is worth expressing, because you're afraid of people with "crystallised wisdom",' he said.

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Federation calls for national fire strategy

A new strategy for national fire safety is needed, says **Dennis Davis**, executive director of the Fire Sector Federation

he Fire Sector Federation (FSF) is calling for a wider discussion to create a national fire safety

strategy that goes beyond current legislative proposals.

The Developing a National Strategy for Fire Safety document sets out a possible pathway for the fire sector and government to work together to create a safer society.



Backed by the Smoke Control Association, the plans were developed by a new FSF Fire Safety Strategy Board, with expertise drawn from across sectors, including fire safety, fire and rescue, construction, insurance, and building control.

The Federation seeks government support to ensure fire remains a priority, to integrate policy across departments and devolved administrations, and to make full use of the technical expertise from the specialised fire sector.

Main priorities identified are: raising competency; mitigating fire risk in modular and other buildings using mass timber; and partnering the construction sector to raise awareness of fire risk from innovative products and methodologies.

While significant new legislation is being introduced after the Grenfell Tower tragedy, it is incumbent upon everyone in the built environment to avoid further complacency and address problems we know continue to exist and may evolve in future. Industry is well placed to understand these problems and, just as importantly, some of their solutions.

The Federation believes a National Fire Strategy is the most effective way to achieve the shared aim of a fire-safe society. Having an agreed roadmap to deliver an effective and resilient fire-safety agenda aligned within a secure and sustainable environment is, it suggests, the best way to secure that aim.

The UK's cycle of stable-door laws following major tragedies has to be replaced with a proactive approach that secures a holistic solution to prevent and protect society, and the economy, from the consequences of such terrible events.

This highlights the need for 'fire' to be a higher priority for government, with a better understanding of the complex factors involved and for improved integration of policy across ministerial portfolios.

Awaiting another tragedy before moving fire safety up the policy agenda would only represent failure and suffering.

The Federation invites opinion, views, and partners to consider and comment on its proposals; the White Paper is available to download at **bit.ly/scajan22**

Don't forget the Nabers

In October 2019, the government said it would consult on a scheme to rate commercial and industrial buildings on their actual energy consumption and carbon emissions. Hywel Davies looks at what has happened since

ost car owners know the miles per gallon of their vehicle. We're all used to energy labels on white goods. Yet the energy used in buildings goes largely without accurate measurement, unrated and undisclosed.

Energy labelling has improved the efficiency of appliances dramatically. In Australia, the National Australian Built Environment Rating System, Nabers, has transformed the property market over a 20-year period.

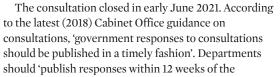
Before the 2019 General Election, the UK government told the Climate Change Committee that it would consult on a scheme to rate commercial and industrial buildings on their actual energy consumption and carbon emissions. In March 2021, after a pause while the world responded to the pandemic, the Department for Business, Energy and Industrial Strategy (BEIS) consulted on *Introducing a performance-based policy framework in large commercial and industrial buildings in England and Wales*.

The proposals included the introduction of a system of rating building energy performance along the lines of the Nabers model. In the executive summary it stressed the importance of putting in place 'clear and ambitious policies' to 'make sure the UK builds back greener [from the pandemic], unlocking thousands of skilled and resilient jobs'.

As the host of COP26 in November 2021, and the first major economy to pledge to achieve net zero greenhouse gas emissions by 2050, there was some pressure on the UK to demonstrate that it was still committed to giving a global lead.

We were told that 'delivering our commitments requires decisive action now, and building an economy that will thrive in the future can only be achieved by building an economy that is not reliant on fossil fuels'. How true those words have turned out to be.

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





"Departments should publish responses to consultations within 12 weeks...18 months on, we have neither a response nor an explanation" consultation or provide an explanation why this is not possible'. Eighteen months on, we have neither a response nor an explanation.

With unprecedented fuel bills, the cost of supporting businesses and consumers (also voters in a democracy) through the energy crisis will be second only to the cost of pandemic support. Even before Russia's onslaught on Ukraine, decarbonising the built environment in general - and commercial and industrial buildings in particular - was a significant challenge. There are about 1.7 million such buildings, of many types, shapes, sizes and ages. About 120,000 of them are larger than 1,000m², and consume more than half the energy used by the entire commercial sector -and about a sixth of the total energy used in UK buildings.

A reduction in the energy used in these buildings would make a massive contribution to cutting the associated carbon emissions from these buildings and the risk of power cuts this winter. It would also make a long-term contribution to lowering demand for zero carbon energy, reducing the costs of the transition to a zero carbon system.

It is little short of incomprehensible that we still have no response from BEIS to the 2021 consultation. The proposals for a system that enables businesses to

measure their actual energy use in operation and to rate their buildings accordingly are not new. The public sector has used Display Energy Certificates (DECs) for more than 15 years, and these were almost adopted for all larger buildings via an extension of the DEC scheme more than a decade ago, before being dropped suddenly.

Nabers has radically reshaped the property market in Australia. After being championed by the Better Buildings Partnership, CIBSE and others in the UK, we now have Nabers UK, a performance-based rating scheme for commercial buildings.

It offers the obvious means to rate large commercial buildings now. Currently a voluntary scheme, it could drive energy saving and the upskilling required to deliver and operate larger, energy efficient buildings effectively, across the commercial sector. What on earth are we waiting for, BEIS?





The 2023 Building Performance Awards shortlist has now been announced and we are looking forward to joining together to celebrate excellence in the built environment at the prestigious Awards ceremony.

WINNERS ANNOUNCED:

cibse.org/BPA

CIBSE Building Performance Awards 2023 Wednesday 1 March 2023 Park Plaza Westminster Bridge, London

> @CIBSEAwards #BPA2023

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COUNTDOWN TO ZERO

Decarbonisation and building safety dominated the debates at CIBSE's Build2Perform Live conference and exhibition, at ExCeL London. Alex Smith and Molly Tooher-Rudd find out how CIBSE and the wider industry are rising to the twin challenges of cutting carbon and keeping people safe in buildings



he first Build2Perform Live event for three years focused on two areas that will change forever how building services engineers design and deliver buildings: the elimination of carbon and the guarantee of safety.

Held at ExCeL London for the first time, the event attracted 80 speakers and 60 exhibitors, and offered 45 hours of CPD and other technical presentations. Nearly 3,000 people registered over the two days.

CIBSE President Kevin Mitchell opened Build2Perform and said CIBSE was 'leading by action and not just words' to deliver the changes required by the Building Safety Act.

Speakers from government and the new Building Safety Regulator explained how the regime described in the Building Safety Act would affect everyone in the construction and management of buildings. HM inspector of health and safety Neil Hope-Collins said there would be severe consequences for individuals and companies that ignored the new regime. 'Non-compliant building works could result in unlimited fines and up to two years in prison,' he warned. (For the session on dutyholders and competence, see page 20.)

Zeroing in

The cross-industry quest to define net zero through the Net Zero Carbon Buildings Standard (NZCBS) kickstarted the conference programme. Other related sessions tackled the decarbonisation of heat, the transition from gas boilers to heat pumps, and the challenge of measuring embodied carbon.

CIBSE's groups, societies and regions made substantial contributions, and held seminars on the new Code for Lighting, TM65 and TM66 embodied energy guides, and heat pump guidance. The Society of Digital Engineering hosted the Digital Engineering Awards – see CIBSE News on page 12 – and led sessions on the key issue of information management around fire safety.

The NZCBS will set limits for operational and embodied carbon in new and retrofitted buildings, after assessing what reduction in emissions is needed, across 14 building sectors, for the industry to contribute adequately to "The problem with a combined [hydrogen and heat pump] approach is having to deal with two sets of infrastructure"

BUILD2 PERFORM CIESS KNOV THEATRE

the UK's carbon reductions. 'The standard will be the single point of truth and will help avoid greenwashing,' said IStructE's Patrick Hayes. 'It will facilitate good design and it will target carbon reduction through the RIBA stages.'

In a call for evidence extended to January, the group requested operational and embodied data to help create benchmarks and understand what limits and targets should be set for different building types. CIBSE's head of sustainability, Julie Godefroy, said the NZCBS invited modellers to work with them from January, on energy performance models.

The future of heat

Delegates heard about the challenges of meeting consumption peaks, storing energy, and ensuring flexibility in the system. Tadj Oreszczyn, professor of energy and







Tadj Oreszczyn speaking at a session on the future of heat debate at the two-day event at London ExCeL

environment, University College London, said that gas must disappear, to be replaced by heat pumps and district heating, to reach net zero. However, heat pump deployment is difficult with current gas to electricity prices, he said, adding: 'We must prepare for price and security instability.'

Oreszczyn discussed the viability of a slow transition, with gas and heat pump hybrids. 'These could replace technology without big changes and reduce emissions in the short term. It's a difficult balance; we don't have long to evaluate our options.'

Ted Pilbeam, building services and sustainability director at VolkerFitzpatrick, argued that we should not discount other technologies. I'd like to see a lot more research on hydrogen – even if it doesn't work, at least we will learn.'

Concern over affordability of all-electric solutions was aired by the audience. 'We'd have to replace pipes with cables, which would be incredibly expensive.' Further, it was asked: 'Will the Grid be able to cope?'

'The debate between hydrogen and electricity is a sensitive one,' said Oreszczyn. 'Hydrogen has advantages, but it's going to be a while before this can be widely deployed. There are equal infrastructure problems with hydrogen and heat pumps. The problem with a combined approach is having to deal with two sets of infrastructure.'

The challenges of moving to all-electric buildings are highlighted in *TM67*: *Electrification of buildings for net zero*. Chair of the CIBSE Technology Committee Katie Clemence-Jackson facilitated a panel featuring two members of the TM67 working group, chair Tony Day and Chris Twinn.

The falling carbon intensity of electricity compared with gas was the main reason for the growth of heat pumps, said Day, with it predicted to be zero by 2032. However, he added that there is a huge shortfall in electrical capacity on the Grid. During the 'Beast from the East' in 2018, the amount of energy the gas grid drew instantaneously was 200GW at peak, whereas the peak of the electricity grid is only about 50GW. 'If we transferred all of that gas energy onto the electrical network, the supply system couldn't cope. Even with good COPs, it will double demand on the electricity network,' Day said.

A fabric-first approach would be essential to minimise loads, he added, but electrical demand could be managed with intelligent design and smart networks, and energy storage would form part of the solution.



There were 60 exhibitors at Build2Perform Live

RETROFITTING HERITAGE BUILDINGS

Minimising the risk of damaging heritage properties with inappropriate retrofits was the subject of a debate led by CIBSE's Retrofit in Heritage Committee. There are an estimated 500,000 buildings in the UK that require retrofitting, and the panel debated the need for relevant accreditation schemes and discussed the balance between making carbon savings and conserving a building's heritage.

RMJM London's Bill Bordass said he was dubious about the mechanics of an accreditation scheme. 'I have seen many rookie fixes from qualified engineers,' he said. 'The sensitivity needed when dealing with heritage buildings can't necessarily be taught.'

James McCosh, partner, van Heyningen and Haward Architects, also questioned how helpful a scheme would be: 'Certification isn't a magical cure – I've seen the cost and time that accreditation takes in our business; we can still do good work without it.'

However, Morwenna Slade, head of historic building climate change adaptation at Historic England, disagreed. 'Without an accreditation scheme, how can you ensure engineers are competent? Certification will demonstrate the job can be done well,' she argued.

Bordass said that traditional buildings are sustainable because they have lasted, and added: 'We don't want people who don't know how to design new buildings to work properly to be unleashed on old buildings.'

Slade agreed, and said that creating solutions with incomplete knowledge may lead to incorrect measures.

Ann-Marie Fallon, associate director at Architype, warned that heritage buildings could become ghost establishments in the wake of the current energy crisis.

'Use is key to sustainability,' she said. 'If buildings are retrofitted, we need to ensure they continue to be used.' >> Day questioned who would pay for the upgrading of the Grid, and said developers and distribution network operators would have to form a dynamic relationship to ensure electrical requirements were met.

Clemence-Jackson said heat pumps are in danger of being more expensive than gas systems with the current cost difference between gas and electricity. 'We have to make sure we're not making heating more unaffordable,' she said. 'As designers, there is an opportunity to deliver efficient, low carbon buildings that don't break the budget and match the supply of electricity to demand.'

With gas currently at 10.3p/kWh and electricity 34p/kWh, Twinn pointed out that heat pumps will have to have a COP of at least three all year around to make them cheaper than gas boilers. Existing stock will be the most difficult to decarbonise, he added, and clients are deterred by the cost of heat pumps and the upgrades of emitters and fabric required to run lower-temperature systems.

Twinn described a cost 'sweet point', where just enough fabric improvements are carried out to allow existing emitters to operate at the lower temperatures produced by heat pumps. 'It then becomes a step-by-step approach, he said. 'Nine times out of 10 the client doesn't have enough money for all of this. But at least the fabric-first approach reduces the bills in the short run, and a heat pump can be added in the future.' CIBSE has published two technical guides on the life-cycle of heat pumps, from design to decommissioning. AM16 covers multi-unit residential buildings and AM17 large non-domestic buildings.

Joshua Bird, lead, building services, at Arup, highlighted the consequences of annual refrigerant leakage on whole life carbon assessments. 'Emissions associated with leakage may equal the savings made with a



"As designers, there is an opportunity to deliver efficient, low carbon buildings that don't break the budget"

heat pump,' he said. 'If you're using a high GWP (global warming potential) refrigerant, leakage rates will have a huge impact.'

In a session on embodied carbon, Clara Bagenal George, associate at Elementa Consulting, explained how CIBSE's TM65 calculation methodology fills a void for construction materials because environmental product declarations showing embodied energy in components are rare. Elementa's Will Bury gave a detailed explanation of how the calculation tools could be adopted for use outside of the UK, and stressed the importance of 'making sure that everyone is consistent with the methodology'.

In 2023, CIBSE will release TM65.2 for offices, and a carbon database for MEP

Bob Bohannon speaking at a circular lighting debate

components is in development. Hugh Dugdale, associate principal at Elementa Consulting, said: 'It will be the first port of call for design teams to look up product values to use in early calculations.'

CIBSE's TM66 Creating a circular economy in the lighting industry was discussed in a session led by its lead author, Bob Bohannon, head of policy and academy at the Lighting Industry Association, and senior lighting designer and chair of the SLL education committee.

Bohannon said TM66 is designed to help make a business case for going circular, and he described the Circular Economy Assessment Method, which gives lighting products a score from 0-4 based on the circularity of four elements: product design; manufacturing; materials; and eco-system (see page 30).

A host of guides and application manuals will be released by CIBSE next year, and the *Journal* will have a regular round-up of key documents. CIBSE Members can access these at www.cibse.org/knowledge-research. CJ





Putting building safety first

The Building Safety Act includes new requirements for the client, principal designer and principal contractor to manage building safety risks. A Build2Perform panel discussed the responsibilities and competencies required

nder the Building Safety Act, dutyholders are required to manage building safety risks, with clear lines of responsibility during the design, construction and completion of all buildings. There are three duty holders: the client, the principal designer, and the principal contractor.

A session on the second day of Build2Perform looked at the responsibilities of the dutyholders and the competencies required.

Vince Arnold, CIBSE Board member and trustee, said the impact of the act would be immense, and part of the challenge of improving competency is that the industry wasn't aware it was incompetent, 'so there wasn't a plan to fix it'.

Graeme Fox, director of technical, BESA, agreed: 'We really have a very bad habit of not addressing issues until they're right in your face – that is a culture we really need to change.'

Neil Hope-Collins, of the Health and Safety

Executive, outlined three questions that those in the industry should ask themselves: Do you understand your area? Do you understand what you're talking about? Are you able to demonstrate what it is you are doing?

The key is to identify the problems now, before they become a bigger issue, he added. 'I want you to understand the significance of those faults – and I want you to understand what you need to do to rectify those faults,' he said.

While many can declare competency with 'textbook knowledge', it is more important to demonstrate competence, said Hope-Collins, who believes the industry needs to 'promote an understanding of how to self-assess to ensure people have the necessary skills, knowledge and experience for their field of work'.

Evaluating the competency of contractors before a project begins is also vital, and clients should ask questions: 'If you don't understand the answer, ask them to explain it in language that you do understand,' said Hope-Collins. 'Because, if they can't explain it properly, do they understand it themselves? If someone truly understands their subject, they should be able to explain it to someone else.'

Clearly outlining the process for determining competency is crucial, and comes under the golden thread of information. 'The thread is not asking for new information; it's the information that allows you to do the job you need to do – that's of value to the work of your contractors, to the building, and to the person who looks after the building,' he said.

This information will give assurance that the building satisfies all functional requirements of the Building Regulations. 'When you're talking about those who are doing the building work, you're talking about the dutyholders,' Hope-Collins said. 'There will be legal requirements on dutyholders to ensure that any building is properly monitored, managed and planned.'

Recognising engineers who inspire us all Proposals for Gold, Silver and Bronze medals

Help us celebrate engineers, colleagues and mentors whose service has marked the industry. Proposals for the 2023 Gold, Silver and Bronze medals are now open. You can put forward individuals who have made an outstanding contribution to the industry or the Institution and its charitable objectives.

We're looking forward to receiving your proposals and recognising those whose loyal service has inspired us all - and have helped raise the profile of our profession. The deadline for proposals is 31 March 2023



Find out more at cibse.org/proposals

MENTAL HEALTH MATTERS

Understanding and addressing mental health within building services is essential. Three experienced professionals in the industry share their advice for integrating mental health support and policy in the workplace. **Molly Tooher-Rudd** reports

he construction industry has gone through unparalleled levels of upheaval in recent years. Covid and Brexit have disrupted working lives and contributed to a skills shortage that has put more pressure on engineers tasked with delivering ever more complex buildings.

While the drive for net zero and the Building Safety Act make 2023 a critical year for building services, it is important to pause for thought and consider how individuals are coping with the pressures of a post-pandemic world, in which the separation between work and home has become more blurred.

Industry reports indicate an increasing number of people in construction struggling with mental health. A 2020 report by the Chartered Institute of Building found that almost a third of employees in construction experience elevated levels of anxiety, while the Office for National Statistics recently revealed that suicides in the sector jumped by 5% in 2021, to 507. Analysis by the Lighthouse Construction Industry Charity found that this was four times higher than in other sectors.

James Bevis, managing director of Exyte Hargreaves, has seen more pressures on building services personnel since 2020: 'We have faced a multitude of unprecedented socio-economic incidents: Covid, the cost-of-living crisis, Brexit pressures, material and labour shortages. Add all of that into the same melting pot and it's clear to see it hasn't been easy for anyone.'

Kathryn Cox, HR director at ChapmanBDSP, believes people are struggling to maintain a work/life balance. 'Improvements in technology mean people are never not working; there is constant access to the online workspace,' she says.

The impact on mental health of everyday working pressures should not be ignored, adds Francesca Scull, Leadership & Organisation Development HR business partner at HDR. 'I'm not alone in observing my colleagues struggle with tight deadlines, demanding clients and suppliers, and looking after staff, she says.

So, how are these companies supporting the mental health of their employees? An HDR recruitment drive in 2022 has helped to take pressure off senior engineers, says Scull. 'We have hired around 23 graduates and apprentices, and it's boosted morale. Increasing the workforce allows senior engineers to delegate tasks to make their own workloads manageable, and pass on valuable skills to future industry leaders.'

HDR also offers mental health first aid training, hosted by charity Mind, for which any employees can volunteer. It now has 23 mental health champions. 'We also have an annual coffee morning to emphasise the Time for Change initiative and raise awareness around mental health in our offices,' adds Scull.

ChapmanBDSP has as many mental health first aiders

(MHFA) as it does standard first aiders, says Cox, all trained through St John Ambulance. They are the go-to people for anyone in the company. 'MHFA publish a monthly newsletter, reminding people to take regular breaks, go for walks, speak to their colleagues. Sometimes, it is small changes that make all the difference,' Cox adds. The company also hosts annual wellness and stress awareness weeks.

Exyte Hargreaves has several MHFA too, and 'fully supports sitebased initiatives led by our contracting partners', says Bevis.

Cox believes preventative action is key. 'People will cope and cope until they can't cope any more. We want to try to catch it before it gets to a point where it needs a lot of intervention,' she says. Working with the clinical side of mental health is more challenging, however. 'Even with personal experience or a lot of empathy, our MHFA are not experts,' adds Cox. 'I think the next stage is to train line managers in this area.'

If a real concern for someone's safety is identified, Scull, at HDR, says



that HR is notified immediately. 'We promote Mind's online resources for self-referral, alongside our employee assistance programme, which is completely confidential and available 24/7,' she adds.

Similar assistance programmes are active at ChapmanBDSP and Exyte Hargreaves, with unlimited hours of free counselling available. Exyte Hargreaves is also about to launch a new health and wellbeing programme for its teams, which includes a hub where employees can access articles and self-help guides.

The importance of listening

Bevis says it's important to recognise that employees have particular needs and as an organisation be attuned to unusual behavioural changes at work that may tell you someone is struggling. 'Has that person become withdrawn? Are they taking more sick days or isolating themselves from friends and colleagues? We have several strong managers at Exyte Hargreaves who are crucial in identifying the people who need help at the earliest stage.'

HDR's number one value is to listen first. 'There can be a lot of talking,' says Scull, 'but it's listening we need more of.' She adds that firms should avoid unnecessary strain on their staff when delivering for

"In any business venture, stress is counterproductive. Work-life balance, or happiness, is of primary concern for the building services staff" – Francesca Scull



clients. 'It's about being mindful of delivering the best project without risking the health of the workforce,' she says.

Cox stresses the importance of making people aware of mental health 'If you can reach a point where they are comfortable having these conversations, then you have achieved a great deal,' she says. Bevis agrees: 'Keep talking and count on your support network. Whether it's a manager, a friend or family member – don't face your challenges alone.'

Cox believes professional membership bodies also have a role to play. 'Mental health can affect any individual at any time; what's important is the framework available to help,' she says.

The Construction Leadership Council has asked the Lighthouse Construction Industry Charity (www. lighthouseclub.org) and Mates In Mind (www.matesinmind. org) to co-chair a project to improve wellbeing and welfare in construction. The Make it Visible initiative aims to reduce stigma around mental health and increase awareness of support services. It will unite the HSE, trade and professional bodies, clients and contractors to drive the change to improve wellbeing and, ultimately, reduce suicides.

The initiative is an opportunity to put in place a framework for the benefit of future generations of engineers and construction workers. As Cox says: 'I'm not sure you can ever do enough in area – it's here, it's not going away'. CJ

For support with mental health visit **www.mind.org**

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1 Understanding mental health in the built environment, CIOB, 2020

IT'S TIME TO TALK ABOUT MENTAL HEALTH



Don't be afraid to get help, says Exyte's David Fitzpatrick

I am of the generation that was told to 'man up' when faced with anxiety or stress. Through personal experience, however, I realise the impact stress-related illness can have on you, and how important it is to talk to people about how you are feeling, in order to start the journey back to health.

I am a normal working bloke, spending time visiting customers, managing them

through their work and, sometimes, personal struggles, volunteering for charitable work, and doing work-related social events.

How many of you have found yourself getting up earlier and earlier to fit everything in and then realising this has become the norm? You get frustrated by the demands on your time, the constant calls, and the number of emails, which leave you no time to do your work. That's life and, most of the time, we cope – but if you get any of the following symptoms, as I did, maybe it's time to ask for help. The obvious ones are tiredness, getting frustrated, losing your temper with colleagues and family, not looking after your health, always eating on the run. You just get through the week, but then Saturday and Sunday become work days.

That was my life - until it got worse. There were increasing signs of anxiety and stress: I followed a car that cut me up on the motorway so I could give the poor bloke a piece of my mind; I sat in my car trembling and in tears because I could not face walking into the office; never sleeping more than three hours a night; and hearing my voice change in meetings as I was so frightened of being heard.

I finally broke. Luckily, I have a very supportive family and friends, who helped me to get the right support and on track to getting better. But it made me realise how important it is to have access to skilled people much earlier. Many people are going through the same, but feel they cannot talk about it. So, for me, it's time to 'man up' and be comfortable talking about mental health, and to listen to those who might need help. After metering its Battersea HQ, Foster + Partners found that IT, lighting and small power made up a significant proportion of the energy used in the building. As part of the consultant's road to net zero, **Stuart Humber** looked at four options for cutting the energy use intensity of office power

POWER ADDRESSING

s concern mounts about the effects of climate change, the international community has made commitments to limit global temperature rises. In the 2015 Paris Agreement (COP21), countries signed up to limiting temperatures to well below 2°C above pre-industrial levels, aiming for 1.5°C. A report by the

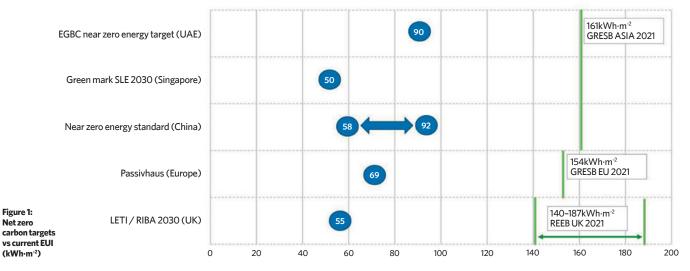
Intergovernmental Panel on Climate Change in 2021 sets out the risks of exceeding 1.5° C and the need for urgent action in reducing CO₂ emissions. The consensus is clear: global emissions need to be net zero carbon by 2050 to avoid harmful climate change.

The built environment is responsible for a significant proportion of CO_2 emissions. In the UK, it contributes 23% of national CO_2 emissions¹, with offices responsible for 17% of the building total.

This article compares operational energy targets currently being set for zero carbon buildings with current building performance. It asks whether zero carbon in operation can be achieved for UK offices without major disruption to how we work? A case study using an office building from the Foster + Partners London campus is used to illustrate some practical options.

In recent reports, the UK Green Building Council, LETI and RIBA have set out sector-specific net zero carbon targets, focusing on embodied carbon and operational energy. We focus on operational energy here because of the importance of existing buildings in the UK and the potential for short-term savings.

The LETI/RIBA targets have been defined topdown, determining the potential for zero carbon energy generation in the UK by 2030 and allocating this energy among the building stock. If the energy targets are



Zero carbon targets vs measured EUI (kWh·m⁻²)



Sub-metering was installed in this Foster + Partners' office

exceeded, fossil fuels will still be needed as part of our energy mix. LETI/RIBA state a maximum energy use intensity (EUI) for offices of 55kWh·m⁻² per year by 2030.

How close is the average UK office building to the targets now, and what is the scale of the challenge? Data on actual EUI and CO2 emissions is not always easy to find, but national and global benchmarking schemes produce summaries comparing performance. In the UK, a national survey of UK building stock was carried out in 2012² and the Better Buildings Partnership produces

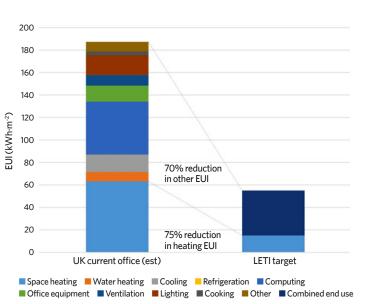


Figure 2: Typical office energy end use

A selection of current net zero targets with measured EUI for Europe and Asia is shown in Figure 1. (Note: the China standard does not include plug loads.)

Current office building EUI is exceeding net zero targets significantly. An average UK air conditioned office has an EUI of 187kWh·m⁻² per year and needs to reduce its energy consumption by around 70% to become net zero ready.

Even though the scale of the challenge is daunting, there is reason for optimism. Examples of newly built offices that have gone through a soft landing process show that low EUI is possible, while surveys following a group of UK buildings over time³ show a downward trend in office building EUI, with nearly 30% savings over 10 years.

In this article, we focus on office equipment and lighting energy consumption. These end-use categories, together, are responsible for 40-50% of EUI, so will need to be cut significantly (Figure 2). The average UK office EUI for IT, small power and lighting is 79kWh·m⁻² per year, but will need to be cut to around 25kWh·m⁻², leaving the remainder of the energy allowance for HVAC and other systems.

Foster + Partners has its main office campus in Battersea, London, where the majority of its staff are based. For environmental, social and corporate governance reporting and building performance

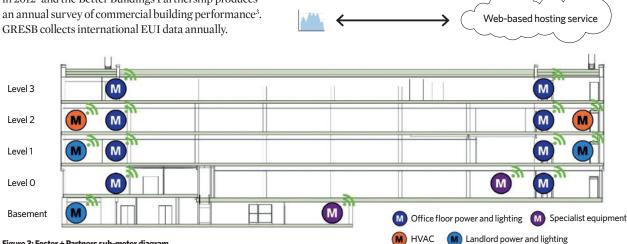


Figure 3: Foster + Partners sub-meter diagram

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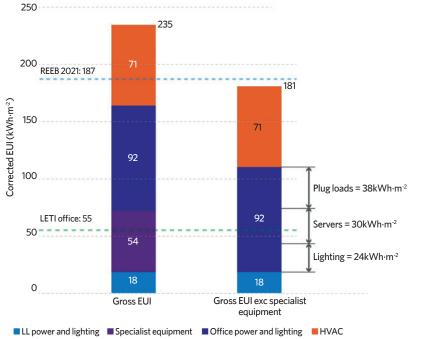
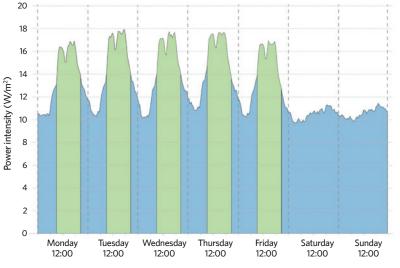


Figure 4: EUI breakdown by end use at Foster + Partners' office building

monitoring, energy data is routinely collected from the buildings and, earlier this summer, a new sub-metering system was tested in one of the buildings (see Figure 3). This consists of 15 meters installed on distribution boards to separate HVAC, common areas and office floors. For the office floors, small power, lighting and fan coil units are combined on the distribution boards.

The sub-metering system uses smart meters with GSM modem connection to a data-collection web service. Using GSM-based communications for metering simplifies the set up compared with BMS-connected metering, and improves reliability. From the web service, data is downloaded regularly, either as data files (csv format) or through an application programming interface. Once the data has been stored locally, the building energy use is visualised through Microsoft's Power BI dashboard.

Data quality is assessed by identifying missing or zero readings. Overall, the proportion of zero or missing readings is around 10%, so



Core + exended hours 08:30-20:00 Out of office hours

Figure 5: Proportion of energy in core working hours and unoccupied hours

the EUI figures were increased by 10% to compensate. Data was collected in August, September and October 2022, and is pro-rated to annual EUI. Overall EUI will be recalculated when a full annual data set is available.

The building was built in the 2010s and is all-electric with air source air conditioning for heating and cooling. In terms of overall performance, excluding specialist equipment (model making and prototyping), the building is similar to average UK offices. The heating/ cooling energy is slightly lower than average and office power higher (see Figure 4).

To break down the office power, lighting and equipment on a typical floor were surveyed, together with occupation throughout the working day⁵. These were compared with sub-meter data and the end-use split estimated. Office power EUI is measured at 92kWh·m² per year, which is more than three times higher than the LETI/RIBA target of 25kWh·m² per year. Plotting the average weekly trend in power intensity, we can see high usage outside of regular office hours, with the minimum power never falling below 50% of the peak (see Figure 5).

Reducing office power

To reach the target for net zero carbon operation, a large reduction in office equipment, server and lighting energy is needed. This must be balanced with the needs of the business, however, to provide a flexible working environment without compromising productivity or user convenience. The options in the panel (below) have the potential to reduce operational energy.

Initially, energy efficiency equipment was investigated before considering changes to out-of-hours operations and then office hours. Although none of the options reduces office power EUI to the 25kWh·m⁻² target, if we exclude server energy it is possible to reach the target with Option 2. With Option 3, reducing office flexibility results in further savings, but these are relatively small and would have a high impact on the operation of the office.

Efficient IT equipment should be used for significant energy savings with little impact on operations. Energy use should also be cut when the building is unoccupied – ideally by shutting down equipment. The importance of this is recognised elsewhere. For example, in California building regulations⁶ state offices must have controlled electrical sockets linked to occupancy sensors or timer controls. Something similar should be adopted in the UK.

>>

OPTIONS FOR NET ZERO READY OPERATION

Option 1: improving energy efficiency

- Replace all desktop PCs with laptops. In a recent study, we found new laptops were 40-60% more efficient than PCs
 Optimise lighting controls
- Option 2: enforce power off out of hours
- Turn off power to office floors out of hours
- Switch off lighting on office floors out of hours
- Option 3: reduce extended hours working
- Restrict office hours to 9:00-18:00



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NET ZERO IT, LIGHTING AND SMALL POWER

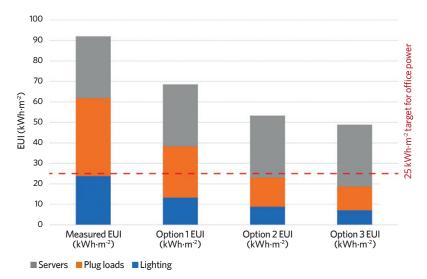


Figure 6: Estimated savings from different scenarios

More investigation is needed to address server energy >> consumption, which must be reduced in a net zero operational building. Server functions could be moved off site to cloud-based services, but the overall impact on energy use is not obvious and it may increase energy consumption elsewhere. One thing that is clear is that plug loads and IT equipment must be better understood by engineers if we are to design net zero ready offices.

Although not discussed in detail here, the HVAC system is being investigated by the facilities team for potential improvements to energy efficiency. Local override controls are being considered so that HVAC can be turned off centrally by default for out-of-hours periods and enabled only if needed. This should reduce the overall plant run times. Further into the future, we would like to introduce natural ventilation for mixed-mode operation by altering the glazing system



Energy-cutting measures must be balanced with the needs of the business

to add opening panels. Natural ventilation has recently been introduced to the nearby main studio building and is being monitored to assess impact on energy use and indoor air quality.

Finally, the impact of home and hybrid working is not investigated, but may be important for office EUI. As new working patterns are adopted, we need to understand how to adapt office design to minimise energy use. CJ

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- 6 Building energy efficiency standards for residential and non-residential buildings (Title 24, Part 6, and associated administrative regulations in Part 1), 2022, California Energy Commission

	Current power intensity (W/m²)	Option 1 power intensity (W/m²)	Option 2 power intensity (W/m²)	Option 3 power intensity (W/m²)
Lighting	5.0 / 2.9	4.0 / 1.0	4.0 / 0.0	4.0/0.0
Plug loads	8.0 / 4.5	6.4/2.4	6.4/0.0	4.8/0.0
Servers	4.5/4.5	4.5/4.5	4.5/4.5	4.5 / 4.5

Table 1: Summary of target office power for energy efficiency options (office hours/out-of-office hours)

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LIGHTING THE WAY

CIBSE's TM66 CEAM-Make guides manufacturers through CE requirements for lighting equipment and helps specifiers understand what they need to look for. **Dave Hollingsbee**, of Stoane Lighting, outlines how his firm has adopted the guidance – and what it still has to do



t is gratifying to see the speed at which industry is adopting TM66, CIBSE and the Society of Light and Lighting's guide to creating a circular economy in lighting. As well as offering practical guidance to adopting circularity, it provides an assessment method that allows manufacturers and specifiers to compare products' environmental impact.

Known as TM66 Circular Economy Assessment Method (CEAM)-Make, it measures products according to their design, material use, manufacturing method and ecosystem. Stoane Lighting has been using the methodology for two years to assess its products and, as a result, has updated its design and manufacturing processes to embrace circular principles.

There is also a simpler tool, TM66 CEAM-Specify, that allows designers, specifiers and engineers to make a quick comparison between products.

TM66 CEAM-Make features a list of 72 questions, with most asking for back-up evidence. These are split into four sections (see panel below). The following is a summary of Stoane Lighting responses and details of some of the changes it has made to its products and processes to improve circularity.

Availability of spare parts: this is asked in relation to optics, light sources, accessories, and so on, with higher marks for longer periods of

AREAS OF ASSESSMENT IN TM66 CEAM-MAKE

- Product design: covering topics such as design for long life and repair
- Materials: usage of recyclable materials rather than virgin
- Manufacturing: additive and subtractive techniques and localisation
 Ecosystem: repair or upgrade services to complement circular economy design

cover. Our five-year warranty and 20-year duty of care contribute positively to the score.

Durability of the luminaire and its parts over its lifetime: robust construction helps here, as again does the 20-year duty of care and an aspiration for extended life. More points are available relating to the ease of repair and ease of disassembly, as well as complexity of tools needed and access to information. We provide disassembly instructions for all products.

Use of adhesives: there is a higher score when no adhesives are used. Generally, Stoane scored well here.

In-house manufacturing: points are awarded according to the proportion of the luminaire made in-house. More control of components makes it easier to support repairs and remanufacturing in the future. Stoane manufactures in-house, uses its own designs and retains its drawings.

Geographical distance from manufacturer to installation site: the shorter the distance the better, so it is easier to facilitate repair and remanufacturing. As a UK manufacturer with most business in the UK, Stoane scores well.

Minimising unreusable waste: Stoane gained credit for product developments that avoided unavoidable waste.

Corporate social responsibility: the tool recognises that firms with audited CSR policies are more engaged. Being an employee-owned firm scores points for Stoane, which is a verified-benefit corporation (B-Corp) and silver-accredited by EcoVardis.

Increasing use of recycled material: Stoane's primary aluminium supplier uses high-percentage recycled content and we are making inroads into onsite remelting of our aluminium waste. We are also sequestering and elevating captured overspray from our finishing plant into high-value product.

Reusing components: marks are available if designs reuse, or can reuse, components from sister products. Stoane's ZTA range has intercompatibility across product types.

Biodegradable packaging materials: Stoane has moved from plastic packing to paper and card, and has volatile organic compound-free ink stamps.

Category	Points scored	Max points possible	Assessment
Product design	82.0	134.0	2.4
Manufacturing	33.4	46.5	2.9
Materials	11.0	24.0	1.8
Ecosystem	37.0	43.0	3.4
Overall performance	163.4	247.5	2.6

Score for ZTA spotlight in TM66 CEAM-Make

How to analyse the score				
0 to 0.5	Very poor circular economy performance			
0.5 to 1.5	Some circular economy functionality			
1.5 to 2.5	Definite/substantial progress to circularity			
2.5 to 3.5	Excellent circularity			

Table 1: Scores for the ZTA spotlight across four assessment areas



with an 'excellent' TM66 rating of 2.6

Mobile workshop: Stoane gained points for operating a mobile workshop to upgrade, repair and remanufacture on site.

Long warranties: high marks are given for product and parts supported for more than 10 years. Stoane has a 20-year duty of care.

There are other areas that Stoane is currently considering:

Date of manufacture on products: this helps in determining time in use, schedule for repair, and so on.

Component reduction: TM66 targets the reduction in component count and materials used. Theoretically, this simplifies products and makes them easier to treat at end of life or during repair.

3D printing: the tool incentivises efforts to reduce material wastage in manufacture. We use 3D print patterns, jigs, prototypes, and so on, but don't use it yet in production because of thermal, structural and longevity concerns.

Training: TM66 incentivises highquality, degree-level training in circular and environmental qualifications. We have numerous design and engineering graduates, and a PhD material scientist.

Plastics marked: points available if plastics used are marked. Not all of ours are.

Biodegradable materials: points are available for using biodegradable natural materials. It is important to look at this holistically. A good example of where circularity (TM66) should be looked at in parallel with carbon, employing TM65 'Embodied carbon in building services' and life-cycle analysis with consideration of actual life expectancy.

Longer warranties: points are awarded for extending warranty periods beyond five years. This has happened in some areas.

Light sources used exceed L70 100,000 hours: it is essential to consider other factors such as TM30-153 for a holistic view.

Serial number/QR code: a code linked to a luminaire logbook with service history gains points. Further passport-style tracking is under review.

We have begun to make TM65 and TM66 data available for all standard products via the 'environmental' button on our product pages. We have plans to present TM65 and TM66 data clearly on all fixtures we feature.

We are aware of a growing number of independent lighting design practices starting to seek TM data as a default, and provide specification tools, such as Arup's Luminaire Broker, while Spektd (offering luminaire specification software for lighting designers) also now has a field for TM66.

The impact on project procurement of TM66 could be substantial if all product scores are collated. Specifiers hold the power to make a much greater difference than individual manufacturers. **CJ**

TM66 is available at www.cibse.org/knowledge

DAVE HOLLINGSBEE is managing director at Stoane Lighting

THE HOPE SCULPTURE, GLASGOW

Lighting design: Buro Happold

The Hope Sculpture was created by designer and artist Steuart Padwick as part of Glasgow's COP26 legacy. The figure of the gender-, ageand race-neutral child reaches its arms out to a greener, hopeful future.

It was the first project to use TM66, says Stoane Lighting, with the Tadpole spotlight earning an 'excellent circularity' score. Buro Happold not only wanted a manufacturer that had lighting equipment based on circular credentials and sustainable manufacture, but also encouraged the company to reuse existing equipment.

'The finishes of the samples we provided to senior lighting designer Alexia Gkika were a bit mismatched, but that didn't matter to the performance of the fitting,' says MD Dave Hollingsbee. 'Instead, it was a nod to the key design narratives: use of reclaimed materials, upcycled equipment and low embodied-carbon content.'

The fittings supplied were miniature IP66rated Tadpole spotlights on bespoke arms and a single downlight to sit underneath the cementfree concrete statue. 'For this, we repurposed existing components to create something bespoke for the project,' says Hollingsbee.



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SPECIAL FEATURES

This month: News, Convent Way case study, aquifer thermal energy storage



Government awards £30m to heat network projects

Green Heat Network Fund grants go to Hull, Peterborough and Wigan

A government push to cut heating emissions has resulted in ± 30 m of funding for three communities' low carbon energy projects.

Hull and Peterborough are the first areas to benefit from the Green Heat Network Fund (GHNF), a £288m scheme set up to support the installation of heat pump, solar and geothermal technologies. A third development, in Wigan, will receive £2.6m of funding from the Heat Networks Investment Project.

Energy minister Lord Callanan said: 'It is vital that we invest in cutting-edge technologies that move us away from heating our homes and businesses with carbon-emitting fossil fuels.' Emissions equivalent to taking 5.6 million cars off the road for a year are expected to be cut by the GHNF scheme.

Peterborough's Integrated Renewables Infrastructure scheme, which burns nonrecyclable household waste to generate electricity and heating, is to receive around £14.4m. Just less than £13m will go towards a heat network in Hull that will reduce carbon emissions by more than 2,000 tonnes per year.

Wigan's funding will be used to develop a ground source heat pump system to generate heating and hot water for a £190m redevelopment project.

To boost investment in heat networks further, the GHNF application process offers streamlined access to the UK Infrastructure Bank's £4bn local authority lending product.

Vital Energi to connect Enfield to Meridian One

Vital Energi has been selected by Vistry Partnerships to deliver a district heat network project connecting Meridian One to the wider Enfield community. An extension of 2.5km of pipework will be added to the existing network, using multiple connections to deliver low carbon heat and hot water.

Meridian One is the first phase of the £6bn Meridian Water regeneration scheme to build 10,000 new homes. Ashley Walsh, managing director, heat networks, at Vital Energi, said: 'All welds will undergo ultrasonic testing, the pipework will be subject to pressure testing and hydraulic flush, and our solution includes a built-in alarm system that can identify network issues before they become a problem.'

Vital Energi has also future-proofed the network to make further connections easier.

Solar PV installed in decarbonisation project at college

A photovoltaic system installed on the rooftop of Burnley College Sixth Form Centre is expected to generate 280kWp of clean energy each year. The project is set to cut the school's annual electricity bills by more than £108,000 based on current energy prices.

The 750-module system comprises three solar arrays, recommended by installer Shawton Energy to maximise solar energy generation and provide cost-effective maintenance and operation.

An on-campus 'energy hub' has also been created to give students a hands-on opportunity to explore careers in renewable energy.

The decarbonisation project uses SolarEdge Power Optimizers that are directly attached to solar modules, maximising the output of individual modules, while providing real-time data on system performance and health.

'The technology provides advanced built-in safety features, reliability, and remotemonitoring tools, to allow us to create a system that we can manage effectively and maintain for many years,' said Jamie Shaw, managing director at Shawton Energy.



Guide published to protect heat network customers from soaring bills

New guidelines for addressing soaring heating bills and handling customer complaints have been issued by the Heat Trust. It urges heat providers to offer flexible payment plans to support families struggling to afford bills.

It had warned that monthly bills may rise as high as \pm 1,000 before the government announced support plans. However, households connected to communal heat networks will fall outside of the energy price cap.

Until new plans for how tenants on heat networks will receive financial aid is announced, the Heat Trust is expecting energy providers and landlords to experience an influx of billing disputes and complaints.

CASE STUDY CONVENT WAY

CURRENT CHALLENGE

To connect the all-electric Convent Way Passivhaus scheme to the constrained local grid in West London, the project team has reduced the load estimate by 53% compared with the conventional Rule of Thumb calculation method. Andy Pearson speaks to OODA Consulting's Henry Metcalfe about how this was achieved

> hen the London Borough of Hounslow set about redeveloping the Convent Way estate, it decided to demolish the existing 1960s buildings, with their

chronic repair issues. It would replace them with a scheme that will set a new urban dwelling standard for the borough and help residents address fuel poverty.

Bell Phillips Architects developed a masterplan for the estate, based on the delivery of 967 new Passivhaus homes, mostly apartments. The plan is to deliver it over five phases, to allow the current residents to be rehoused progressively without having to leave the estate.

Because the scheme is aligned with the RIBA 2030 climate challenge, embodied carbon is expected to be reduced with each phase of delivery.

The concept was for the 117 homes being built under Phase A to be all-electric, and for the homes' parking spaces to incorporate electric vehicle charge points. To deliver this sustainable scheme, the architect appointed QODA Consulting as MEP and sustainability engineers.

Together they set about designing the

first phase of the scheme to RIBA Stage 3, to enable it to be tendered. 'The full design and construction of Phase A will provide the template for the remaining phases,' says Henry Metcalfe, senior electrical engineer at QODA Consulting.

Constrained grid

Realisation of the all-electric concept, however, was far from straightforward in this area of West London, where there are already huge stresses on the electricity Grid. The district network operator (DNO) for the area is Scottish and Southern Electricity Networks (SSEN), which capped the additional load that the scheme could impose on its electricity infrastructure at 1MVA per year.

'As long as we phase the development and keep the additional electrical demand below 1MVA per year, SSEN says it can be accommodated,' says Metcalfe. The challenge for QODA was to develop an allelectric building services solution to comply with this requirement.

The scheme's heating was always going to have to be all-electric, adds Metcalfe, because there are no adjacent heat networks for the scheme to tap into. Using the BSRIA Rule of Thumb from 2011 gives a load of 7.5kW

per apartment for high-specification flats with electric cooking and heating. Even with the coincident diversity factor that BSRIA says may be applied for apartment blocks, Metcalfe says the figure is still extremely high and 'obviously outdated' - so QODA set about developing a more accurate estimate for the apartments.

The fabric-first approach enshrined in Passivhaus principles helped keep heating loads low. The proposal has been modelled on a 2050 weather file to future-proof the design. 'We did a lot of work with the architect to create the most efficient building form that would maximise solar gain in winter and minimise overheating in summer,' explains Metcalfe.

Initially, direct electric heating was considered. Although this would have been easier to install - and probably easier for







Left: The scheme's embodied carbon is expected to be reduced with each phase of delivery



estimate the peak diversified demand for Phase A at 176.4kW. 'I used the Passivhaus specific heating demand requirement of 15kWh·m² per year and specific heating load of 10W·m² into a tool I created in Excel and used the number of each apartment type to work out the total heat load,' he says.

Using the diversified ambient loop heat demand figure of 176.4kW, Metcalfe applied the heat pump COP to get an estimate for the electrical input. 'If you then factor in the coefficient of performance of 4.2 for the initial heat pump, that gives an electrical input of 42kW, he explains. If you then divide this figure by 117 (the number of apartments) you get a figure of 0.36kW.

'You can then add this figure to the 4kW electrical input for the apartment heat pump, which is fitted with an integral pump to allow for pumping power, you get an approximate total electrical input per apartment of 4.36kW for heating plus small power and lighting loads,' adds Metcalfe.

Apartment heat pumps have been designed to run in cooling mode in summer to provide tempered air via an MVHR. In the cooling season, the heat pump will temper the air via a cooling coil in the supply air ductwork.

Heat removed from the apartments is



"A second-stage heat pump in each apartment will upgrade the ambient loop heating temperature from 20°C to 45°C"

occupants to use - Metcalfe says it is 'not as efficient as a heat pump-based solution and has limited load diversity at scale'.

Instead, QODA has opted for what Metcalfe describes as a 'two-stage' heat pump solution incorporating an ambient loop' for the scheme's first phase. 'Heat pumps are so much more efficient at scale due to the diversity that can be applied, and they have a better coefficient of performance (COP) than direct electric,' he adds.

The two-pipe ambient loop serves all three apartment blocks being constructed under the initial phase. The large first-stage

air source heat pump mounted on the roof of one of the blocks will maintain the loop temperature at around 25°C. 'That heat pump has a heat load that has been diversified by the mechanical engineer, as recommended in CIBSE CP1, so we simply provide the electrical input to meet that diversified heat demand,' Metcalfe says.

A second-stage heat pump in each apartment will upgrade the ambient loop temperature from 25°C to 45°C for space heating. Radiators are significantly larger than if they were operating at Delta T of 50°C. However due to the reduced heat losses, they are still modest in size.

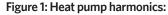
The domestic hot water (DHW) is also generated by the second stage heat pump, and stored in an integral cylinder at high temperatures that prevent legionella growth.

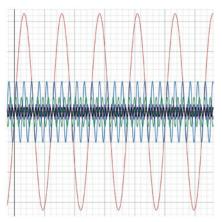
Metcalfe says QODA was able to

>>

CASE STUDY CONVENT WAY

Built in five phases, the new estate will eventually have 967 Passivhaus homes, mostly apartments





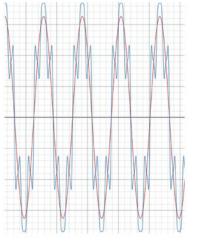
The left-hand graph shows the normal current sine wave in red, with the other colours showing the harmonic distortions at each fundamental frequency

 rejected into the ambient loop so other apartments can use the heat to reduce the need to run the main heat pump.

One major issue thrown up by the project is electrical harmonics generated by the heat pumps. 'We've been talking to a major heat pump manufacturer,' says Metcalfe. 'The data they provide are rated power, full load current, starting current, and nominal running current; what they don't give you is any kind of harmonic information on waveform distortion.'

Electrical systems can tolerate some harmonic content, but when harmonics are excessive, problems can arise, including overheating of the distribution cables and circuit breakers. When Metcalfe plotted the harmonic distortion information he had obtained from one heat pump manufacturer on a graph, he found the harmonics of above were excessive at over 10% (see Figure 1).

'It depends on the heat pump model, but the manufacturer gives it as between 30% and 40% total harmonic distortion over the



The right-hand graph shows the normal current sine wave in red, with the sum of the harmonic distortions in blue – in this case, an increase in 20% in the full load current

"If we were to size the cable taking the heat pump data sheet at face value, we'd potentially be undersizing the distribution"

normal sine wave,' explains Metcalfe. He says it is normal to allow between 5% and 10% to account for harmonics when cable sizing: 'Anything more than that and you'd expect the manufacturer to have some sort of passive filter in place to limit the impact, but not in this case.'

As a consequence, the associated harmonics resulted in a 20% increase in the full load current. 'Essentially, if we were to size the cable taking the heat pump data sheet at face value, we'd potentially be undersizing the distribution, because this 20% noise would be adding resistance and heat to our cables, causing them to overheat - I was quite shocked, Metcalfe says.

It's not just the main heat pump for which harmonics are an issue. There would also be an element of noise from each of the dwelling heat pumps, 'which all add up', says Metcalfe. The solution, he says, is to keep the problem loads separate from the other loads.

'We can oversize the electrical distribution for the problem loads to accommodate the noise – but if it the harmonics issues with heat pumps gets worse we would like to investigate using passive filtration,' he explains.

Charging electric vehicles

The issue of harmonics is also expected to affect the electrical infrastructure for the scheme's electric vehicle (EV) charging, and Metcalfe has contacted major EV manufacturers for information on harmonics.

'Electric cars will accept AC from the charger; it's the cars themselves that transform AC to DC to charge the batteries. So within the car there will be an inverter creating its own level of harmonic distortion that will go back through the charger and on to our distribution,' he says.

'I'm only presuming this because I haven't received information back, but I doubt they are putting passive electrical filters on their cars, so when you many cars plugged in, it will be a cumulative of the harmonics going back to the distribution board.'



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➤ Convent Way has 45 EV charge points serving the 117 apartments. This complies with the London Plan's requirement for 20% active charging and with the new Approved Document S (ADS) of the Building Regulations, which goes beyond the requirements of the London Plan. Because the number of parking spaces is less than the number of dwellings, all parking spaces must have access to an electric vehicle charge point, and the charging points must be 7kW minimum, to comply with ADS.

Rather than size the electrical supply for all 41 points charging simultaneously, Metcalfe says the latest amendment to the wiring regulations, BS7671, allows diversity of use to be taken into account to help manage the EV electrical loads and a requirement for load management.

As the number of charge points is less than the number of dwellings, UK Power Networks gives a diversity factor of 0.8 that can be applied on condition there is some form of load management or shedding.

Managing the EV loads (see panel, right) is important because, when combined with the electrical loads from the dwellings, they give the total electrical load for the scheme. 'If we had based the loads on the BSRIA Rule of Thumb figure, with load diversity applied to the apartments but not to EV charging, we'd be at a total load of 1.197MVA for the scheme, which is higher than the 1MVA the DNO can accommodate,' says Metcalfe.

However, by building to Passivhaus standards to reduce energy needed for heating, using heat pumps, having more accurate load assessments, and incorporating diversity for EV charging, the estimated total electrical demand figure is now low enough to enable the first phase of the Convent Way regeneration scheme to go ahead.

'By reducing and managing load where possible and estimating a more realistic consumption of the building we've managed a 53% reduction in assumed maximum electrical demand, to 634kVA,' Metcalfe says. Quite an achievement. **CJ**

"BS7671 allows diversity of use to be taken into account to help manage the EV electrical loads and a requirement for load management"





EV LOAD MANAGEMENT

If the EV chargers run at 100% they will have a big impact on the loads, says Metcalfe. 'We've had to look at this in an intelligent way because we don't know how many residents will have EVs – and of those who do, we don't know how many vehicles are likely to be charging simultaneously,'

There are two methods of managing the cumulative loads from the EV charge points – dynamic or active – and the scheme is likely to have a combination of the two.

In the case of a dynamic load limit, where all the chargers are fed from one distribution board, Metcalfe says the load limit could be set at a pre-determined limit by programming the chargers on a first come first served basis, or by lowering the output to all charge points so all cars will be charged at the same rate.

'That would be unintelligent load management because it does not take into account what's happening with the rest of the site,' he says.

Active load management would work in conjunction with the dynamic load limit using a current transformer (CT) clamped onto the live or neutral wire coming into the building. The alternating current flowing in the CT's winding produces a magnetic field, which induces a current proportional to current being drawn by the Phase A development.

'If we can understand what power is being drawn by the site, we can control the rate of EV charging accordingly,' Metcalfe explains. 'We will still have a preset limit, but at night – when demand drops – there will be a scenario when we could surpass the unintelligent EV limit.'





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A PLAN FOR ALL SEASONS

Seasonal thermal storage has the potential for significant carbon savings, but there are few examples in the UK. **Alex Smith** speaks to Belgium firm IFTech about how the technology can provide low carbon heating and cooling for energy networks

eating and cooling buildings with electricity, rather than gas, is seen as essential to the UK hitting its 2050 net zero targets. With green hydrogen for heating not expected until at least 2030, the transition to all-electric buildings is in full swing. Heat pumps are now the default specification on new schemes and retrofits, but there are concerns that the demand for electric heating and cooling – as well as charging for electric vehicles – will be too much for grids to cope with.

Developers are having to factor into their projects the costly upgrade of electrical infrastructure. The all-electric Convent Way housing development in west London, for example – featured on page 34 – is facing significant infrastructure costs because of local grid constraints.

One way to reduce a scheme's electrical power requirements is to store power from renewables and waste energy on site, through the use of battery or thermal energy storage. Storing heat and coolth evens out the demands on the power grid, reduces energy bills for consumers, and cuts carbon emissions.

Aquifer thermal energy storage (ATES) is a seasonal storage technology that is experiencing renewed interest as building owners strive for net zero and reduced bills. Well established in the Netherlands and Belgium, ATES is an open-loop system that stores coolth and heat in two aquifers at up to 250 metres underground. It can be used in conjunction with individual buildings or energy networks.

UK heat pump manufacturer Clade has partnered with Belgium ATES company IFTech to promote the

technology in the UK market. IFTech has already built 10 aquifers in the UK, but thinks there is plenty of room to grow. 'As we overload the Grid, and as renewables become more dominant, we need to manage both sides of the Grid – demand and supply,' says Raf Schildermans, director at IFTech. 'ATES systems allow you to do this on a seasonal basis.'

THERMAL STORAGE ATES

In IFTech ATES systems renewable and waste energy generated by developments is stored at temperatures of 7°C and 17°C in cool and warm aquifers. In the summer, thermal energy is extracted from the cool aquifer to provide cooling and, in the winter, thermal energy from the warm store can be used for heating. Aquifers can be injected with waste heat and cool, from the building or energy network, that would otherwise be lost to the atmosphere. For example, the waste heat generated by a heat pump when providing cooling in summer can be injected into the warm store, to be used in the winter for heating.

One project is at Wandsworth Riverside Quarter, where an ATES works across an energy network delivering 1.80MW of heating power and 2.75MW of cooling. The system of eight wells reduces the development's annual carbon emissions by 450 tonnes. Another project is at the National Maritime Museum in Greenwich, which had an ATES with heat pump installed in its new South Wing in 2011. Heating and cooling capacity is 300kW and 350kW respectively.

The key to a well-performing system is maintaining the delta T between aquifers at 10K, says Schildermans. 'If you don't safeguard the delta Ts, your efficiency won't be any better than an air source heat pump,' he adds. The set-up consists of the storage water system and a geothermal energy centre. The control unit must allow the system to be monitored and charged remotely. 'It's important to safeguard yields. We monitor temperatures, flows and energy balance,' says Schildermans.

Software generates a monthly report showing heating and cooling and the coefficient of performance. You can see yield and temperatures \gg

THERMAL STORAGE ATES



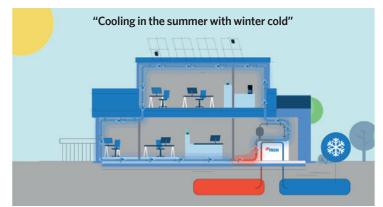
Figure 1: The cool and warm aquifers in the winter and summer

decreasing gradually, so there is time to mitigate any problems,' says Schildermans. One issue is a building using more heating than designed for, meaning temperatures fall in the warm aquifer. To maintain temperatures in the aquifers, the system provides cool or heat via dry coolers or heat pumps. Ideally, you don't want to use these 'balancing assets', as they will require power and decrease the system's efficiency.

Smart energy grids are making it more cost-effective to charge the aquifers. 'If we need more heat, we can charge the aquifer when there is a lot of PV production on sunny days, for example,' Schildermans says. Charging the cool aquifer is more challenging, as the average price of electricity in winter is high – but passive cooling is possible, says Schildermans, because you can use electricity powered by wind, or at night when there is less demand and it is cheaper. Cooling is the 'real power' of ATES, he adds: 'There is no more efficient technology. You earn your return on investment rapidly because of the high price of cooling.'

As maintaining the ATES is so important, the company offers an 'energy as a service' model, where clients pay a yearly energy cost for guaranteed performance from the ATES. This can include costs for electricity, exploitation, maintenance and even investment.

Operators of ATES networks can help balance the system by offering incentives to occupiers to heat or cool buildings. They may give away cooling if it helps charge the heating aquifer when needed. In one ATES in Germany, Schildermans says traffic-light signals indicate to occupants how expensive it is to heat or cool at any one time.



ATES can work on ambient networks with decentralised heat pumps serving apartments, or on a centralised system where one heat pump can produce water at higher temperatures. In Belgium and the Netherlands, they are working on bringing down the heat demand in existing buildings so that energy networks can move to lower ambient temperatures. 'If users have high-energy distribution systems, that is demanding for a 5th-generation network. Ideally, you would carry out deep retrofits, so reduce heating demand,' says Schildermans.

In the Netherlands, IFTech have established a series of aquifers over 10 years to deliver 25MW of cooling and heating to a mix of new and retrofitted buildings. 'With this technology, you can be modular and drill wells when you need the extra capacity,' says Schildermans.

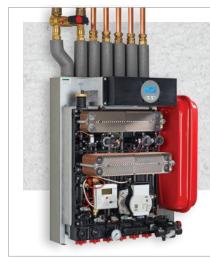
So what are the opportunities in the UK? Tim Rook, Clade's chief markets officer, says universities and hospitals are showing interest in the technology. 'University energy bills are going up astronomically, so they have to have a serious look at what they are doing', he says. CJ

GROUNDS FOR ATES

The success of ATES depends on ground conditions. A feasibility study is essential before test drilling, says Rook. Unless IFTech has empirical data on ground conditions, it will do a pre-feasibility study to estimate the 'yield' from the well. Test drilling assesses the geohydrological potential of the site when underground conditions are uncertain, and, if successful, becomes the borehole for the well.

Ground conditions must be well understood for drilling, says Schildermans. In London, the chalk requires certain materials in the casing to avoid corrosion, while filters are essential in sandy areas. It is also important to drill to the right depth to avoid the risk of not extracting enough water. When designing the location of wells, heating and cooling bubbles must not contaminate each other, says Schildermans. A big system will have different warm and cold bubbles working together.

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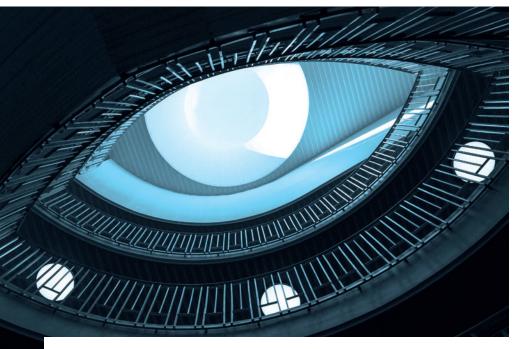
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CPD PROGRAMME



Responsible monitoring of built environments

This module explores the recently published *TM68 Monitoring indoor environmental quality* and its guidance on the ethical approach to measurement, monitoring and data management

The measurement of indoor environmental quality (IEQ) and the responsible management of resulting data is fundamental not only to control the building services systems, but also to assess and improve the opportunities for success in creating safe and responsible built environments. This CPD will draw selectively on the recently published *Technical Memorandum 68 Monitoring indoor environmental quality* (TM68), and will specifically focus on the guidance on the ethical approach to measurement and monitoring of built environments, as well as the increasingly challenging task of responsible data collection and management.

The much misattributed and misquoted adage 'If you can't measure it, you can't manage it' provides a suitably succinct reminder of the need for a robust and appropriate sensing, monitoring and data management regime for building services systems. There has been much written about the 'performance gap', and there are increasingly urgent demands on building operators to moderate energy usage, operational costs and environmental impact while maintaining safe and healthy built environments. The publication of the new TM68 is, therefore, a particularly well-timed addition to the CIBSE catalogue. Although the TM does not profess to be an encyclopaedic reference, it effectively provides an excellent framework by covering key requirements for environmental measurement, monitoring and associated data management in buildings. (Much of this article is based on abstracted and abbreviated text taken from the TM – for more complete detail, see the TM, freely downloadable for CIBSE members.)

TM68 provides an overview of how data collected in real buildings can convey meaningful information about IEQ by providing primers on current technologies and recommendations. It notes that 'priority has been given to factors that directly impact occupants' comfort and wellbeing'. The initial chapter provides a summary of the most important issues to be considered before embarking on an IEQ monitoring project, such as stakeholders' involvement, ethical considerations



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and privacy issues, among others. The following four chapters - thermal comfort, air quality, luminous quality, and acoustic quality - examine units and performance metrics, available instruments and sensors, practical sampling considerations, and reallife case studies. These four chapters are not considered further in this article - which is not to diminish their importance or the quality of the work, but simply in order to focus on some of the more novel aspects covered in the TM. The final chapter of the TM provides a rare contextualisation for built environment professionals of continuous sensing systems and data management - this will be explored in more detail later in this article.

For those who are research active, the potential impact of measurement on building occupants has long required a formal assessment prior to any activity being undertaken. The TM gives an early airing to ethical issues that, historically, may not have been seen as relevant to, or previously given the priority by, practising building services engineers as much as they are today. It is contended that the pervasiveness of measurement possible with new technologies – especially imaging, wearables and so-called internet of things (IoT) devices – gives rise to concerns about surveillance such that it should be considered alongside or before the technical considerations, perhaps as part of the goal-setting and expectationmanagement process.

The TM cites various legislative and guiding instruments that provide a base line for good practice, noting the reasonable expectation to meet or exceed these requirements. The legislative tools typically focus on fundamental aspects of privacy, such as obtaining consent, data use and storage, and other practices typically known as 'data management'. Elements of a good data management plan are noted as including: Clear consent gathering

- Secure transfer and storage
- Appropriate use of different data streams
- Limiting usage of data to the purposes set
- out in the original consent statements Secure and timely deletion of data, whether on request or upon expire of
- whether on request or upon expiry of consent or expected term.

A rule of thumb is suggested that when data are traceable to a person or record, any aspects of a person – such as medical history, preferences or feedback – they must be handled with more care and security than, say, environmental data. This might mean restricted access, automatic deletion or expiry, better encryption, or other measures.

Although the TM suggests that designers and specifiers of buildings and systems cannot reasonably be held responsible for enforcing ethical limits on clients and data users, it notes that the specifier is obliged to ensure that both the design of the system and the documentation contain guidance and reasonable safeguards against misuse.

An area of the TM that truly catches the zeitgeist – and one that is likely to stretch the knowledge envelope for many professionals in the built environment – is addressed in the extensive final chapter, which considers the management of continuous sensing systems and their data. It describes recommendations and best practices for collecting and using data gathered from sensors and meters in and around buildings, focusing on the practicalities of – and issues associated with – data collection from operational buildings.

The TM recommends that the building services engineer should plan for the ways in which protocols (the standardised rules that allow successful transmission of information between devices), systems and standards for data exchange interact with each other, how the data can be made easily accessible,

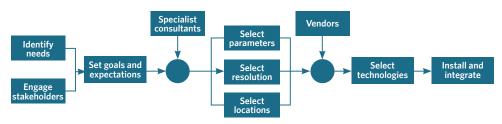


Figure 1: The decision-making process for selecting a continuous measurement system. Addressing several factors at once may improve outcomes for occupants and for the utility of the system

and how they ultimately influence their own workflows or those of other building managers. It suggests that the decision-making process for specifying a sensing system should follow a process familiar to building services engineers, as in Figure 1.

The frequency with which measurements are taken and/or the spatial density of sensors determine the resolution, or granularity, of measurement. More spatial coverage means more hardware, and a greater frequency of collection requires more data to be transmitted, stored and analysed. Approaches – such as varying the resolution at various times or for a particular building use – will depend on how closely a measurement must resemble the 'true' parameter values, and the resulting impact on the proper operation of a building. The TM highlights that there are no fixed rules on the number of data points or frequency of measurement.

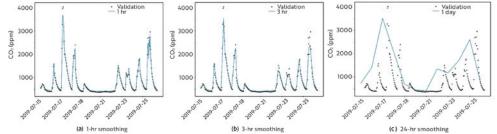
In any case, if the measurement system is not integrated into building workflows it is unlikely that the data gathered will influence the actions of building managers and users, so a growing trend is to gather and integrate multiple data streams from around a building into a single accessible resource.

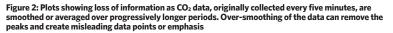
Retrofitting novel IoT-based continuous monitoring systems may be more challenging in existing buildings that may have previously not included any regular data collection. The benefits of aggregating such data can include the ability to control existing heating, ventilation and air conditioning (HVAC) systems using measurements from several IEQ sensors; providing holistic input for predictive maintenance; and automatically reporting to post-occupancy evaluation tools.

Measured environmental data will normally require post-processing that might include cleaning (removing out of range values); transforming (scaling or shifting data); and rounding, truncation or conversion. As illustrated in Figure 2, there is a limit to how much smoothing and cleaning is useful, and an overzealous procedure could obscure a genuine problem that produces an extreme, but valid, measurement and so, for some investigations, raw data may be preferred.

A prerequisite of data management is data security. This is examined in detail in the CIBSE Digital Engineering Series¹ of publications but is covered briefly in the TM, including a list of measures to increase resilience to common cyber-security issues (as shown in the boxout panel, 'Measures to increase cyber-security resilience').

Data are most usable when properly and systematically labelled and encoded, and while an installer may be able to systemically specify names and labels for a new system, there may already be existing systems that contain data about a building, such as the building automation and control system (BACS) or BIM models. There may also be existing middleware – software that mediates between different software and systems – that offers the opportunity for easier integration using





standard components. Compatibility with existing data sources can significantly improve the value of the measured data.

IEQ measurement systems increasingly store and analyse data employing applications hosted in remote 'cloud' infrastructure. The data would normally be stored in databases that include the recently applied 'time series' databases, which enable continuous and efficient storage and processing of large amounts of real-time data organised in time-value pairs. Data should normally only be stored if they will be used at some point, and reasons for storing data for an extended time may include: Looking at long-term trends

- Novel methods and analyses made possible by large datasets
- Comparison of performance across several years
- Benchmarking across different building types
- Future research opportunities.

There may be client requirements for data to stay on site or within a certain jurisdiction because of security concerns, and data may need to be deleted after a reasonably short period to reduce the possibility of being nefariously used to gather intelligence. Offsite storage and analysis, especially when hosted on the public cloud, will ease the display, sharing and analysis across multiple interfaces and access points. A BACS may still be a local processor for the data – displaying, analysing and controlling systems based on measured data – but cloud-based systems can significantly expand the opportunity for reporting, certification, or multi-building analysis.

There are opportunities to reduce data transfer, throughput and storage with the use of so-called 'edge computing', where sensing tools and local communication devices interpret raw data and transmit only the information that is relevant to a human user or BACS. For example, an 'intelligent' camera could analyse images to determine the number of people in a given space and only transmit this value back to the cloud, without retaining the source image. This can help alleviate privacy concerns, reduce the data transfer, and so reduce data storage. Many sensors/ devices now include integrated data logging and networking to enable direct connection to the web.

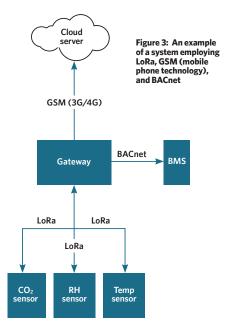
Systems – particularly cloud-based – can self-diagnose and provide alerts or health indicators in real time. However, performance and reliability will be improved with maintenance, systems redundancy, regular testing, and inspection.

The TM provides an overview of common technologies and protocols for data collection from IEQ sensors, noting that the best protocol for a continuous monitoring system will depend on the sensing devices being used, existing communication infrastructure, and the extent of acceptable intervention or disruption. Each protocol offers advantages and disadvantages in terms of cost, limits on coverage and granularity, and reliability. Data can also be served directly by a sensing device, or using protocols such as building automation and control network (BACnet) over wired, wireless or physical internet protocol (IP) ethernet connections.

It is important to ensure that the data are usable and 'fresh' – delivered to a server or user at the correct time. There are a multitude of vendors and protocols for systems that measure indoor environmental conditions, where data are collected by a continuous measurement system and either passed to a cloud server before being pulled back down by other systems, or exchanged by the hardware on site. Onsite compatibility of systems would entail sharing of communication hardware so that data are available from multiple systems without going through the cloud. This can be achieved by the building manager or owner themselves, either by using industrystandard protocols such as BACnet, hardware 'bridges' (physical devices that can

MEASURES TO INCREASE CYBER-SECURITY RESILIENCE

- End-to-end encryption of data
- Reduction of personally identifiable data collected
- Safe deletion of personal data after reasonable use
- Stronger authentication process for manager or administrator users
- Limited remote access to data and control or administration systems
- Removal of rights for departed employees and contractors
- Ensure data service providers hold and process data to appropriate information security standards



communicate with sensors from different vendors), software drivers or middleware, or some combination of these. An advantage offered by some modern IoT protocols, such as LoRa (from 'long range') illustrated in Figure 3, is that in theory the communication hardware provided by any manufacturer can be used to transmit the data from sensors made by any other manufacturer.

Two systems that use the same protocol may not necessarily 'talk' to each other automatically, but may instead need middleware or drivers. Open APIs (simplified, openly available software links between applications) allow IEQ measurement systems to be connected to existing building automation systems without the need for specialist drivers or hardware. Most system providers will deliver (serve) data in common formats through an API (which would require proper security authentication) allowing building management teams to interrogate and store data on their own servers, databases and spreadsheets.

Once data are collected at a site, they must be typically transmitted to a cloud database (known as 'backhauling') – the TM discusses wired versus wireless backhauling – plugging into a physical wired network, and the use of existing IT systems compared with a physically separate network.

This article has provided a flavour of TM68 that the foreword suggests 'aims to provide a starting point for all building professionals', and it would appear a worthwhile investment for any building professional to take the time to discover, or refresh, knowledge in this fundamental technology that underpins the success, or failure, of built environments. © *Tim Dwyer*, 2023.

Turn to page 48 for references

Module 210

January 2023

- > 1. Which of these is not explicitly covered as a chapter in TM68?
 - □ A Acoustic quality
 - 🗆 B Air quality
 - □ C Luminous quality
 - D Occupant satisfaction
 - 🗆 E Thermal comfort
 - 2. At what point is it suggested that concerns about surveillance should be considered?
 - $\hfill\square$ A \hfill As goals and expectations are set
 - □ B As locations are selected
 - \Box C As resolution is established
 - □ D During parameter selection
 - 🗌 E When obtaining input of specialist consultants
 - 3. Which of these is not specifically listed as a measure to increase resilience to cyber-security issues?
 - □ A Employ passwords with at least eight characters
 - □ B End-to-end encryption of data
 - C Limited remote access to data and control or administration systems
 - D Removal of rights for departed employees and contractors
 - □ E Safe deletion of personal data after reasonable use
 - 4. What is the term for computing technology that, for example, would include the use of a camera that processes images and then only sends data providing the number of room occupants (with no image) to the cloud?
 - 🗆 A Edge
 - 🗌 B LoRa
 - 🗆 C BACnet
 - D Time series
 - 🗆 E Raw
 - 5. What does the term 'backhauling' refer to?
 - A Drawing on external data sets (such as weather forecasts)
 - B Feedback from the environmental parameter to the sensor
 - C Method of transferring data from Wi-Fi to ethernet
 - D Moving site-collected data to a cloud database
 - □ E Returning responses from cloud controller to site

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References:

1 Digital Engineering Series, CIBSE bit.ly/CJJan23CPD1

PRODUCTS & SERVICES

> Products of the month

Rinnai launches free design service for heating and hot water

Heating manufacturer says service will make capital and operational savings

new design service offered by Rinnai aims to help customers make important decisions about the products selected for its hot water and heating systems. The company says the benefit of having a specifically designed system are savings in purchase and running costs, and the reductions in carbon emissions.

Certain properties may be better suited to a specially designed heating and hot water delivery system, says Rinnai. For example, hybrid heat pump or solar thermal with BioLPG options could be the better solution for heating and hot-water delivery when considering offgrid rural locations. This set-up is particularly valuable for customers with a high demand for heating and hot water, according to Rinnai.

Inner-city occupants might be advised to look at utilising hybrid designs, including hydrogen-ready units for gas blends of up to 20%.

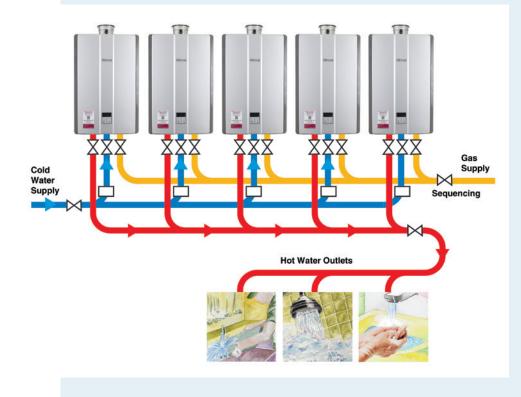
An example of this would be a customer who owns an urban retirement community, consisting of three Edwardian houses with a mixture of different heating and hot water delivery applications. Rinnai is able to design and install one whole system that guarantees maximum output and minimises fuel and operational costs, while considering the feasibility of the solution from the perspective of the building and the budget.

As well as advising on what system should be installed, Rinnai will design a heating and hot water system that complements the customer's site. At any location, Rinnai can engineer a system that will help the client to reduce costs and carbon emissions.

Rinnai operations director, Chris Goggin, said: 'We have positioned the Rinnai name as a company that offers the highest quality product and best available value with service excellence. It is a position of responsibility and we have maintained a stance of doing the absolute best we can for customers.

'We believe implicitly in this basic premise: we





do the best we can, and we achieve what our customers want and expect. And that includes anticipating the future. We are manufacturers of proven excellence and are using our core competencies of design engineering solutions to suit all possible future needs and fuels.'

Rinnai offers a range of decarbonising and cost-reducing energy options that are applicable to all types of properties. Heat pump, BioLPG, solar and hydrogen solutions can fulfil all domestic and commercial energy demands.

The new heating and hot-water delivery design service is to become part of Rinnai's H3 range of products. It will offer customers details on reducing costs and will help ensure correct decisions are made about system design and installation.

Rinnai's H3 product roadmap is engineered as a pathway to reach net zero carbon targets. The product and service offering is based on hydrogen, heating and heat pumps, which allows residential and commercial sites to maximise their energy efficiency and performance in striving for net zero and decarbonisation.

Additionally, Rinnai is focused on developing electrical formats for all existing product ranges, to be introduced within the next few months. This includes a wide selection of commercial heat pumps, alongside hydrogen blends-ready and hybrid hot-water heating systems.

Rinnai's commercial and domestic hotwater products offer a limitless supply of instantaneous temperature controlled hot water, said the company, and all units are designed to align with present and future energy sources and accept either natural gas or hydrogen gas blends. Rinnai said units are also suited for off-grid customers who require LPG and BioLPG or rDME.

Rinnai's water-heating products are all hydrogen-blends ready now, including the world's first 100% hydrogen-powered water heater. Rinnai products also accept BioLPG capable of delivering net zero carbon emissions.

- For more information on the Rinnai product range visit www.rinnai-uk. comcarbon-cost-comparison-form
- For the free service email engineering@ rinnai-uk.com or phone 0300 373 0660

> Products of the month

Rinnai announces solar products for continuous-flow hybrid systems

Partnership with Naked Energy sees integration of solar collectors in systems

Raward-winning range of VirtuHOT and VirtuPVT solar thermal collectors alongside its heating and hot water systems.

Naked Energy is a British design and engineering business, with a focus on innovation in solar thermal and PVT. Its VirtuPVT collector combines solar photovoltaic and solar thermal technology (PVT) to generate both electricity and heat from a single collector, and its modular design makes them the world's highest energy density solar technology, according to Rinnai.

The VirtuHOT collector generates solar heat only, and offers high-energy density over a broad temperature range.

Solar thermal power is an important tool for supporting the road to decarbonisation. Naked Energy's high-energy density solutions are capable of decarbonising heat costeffectively and with limited space. Its solar PVT technology delivers up to 3.5 times the carbon savings per m² in comparison with conventional solar PV. Combined with the Rinnai continuous flow hot-water heating system, this will save carbon that is created through any of the traditional storage-based systems, while also creating a low carbon solution that combines the simplicity of installation with cost-effectiveness.

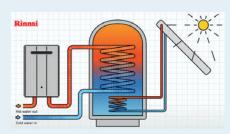
'This is a genuine and unique innovation in marrying the technology of solar thermal products with continuous-flow hot-water heating to minimise fuel and operating costs,' says Chris Goggin, Rinnai operations director.

'The solar gains created by Naked Energy are supported by Rinnai innovations. This technology can read the incoming water temperature and modulate to maximise the solar gains'.

All of Rinnai and Naked Energy's solar thermal products are aligned with their hot-water heating systems and units. These are also designed to be both hydrogen blends-ready (20%) and renewable liquid fuel (BioLPG) ready. Using less space, the VirtuHOT solar thermal design will gain solar energy while the continuous-flow water heaters will modulate to use less energy while creating more plant room space.

The solar, water heater and hybrid technology is designed with efficiency and effectiveness in mind. Multiple workshops







with experienced installers were hosted during the core design phase for the VirtuHOT. Valuable insights gained from the sessions were integrated into the model and inspired innovation for the methods of transportation, installation, and maintenance.

VirtuHOT's low-profile design and modular assembly keeps life simple for installers and maintenance teams. The same holistic thinking applies to the lightweight, high-output Rinnai water heaters, as these have also been designed with ease of installation in mind.

Rinnai water heaters modulate from 58kw to 4.4kW, so the smart systems only use fuel to boost the temperature by the precise solar deficit. This harnesses renewable gains without compromising on performance. The greater returns from VirtuHOT delivers up to 50% greater financial returns per m² in comparison with conventional solar technology.

Up to 30% of operational running costs can be saved when using intelligent hot water systems, compared with alternative storage systems. This helps reduce fuel costs and the exposure to ever-increasing energy and climate change legislation.

A design-led architecture and turnkey solution makes VirtuHOT easy to install, keeps maintenance to a minimum and is backed by a warranty of up to 10 years. The compact (670x470x276mm), lightweight water heaters (one-man lift) can be sited internally or externally.

Rinnai say the VirtuHOT solar products will perform in any environment and reduce scope one emissions using 100% renewable solar heat at a higher energy density. The products have a simple modular assembly, with integrated mounting. It is self-ballasting and there is no need for roof penetration. Designed for commercial scale, the solar products are compatible with any roof type, with an installed height of only 26.5 cm.

Solar thermal and hybrid systems can be supplied to support both new and retrofit projects, lowering carbon and connection technologies, and energies at any site.

Commercial products that accept clean sources of energy are in development, in the form of hydrogen and renewable dimethyl ether (rDME), along with a growing range of electrical equipment. To facilitate this progress, Rinnai employs more than 465 design engineers and reinvests 6% of its annual revenue in R&D.

Rinnai's H3 range consists of hydrogen/ BioLPG, heat pump and hybrid technologies. All are supported by system design, along with carbon, capital and operational costings feasibility studies, to ensure that the correct solution is selected for any building type.

For more information contact engineer@rinnai-uk.com

> Products of the month

New generation R-32 VRF system helps decarbonise commercial buildings

Toshiba's variable refrigerant flow system offers up to 80% reduction in carbon emissions

oshiba Carrier's new generation variable refrigerant flow (VRF) system offers a reduction of up to 80% in equivalent carbon emissions, according to the company. This has been achieved through operation on lower global warming potential (GWP) R-32 refrigerant and reduced refrigerant charge of the system.

It gives end-users an efficient, high-quality cooling and heating solution, enabling offices, shops and restaurants, healthcare facilities, and educational establishments to achieve sustainability credentials, Toshiba says.

'With the race to achieve net zero, building owners and operators are under increasing pressure to minimise their carbon footprint,' says David McSherry, head of Toshiba DX, residential and light commercial, TCUK. 'As the price of R-410A rises and availability falls, R-32 offers the optimum alternative, with significantly lower GWP, reduced costs and



improved energy efficiency. It's a win-win for customers and the environment.'

Modifications to enhance comfort performance and energy efficiency contribute SEER of up to 8.9 and SCOP up to 4.67, including selecting either three-pipe heat recovery or two-pipe heat pump operation; a new twin-rotary compressor with liquid injection; split heat exchanger; sub-cooling plate heat exchanger; new, high-performance fan motor; and unique thermodynamic circuit. Innovative flow selectors with up to 12 ports give enhanced flexibility and optimise the ability of SHRM Advance to deliver simultaneous cooling and heating.

Heat recovery technology further improves energy efficiency, minimising carbon footprint. SHRM Advance can also be customised to operate as a two-pipe heat pump system. A full range of 13 different types of indoor unit are available, from 0.3 to 10HP capacity.

SHRM Advance is also available with a fresh-air ventilation duct and a mediumtemperature water module. Supported by a 70-200% diversity ratio, full system customisation can overcome site-specific project constraints.

Safe operation leak detection and shut-off valve systems are integrated. To ensure regulatory compliance at the design stage, equipment selection software takes account of mandatory requirements, based on floor area and refrigerant quantity. This gives installers and consultants full guidance to compliance.

For more information, contact Andrew Bailey, 01323 723 944, andrew.lingfield@btinternet.com

Rinnai offers electric hot-water storage solutions

New electrical option in hot water storage for commerical or larger domestic settings

s an integral part of their H3 initiative, Rinnai has designed and produced an electrical option in hot-water storage units for commercial applications.

The new Infinit-E range is fitted with between one and six titanium elements, which Rinnai says ensures a productive and sustained product life-cycle. Made available in systems from 12kW to 72kW, the Infinit-E range is designed for all commercial and larger residential settings.

All of the electric cylinder models in the Infint-E range are manufactured with stainless steel, providing an added level of durability, says Rinnai. The inclusion of stainless steel results in a lightweight model that can be easily transported and handled.

The maximum weight of an empty Infinit-E model is 54kg. Rinnai says that quality manufacturing and design ensure all Infinit-E models are durable and robust. Minimal maintenance is required by the customer



throughout the products' working life, said Rinnai with comprehensive warranties provided.

The product is designed to be versatile, as all the electrical elements can be fitted to a single-phase or three-phase supply should site limitations demand. Each contained element within the appliance range has its own controllable thermostat with a temperature range between 49°C and 90°C.

Fuse protection is applied to all elements. This

functions to eliminate the need for expensive sacrificial anodes because of the inclusion of stainless steel within the manufacturing process.

Rinnai's H3 range offers products that are a solution to lower energy costs and decarbonisation. The firm's innovation manifesto outlines a path to carbon neutrality, as well as a pledge to fully decarbonise company operations by 2050. Rinnai plans to further support the transition to clean energy with a wider variety of domestic heating options across multiple energy vectors.

All of Rinnai's water heating products are hydrogen-blends ready, and will accept BioLPG capable of delivering net zero carbon emissions.

Comprehensive training courses are offered, along with technical support in all aspects of the water heating industry. More information can be found on Rinnai's website and its 'Help Me Choose' webpage.

The Infinit-E range of electrical water cylinders is available to purchase now.

Visit www.rinnaiuk.com

Aquatech Pressmain pressurisation units keep the cold at bay >

Aquatech Pressmain's Aquaspill range of pressurisation units are designed to maintain the water pressure and manage expansion in heating and chilled water systems

Engineered for large commercial and district heat

networks, the units run with working temperatures of 3°C to

200°C, fill pressure of up to 25.0 bar and have almost unlimited system content, utilising their modular spill-tank design.

The inbuilt controls alert the user of any situations that may occur while providing interlock protection for the boilers/chillers and circulating pumps, and a comprehensive building management signals package.

For more information visit www.aquatechpressmain.co.uk or contact sales@aqpm.co.uk

Cloco heat pump success at Suffolk primary school



Elco has celebrated the continued performance of two air source heat pumps at a Suffolk primary school, 10 years after installation.

Operating at high COPs of up to 3.7, the aerotop units are estimated to have helped the school to save up to 15 tonnes of carbon.

'It's fantastic to see the ELCO units still operating to the same level as they did in 2012', said Mark Ferris, UK Specification Manager for ELCO. The heat pumps supply efficient space heating via a low-temperature underfloor heating circuit.

For more information visit www.elco.co.uk.

SoPHE Young Engineers of the Year Awards 2022 ~

Pump Technology Ltd and Jung Pumpen GmbH were sponsors of the SoPHE Young Engineers of the Year Awards 2022. Winner Freya Scott (right), and runner up Rachel Yates (left), both from Arup, are pictured being congratulated on their achievements by Sanjay Modasia, the event organiser.

Pump Technology Ltd and Jung Pumpen GmbH look forward to continuing their SoPHE support, by providing training opportunities and a programme of 'pop-in visits' for engineers who wish to view pumping products relevant to a project on which they are currently working.

For more information call 0118 9821 555 or visit www.pumptechnology.co.uk



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The low-down

The recent *Building for 2050* report identifies key steps that need to be taken to overcome the challenges of developing low carbon homes. Co-author Alison **Crompton** answers questions about its findings

lison Crompton is a regional director at Aecom, working on projects for sustainability, buildings and places. She has played a significant role in producing *Building for 2050*, an evidenced-based report on the drivers and barriers involved in the large-scale construction of low-cost, low carbon housing. Key challenges identified were a lack of skills, performance gaps and high costs . The report looked at four eco-home projects (see page 9) and was produced for BEIS by Aecom, after five years of research.

How can industry upskill for low carbon homes?

Upskilling is needed across the entire industry, from the developers and design teams to local planning authorities, those building homes, and sales and handover teams. They need to be armed with the right knowledge, which suggests a role for a central body and for professional institutions.

Higher education bodies should play a role in informing those coming into the industry. A key element of upskilling is ensuring appropriate advice and guidance is passed to householders as part of the handover.

Who will pay for the upgrade of energy structure?

New business models are needed so developers and homeowners don't pay full investment costs upfront. This could work in the same way that gas infrastructure is paid for via gas standing charges in energy bills, over several years. Government may help to unlock some of the barriers of lack of energy infrastructure in some larger, unconnected sites.

How do you close the performance gap in low carbon schemes?

Delivering as-designed performance begins with the brief and the design team. Clients should ask for a home that delivers as-built performance, and the design team should ensure the building fabric, building services, and available space within dwellings are aligned.

Design details - such as airtightness, thermal bypass and thermal bridging -



should be considered. Examples include junctions between pre-manufactured and onsite elements, the location and coordination of service runs, and junctions with masonry, steel or other materials that break the insulation, airtightness or windtightness layer.

Duct runs for ventilation systems need to be short/efficient; equipment should be in a suitable location; all equipment should be of a similar standard; controls need to be easily accessible, as well as easily understood. It is vital that residents understand and optimise the energy use of their home.

Attention to detail is so important in low carbon homes. Missing insulation or poorer airtightness has a proportionately more significant impact than in traditionally built homes, as overall space-heating demand is lower. Site managers must be vigilant, with regular testing, and any shortfalls redressed.

Thermal imaging will probably help identify areas of poor performance that need to be addressed before practical completion. Some developments may benefit from constructing one or two pilot low carbon homes and identifying any key areas of training, which may result in specification changes. Design, installation and commissioning of ventilation systems is a particular area where industry performance should be improved.

Sales teams should clearly explain the low carbon features, and housebuilders need to focus on delivering customer-focused homes that can demonstrate, at point of sale, previous performance in use.

The final key element is the quality of guidance at the handover stage, and ongoing support to residents. This ties in to several key learnings from *Building for 2050*: performance in use needs improving, with the adoption of simpler designs that are easily built and operated; developers and design teams should adopt a range of output metrics, not only low carbon targets; it is essential to ensure planned performance is delivered so that running costs and carbon emissions are low.

How do you ensure residents don't feel frustrated by their eco-homes?

Developers need to focus on tailoring designs to residents, with ease of use a key design target. Further, the handover process should be properly resourced. A low carbon home should not 'constrain' a resident, but should be comfortable, easy to use, and maintain low energy, low carbon living.





NATIONAL EVENTS AND CONFERENCES **CIBSE Building**

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CIBSE Technical Symposium

20-21 April, University of Strathclyde, Glasgow The 2023 Symposium will focus on the challenge of delivering net zero carbon buildings over the next 25 years. www.cibse.org/ technicalsymposium

CIBSE REGIONS AND GROUP EVENTS

For up-to-date information on regions and groups meetings, webinars and podcasts, visit www.cibse.org/events

West Midlands: Building **Regulations Approved** Document O Overheating Reflection on early use 10 January

This roundtable will feature experts in assessment of overheating, plus a ventilation/

Membership webinars

cooling supplier and a designer for a property developer.

SLL: Defining colour: Using TM30 as a specification tool 17 January

This in-person CPD will look at TM30 as a means of defining colour for lighting.

CIBSE Certification webinar: Restoring the Palace of Westminster 23 January

The online event will feature speaker Andrew Piper, technical director at the Houses of Parliament Restoration and Renewal Programme. Register at bit.ly/Jan23ev

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CIBSE training courses have been reformatted to work online, with a live trainer, so you can expect the same interaction and participation as you would in a classroom setting.

Upcoming courses:

ISO 50001:2018 Energy management system 16-17 January

Design of ductwork systems 16 January

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The latest CIBSE Journal webinar, sponsored by Kohler, titled Getting the elephant in the room – effective design of resilient UPS facilities, is now available on demand. Register to watch this and all other Journal webinars at www.cibsejournal.com/cpd/webinars/

Electrical services explained 17-19 January

Energy surveys 20 January

Energy Savings Opportunity Scheme 20 January

Low carbon consultant building design 23-24 January

Building services explained 24-26 January

Mechanical services explained 24-26 January

Low carbon consultant building design 26-27 January

Energy efficiency-related Building Regulations: Partl 30 January

Design of heating and chilled water pipe systems 7 February

Mechanical services explained 7-9 February

Fire safety Building Regulations: Part B 8 February

Low carbon consultant building design 9-10 February

ISO 50001:2018 Energy management system 9-10 February

Mechanical services explained 14-16 February

Electrical services explained 14-16 February

Introduction to the Building Safety Act

16 February

Energy strategy reports 17 February

Power system harmonics 20 February

Air conditioning and cooling systems 21 February

Building services explained 21-23 February

Energy efficiency-related Building Regulations: Part L

22 February

Embodied carbon in MEP design: How to use CIBSE TM65 24 February

Energy efficiency-related Building Regulations: Part L 27 February

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other membership webinars, go to: bit.ly/CJJan22Ev1

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For further details and to register: www.cibse.org/webinars



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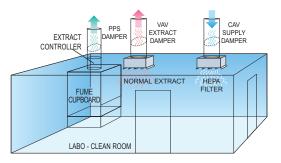
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